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# The New Encyclopædia Britannica

Volume 11

MICROPÆDIA

Ready Reference

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# How to use the MICROPAEDIA

The 12 volumes of the MICROPAEDIA contain tens of thousands of shorter articles on specific persons, places, things, and ideas, arranged in alphabetical order. The MICROPAEDIA can be used as an information resource on its own; and it can function as support for the longer articles in the MACROPAEDIA (to which it refers whenever appropriate). The MICROPAEDIA in turn is supported by references in the INDEX and by the lists of suggested readings in the PROPAEDIA. Finally, the MICROPAEDIA is the portion of the *Encyclopædia Britannica* best suited for the reader who wishes to browse among the countless subjects in all fields of human learning and history in all times and places.

## Alphabetization

Entry titles are alphabetized according to the English alphabet, A to Z. All diacritical marks (such as in ö, ł, or ñ) and foreign letters without parallels in English (such as ayin [ʿ] and hamza [ʾ]) are ignored in the alphabetization. Apostrophes likewise are ignored. Titles beginning with numbers, such as **1812, War of**, are alphabetized as if the numbers were written out (**Eighteen-twelve, War of**).

Alphabetization proceeds according to the "word-by-word" principle. Thus, **Mount Vernon** precedes **mountain**; any **John** entry precedes **John Henry**, which in turn precedes **Johne's disease**. Any character or string of characters preceding a space, hyphen, or dash is treated as a word and alphabetized accordingly. Thus, **De Broglie** precedes **debenture**, and **jack-o'-lantern** precedes **jackal**. Titles with identical spellings are arranged in the following order: (1) persons, (2) places, (3) things.

For many rulers and titled nobility, chronological order, as well as alphabetical order, governs placement. Rulers of the same given name (*e.g.,* William) may be grouped together, separate from other entries, and indicated by the symbol •. They may be subgrouped alphabetically by country and, within each country, arranged chronologically (**William I, William II**, etc.). Nobility or peers of the same titled name (*e.g.,* **Essex, EARLS OF**) are similarly grouped together, separate from other entries; they are indicated by the symbol • and arranged chronologically.

Places with identical names are arranged in the alphabetical order of the countries where they are located. Identical place-names in the same country are alphabetized according to the alphabetical order of the state, province, or other political subdivision where they are found.

## Entry arrangement

The titles of entries are arranged according to the forms commonly found in indexes and dictionaries, with some special conventions.

Entry titles for certain physical features, institutions, structures, events, and concepts are ordinarily inverted to place the substantive word first. Thus, the Bay of Bengal is entered as **Bengal, Bay of**; the Bank of England as **England, Bank of**; the Tower of London as **London, Tower of**; the Siege of Vienna as **Vienna, Siege of**; and the balance of power as **power, balance of.** If the name of a physical feature, institution, structure, event, or concept has two or more descriptors, it is entered under the descriptor appearing first. Thus, the Episcopal Church in Scotland is entered as **Episcopal Church in Scotland** (not **Scotland, Episcopal Church in**); the Leaning Tower of Pisa as **Leaning Tower of Pisa**; and the kinetic theory of gases as **kinetic theory of gases**.

The entries for most Western persons are arranged so that one can read a name in correct order by beginning after the first comma, proceeding to the end of the boldface type, returning to the beginning word or words, and proceeding forward to the first comma. Thus, the entry **March, Patrick Dunbar, 2nd Earl of**, is read "Patrick Dunbar, 2nd Earl of March"; the entry **Orléans, Louis, duc d'**, is read "Louis, duc d'Orléans." Names of Far Eastern origin are given in Oriental order, with the surname preceding the personal name (*e.g.,* **Tōjō Hideki, Deng Xiaoping, Nguyen Cao Ky**).

## Cross-references

Some cross-reference entries appear in the MICROPAEDIA for the purpose of leading a reader from names that are familiar to alternate names that may not be. Cross-references also appear frequently within or at the ends of standard entries, where they are identified by *see, see also, see under, q.v.* (*quod vide,* "which see"), or *qq.v.* (*quae vide,* "which see," plural).

Certain entries serve both as relatively brief essays on general subjects and as cross-references to the same subjects treated at greater length and in greater depth in the MACROPAEDIA. Such an entry (*e.g.,* **igneous rock**) begins with a definition of the subject and then provides the following cross-reference: "A brief treatment of igneous rocks follows. For full treatment, *see* MACROPAEDIA: Minerals and Rocks.

Entries on certain broad subjects (*e.g.,* **music**) direct the reader to several relevant articles in the MACROPAEDIA and also to the PROPAEDIA for listings of related articles in the MICROPAEDIA.

## Abbreviations

Abbreviations used in the MICROPAEDIA are given in a list that appears at the end of every MICROPAEDIA volume.

## Territorial boundaries

In articles and maps indicating disputed geopolitical boundaries and territories, the attribution of sovereignty or administrative subordination to any specific area does not imply recognition of the status claimed by an administering power.

**Solovyov, Sergey Mikhaylovich,** Solovyov also spelled SOLOVIEV (b. May 5 [May 17, New Style], 1820, Moscow, Russia—d. April 4 [April 16], 1879, Moscow), one of the greatest Russian historians.

The son of a clergyman, Solovyov graduated from Moscow University in 1842 and joined the faculty of that institution as an assistant professor of Russian history in 1845. He became a full professor in 1850 and served in that capacity until his retirement in 1877. In the course of his academic career Solovyov held several important administrative posts at Moscow University, published several works concerning Peter I the Great and Alexander I, and acted as tutor to the tsarevich Nikolay Aleksandrovich (1859) and to the future tsar Alexander III (1866). Solovyov's reputation as one of the greatest of all Russian historians rests on his monumental 29-volume *History of Russia From Ancient Times*, 28 volumes of which were published between 1851 and Solovyov's death in 1879. The *History* wove a vast body of data into a unified and orderly whole that provided an exceptionally powerful and vivid picture of Russia's political development over the centuries. The work inaugurated a new era in Russian scholarship with its depiction of Russia as evolving through organic and rational processes from a primitive, family-based society into a centralized, autocratic state. Solovyov's work greatly influenced virtually all later Russian historians.

**Solovyov, Vladimir Sergeyevich,** Solovyov also spelled SOLOVIEV (b. Jan. 16 [Jan. 28, New Style], 1853, Moscow, Russia—d. July 31 [Aug. 13], 1900, Uzkoye, near Moscow), Russian philosopher and mystic who, reacting to European rationalist thought, attempted a synthesis of religious philosophy, science, and ethics in the context of a universal Christianity uniting the Orthodox and Roman Catholic churches under papal leadership.

He was the son of the historian Sergey M. Solovyov. After a basic education in languages, history, and philosophy at his Orthodox home, he took his doctorate at Moscow University in 1874 with the dissertation "The Crisis of Western Philosophy: Against the Positivists." After travels in the West, he wrote a second thesis, a critique of abstract principles, and accepted a teaching post at the University of St. Petersburg, where he delivered his celebrated lectures on *Godmanhood* (1880). This appointment was later rescinded because of Solovyov's clemency appeal for the March 1881 assassins of Tsar Alexander II. He also encountered official opposition to his writings and to his activity in promoting the union of Eastern Orthodoxy with the Roman Catholic church.

Solovyov criticized Western empiricist and idealist philosophy for attributing absolute significance to partial insights and abstract principles. Drawing on the writings of Benedict de Spinoza and G.W.F. Hegel, he regarded life as a dialectical process, involving the interaction of knowledge and reality through conflicting tensions. Assuming the ultimate unity of Absolute Being, termed God in the Judeo-Christian tradition, Solovyov proposed that the world's multiplicity, which had originated in a single creative source, was undergoing a process of reintegration with that source. Solovyov asserted, by his concept of Godmanhood, that the unique intermediary between the world and God could only be man, who alone is the highest part of nature capable of knowing and expressing the divine idea of "absolute unitotality" in the chaotic multiplicity of real experience. Consequently, the perfect revelation of God is Christ's incarnation in human nature.

For Solovyov, ethics became a dialectical problem of basing the morality of human acts and decisions on the extent of their contribution to the world's integration with ultimate divine unity, a theory expressed in his *The Meaning of Love* (1894).

**Solow, Robert Merton** (b. Aug. 23, 1924, Brooklyn, New York, N.Y., U.S.), American economist who was awarded the 1987 Nobel Prize for Economics for his important contributions to the theory of economic growth.

Solow received his B.A. (1947), M.A. (1949), and Ph.D. (1951) degrees from Harvard University. He began teaching economics at the Massachusetts Institute of Technology in 1949 and became a full professor there in 1958. He served on the Council of Economic Advisers in 1961–62 and was a consultant to that body from 1962 to 1968.

In the 1950s Solow developed a mathematical model that could show the relative contributions of various factors to producing sustained national economic growth. Contrary to traditional economic thinking, he showed that the rate of technological progress is actually more important than capital accumulation and increases in labour in achieving such growth. The greater efficiency and productivity that result from qualitative improvements such as new machines and improved human skills are thus more important than strictly quantitative investments that result in a greater number of machines and factories. From the 1960s on, Solow's studies were influential in persuading governments to channel their funds into technological research and development in order to spur economic growth.

**Solstad, Dag** (b. July 16, 1941, Sandefjord, Nor.), novelist, short-story writer, and dramatist, one of the most significant Norwegian writers to emerge during the 1960s.

Solstad began his career as a writer of short experimental fictions that investigated the themes of identity and alienation: *Spiraler* (1965; "Spirals") and *Svingstol* (1967; "Swing Chair"). His novel *Ir/ Grønt!* (1969; "Patina! Green!") described the efforts of a peasant student to escape his limited background. Solstad's fiction took a more directly political turn with the novel *Arild Asnes, 1970* (1971), which traced the development of a young man to the point at which he perceived that political revolution was necessary and must be brought about by conflict. In *25 September Plassen* (1974; "September 25th Square") he showed the growing political awareness on the part of factory workers in the period following World War II. *Svik. Forkrigsår* (1977; "Betrayal: Prewar Years") and *Krig. 1940* (1978; "War: 1940") were the first two in a series of novels that gave a minutely documented account of Norway in World War II.

**solstice,** either of the two moments in the year when the Sun's apparent path is farthest north or south from the Earth's Equator. In the Northern Hemisphere the summer solstice occurs on June 21 or 22 and the winter solstice on December 21 or 22. The situation is exactly the opposite in the Southern Hemisphere, where the seasons are reversed. The term solstice also is used in reference to either of the two points of greatest deviation of the ecliptic (the Sun's apparent annual path) from the celestial equator.

At the time of the summer solstice in the Northern Hemisphere, the North Pole is tilted 23.45° (23°27′) toward the Sun. Because the Sun's rays are shifted northward by the same amount, the vertical noon rays are directly overhead at the Tropic of Cancer (23°27′ N). Six months later, the south polar end of the Earth is inclined 23.45° toward the Sun. On this day of the summer solstice in the Southern Hemisphere, the Sun's vertical overhead rays progress to their southernmost position, the Tropic of Capricorn (23°27′ S). *Compare* equinox; *see also* season.

**Solti, Sir Georg,** original name GYÖRGY SOLTI (b. Oct. 21, 1912, Budapest, Hung.—d. Sept. 5, 1997, Antibes, France), Hungarian-born British conductor and pianist, one of the most highly regarded conductors of the second half of the 20th century.

Solti studied at the Liszt Academy in Budapest with Béla Bartók and Zoltán Kodály. At 18 he joined the coaching staff of the Budapest Opera and made his conducting debut there in 1938. A Jew, he found safety in Zürich during World War II, but his alien status prevented him from conducting professionally. He won the Geneva International Piano Competition in 1942. After the war, he became musical director of the Bavarian State Opera in Munich (1946–52), the Frankfurt Opera (1952–60), and Covent Garden (1961–71). He was knighted in 1971 and assumed British citizenship in 1972.

From 1969 to 1991 he was musical director of the Chicago Symphony Orchestra, reestablishing that orchestra's international reputation. He served in the same post for the Orchestra of Paris (1972–75) and acted as musical adviser to the Paris Opéra from 1971 to 1973. He was the principal conductor and artistic director of the London Philharmonic Orchestra from 1979 to 1983.

As a conductor Solti was best known for his dramatic and deeply felt interpretations of operas, symphonies, and other large-scale works by W.A. Mozart, Ludwig van Beethoven, Franz Schubert, Richard Wagner, Richard Strauss, and Gustav Mahler. He was particularly notable for his sharp attention to musical detail and his ability to evoke a wide range of tonal colours from an orchestra. He made many highly praised recordings from the late 1940s as both conductor and solo performer. In 1966 Solti made the highly acclaimed first complete recording of Richard Wagner's opera cycle, *The Ring of the Nibelung* (*Der Ring des Nibelungen*).

**solution,** in chemistry, homogenous mixture of two or more substances in relative amounts that can be varied continuously up to what is called the limit of solubility. The term solution is commonly applied to the liquid state of matter, but solutions of gases and solids are possible. Air, for example, is a solution consisting chiefly of oxygen and nitrogen with trace amounts of several other gases, and brass is a solution composed of copper and zinc.

A brief treatment of solutions follows. For full treatment, *see* MACROPAEDIA: Matter.

Life processes depend in large part on solutions. Oxygen from the lungs goes into solution in the blood plasma, unites chemically with the hemoglobin in the red blood cells, and is released to the body tissues. The products of digestion also are carried in solution to the different parts of the body. The ability of liquids to dissolve other fluids or solids has many practical applications. Chemists take advantage of differences in solubility to separate and purify materials and to carry out chemical analysis. Most chemical reactions occur in solution and are influenced by the solubilities of the reagents. Materials for chemical manufacturing equipment are selected to resist the solvent action of their contents.

The liquid in a solution is customarily designated the solvent, and the substance added is called the solute. If both components are liquids, the distinction loses significance; the one present in smaller concentration is likely to be called the solute. The concentration of any component in a solution may be expressed in units of weight or volume or in moles. These may be mixed—*e.g.*, moles per litre and moles per kilogram.

Crystals of some salts contain lattices of ions—*i.e.*, atoms or groups of atoms with alternating positive and negative charges. When such a crystal is to be dissolved, the attraction of the oppositely charged ions, which are

largely responsible for cohesion in the crystal, must be overcome by electric charges in the solvent. These may be provided by the ions of a fused salt or by electric dipoles in the molecules of the solvent. Such solvents include water, methyl alcohol, liquid ammonia, and hydrogen fluoride. The ions of the solute, surrounded by dipolar molecules of the solvent, are detached from each other and are free to migrate to charged electrodes. Such a solution can conduct electricity, and the solute is called an electrolyte.

The potential energy of attraction between simple, nonpolar molecules (nonelectrolytes) is of very short range; it decreases approximately as the seventh power of the distance between them. For electrolytes the energy of attraction and repulsion of charged ions drops only as the first power of the distance. Accordingly, their solutions have very different properties from those of nonelectrolytes.

It is generally presumed that all gases are completely miscible (mutually soluble in all proportions), but this is true only at normal pressures. At high pressures, pairs of chemically dissimilar gases may very well exhibit only limited miscibility. Many different metals are miscible in the liquid state, occasionally forming recognizable compounds. Some are sufficiently alike to form solid solutions (*see* alloy).

*Consult the* INDEX *first*

**Solutrean industry,** short-lived style of toolmaking that flourished approximately 17,000 to 21,000 years ago in southwestern France (*e.g.*, at Laugerie-Haute and La Solutré) and in nearby areas. The industry is of special interest because of its particularly fine workmanship. The Solutrean industry, like those of other late Paleolithic big-game hunters, contained a variety of tools such as burins (woodworking tools rather like chisels), scrapers, and borers; but blades that were formed in the shape of laurel or willow leaves and shouldered points are the implements that distinguish the Solutrean.

In the early Solutrean, unifacial points (flaked on only one side) are common. In the middle Solutrean, these are gradually replaced by laurel-leaf blades and bifacial points. Tiny blunt-backed flint blades and scrapers and single-shouldered points also occur. Bizarre implements, with notches or asymmetrical shapes, appear; these and laurel-leaf blades so fine as to have precluded their use as tools suggest the production of fine-flaked implements for purposes of luxury alone. In the late Solutrean, the willow-leaf blade (slim, with rounded ends and retouching on one side only) of extremely fine workmanship made its appearance. Bone needles with eyes occur and indicate the use of fitted clothing, useful in a near-glacial climate. There is much evidence of the use of ornament: bracelets, bead necklaces, pendants, bone pins, and coloured pigments must have been used for personal adornment. Stone friezes, bas-reliefs, and paintings on stone plaques and cave walls are known. Even tool stone was chosen for its beauty; coloured quartz, jasper, and handsome flints abound.

The origin of the Solutrean stoneworking technique is in some dispute. Most of the evidence indicates it was an invention indigenous to the Dordogne region of France, but some scholars attribute its swift appearance to the arrival of a new people and its equally swift disappearance to destruction of the Solutrean people by another group arriving with a different tool industry. The Solutrean follows the Perigordian and Aurignacian industries and is succeeded by the Magdalenian.

**Solvay, Ernest** (b. April 16, 1838, Rebecq-Rognon, near Brussels, Belg.—d. May 26, 1922, Brussels), Belgian industrial chemist, best known for his development of a commercially viable ammonia-soda process for producing soda ash (sodium carbonate), widely used in the manufacture of such products as glass and soap.

After attending local schools, Solvay entered his father's salt-making business. At the age of 21 he began working with an uncle at a gasworks near Brussels, and while there he began to develop the conversion method for which he is known.

Although the ammonia-soda process had been understood since 1811, a suitable and economical means of large-scale commercial production had evaded industrial chemists. Solvay, who was unaware that the reaction itself had been known for 50 years, solved the practical problems of large-scale production by his invention of the Solvay carbonating tower, in which an ammonia-salt solution could be mixed with carbon dioxide. In 1861 he and his brother Alfred founded their own company and in 1863 had a factory built. Production started in 1865, and by 1890 Solvay had established companies in several foreign countries. Solvay's method was gradually adopted throughout much of Europe and elsewhere and by the late 19th century had supplanted the Leblanc process, which had been chiefly used for converting common salt into sodium carbonate since the 1820s.

This success brought Solvay considerable wealth, which he used for various philanthropic purposes, including the founding of various international institutes of scientific research in chemistry, physics, and sociology. The Solvay conferences on physics were particularly noted for their role in the development of theories on quantum mechanics and atomic structure.

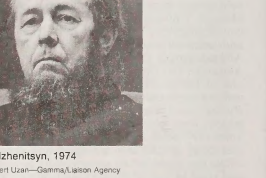
**Solvay process:** *see* ammonia-soda process.

**Solyman** (Turkish or Arabic personal name): *see under* Süleyman.

**Solzhenitsyn, Aleksandr (Isayevich)** (b. Dec. 11, 1918, Kislovodsk, Russia [U.S.S.R.]), Russian novelist and historian, who was awarded the Nobel Prize for Literature for 1970 and was exiled from the Soviet Union in 1974.

Solzhenitsyn was born into a family of Cossack intellectuals and brought up primarily by his mother (his father was killed in an accident before his birth). He attended the University of Rostov-na-Donu, graduating in mathematics, and took correspondence courses in literature at Moscow State University. He fought in World War II, achieving the rank of captain of artillery; in 1945, however, he was arrested for writing a letter in which he criticized Joseph Stalin and spent eight years in prisons and labour camps, after which he spent three more years in enforced exile. Rehabilitated in 1956, he was allowed to settle in Ryazan, in central Russia, where he became a mathematics teacher and began to write.

Encouraged by the loosening of government restraints on cultural life that was a hallmark of the de-Stalinizing policies of the early 1960s, Solzhenitsyn submitted his short novel *Odin den iz zhizni Ivana Denisovicha* (1962; *One Day in the Life of Ivan Denisovich*) to the leading Soviet literary periodical *Novy Mir* ("New World"). The novel quickly appeared in that journal's pages and met with immediate popularity, Solzhenitsyn becoming an instant celebrity. *Ivan Denisovich,* based on Solzhenitsyn's own experiences, described a typical day in the life of an inmate of a forced-labour camp during the Stalin era. The impression made on the public by the book's simple, direct language and by the obvious authority with which it treated the daily struggles and material hardships of camp life was magnified by its being one of the first Soviet literary works of the post-Stalin era to directly describe such a life. The book produced a political sensation both abroad and in the Soviet



Solzhenitsyn, 1974
Gilbert Uzan—Gamma/Liaison Agency

Union, where it inspired a number of other writers to produce accounts of their imprisonment under Stalin's regime.

Solzhenitsyn's period of official favour proved to be short-lived, however. Ideological strictures on cultural activity in the Soviet Union tightened with Nikita Khrushchev's fall from power in 1964, and Solzhenitsyn met first with increasing criticism and then with overt harassment from the authorities when he emerged as an eloquent opponent of repressive government policies. After the publication of a collection of his short stories in 1963, he was denied further official publication of his work, and he resorted to circulating them in the form of *samizdat* ("self-published") literature—*i.e.*, as illegal literature circulated clandestinely—as well as publishing them abroad.

The following years were marked by the foreign publication of several ambitious novels that secured Solzhenitsyn's international literary reputation. *V kruge pervom* (1968; *The First Circle*) was indirectly based on his years spent working in a prison research institute as a mathematician. The book traces the varying responses of scientists at work on research for the secret police as they must decide whether to cooperate with the authorities and thus remain within the research prison or to refuse their services and be thrust back into the brutal conditions of the labour camps. *Rakovy korpus* (1968; *Cancer Ward*) was based on Solzhenitsyn's hospitalization and successful treatment for terminally diagnosed cancer during his forced exile in Kazakhstan during the mid-1950s. The main character, like Solzhenitsyn himself, was a recently released inmate of the camps.

In 1970 Solzhenitsyn was awarded the Nobel Prize for Literature, but he declined to go to Stockholm to receive the prize for fear he would not be readmitted to the Soviet Union by the government upon his return. His next novel to be published outside the Soviet Union was *August 1914* (1971; *August 1914*), a historical novel treating Germany's crushing victory over Russia in their initial military engagement of World War I, the Battle of Tannenburg. The novel centred on several characters in the doomed 1st Army of the Russian general A.V. Samsonov and indirectly explored the weaknesses of the tsarist regime that eventually led to its downfall by revolution in 1917.

In December 1973 the first parts of *Arkhipelag Gulag* (*The Gulag Archipelago*) were published in Paris after a copy of the manuscript had been seized in the Soviet Union by the KGB. (*Gulag* is an acronym formed from the official Soviet designation of its system of prisons and labour camps.) *The Gulag Archipelago* is Solzhenitsyn's attempt

to compile a literary-historical record of the vast system of prisons and labour camps that came into being shortly after the Bolsheviks seized power in Russia (1917) and that underwent an enormous expansion during the rule of Stalin (1924–53). Various sections of the work describe the arrest, interrogation, conviction, transportation, and imprisonment of the Gulag's victims as practiced by Soviet authorities over four decades. The work mingles historical exposition and Solzhenitsyn's own autobiographical accounts with the voluminous personal testimony of other inmates.

Upon publication of the first volume of *The Gulag Archipelago,* Solzhenitsyn was immediately attacked in the Soviet press. Despite the intense interest in his fate that was shown in the West, he was arrested and charged with treason on Feb. 12, 1974. Solzhenitsyn was exiled from the Soviet Union on the following day, and in December he took possession of his Nobel Prize.

In 1975 a documentary novel, *Lenin v Tsyurikhe: glavy* (*Lenin in Zurich: Chapters*), appeared. Subsequently, Solzhenitsyn traveled to the United States, where he eventually settled. The second and third volumes of *The Gulag Archipelago* were published in 1974–75. Solzhenitsyn produced two books of nonfiction in 1980: *The Oak and the Calf,* which portrayed literary life in the Soviet Union, and the brief *The Mortal Danger,* which analyzed what he perceived to be the perils of American misconceptions about Russia. In 1983 an extensively expanded and revised version of *August 1914* appeared in Russian as the first part of a projected series, *Krasnoe koleso* (*The Red Wheel*); other volumes (or *uzly* ["knots"]) in the series were *Oktyabr 1916* ("October 1916"), *Mart 1917* ("March 1917"), and *Aprel 1917* ("April 1917").

In presenting alternatives to the Soviet regime, Solzhenitsyn tended to reject Western emphases on democracy and individual freedom and instead favoured the formation of a benevolent authoritarian regime that would draw upon the resources of Russia's traditional Christian values. The introduction of glasnost ("openness") in the late 1980s brought renewed access to Solzhenitsyn's work in the Soviet Union. In 1989 the Soviet literary magazine *Novy Mir* published the first officially approved excerpts from *The Gulag Archipelago.* Other works were also published, and Solzhenitsyn's Soviet citizenship was officially restored in 1990. He ended his exile and returned to Russia in 1994.

**soma,** in ancient Indian cult worship, an unidentified plant, the juice of which was a fundamental offering of the Vedic sacrifices. The stalks of the plant were pressed between stones, and the juice was filtered through sheep's wool and then mixed with water and milk. After first being offered as a libation to the gods, the remainder of the soma was consumed by the priests and the sacrificer. It was highly valued for its exhilarating, probably hallucinogenic, effect. The personified deity Soma was the "master of plants," the healer of disease, and the bestower of riches.

The soma cult exhibits a number of similarities to the corresponding haoma cult of the ancient Iranians and is suggestive of shared beliefs among the ancient Indo-Europeans in a kind of elixir of the gods. Like haoma, the soma plant grows in the mountains, but its true origin is believed to be heaven, whence it was brought to earth by an eagle. The pressing of soma was associated with the fertilizing rain, which makes possible all life and growth. In the post-Vedic classical period, soma is identified with the moon, which wanes when soma is drunk by the gods.

**soma,** in biology, all the living matter of an animal or a plant except the reproductive, or germ, cells. The distinction between the soma and the germ cells was propounded by the 19th-century German biologist August Weismann in the "germ plasm" theory that emphasized the role of the immortal, heredity-carrying genes and chromosomes, which are transmitted through successive generations of each species and determine the character of each individual in the propagative chain.

**Somadeva** (fl. 1070), Kashmiri Brahman of the Śaiva sect and Sanskrit writer who preserved much of India's ancient folklore in the form of a series of tales in verse.

The court poet to King Ananta of Kashmir, Somadeva apparently was commissioned to compose a cycle of stories to amuse and calm the queen Sūryamati during a political crisis. He borrowed from an earlier work, now lost, the *Bṛhat-katha* ("Great Tale") by the Sanskrit writer Guṇāḍhya, who probably had used Buddhist sources of an even earlier period. Somadeva's work *Kathā-saritsāgara* ("Ocean of Rivers of Stories") bears a strong resemblance to medieval European fairy tales: magic, demons, bloody orgies, vampires, love, and high adventure abound in the 124 sections, or chapters, known as *taraṅga* ("waves"). An English translation by Charles H. Tawney, titled *The Ocean of Story,* was published in 1924–28. Somadeva wrote his monumental work during the two periods of Ananta's interrupted rule, which ended in 1077.

**Somali,** people of Africa occupying all of Somalia, a strip of Djibouti, the southern Ethiopian region of Ogaden, and part of northwestern Kenya. Except for the arid coastal area in the north, the Somalis occupy true nomad regions of plains, coarse grass, and streams. They speak a language of the Cushitic branch of the Afro-Asiatic (formerly Hamito-Semitic) family.

It is believed that in the 14th century the Somalis, converted to Islām by Arabs from across the Red Sea, began their expansion southward from the arid steppes to their present borders, which overflow what was traditionally known as Somaliland. Although three great divisions of Somalis exist, roughly corresponding to the northern, central, and southern parts of the region, the Somalis demonstrate considerable cultural unity.

The basis of Somali society is the *rēr,* or large, self-contained kinship group or clan, consisting of a number of families claiming common descent from a male ancestor. A Somali has obligations both to his *rēr* and to the loosely defined tribe of which his *rēr* is a part. Government of the *rēr* is markedly patriarchal, although the chief is chosen by a group of elders who counsel him.

The Somalis are primarily nomadic herders who, because of intense competition for scarce resources, have been extremely individualistic and frequently involved in blood feuds or wars with neighbouring tribes and peoples. Their conception of Islām is vague, and religious practices are dominated by the worship of ancestral saints.

A second category of Somalis are the townspeople and agriculturists of the urban centres, especially along the coast of the Horn of Africa, where intense and prolonged intimacy with the Islāmic tradition has rendered the culture highly organized and religiously orthodox and where geographic position has turned the townspeople into commercial middlemen between the Arab world and the nomadic tribes of the interior.

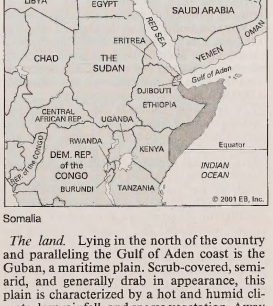
**Somali Basin,** submarine basin on the floor of the southwestern Arabian Sea, an arm of the Indian Ocean, east of Somalia. The Carlsberg Ridge separates it from the shallower Arabian Basin to the northeast. The Somali Basin also connects with the Mascarene and Madagascar basins to the south, with sill depths greater than 11,800 feet (3,600 m). Sill depths between the Somali and Arabian basins have been deduced from the minimum temperatures observed in the two areas.

**Somali Current,** surface current of the western Indian Ocean, caused during the northern summer months by the blowing of the southwest monsoon along the coast of East Africa, moving coastal waters northeastward along with it for about 950 miles (1,500 km). At longitude 6°–10° N (off Somalia), the northeastward Somali flow turns eastward as the Monsoon Current. With the monsoon's reversal to the northeast in September, the current begins to weaken until, in the winter, it disappears entirely to be replaced by a slow southwestward drift.

**Somalia,** Somali SOOMAALIYA, Arabic AṢ-ṢŪMĀL, country of northeastern Africa located in the Horn of Africa, the most easterly projection of the continent. Stretching from the Equator to the Red Sea, Somalia is bounded on the north by the Gulf of Aden, on the east by the Indian Ocean, on the west by Kenya and Ethiopia, and on the northwest by Djibouti. Its capital is Mogadishu. Area 246,000 square miles (637,000 square km). Pop. (2000 est.) 7,253,000.

A brief treatment of Somalia follows. For full treatment, *see* MACROPAEDIA: Eastern Africa: *Somalia.*

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.




Somalia

*The land.* Lying in the north of the country and paralleling the Gulf of Aden coast is the Guban, a maritime plain. Scrub-covered, semiarid, and generally drab in appearance, this plain is characterized by a hot and humid climate, low rainfall, and sparse vegetation. Away from the Gulf of Aden the plain rises to the precipitous north-facing cliffs of dissected highlands, which form rugged mountain ranges that extend from the northwestern border with Ethiopia eastward to the tip of the Horn. Along this range occur the highest elevations in the country, including Mount Surud Cad, reaching an elevation of 7,897 feet (2,407 m). To the south the mountains give way to the Hawd Plateau, which is cooler and drier. The extreme south consists mainly of flat plains. The two major rivers, the Jubba and the Shabeelle, rise in Ethiopia and flow southward across the country toward the Indian Ocean. Somalia lies within the tropical and subtropical zones. Mean daily maximum temperatures range from 86° to 107° F (30° to 42° C), while mean daily minimums range from about 65° to 80° F (18° to 27° C). Rainfall is usually higher in the south and northwest and varies from 4 to 24 inches (100 to 610 mm) over the country as a whole. Most of the northern areas of Somalia support scattered low trees and widely scattered patches of grass. In higher regions small forests are found. The country's animal life includes lion, elephant, hyena, fox, leopard, giraffe, zebra, and antelope. Only a small percent of Somalia's land area is arable, nearly half of which is cropped with cereals. More than half of the

land area, however, is available as pasture or rangeland.

*The people.* More than two-thirds of Somalia's populace are nomadic or seminomadic. During the dry season the nomads concentrate in villages near water sources; when the rains begin, they disperse with their herds. Traditionally, nomadism has been considered the most desirable lifestyle. Somalis constitute the vast majority of the population. Cultural divisions between pastoral nomads and sedentary cultivators and herdsmen have been weakened by large migrations from the countryside into towns, but most Somalis maintain a strong loyalty to one of many clans and subclans. The Somali language, spoken throughout the country, has been one of the nation's strongest unifying factors. Islām is the official religion and is practiced by most Somalis.

The largest concentrations of sedentary population are in the south and in the Jubba and Shabeelle valleys. Although the arid areas are sparsely populated, the urban population has increased rapidly since World War II and continues to grow. The cities of Somalia are not large. Mogadishu, the capital and largest city, was ravaged by civil war in the early 1990s.

Somalia's annual rate of population growth normally has been above average for sub-Saharan Africa, despite the country's high infant mortality rate and low life expectancy of 45 years for men and 48 years for women. In the 1970s and '80s Somalia had an influx of refugees numbering nearly 1,000,000—driven by war and drought from the Ogaden region of Ethiopia. During the early 1990s hundreds of thousands of Somalis died as a result of the violence, starvation, and disease that accompanied the drought and civil war. An estimated 1,000,000 refugees fled the country.

*The economy.* Somalia has a developing, mixed economy largely based on livestock and agriculture. It deteriorated rapidly after the outbreak of civil war in the early 1990s. The gross national product (GNP) per capita remains among the lowest in the world.

Agriculture traditionally has contributed about two-thirds of the gross domestic product (GDP) and has employed almost three-fourths of the workforce. The livestock industry expanded rapidly, beginning in the 1960s, and during the 1980s livestock products constituted in excess of the total exports. Bananas and other fruits are grown along the Jubba and Shabeelle rivers; other crops include sugarcane, cotton, corn (maize), and sorghum. During the 1970s and '80s government efforts to revitalize the Somalian fishing industry improved the size of catches.

Industry, accounting for a negligible portion of the GDP and employing much less than one-tenth of the workforce, is small-scale and consists mostly of meat and fish processing and textile and leather-goods production. Most of the enterprises have been state-owned, but the private sector is of increasing importance. Electricity is limited to the urban areas and is entirely generated by thermal sources.

The national budget of Somalia normally has been divided into the ordinary budget, which was financed from internal sources, and the development budget, which was largely financed from overseas sources. Somalia is burdened by an increasing balance of payments deficit, and increasing amounts of foreign assistance have been required to offset deficits. Imports, composed largely of petroleum products, fertilizers and pesticides, basic manufactures, and foodstuffs, are supplied chiefly by western Europe. Italy, Saudi Arabia, and Yemen have been the chief markets for Somalia's exports of livestock, skins and hides, and bananas. The country has no railways, and internal transportation is by truck and bus. International and domestic air service is available, however, and there are several deep-water ports.

*Government and social conditions.* Since independence in 1960, Somalia has nominally been a republic. Its 1979 constitution vested executive power in the president and legislative authority in an elected People's Assembly, from which a central committee and cabinet were to be chosen. In reality, political parties as well as armed rebel groups have been based on loyalties to clan and region, and Somalia has never known stable, democratic rule. The central government collapsed in 1991, and control devolved into the hands of local clan leaders. In fact, no effective central government exists in the country. Much of Somalia's judicial system is based on Islāmic law, but an independent judiciary does not exist.

Health service in Somalia normally is provided through hospitals in the country's larger towns and cities, while a network of dispensaries serve the rural areas. Tuberculosis and leprosy are common diseases, but the major health problem is maternal and infant mortality. Doctors, however, are few, and medical supplies scarce; nurses and laboratory technicians are virtually unavailable. Social conditions are poor, and wages are at the subsistence level.

Education is officially compulsory at the primary level, but less than one-fifth of all primary-age children actually attend school. Secondary education is not compulsory. Somali National University (1954) at Mogadishu is the major institution of higher education. There are also vocational and teacher-training schools. Newspapers, printed in Arabic, Italian, or English, can be read only by a small educated elite. Radio Mogadishu and Radio Hargeysa broadcast daily in Somali.

*Cultural life.* Poetry is important in Somalia and deals with such subjects as war, peace, women, horses, and camels. Folk dancing is also a popular art. Somalis have a rich oral literature touching on subjects such as astronomy and astrology. The two principal cultural institutions in the country are the Garesa Museum and the National Theatre.

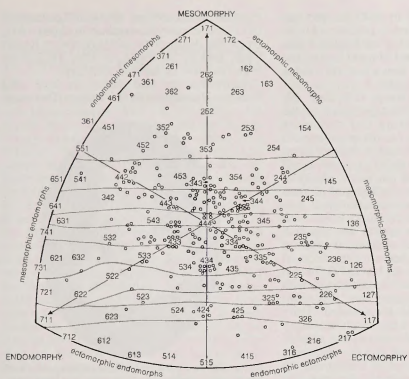
*History.* The northern and eastern Somali coasts probably formed part of Punt, mentioned in ancient Egyptian writings. Between the 7th and 10th century, immigrant Muslim Arabs and Persians developed trading posts along the Gulf of Aden and Indian Ocean coasts. By the 10th century the area inland from the Gulf of Aden was occupied by Somali nomads, and the south and west were inhabited by various groups of pastoral Oromo peoples. By this time Islām was firmly established in the trading centres of Mogadishu, Marka, Baraawe, Seylac, and Berbera. Intensive European exploration began after the British occupation of Aden in 1839. The British set up a protectorate in the north in 1884. In 1889 Italy acquired two protectorates in the northeast corner of Somalia, and in 1905 Italy assumed responsibility for another colony on the southern part of the Somali coast. In the early 1900s British rule of its dominions was hampered by Sayyid Maxamed Cabdulle Xasan, who rallied national Muslim solidarity against the British colonizers. In Italian Somaliland, however, Italian settlement was encouraged, and in 1936 Italian Somaliland was incorporated as a state in the Italian East African empire. During World War II the Italians invaded British Somaliland (1940); a year later British troops retook the area, and Britain administered the whole area until 1950, when Italian Somaliland became a United Nations trust territory, administered by Italy. In 1960 it was united with the former British Somaliland, and the two became the independent Republic of Somalia. In 1967 Cabdirashiid Cali Sherma'arke was elected president and Maxamed Xaaji Ibrahiim Cigaal became prime minister. Sherma'arke was assassinated in 1969, and the government of Prime Minister Cigaal fell to a military coup led by Major General Maxamed Siyaad Barre. Siyaad replaced the parliamentary regime with a Supreme Revolutionary Council consisting of military officers, formed the Somali Democratic Republic, and established strong relations with the Soviet Union. In 1977 Somalia invaded the Ogaden region of Ethiopia (inhabited almost entirely by ethnic Somalis) in an unsuccessful attempt to annex the territory. When the Soviet Union switched its support to Ethiopia, Siyaad's armies were pushed back into Somalia, and hundreds of thousands of refugees from the Ogaden region filled camps near the Ethiopian border. Siyaad was ousted in 1991 by an alliance of clan-based rebel groups. The country fragmented into a number of regions, each controlled by a clan or an alliance of clans. Fighting disrupted agricultural production, which was already suffering the effects of a prolonged drought; an estimated 1.5 million Somalis were threatened with starvation. Beginning in December 1992 a multinational force, led by the United States, intervened to secure food supplies but withdrew in the face of violent clan assaults in 1995. The country remained fragmented throughout the rest of the century, until May 2000 when a conference of national leaders established a charter for a transitional government. In August the transitional national assembly elected Abdiqassim Salad Hassan interim president.

**Somaliland,** historically, the area now comprising Somalia and Djibouti.

The region probably formed part of the "Land of Punt" known to the ancient Egyptians. Between the 7th and the 12th century AD, Muslim traders from Arabia and Iran settled on the coast, founding the cities of Seylac and Berbera on the Gulf of Aden, and Marka, Baraawe, and Mogadishu along the Indian Ocean. They exported precious gums, ostrich feathers, and slaves, waged war against the Christian Ethiopians of the interior, and organized themselves into sultanates (Adal, centred at Aybar, and Ajuran, centred at Mogadishu). The nomadic Somalis, who occupied the northern part of the country between the 10th and the 15th centuries, adopted Islām and served in the armies of the sultanates. Gradually the sultanates themselves came under Somali control, and the Somalis expanded southward toward Kenya.

When the European nations began to partition Africa among themselves in the late 19th century, France already possessed (from 1862) a station at Obock near the mouth of the Red Sea, other areas of the north coast were occupied by Egypt, and southern Somaliland recognized the overlordship of the sultan of Zanzibar. By the end of the 1880s France had expanded its holdings to the area of present Djibouti, Britain had established a protectorate over the north coast opposite its base at Aden, and Italy controlled the remainder of the country. In the north the Muslim leader Sayyid Maxamed Cabdulle Xasan began a war against the British in 1899 and maintained his hold over the interior until his death in 1920. The Italians acquired Jubaland in the extreme south after World War I, and in 1936 they united their Somali possessions with Ethiopia to form Italian East Africa. The British won control of the Italian zone during World War II. In 1960 British and Italian Somaliland were united to form the independent Republic of Somalia. French Somaliland (renamed the French Territory of the Afars and Issas in 1967) became independent as the Republic of Djibouti in 1977. An independent Republic of Somaliland that was declared following the collapse of central government in Somalia in the early 1990s failed to achieve international recognition.

**somatotype,** human body shape and physique type. The term somatotype is used in the sys-




Distribution of somatotypes of a group

tem of classification of human physical types developed by U.S. psychologist W.H. Sheldon. In Sheldon's system, human beings can be classified as to body build in terms of three extreme body types: endomorphic, or round, fat type; mesomorphic, or muscular type; and ectomorphic, or slim, linear type. A somatotype number of three digits is determined for an individual classified by the system, with the first digit referring to endomorphy, the second to mesomorphy, and the third to ectomorphy; each digit is on a scale of one to seven. Hence the extreme endomorph has the somatotype 711, the extreme mesomorph 171, and the extreme ectomorph 117. The classification numbers are negatively correlated, so that a high number in one class precludes high numbers in the others; in practice, extreme types (711, 171, 117) are rare or nonexistent, and the person of normal build has a somatotype approaching 444, evenly balanced between extremes. *See also* ectomorph; endomorph; mesomorph.

**Sombart, Werner** (b. Jan. 19, 1863, Ermsleben, Saxony, Prussia—d. May 18, 1941, Berlin), German historical economist who incorporated Marxist principles in his theories despite his attraction to Nazi theories.

Sombart, the son of a wealthy landowner and politician, was educated in Berlin, Pisa, and Rome, obtaining his Ph.D. at the University of Berlin in 1888. After teaching at Breslau he was appointed to an academic position in Berlin (1906), becoming a full professor in 1918.

Sombart was initially an enthusiastic supporter of Marxism but later became more conservative and strongly anti-Marxist. Nevertheless, his historical works on classes and the evolution of economic society, especially *Modern Capitalism* (1902), shows strongly the influence of Marx in his methodological approach. In this and later studies of capitalism Sombart propounded an evolutionary view of capitalism but not one that predicted its decay. He envisaged three stages in its evolution: the phase of the pre-Industrial Revolution merchant adventurer, the entrepreneurial phase, and the cooperative phase, with public ownership in the third one.

Although his work could be interpreted as supporting the economic views of National Socialism he was unsuccessful in playing a part in Nazi politics. In his *Die Juden und das Wirtschaftsleben* (1911) he was harshly critical of the role of Jews in the development of the modern market system. Sombart was widely recognized in his day despite his Nazi sympathies. Since his death, his name has fallen into obscurity.

**sombrero,** broad-brimmed, high-crowned hat made of felt or straw, worn especially in Spain, Mexico, and the southwestern United States. The sombrero, its name derived from the Spanish word *sombra,* meaning "shade," first appeared in the 15th century. Gentlemen often wore tan, white, or gray felt sombreros, while the peasants wore straw.

In Mexico the brim of the sombrero could be as much as two feet (60 centimetres) wide.



Mexican charro wearing a sombrero
Constantine Manos—Magnum

Adopted by ranchers and frontiersmen in the United States, the sombrero was modified into the cowboy hat.

**Somdet Chao Phraya Si Suriyawong:** *see* Si Suriyawong, Somdet Chao Phraya.

**Somers (of Evesham), John Somers, Baron** (b. March 4, 1651, Whiteladies, Claines, near Worcester, Worcestershire, Eng.—d. April 26, 1716, Brookmans, near Mimms North, Hertfordshire), English statesman, the chief minister to King William III of England from 1696 to 1700, and the leader of the group of influential Whigs known as the Junto from 1696 to 1716.

Admitted to the bar in 1676, he made his reputation by assisting in the successful defense (1688) of the seven Anglican bishops who were brought to trial for sedition by the Roman Catholic king James II. After James was deposed by William of Orange (later King William III), Somers was elected to Parliament (1689), and he became chairman of the committee that drew up the Bill of Rights. William appointed him attorney general (1692) and lord keeper of the great seal (1693); by 1696 he had become the King's leading adviser and the spokesman for Whig opinion. He became lord high chancellor and was elevated to the peerage in 1697, but the Tory majority in the House of Commons attacked him so vigorously that William asked for his resignation in 1700. In 1701 he was impeached by the House of Commons for abuse of ministerial power and his role in the Partition Treaties, but the House of Lords acquitted him. Although Queen Anne (ruled 1702–14) made him lord president of the Privy Council in 1708, Somers fell from power when the Tories won control of the government in 1710. In 1714 he became a member of George I's privy council. He died two years later without issue, and the barony became extinct. See W.L. Sachse, *Lord Somers* (1975).



Somers, detail of a painting by Sir Godfrey Kneller, c. 1700–10; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

**Somerset,** county of southwestern England, bordered on the northwest by the Bristol Channel. It covers 1,322 sq mi (3,451 sq km) and has five administrative districts: Mendip and Sedgemoor in the north, Yeovil and Taunton Deane further south, and West Somerset. The county consists of a low-lying basin, called Sedgemoor, near the coast, bounded on the northeast by the Mendip Hills and on the west by Exmoor and the Quantock Hills. The Mendips and the Quantock Hills are designated Areas of Outstanding Natural Beauty, and a large part of West Somerset is made up of Exmoor National Park. Long scenic stretches of the county's coastline have been selected for conservation.

Prehistoric settlement occurred chiefly on the relatively open uplands, particularly the Mendip Hills, but a prehistoric lake village has been excavated at Glastonbury. The Romans mined lead and built villas. From the 7th century Somerset formed the westernmost part of the Kingdom of Wessex, and castles such as those at Dunster and Taunton were built after the Norman Conquest.

Somerset is mainly an agricultural county. Dairy farming and stock rearing are important, and there is some market gardening. The county is traditionally associated with cider production, and the village of Cheddar, in the Mendip Hills, has given its name to the cheese.

Limestone and sandstone are quarried in the upland areas of the county, and elsewhere sand and gravel are worked. Peat extraction is important on Sedgemoor. In 1965 a nuclear power station was completed on the coast at Hinkley Point. Tourists, very important to the economy, are drawn by the Bristol Channel resorts such as Minehead and Burnham and by a number of National Trust properties and other historic mansions open to the public. The M5 motorway, passing Bridgwater and Taunton, connects Somerset with England's heavily urbanized areas and acts as a ma-

jor artery in bringing summer visitors to the county. Pop. (1983 est.) 435,700.

**Somerset,** EARLS AND DUKES OF, titled English nobility of three creations, in the families Beaufort, Carr, and Seymour, grouped below chronologically and indicated by the symbol •.

**• Somerset, Edmund Beaufort, 1st duke of,** 1ST EARL OF DORSET, also called (1444–48) 4TH EARL OF SOMERSET (b. *c.* 1406—d. May 22, 1455, St. Albans, Hertfordshire, Eng.), English nobleman and Lancastrian leader whose quarrel with Richard, duke of York, helped precipitate the Wars of the Roses (1455–85) between the houses of Lancaster and York.

He was a member of the Beaufort family, which in the 1430s obtained control—with William de la Pole, duke of Suffolk—of the government of the weak king Henry VI (ruled 1422–61 and 1470–71). He was created earl of Dorset in 1441 and inherited the earldom of Somerset from his brother in 1444. A veteran of the English campaigns in France, Beaufort was appointed captain general in France in 1447, and in the following year he was created duke of Somerset.

His poor leadership was largely responsible for the reconquest of Normandy by the French in 1449–50. Public indignation over this disaster brought about the fall of Suffolk, but Somerset survived the storm and became Henry's chief minister. His unrelenting enemy was the powerful Richard, duke of York. Following Henry's mental collapse in July 1453, Parliament imprisoned Somerset (*c.* December 1453) and appointed York lord protector of the realm. The King recovered in December 1454, however, and shortly thereafter Somerset was restored to his former role in government. York then resorted to arms, and in May 1455 Somerset was killed by York's troops at the Battle of St. Albans.

**• Somerset, Henry Beaufort, 2nd duke of,** 2ND EARL OF DORSET (b. 1436—d. May 15, 1464, Hexham, Northumberland, Eng.), leading Lancastrian in the English Wars of the Roses.

He was the eldest son of Edmund Beaufort, the 2nd duke; and, as duke of Somerset, marquess of Dorset, and titular count of Mortain, he was the victorious Lancastrian commander at the battles of Wakefield (1460) and of St. Albans (1461). But he fled to Scotland after the disaster of Towton (1461) and was then attainted and condemned to forfeiture. Failing to get French help, he deserted to the Yorkists in 1463 and was restored to his position; but a further equivocation brought his attainder, forfeiture, and execution on the day of his defeat and capture as Lancastrian commander at the Battle of Hexham.

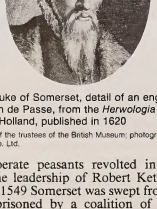
When his brother Edmund, "duke of Somerset" to the Lancastrians alone, was captured and beheaded at the Battle of Tewkesbury (May 6, 1471), the male line of Beauforts ended.

**• Somerset, Edward Seymour, 1st duke of,** BARON SEYMOUR OF HACHE, byname THE PROTECTOR, also called (1523–36) SIR EDWARD SEYMOUR, or (1536–37) VISCOUNT BEAUCHAMP OF HACHE, or (1537–47) EARL OF HERTFORD (b. *c.* 1500/06—d. Jan. 22, 1552, London), the Protector of England during part of the minority of King Edward VI (reigned 1547–53). While admiring Somerset's personal qualities and motives, scholars have generally blamed his lack of political acumen for the failure of his policies.

After the marriage of his sister, Jane Seymour, to King Henry VIII in 1536, he rose rapidly in royal favour. He became earl of Hertford in 1537, and in 1542 he was appointed lord high admiral, a post he soon relinquished. He commanded the English forces that invaded Scotland in 1544 and sacked Edinburgh; a year later he won a brilliant victory over the French at Boulogne.

After the death of Henry VIII (Jan. 28, 1547), Hertford was named protector by the regency council that Henry had nominated to run the government for the nine-year-old king Edward. He soon became duke of Somerset (Feb. 16, 1547) and for two and a half years acted as king in all but name. His chief rival for power was John Dudley, earl of Warwick. Somerset tried, unsuccessfully, to persuade the Scots to join a voluntary union with England, but, when his appeal was rejected, he destroyed all chances of reconciliation by invading Scotland and defeating the Scots at the Battle of Pinkie (Sept. 10, 1547). In domestic affairs, the Protector proceeded with moderation in consolidating the Protestant Reformation in England. He repealed Henry VIII's heresy laws, which had made it treason to attack the king's leadership of the church; the first *Book of Common Prayer,* which was imposed (1549) by an Act of Uniformity by Somerset, offered a compromise between Roman Catholic and Protestant learning. Nevertheless, these and other apparently moderate measures stirred up antagonisms that resulted in Catholic uprisings in western England in 1549.

Somerset attempted to aid the rural poor by forbidding enclosures—that is, the taking of arable common land by the propertied classes to use as pasturage—and this action led to his downfall. The landowners foiled his efforts;



The 1st Duke of Somerset, detail of an engraving by Willem van de Passe, from the *Herwologia Anglica,* by Henry Holland, published in 1620

By courtesy of the trustees of the British Museum: photograph, J.R. Freeman & Co. Ltd.

the desperate peasants revolted in Norfolk under the leadership of Robert Kett; and in October 1549 Somerset was swept from power and imprisoned by a coalition of Warwick and the propertied classes. When the coalition broke down, he was released in February 1550 and ostensibly reconciled with his rival. But in October 1551, the Duke of Northumberland (as Warwick was then called) had Somerset imprisoned on a trumped-up charge of treason. Four months later he was executed. A.F. Pollard's biography, *England Under Protector Somerset* (1900), presents a favourable picture of the Protector, but he is severely judged by M.L. Bush in *The Government Policy of Protector Somerset* (1975).

**• Somerset, Robert Carr, earl of,** Carr also spelled KER, also called (1607–11) SIR ROBERT CARR, or (1611–13) VISCOUNT ROCHESTER (b. *c.* 1590—d. July 1645), favourite of King James I of England from 1607 to 1615. His influence on governmental policy was slight, but he brought discredit on James's court by his involvement in a scandal.

Son of a Scottish nobleman, the handsome Carr first attracted James's interest in 1607. The King soon made him a gentleman of the bedchamber, and thereafter he rose rapidly in royal favour, becoming Viscount Rochester in 1611 and a privy councillor in April 1612. Upon the death of the chief minister, Robert Cecil, earl of Salisbury, in May 1612, Carr began to serve as James's secretary.

Meanwhile, he had fallen in love with Frances Howard, wife of Robert Devereux,



Robert Carr, earl of Somerset, oil painting after a portrait by J. Hoskins, *c.* 1620–25; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

3rd earl of Essex. He persuaded James to have a commission annul Frances' marriage, and during these proceedings Frances, probably with Carr's assistance, secretly poisoned Carr's former friend and mentor Sir Thomas Overbury (died Sept. 15, 1613), who had opposed the annulment. Carr and Frances were married in December 1613, shortly after Carr had been made earl of Somerset and treasurer of Scotland. He became lord chamberlain in 1614, but in the following year the circumstances of Overbury's death were made public. Somerset and Frances were found guilty of murder; they were imprisoned until 1621 and pardoned fully in 1624. Carr died 21 years later in obscurity.

**• Somerset, Charles Seymour, 6th duke of,** BARON SEYMOUR OF TROWBRIDGE (b. Aug. 12, 1662—d. Dec. 2, 1748, Petworth, Sussex, Eng.), British statesman during the reign of Queen Anne, who helped to secure the accession of George I of Hanover.

His brother, Francis Seymour, inherited the dukedom on the death of a cousin (the 4th duke) but was shot in 1678 at the age of 20 by a Genoese gentleman named Horatio Botti, whose wife Somerset was said to have insulted. Charles, who thus inherited the barony of Seymour of Trowbridge along with the dukedom of Somerset, was educated at Trinity College, Cambridge; and in 1682 he married a great heiress, Elizabeth, daughter of Joceline Percy, earl of Northumberland, who brought him immense estates, including Alnwick Castle, Petworth, Syon House, and Northumberland House in London. In 1683 Somerset received an appointment in the King's household, and two years later a colonelcy of dragoons; but at the Revolution of 1688 he bore arms for William of Orange.

Having befriended Princess Anne in 1692, he became a great favourite with her after her accession to the throne, receiving the post of master of the horse in 1702. Finding himself neglected by Marlborough, he made friends with the Tories and succeeded in retaining the Queen's confidence, while his wife replaced the Duchess of Marlborough as mistress of the robes in 1711. In the memorable crisis when Anne was at the point of death, Somerset acted with Argyll, Shrewsbury, and other Whig nobles who, by insisting on their right to be present in the privy council, secured the Hanoverian succession to the crown. He retained the office of master of the horse under George I until 1716, when he was dismissed and retired into private life.

**Somerset, Edward:** *see* Worcester, Edward Somerset, 2nd Marquess of.

**Somerset, FitzRoy James Henry:** *see* Raglan, FitzRoy James Henry Somerset, 1st Baron.

**Somerville,** city, Middlesex county, eastern Massachusetts, U.S. It lies along the Mystic River and is surrounded by Boston (Charlestown), Cambridge, Arlington, and Medford. Settled in 1630, it was originally known as the Cow Commons and was entirely fenced in until 1685. In the city stands the Old Powder House (*c.* 1704), from which the British general Thomas Gage seized gunpowder in 1774. Somerville was the last of the Mystic valley towns to separate (1842) from the early Charlestown colony. Its name is said to honour Captain Richard Somers, hero of the Tripolitan-American War. After the American Revolution, brickmaking became important, and the opening of the Middlesex Canal (1802), which passed through Somerville, added to its desirability as an industrial site. By 1835 the town was a regular stop on the new Boston and Lowell Railroad. Its greatest growth in population and industrial activity occurred after 1900, when slaughtering and meatpacking developed as the principal economic activities.

The city has become a residential and industrial suburb of Boston with some importance as a distribution centre. Inc. town, 1842; city, 1871. Pop. (1993 est.) 72,532.

**Somerville,** borough, seat (1784) of Somerset county, north-central New Jersey, U.S. It lies along the Raritan River. Settled by Dutch farmers in the late 17th century, it took its present name in 1801. The Wallace House (a state historic site) was headquarters for General George Washington during the winter of 1778–79. Somerville's growth was stimulated by the opening of the Delaware and Raritan Canal in 1834 and by the completion of the Elizabethtown and Somerville Railroad (later Jersey Central) in 1842. The borough is now a trade centre for nearby farm and industrial areas. Its light manufactures include drugs and electronic equipment.

The Old Dutch Parsonage (1751), a state historic site, was where Rutgers University (now in New Brunswick, a few miles southeast) and the New Brunswick Theological Seminary were first established. The Duke estate, established by tobacco magnate James B. Duke, is a research and exhibition centre for the New York Horticultural Society. The Knox-Porter Resolution ending the state of war between the United States and Germany was signed (July 2, 1921) by President Warren G. Harding at the Somerville estate of Joseph Frelinghuysen. Somerset County College (1968) is in the borough. Inc. town, 1863; borough, 1909. Pop. (1993 est.) 11,943.

**Somerville, William,** Somerville also spelled SOMERVILE (b. Sept. 2, 1675, Colwich, Staffordshire, Eng.—d. July 17, 1742, Henley-in-Arden, Warwickshire), British writer who, after studies directed toward a career at law, lived the life of a country gentleman, indulging in the field sports that were to make up the subject matter of his best-known poems, especially *The Chace* (1735). That poem traces the history of hunting up to the Norman Conquest of England (1066) and gives incidental information on kennel design, hare hunting, stag hunting, otter hunting, the breeding and training of dogs, and dog diseases and bites. Among the many digressions is one on Oriental hunting.

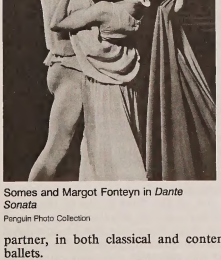
**Somerville and Ross,** also called E.Œ. SOMERVILLE AND MARTIN ROSS, pseudonyms of EDITH ANNA OENONE SOMERVILLE and VIOLET FLORENCE MARTIN (respectively b. May 2, 1858, Corfu, Greece—d. Oct. 8, 1949, Castlehaven, County Cork, Ire.; b. June 11, 1862, Ross House, County Galway, Ire.—d. Dec. 21, 1915, Cork, County Cork), Irish cousins and writers who collaborated on a series of novels and short stories that wittily and sympathetically portrayed Irish society in the late 19th century. Edith Somerville continued to use their joint pseudonym after her cousin's death, claiming that she was still inspired by her.

Violet Martin grew up in a genteel Protestant literary family living on a country estate, Ross House, in somewhat straitened finances. After her father's death in 1872, the family lived in Dublin, where she attended Alexandra College. Edith Somerville's father was a British army lieutenant colonel serving in Corfu who retired a year after her birth and returned the family to Drishane House in rural County Cork, where Somerville spent all her childhood. She studied briefly at Alexandra College and studied painting at studios in London, Düsseldorf, and Paris.

The 27-year-old Somerville and the 23-year-old Martin first met on Jan. 17, 1886, and began a literary partnership that resulted three years later in their first book, *An Irish Cousin* (1889). By the time that Martin died in 1915 they had cowritten 14 books, including a powerful novel called *The Real Charlotte* (1894) and a collection of short stories, *Some Experiences of an Irish R.M.* (1899), which, with its sequels, is their most popular work. After 1915 the Somerville and Ross name appeared on such Somerville works as *Irish Memories* (1917), *Mount Music* (1919), and *The Big House of Inver* (1925).

During their life together, the cousins resided at Ross House and Drishane House but traveled frequently, abroad and at home. Both were excellent horse riders to the fox and hounds, and Martin suffered a serious hunting accident in 1898, from which she never fully recovered. In later years Somerville often traveled, visiting Denmark and France and joining her friend the English composer, author, and feminist Dame Ethel Mary Smyth in trips to Italy and the United States.

**Somes, Michael,** in full MICHAEL GEORGE SOMES (b. Sept. 28, 1917, Horsely, Gloucestershire, Eng.—d. Nov. 18, 1994, London), English dancer, premier danseur and assistant director of the Royal (formerly Sadler's Wells) Ballet. His extensive repertoire included leading roles, frequently as Margot Fonteyn's



Somes and Margot Fonteyn in *Dante Sonata*
Penguin Photo Collection

partner, in both classical and contemporary ballets.

In 1934 Somes received the first scholarship given to a male by the Sadler's Wells School, and in 1935 he joined the ballet company. By 1937 he was appearing in solo parts; his first major creation was in Frederick Ashton's *Horoscope* (1938). After serving in World War II, he returned to create additional important roles in ballets choreographed by Ashton, including *Symphonic Variations* (1946), *Cinderella* (1948), *Daphnis and Chloë* (1951), *Tiresias* (1951), and *Ondine* (1958). He also performed in such classical ballets as *Swan Lake, Giselle,* and *The Sleeping Beauty.*

In 1950 Somes succeeded Robert Helpmann as Margot Fonteyn's official partner, and in 1959 he was made a Commander of the Order of the British Empire. After retiring as premier danseur (1961), he became assistant director of the Royal Ballet in 1963 and appeared in pantomime roles such as the Father in *Marguerite and Armand* (1963). Leaving his assistant directorship in 1970, he remained with the Royal Ballet as its principal teacher until 1984.

**Someş River,** Hungarian SZAMOS, river, one of the most important in Transylvania, northwestern Romania. It has two headstreams: the Great Someş, which rises in the Rodnei Mountains and flows southwest, and the Little Someş, which rises in the Apuseni Mountains as the Someşu Cald and Someşu Rece and flows northeast. The two headstreams flow rapidly out of the mountains to meet at the town of Dej in the Transylvanian Basin. From there the river follows a zigzag course toward the northwest to enter the Tisza (Tisa) River in Hungary after a course of about 250 miles (400 km), including either headstream. Between Dej and the Tisza, the Someş is joined by several tributaries. The city of Satu Mare is located on the Someş.

**somite,** in embryology, one of a longitudinal series of blocklike segments into which the mesoderm, the middle layer of tissue, on either side of the embryonic spine becomes divided. Collectively, the somites constitute the vertebral plate. Out of the somites arise the sclerotome, forerunner of the bodies and neural arches of the vertebrae; the dermatome, precursor of the connective tissue of the skin; and the myotome, or primitive muscle, from which the major muscles of vertebrates are derived. The term somite is also used more generally to refer to a body segment, or metamere, of a segmented animal.

**Somme,** *département,* Picardie *région,* northern France. Somme fronts the English Channel for about 30 miles (48 km) and embraces the valley of the river that bears its name. With an area of 2,382 square miles (6,170 square km), it was created from a large part of the historic province of Picardy, or Picardie, and also from a small portion of the neighbouring province of Artois. The estuary of the Somme River and the Bay of Somme occupy a large part of the low-lying coast.

The Somme River flows generally from the east to the northwest along its marshy valley through Péronne, Amiens (capital of the Somme *département*), and Abbeville. The Bresle River, to the south, and the Authie, to the north, flow parallel to the Somme along the borders of the *département.*

The climate is mainly oceanic, with frequent showers. The land is extremely fertile in the southwest where the cliffs rise above the English Channel. The estuaries of the Somme and the Authie have silted up, creating marshlands beyond the cliffs. Sand dunes have formed along the shore, which is dotted with harbours and small seaside resorts. Cattle and market gardens flourish in the reclaimed marshland and along the river valleys. Cereals, fodder, and sugar beets are grown and cattle are raised on the rolling chalk plateau of Picardie, which extends over most of the *département.* There are some industries (tex-

tiles, food processing, metals, chemicals, and rubber) in the vicinity of Amiens, Abbeville, Vimeu, and other towns; but the region is predominantly rural. Many cemeteries mark the Somme valley battlefields of World War I, located in a region over which armies have fought throughout French history. The *département* has four *arrondissements:* Amiens, Abbeville, Jimeu, Montdidier, and Péronne. It is in the educational division of Amiens. Pop. (1990) 547,825.

**Somme, First Battle of the** (July 1–Nov. 13, 1916), costly and largely unsuccessful Allied offensive on the Western Front during World War I.

The Germans were securely entrenched and strategically located when the British and French launched their frontal attack on a 21-mile (34-kilometre) front north of the Somme River. A week-long artillery bombardment preceded the British infantry's "going over the top," but the latter were nevertheless mown down as they assaulted the virtually impregnable German positions. The British sustained nearly 60,000 casualties (20,000 dead) on the first day of the attack. In September the British introduced their new weapon, the tank, into the war for the first time, but with little effect on the battle. The Somme offensive gradually deteriorated into a battle of attrition. In October torrential rains turned the battlefield into an impassable sea of mud, and by mid-November the Allies had advanced only 5 miles (8 km).

Although the figures have been much disputed, the casualties from the First Battle of the Somme perhaps amounted to roughly 650,000 German, 195,000 French, and 420,000 British. The Battle of the Somme became a metaphor for futile and indiscriminate slaughter. By taking the offensive in the Somme, the Allies did manage to relieve the German pressure on Verdun, however.

**Somme, Second Battle of the,** also called BATTLE OF SAINT-QUENTIN (March 21–April 5, 1918), partially successful German offensive against Allied forces on the Western Front during the later part of World War I.

The German commander, General Erich Ludendorff, believed that it was essential for Germany to use the troops freed from the Eastern Front by the collapse of Russia to achieve a victory on the Western Front in the spring of 1918, before American troops arrived in sufficient numbers to effectively reinforce the warweary Allies. His first offensive was directed against the rather weak British armies north of the Somme River, between Arras and La Fère. The British trenches were shelled and gassed before a massive morning attack in dense fog, which took the British by surprise. Their first and second lines quickly fell, and by March 22 the shattered British 5th Army was in retreat and had lost contact with the French to the south. The Germans moved rapidly forward, hoping to drive a permanent wedge between the French and the British, but by March 28, the Allies had quickly assembled new troops that checked the German advance east of Amiens. The German offensive had obtained the single largest territorial gain on the Western Front since the early months of the war in late 1914. The Germans had advanced almost 40 miles (64 km) and had taken about 70,000 prisoners, but in spite of these gains the Allied lines were only bent, not broken.

**Somme River,** river, northern France. It rises in the hills at Fonsommes, near Saint-Quentin in the Aisne *département,* and flows generally westward for 152 miles (245 km) to the English Channel, crossing Somme *département* and the ancient province of Picardy. From Amiens, near which its headstreams (including the Ancre and Avre) converge, the Somme follows the floor of a trench across the chalk country. Its valley is a marshy belt; and its line, an important barrier in the approaches from Flanders toward Paris, was of great strategic importance during World War I. The name Somme is derived from the Celtic *samara,* meaning "tranquil." The upper basin of the Somme was the scene of heavy fighting during World War I, particularly the First Battle of the Somme (July–November 1916). The valley was occupied by the Germans in May–June 1940 in World War II and was recovered by the Allies in August 1944.

The basin of the Somme River occupies about 2,300 square miles (6,000 square km). Below Abbeville the Somme enters a sand-encumbered estuary, which requires constant dredging, with the port of Saint-Valéry-sur-Somme situated at its mouth. From the river's upper valley there are canals to the Oise and the Escaut, or Scheldt, rivers, connecting it with the navigable waterways that link Paris and Flanders.

**Sommeiller, Germain** (b. March 15, 1815, Saint-Jeoire, Fr.—d. July 11, 1871, Saint-Jeoire), French engineer who built the Mount Cenis (Fréjus) Tunnel in the Alps, the world's first important mountain tunnel.

While working at the University of Turin on the construction of a compressed-air ram to supply extra power to locomotives on steep grades, Sommeiller conceived the idea of adapting the machine to rock drilling, for which steam power was not suited because of the difficulty of transmitting it over distances. Commissioned to drive the 7-mile (12-kilometre) tunnel under Mount Cenis, between France and Switzerland, Sommeiller introduced his new drill, which he perfected by trial and error, and a little later, dynamite, just invented by Alfred Nobel. The tunnel was completed in December 1870.

**Sommer, Ferdinand** (b. May 4, 1875, Trier, Ger.—d. April 3, 1962, Munich), German historical linguist known primarily for his scholarship concerning Hittite and the classical languages.

During his academic career, Sommer held professorships at the universities of Basel (1902–09), Rostock (1909–13), Jena (1913–24), Bonn (1924–26), and Munich (1926–51). His most important works include *Handbuch der lateinischen Laut- und Formenlehre* (1902; "Handbook of Latin Phonology and Morphology"); *Zur Geschichte der griechischen Nominalkomposita* (1948; "Contributions to a History of the Greek Nominal Compounds"); and a number of significant contributions to Hittite studies, including *Die Ahhijava-Urkunden* (1932; "The Ahhiyawa Documents") and *Hethiter und Hethitisch* (1947; "Hittites and the Hittite Language").

**Sommerfeld, Arnold (Johannes Wilhelm)** (b. Dec. 5, 1868, Königsberg, Prussia [now Kaliningrad, Russia]—d. April 26, 1951, Munich), German physicist whose atomic model permitted the explanation of fine-structure spectral lines.

After studying mathematics and science at Königsberg University, Sommerfeld became an assistant at the University of Göttingen and then taught mathematics at Clausthal (1897) and Aachen (1900).

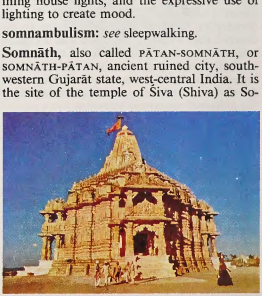
As professor of theoretical physics at Munich (1906–31), he did his most important work. His investigations of atomic spectra led him to suggest that, in the Bohr model of the atom, the electrons move in elliptical orbits as well as circular ones. From this idea he postulated the azimuthal quantum number. He later introduced the magnetic quantum number as well. Sommerfeld also did detailed work on wave mechanics, and his theory of electrons in metals proved valuable in the study of thermoelectricity and metallic conduction.

**Sommo, Judah Leone ben Isaac,** also called LEONE DE SOMMI PORTALEONE, original name YEHUDA SOMMO (b. 1527, Mantua [Italy]—d. 1592, Mantua), Italian author whose writings are a primary source of information about 16th-century theatrical production in Italy.

Sommo wrote the first known Hebrew drama, *Tzaḥut hediḥuta de-qiddushin* (1550; "An Eloquent Comedy of a Marriage"), in which characters such as the pining lover, the comic servant, and the crafty lawyer reflect the influence of the Italian commedia dell'arte. Sommo's experience as a playwright and producer of dramas for various noble patrons was the basis for his *Dialoghi in materia di rappresentazioni sceniche* (c. 1565; *Dialogues on the Art of the Stage*), a summation of contemporary theatre practice containing one of the earliest extant discussions of stage lighting. It gives directions on the use of small reflectors to intensify lighting, the importance of dimming house lights, and the expressive use of lighting to create mood.

**somnambulism:** *see* sleepwalking.

**Somnāth,** also called PĀTAN-SOMNĀTH, or SOMNĀTH-PĀTAN, ancient ruined city, southwestern Gujarāt state, west-central India. It is the site of the temple of Śiva (Shiva) as So-



Temple of Śiva at Somnāth, Gujarāt, India
Baldev—Shostal Assoc.

manātha (which means "lord of the *soma,*" a sacred intoxicating drink, and, by extension, "lord of the Moon"). The temple was sacked by the Turkic Muslim invader Maḥmud of Ghazna in AD 1024–25. Reconstructed in 1169, it was destroyed again in the final Muslim invasions of the late 13th century. Subsequently rebuilt and destroyed on several occasions, it was reconstructed again beginning in 1951. According to an ancient tradition in the Indian epic *Mahābhārata,* Somnāth was the scene of the internecine massacre of the Yādava clan and of the subsequent death of Krishna, the eighth incarnation of Vishnu. Recent excavations there have revealed a settlement dating from about 1500 BC.

Pātan, a port on the old city site, is now overshadowed by the adjacent port of Verāval.

**Somnus** (Greco-Roman god): *see* Hypnos.

**Somogy,** *megye* (county), southwestern Hungary. It extends from the southern shore of Lake Balaton to the Yugoslav frontier with an area of 2,331 square miles (6,036 square km). Once known for its combination of great landed estates and poverty-stricken peasants, it initiated the development of cooperative farms in the 20th century. The main crops are now rye, potatoes, sugar beets, and tobacco. Pigs and sheep are raised, and the swineherds and shepherds developed an art of intricate wood carving for which Somogy is nationally famous. The Lake Balaton shoreline is a recreation area, with Siófok the local focus. Kaposvár (*q.v.*), the *megye* seat, is the principal market town. In the Völgység district the population is mixed Magyar and German with migrants from Transylvania, Bukovina, and the Great Alföld. There is a small petroleum and natural-gas field in southern Somogy, around Babócsa. Pop. (1990 prelim.) 344,925.

**Somolu** (Nigeria): *see* Shomolu.

**Somoza** FAMILY, family that maintained political control of Nicaragua for 44 years.

The founder of the dynasty, Anastasio Somoza García (b. Feb. 1, 1896, San Marcos, Nicaragua—d. Sept. 29, 1956, Ancón, Panama Canal Zone [now Panama]), was the son of a wealthy coffee planter and was educated in Nicaragua and the United States. By marrying the daughter of a prominent Nicaraguan family, he ensured himself a secure political career. He rose quickly through the political ranks to become head of Nicaragua's army, the National Guard, in 1933. With the army at his disposal, he three years later deposed the elected president, Juan Bautista Sacasa; Somoza assumed the office on Jan. 1, 1937. Although he was officially not president from 1947 to 1950, his position as commander in chief guaranteed his continuous, firm rule; his authority was again made official by his election to a presidential term beginning in 1951.

Somoza's administration fostered reforms and made Nicaragua less dependent on banana income. At the same time, however, Somoza amassed a considerable personal fortune, exiled most of his political opponents, and took over the ownership of large areas of land and many businesses.

Following the assassination of Somoza, the presidency passed to his elder son, Luis Somoza Debayle (b. Nov. 18, 1922, León, Nicaragua—d. April 13, 1967, Managua). He won election to his own term of office (1957–63), during which he extended the family's business interests and, by most accounts, ruled more gently than had his father. After he refused to run for a second term, the presidency was held until 1967 by politicians favourable to the Somoza family.

His younger brother, Anastasio Somoza Debayle (b. Dec. 5, 1925, León, Nicaragua—d. Sept. 17, 1980, Asunción, Paraguay), then won the presidency in a general election. He ruled aggressively in the manner of his father, and he continued to expand the family's fortune. He relinquished his office in 1972 but in 1974 returned to the presidency under a new constitution that permitted him to rule until 1981. Violent insurrection against the alleged oppression of Somoza's rule, as well as foreign accusations of violations of human rights, led to his resignation in 1979, and he was assassinated while in exile.

**son et lumière,** English SOUND-AND-LIGHT SHOW, nighttime entertainment conceived by Paul Robert-Houdin, curator of the Château de Chambord on the Cosson River, France, where the first one was presented in 1952. Multicoloured lights of changing intensity are directed against the facade of a historic building or ruin. The changes of light are synchronized with a sound track (relayed through loudspeakers) carrying music and the dramatized story of the site. Usually, no live participants appear. Live effects such as smoke bombs or fireworks are occasionally used.

The medium rapidly became popular in France, where, by the late 20th century, about 50 annual productions took place, notably in the Loire River valley, Versailles, and Invalides. European productions outside France included those in Rome (the Forum) and Athens (the Parthenon). The first British performance was produced in 1957 (Greenwich Palace) and the first U.S. presentation in 1962 (Independence Hall, Philadelphia). The first African production took place at Cairo, Egypt (the Pyramids of Giza), in 1961; the first Asian production was at Delhi, India (the Red Fort), in 1965. *Son et lumière* is also produced at the ruins of Teotihuacán, near Mexico City, and elsewhere.

**Son La,** town, northwestern Vietnam, about 190 miles (310 km) northwest of Hanoi. Son La is a market centre for an agricultural area specializing in corn (maize) and tea but also producing rice, cotton, and livestock. The population of the region is made up predominantly of the Tai Dam (Black Thai), but there are also Meo, Tai Khao (White Thai), and Muong peoples. There is an airport at nearby Na San. Pop. (2001 est.) 18,400.

**Son Pyŏng-hi** (b. 1861—d. 1922), third leader of the apocalyptic, antiforeign Tonghak religious sect in Korea.

Born the illegitimate son of a low-echelon government official, Son grew up in poverty, suffering much discrimination. In 1897 he was elected to the leadership of Tonghak, succeeding Ch'oe Si-hyŏng, and he successfully reconstructed the sect, which had been hurt by the failure of its uprising in 1894.

Branded a political criminal by the state, he went into exile in Japan. When Korea lost its sovereignty to Japan in 1905, he renamed the Tonghak sect the Ch'ŏndogyo (*q.v.*; literally "Religion of the Heavenly Way") and set about reorganizing it as a genuine religion. He undertook educational and cultural projects, running or supporting schools, conducting enlightenment programs for Ch'ŏndogyo followers, and leading campaigns for constructive living. In 1919 he led the nationwide movement for Korean independence.

**Son River,** also spelled SONE, principal southern tributary of the Ganges River, rising in Madhya Pradesh state, central India. It flows north past Manpur and then turns northeast. The river cuts through the Kaimur Range and joins the Ganges above Patna, after a 487-mile (784-kilometre) course. The Son valley is geologically almost a continuation of that of the Narmada River to the southwest. Largely forested, it is sparsely populated. The valley is bordered by the Kaimur Range (north) and the Chota Nāgpur plateau (south). The river's flow is seasonal, and the Son is unimportant for navigation. Dams have been constructed on some of its tributaries, and at Dehri, Uttar Pradesh state, are the headworks of the Son Canal system.

**sonar** (from "*so*und *na*vigation *r*anging"), technique for detecting and determining the distance and direction of underwater objects by acoustic means. Sound waves emitted by or reflected from the object are detected by sonar apparatus and analyzed for the information they contain.

Sonar systems may be divided into three categories. In active sonar systems an acoustic projector generates a sound wave that spreads outward and is reflected back by a target object. A receiver picks up and analyzes the reflected signal and may determine the range, bearing, and relative motion of the target. Passive systems consist simply of receiving sensors that pick up the noise produced by the target (such as a ship, submarine, or torpedo). Waveforms thus detected may be analyzed for identifying characteristics as well as direction and distance. The third category of sonar devices is acoustic communication systems, which require a projector and receiver at both ends of the acoustic path.

Sonar was first proposed as a means of detecting icebergs. Interest in sonar was heightened by the threat posed by submarine warfare in World War I. An early passive system, consisting of towed lines of microphones, was used to detect submarines by 1916, and by 1918 an operational active system had been built by British and U.S. scientists. Subsequent developments included the echo sounder, or depth detector, rapid-scanning sonar, side-scan sonar, and WPESS (within-pulse electronic-sector-scanning) sonar.

The uses of sonar are now many. In the military field are a large number of systems that detect, identify, and locate submarines. Sonar is also used in acoustic homing torpedoes, in acoustic mines, and in mine detection. Nonmilitary uses of sonar include fish finding, depth sounding, mapping of the sea bottom, Doppler navigation, and acoustic locating for divers.

A major step in the development of sonar systems was the invention of the acoustic transducer and the design of efficient acoustic projectors. These utilize piezoelectric crystals (*e.g.*, quartz or tourmaline), magnetostrictive materials (*e.g.*, iron or nickel), or electrostrictive crystals (*e.g.*, barium titanate). These materials change shape when subjected to electric or magnetic fields, thus converting electrical energy to acoustic energy. Suitably mounted in an oil-filled housing, they produce beams of acoustic energy over a wide range of frequencies.

In active systems the projector may be deployed from an air-launched sonobuoy, hull-mounted on a vessel, or suspended in the sea from a helicopter. Usually the receiving and transmitting transducers are the same. Passive systems are usually hull-mounted, deployed from sonobuoys, or towed behind a ship. Some passive systems are placed on the seabed, often in large arrays, to provide continuous surveillance.

**sonata,** form of musical composition for one or more instruments, usually consisting of three or four movements that are contrasted in rhythm and mood but related in tonality.

A brief treatment of the sonata follows. For full treatment, *see* MACROPAEDIA: Musical Forms and Genres.

The use of the word sonata is associated with the rise of instrumental music: its derivation from the Italian *sonare* implies something sounded, as opposed to cantata, something sung. The term first appeared in the 13th century and became widespread toward the end of the 16th century, when instrumental music began to be written in much greater quantities. At that stage its meaning was quite general: Giovanni Gabrieli wrote sonatas for several groups of instruments, to be performed in a church, as well as ones for more modest ensembles.

During the 17th century more precise definitions began to emerge, and the sonata took on its association with small groups of instruments, the names sinfonia, symphony, and concerto being introduced for larger ensembles. At the same time, it became common practice for sonatas to be written in several separate sections, or movements, contrasting in speed, and to be scored for one or two soloists with harmonic support, usually supplied by a keyboard and a bass instrument such as the viola da gamba (a stringed instrument of the period); the two-soloist type is normally called the trio sonata, and it became the central form of chamber music for Baroque composers from Arcangelo Corelli and Henry Purcell to Johann Sebastian Bach and George Frideric Handel. Another development of the period was the distinction between the *sonata da chiesa* (church sonata) and the *sonata da camera* (chamber sonata), a distinction that cut across that between the solo and trio sonata. Church sonatas usually had four movements in a slow-fast-slow-fast pattern; the genre survived until the end of the 18th century. Chamber sonatas were less standardized, sometimes having sequences of dances, as did suites, or the fast-slow-fast pattern that became usual in the Classical period.

Around the middle of the 18th century the trio sonata began to disappear, and with the rise of keyboard virtuosity the sonata for solo harpsichord increased in importance. Domenico Scarlatti wrote more than 500 such sonatas in single-movement form. As Joseph Haydn and Wolfgang Amadeus Mozart understood the sonata, it was in essence a keyboard

solo, perhaps with one other instrument taking a subsidiary part. Both composers adopted the three-movement fast–slow–fast pattern as standard. Beethoven also adhered to this convention in his 32 piano sonatas, though with significant deviations: his last sonata, for instance, has only two movements. He did not, however, accept the dominance of the piano in sonatas with other instruments, and in his violin and cello sonatas the string player becomes an equal partner.

To the next generation of composers the sonata seemed an old-fashioned and constricted form. Robert Schumann and Frédéric Chopin felt more at ease in genres of their own devising; Franz Liszt incorporated a literary program in his *Après une lecture de Dante* and combined the normally successive movements of the sonata into a single span in his Sonata in B Minor. The duo sonata fell into a decline until near the end of the 19th century and the appearance of the late works of Johannes Brahms and César Franck.

In the 20th century the use of the term sonata has become as confused as it was in the Renaissance. Piano sonatas have been composed with explicit reference to the works of Beethoven, including the sonatas of Sir Michael Tippett and Pierre Boulez, but otherwise the form and instrumentation of sonatas has become much freer.

The term sonata form denotes both the organization of tonal material within a movement and the relationship between movements. The main divisions within a movement in sonata form are the exposition, the development, and the recapitulation.

In the exposition the two-part tonal material has an inherent element of contrast. Its themes, though not necessarily two in number, present a conflict of mood. The tension between these parts is heightened by a conflict of key: the opening material is in the tonic key; the contrasting material is in a second key, normally in a close relationship to the tonic but sufficiently distinct to mark a certain distance from the starting point.

In the development any portion of the preceding material and in many cases new, or seemingly new, material may appear in any order and in any combination. Frequently the material is broken down into its constituent fragments, and these fragments are themselves combined and developed. Opposing moods are illustrated and made to interact. Toward the end of the development section a sense of premonition is introduced that is fulfilled by a return of the tonic key and, with it, the original opening material.

In the recapitulation both of the opposites that set up their contrasting tonalities and moods in the exposition are heard again and in the same order. Instead of appearing in a key or keys contrasted with the tonic key, the opposing material now appears in the same, or mainly in the same, key as the opening material. The tension of the opposites is not so much relaxed as brought into balance. A coda may then follow, sometimes of such elaborate proportions as to simulate further development; but a sonata-form movement is complete only if it ends with reconciliation.

**sonata da camera** (Italian: "chamber sonata"), a type of trio sonata (*q.v.*) intended for secular performance.

**sonata da chiesa** (Italian: "church sonata"), a type of trio sonata (*q.v.*).

**sonatina,** in music, curtailed form of the sonata, usually in three short movements, or independent sections. The first movement normally follows the sonata form with respect to the exposition and recapitulation of the musical materials but not necessarily the development section, which is either quite perfunctory or lacking altogether. The sonatina form without development is also found in certain slow movements of full-fledged 18th-century sonatas and in opera overtures (*e.g.*, Mozart's *Marriage of Figaro*).

Early piano sonatinas, including those of Muzio Clementi (1752–1832) and Friedrich Kuhlau (1786–1832), were often intended for pedagogical purposes. Later piano sonatinas, on the other hand, including those of Maurice Ravel (1875–1937) and Ferruccio Busoni (1866–1924), require considerable technical proficiency. Less common are sonatinas for instruments other than piano, such as that for violin, viola, and cello by Darius Milhaud (1892–1974).

**Sønderborg,** port and seaside resort, Sønderjyllands *amtskommune* (county), Denmark, on the southwestern coast of Als Island. It was founded in the mid-13th century around Sønderborg Castle and chartered in 1461. King Christian II was a prisoner at the castle 1532–49. The city was razed in 1864 during a Prussian assault on Danish trenches near Dybbøl nearby Dybbøl Mill, site of heroic Danish resistance, became a symbol of national unity. It passed to Germany and, as a part of the North Slesvig region, was restored to Denmark by a plebiscite in 1920. Sønderborg Castle now houses a museum. The city's chief products are textiles, machinery, furniture, chemicals, margarine, and beer. Pop. (1981) city, 26,885; (1982 est.) mun., 27,867.

**Sonderbund** (German: Separatist League), formally SCHUTZVEREINIGUNG (Defense Union), league formed on Dec. 11, 1845, by the seven Catholic Swiss cantons (Luzern, Uri, Schwyz, Unterwalden, Zug, Fribourg, and Valais) to oppose anti-Catholic measures by Protestant liberal cantons. The term Sonderbund also refers to the civil war that resulted from this conflict.

In 1841 the government of the Aargau canton decreed the dissolution of the Catholic monasteries in its territory, despite the fact that the Federal Pact (constitution of 1815) had guaranteed the monasteries' property. The seven Catholic cantons in 1843–44 agreed that they would dissociate themselves from any canton disloyal to the Federal Pact, and in 1844 the Jesuits, whom 19th-century liberals detested, were invited to take charge of religious education in Luzern. This cantonal act, although constitutionally permissible, provoked widespread popular indignation, and a Bernese staff officer led bands of volunteers from Protestant cantons in an unsuccessful expedition against Luzern in the spring of 1845. The Catholic cantons' subsequent formation of the so-called Sonderbund was even more vehemently denounced by the liberal and radical cantons.

In the summer of 1847, a reformist majority in the Swiss Diet voted for the dissolution of the Sonderbund, for the drafting of a new Federal Pact, and for the expulsion of the Jesuits. The Sonderbund, led politically by Konstantin Siegwart-Müller of Luzern, took up arms in November 1847 and appealed for help from abroad, but neither its military organization, commanded by Johann Ulrich von Salis-Soglio, nor its appeal were satisfactorily effective. The forces of the majority, ably led by Henri Dufour, took Fribourg on November 14 and Zug on November 21; they won a decisive victory at Gislikon on November 23, entered Luzern itself, the nucleus of the Sonderbund, on November 24, and subdued Valais on Nov. 28, 1847. The peace settlement of 1848 required the former members of the Sonderbund to pay 6,000,000 francs for the cost of the war and charged the cantons of Appenzell Inner-Rhoden and Neuchâtel 15,000 and 300,000 francs, respectively, as fines for having been neutral; a new constitution for Switzerland also was adopted. In 1852 the unpaid balance of the war costs was written off.

**Sønderjyllands,** *amtskommune* (county), southern Jutland, Denmark, created in 1970 from the former counties of Tønder, Abenrå-Sønderborg, and Haderslev, with an area of 1,517 sq mi (3,929 sq km). Bounded by the North Sea, the Little Belt, and Germany, the county comprises the historical region of North Slesvig, which passed to Germany in 1864 and was returned to Denmark after a plebiscite in 1920. While the western portion is sometimes marshy, the eastern section has fertile clay loams, and agriculture, livestock raising, and dairying are carried on throughout the county. The administrative centre is at Abenrå (*q.v.*). Christiansfeld in the north was laid out in 1773 by the Moravians, whose famous honey-cake bakery, museum, and cemetery remain. Pop. (1982 est.) 250,409.

**Sondheim, Stephen (Joshua)** (b. March 22, 1930, New York City), U.S. composer and lyricist whose brilliance in matching words and music in dramatic situations broke new ground for Broadway musical theatre.

Precocious as a child, he early showed musical aptitude among other wide-ranging interests. He studied piano and organ, and at 15 wrote a musical at the George School in Bucks County, Pa. Under the tutelage of a family friend, Oscar Hammerstein II, he studied musical theatre. He also studied music at Williams College, Williamstown, Mass., and wrote college shows there. When he graduated in 1950, he received the Hutchinson Prize for composition, a fellowship. He then studied further in New York with the composer Milton Babbitt.

In the early 1950s he wrote scripts in Hollywood for the "Topper" television series. Returning to New York, he wrote incidental music for *The Girls of Summer* (1956). He made his first mark on Broadway as the lyricist for Leonard Bernstein's *West Side Story*, which opened Sept. 26, 1957, in New York City. He was also lyricist for *Gypsy* (1959; music by Jule Styne).

*A Funny Thing Happened on the Way to the Forum*—based on comedies by the Roman playwright Plautus—opened in New York City on May 8, 1962, with music and lyrics by Sondheim. It ran for 964 performances. Two years later, his *Anyone Can Whistle,* closed after only nine performances in April 1964.

Sondheim later won Tony awards for a number of Broadway productions of shows with his music and lyrics—*Company* (1970), on marriage and bachelorhood; *Follies* (1971), which includes many pastiche songs; *A Little Night Music* (1973), based on Ingmar Bergman's *Smiles of a Summer Night* (1955); and *Sweeney Todd: The Demon Barber of Fleet Street* (1979). Harold Prince, producer of the first three shows, also produced *Pacific Overtures* (1976), in which Sondheim looked to Kabuki for stylized effects.

He later collaborated as composer–lyricist with playwright–director James Lapine to create *Sunday in the Park With George,* which opened on Broadway May 2, 1984, after a lengthy preparation. This musical was inspired by the painting "Sunday Afternoon on the Island of la Grande Jatte" by the pointillist Georges Seurat.

Sondheim's acerbic lyrics hit responsive chords with many. Most critics agree that his work marked a break from more traditional and sentimental musical comedies of the earlier decades of the century. "Sondheim: A Musical Tribute" was staged in New York City, March 11, 1973.

*The Last of Sheila* (1973) is a nonmusical film mystery that Sondheim, an enthusiast for games and puzzles (featured in the film), wrote with Anthony Perkins.

*Sondheim & Co.* (1974), by Craig Zadan, is a lively history of Sondheim's work with quota-

tions from him and his associates. Appendixes cover Broadway and other stage productions, original-cast recordings, and motion-picture sound-track recordings.

**Søndre Strømfjord,** inlet, southwestern Greenland, located just north of the Arctic Circle and 60 miles (95 km) southeast of Holsteinsborg. About 120 miles (190 km) long and 1–5 miles (1.5–8 km) wide, the inlet extends northeastward from Davis Strait to the edge of the inland ice cap, where its arms are fed by several glaciers. Near the head of the inlet is Bluie West 8 (BW 8), a U.S. World War II air base, which now serves as a transpolar intermediate stop between Scandinavia and North America.

*Consult the* INDEX *first*

**Sondrio,** city, capital of Sondrio *provincia,* Lombardia (Lombardy) *regione,* northern Italy; it is the chief town of the Valtellina (the upper Adda River valley), near the mouth of the Mallero River, and lies at an elevation of 1,017 feet (310 m), north of Bergamo. It has an archaeological museum, and its old castle, Castello Masegra, is now a barrack. The city, well-known for its wines (notably Sassella), is an agricultural and commercial centre and has cotton and silk textile industries. Sondrio is also a tourist base linked by cableways with nearby Alpine resorts, including Bormio and Santa Caterina Valfurva. It is connected by rail and road with Switzerland via Tirano and the Bernina Pass and by road with the Stelvio Pass and with Bolzano. Pop. (1991 prelim.) mun., 22,817.

**Sone River** (India): *see* Son River.

**sone,** unit of loudness. Loudness is a subjective characteristic of a sound (as opposed to the sound-pressure level in decibels, which is objective and directly measurable). Consequently, the sone scale of loudness is based on data obtained from subjects who were asked to judge the loudness of pure tones and noise. One sone is arbitrarily set equal to the loudness of a 1,000-hertz tone at a sound level of 40 decibels above the standard reference level (*i.e.,* the minimum audible threshold). A sound with a loudness of four sones is one that listeners perceive to be four times as loud as the reference sound.

**Sonepat,** city, east-central Haryāna state, northern India, 27 miles (43 km) north of New Delhi. The city was probably founded by early Aryan settlers about 1500 BC and flourished on the banks of the Yamuna River, which now has receded 9 miles (14 km) to the east. Mentioned in the Hindu epic the *Mahābhārata* as Śonaprastha, the city is in the region known as the Kurukṣetra ("Land of Kurus"), the scene of the epic war between the Kauravas and the Pāṇḍavas. It is one of the largest cities in Haryāna state, and its proximity to New Delhi as a source of raw materials and power has helped its industrial development. Sonepat is one of the major bicycle-manufacturing centres in the country; other products include sewing-machine parts, automobile parts, rolled steel, hosiery, and textiles. Carpets, handloomed textiles, and brass and copper ware are among the handicrafts. The mosque of Abdullah Nāṣer ud-Dīn (built in 1272), tombs of Khwāja Khiżr, and the ruins of the old fort wall are in the city. Pop. (1991 prelim.) 142,992.

**song,** piece of music performed by a single voice, with or without instrumental accompaniment. Works for several voices are called duets, trios, etc.; larger ensembles sing choral music. Speech and music have been combined from the earliest times; music heightens the effect of words, allowing them to be rendered with a projection and passion lacking in speech alone. Singing style differs among cultures, reflecting such variables as social structure, level of literacy, language, and even sexual mores. Wordy solo songs predominate in technologically advanced, highly centralized societies, whereas primitive cultures often stress ensemble singing, with less attention to careful enunciation and a more relaxed vocal quality than is found in, for example, Oriental solo singing.

In Western music, folk song is customarily distinguished from art song. Folk songs are usually sung unaccompanied or with simple accompaniment—*e.g.,* by guitar or dulcimer. They are usually learned by ear and are infrequently written down; hence they are susceptible to changes of notes and words through generations of oral transmission. Composers of most folk songs are unknown.

Art songs are intended for performance by professional, or at least carefully taught, singers, generally accompanied by piano or instrumental ensemble. The notes are written down, and notes and words are thereafter resistant to casual alteration. Popular songs stand midway between folk and art songs with regard to technical difficulty, sophistication, and resistance to change.

Folk songs often accompany activities such as religious ceremonies, dancing, labour, or courting. Other folk songs tell stories; chief among these are narrative ballads and lyrics. Anglo-American ballads are action-oriented, often dealing with a tragic episode. Lyric songs are more emotion-oriented, more sentimental. Both types display relatively simple melodies, usually with only one or a few notes per syllable. The language tends to follow certain conventions and is often repetitive. Music and words are easily understandable.

Art songs in the European tradition are rarely connected with extramusical activities. Their texts tend to be sophisticated, their melodies often wide-ranging and complex, demanding repeated hearings for full comprehension. Art song, like "classical" music, is essentially an urban phenomenon, with origins in the medieval courts, colleges, cities, and churches. Twelfth-century trouvères and troubadours left a large corpus of melodies and sung verse; they were imitated throughout Europe. Melodies and poems are subtle and highly organized, the products of an aristocratic society. Manuscripts indicate no accompaniment; presumably it was improvised.

With the growth of polyphonic music in Europe in the 13th and 14th centuries, composers learned to assign the principal melody to a solo singer, with subsidiary melodies played on instruments. The technique of having one melody imitate a preceding one led by the 15th century to elaborate textures wherein the vocal line's primacy was threatened; there followed a reaction in songs with the simplest possible accompaniment, merely a few chords. These became widely popular, and by the 16th century careful declamation and audibility of text became again a central concern.

Seventeenth-century dramatic music saw further refinement of song style. Distinctions arose between recitative and aria, the former entirely word-oriented and free, with simple chordal accompaniment, the latter more virtuosic and melodically elaborate, with varied accompaniment. Being musically more interesting, arias came to dominate opera, cantata, and oratorio, and in the 18th century relatively little attention was paid to solo song outside these genres. The songs of W.A. Mozart and Joseph Haydn, for example, are not considered among their best works. Only in popular music did simple strophic (stanzaic) songs with keyboard accompaniment flourish.

In the early 19th century Franz Schubert's songs excelled in dramatic realization and musical quality. Robert Schumann, Johannes Brahms, and the other leading Romantic songwriters learned from Schubert not only the art of varying a strophic melody but also the potential significance of the accompaniment. In French song the works of composers such as Gabriel Fauré and Claude Debussy characteristically possess shifting, kaleidoscopic harmonies, influenced in part by the fluid accentual patterns of the language. Twentieth-century composers continued to explore the relation of voice to accompaniment and to expand the singer's range of expression and technique, sometimes treating the voice instrumentally. *See also* chanson; lied.

**Song** DYNASTY (China): *see* Sung dynasty.

**song-babbler,** any of about 140 bird species of the babbler family Timaliidae (order Passeriformes). Also called laughing-thrushes, from a major subgroup, song-babblers are found in tropical Africa and Asia. They include all the brightly coloured timaliids. About 10 to 30



Pied babbler (*Turdoides bicolor*)
Painting by John P. O'Neill

cm (4 to 12 inches) long, they have strong bills and some have rather long tails. They stay under cover but are detected by their songs of quick phrases. Typical song-babblers are the 26 species of the genus *Turdoides.* The common babbler (*T. caudatus*), found from Iraq eastward across India, is 23 cm (9 inches) long, brown, and long-tailed; small parties feed on the ground in scrublands, uttering low warbling sounds. The pied babbler (*T. bicolor*), 21 cm (8 inches) long, of southwestern Africa, is white, with black wings and tail; it is very inquisitive. *See also* laughing thrush.

**Song Jiaoren** (Chinese leader): *see* Sung Chiao-jen.

**Song of Hildebrand** (German ballad): *see* Hildebrandslied.

**Song of Roland, The** (epic poem): *see* Chanson de Roland, La.

**Song of Solomon** (biblical literature): *see* Solomon, Song of.

**Song Qingling** (Mme Sun Yat-sen): *see* Soong Ch'ing-ling.

**songbird,** also called PASSERINE, any member of the suborder Passeres (or Oscines), of the order Passeriformes, including about 4,000 species—nearly half the world's birds—in 35 to 55 families. Most cage birds belong to this group. Songbirds are alike in having the vocal organ highly developed, though not all use it to melodious effect. Classification in this suborder is much disputed. Alaudidae (larks) and Hirundinidae (swallows) are the most distinctive families.

Songbirds range in size from tiny kinglets and sunbirds to comparatively large crows. They are mainly land birds that live in a wide variety of situations, from open grassland to forest. Although songbirds include some of the best songsters, such as thrushes, some have

harsh voices like crows, and some do little or no singing. Songbirds are distinguished from other perching birds by certain anatomical characteristics, especially the more complicated vocal organ, or syrinx.

The syrinx—as the voice-producing structure, or song box, is called—is located at the point where the windpipe divides into two bronchial tubes to go to the lungs. The syrinx is an intricately constructed organ with a firm bony framework and filmlike vibrating internal membranes over which the air, during exhalation, passes rapidly, producing all the many utterances of the bird. A variable number of syringeal muscles and their controlling nerves adjust the tension on the membranes. The song box reaches its greatest complexity in the true songbirds. (But it is not a complicated syrinx alone that determines singing ability, for some true songbirds hardly sing at all). In some birds the windpipe is elongated and elaborately coiled. Sometimes this elongation is enclosed within the breast bone, or sternum. In certain of the birds-of-paradise known as manucodes, the elongated windpipe is coiled on the breast between the skin and the flesh. Presumably this lengthening of the windpipe gives resonance to the voice.

Vocalization in birds includes a wide variety of calls besides the song proper and provides a means of social communication. Bird song is best considered the vocalization that is used in courtship and breeding, chiefly by the male, to advertise that he is ready to mate, to attract the female and perhaps stimulate her sexually, to keep the pair together, and to inform rival males that he has established a territory from which they will be excluded. The male's calls are also part of a threat display that takes the place of actual combat in repelling intruding rivals. However, similar song is sometimes given spontaneously when there is no obvious use for it. Occasionally females sing, and especially in tropical species pairs may duet, again perhaps as a method of reinforcing the bond between the pair. Often the song is delivered from a series of regularly used perches. Some species, especially those that live in grasslands, have flight songs.

Bird song need not be pleasing to the human ear. The hooting of the owl, the monotonously repeated phrases of the North American whip-poorwill, the crazed, repeated whistle of a Malayan cuckoo that has given it the name of the brain-fever bird, and the African tinkerbird's repeated notes, which, from their resemblance to hammering on metal, have given the bird its name—all must be called songs.

Which birds are the best songsters is a question that is subjective. The nightingale of Europe (*Luscinia megarhynchos*), a small thrush, perhaps heads the list of famous songsters of European literature. Also a favourite of the poets was the European skylark (*Alaudia arvensis*). In North America the mockingbird (*Mimus polyglottos*) is a wonderful performer with a rich, melodious, long-continued song. In Australia the lyrebirds, which are not true songbirds, have songs that are superlative in variety and intensity and have a dramatic quality. Though the best songsters may be true songbirds, some birds of other groups have pleasing or musical utterances, like the quavering trill of the screech owl and the cheery whistle of the bobwhite quail.

**Sŏnggyun'guan,** original name KUKHAK, national university of Korea under the Koryŏ (935–1392) and Yi, or Chosŏn (1392–1910), dynasties. Named the Kukhak ("National Academy") during the Koryŏ dynasty, it was renamed the Sŏnggyun'guan and served as the sole highest institute for training government officials during the Yi dynasty.

The national university at first had 200 students, but the number was later reduced to 126. The students were selected from four groups: the official candidates who had passed the lower civil-service examinations and thus qualified for the *saengwon* or *chinsa* degrees; graduates of the four secondary public schools in Seoul; sons of merit subjects; and lower officials.

The university, located in Seoul, had two residential halls, a lecture hall, and a shrine where rites were held regularly in spring and in autumn in honour of Confucius and eminent Confucian scholars. It also offered two programs of study: readings in Confucian classics and literary composition in Chinese.

Upon the Japanese annexation of Korea in 1910, the institute became a centre of Korean Confucianism. After Korea's liberation in 1945, it was reorganized as Sŏnggyun'guan University and equipped with modern educational facilities. Rites honouring Confucius are still held in spring and autumn in the shrine within the compound of the university.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Songhai,** also spelled SONGHAY, also called SONRHAI, ethnolinguistic group inhabiting the area of the great bend in the Niger River in Mali, extending from Lake Debo to the mouth of the Sokoto River in Nigeria. The Songhai are a Negroid people of probable Caucasoid admixture. They are composed of many related groups, the most important of which are the Zerma. Their language, also called Songhai, is of independent stock.

Songhai society traditionally was highly structured, comprising a nobility, free commoners, artisans, *griots* (bards and chroniclers), and, formerly, slaves. Marriage could be polygynous, cousins being preferred partners. Descent and succession are patrilineal. Cultivation, largely of cereals, is practiced intensively only during the rainy season, from June to November. Cattle are raised on a small scale, and fishing is of some importance. Each craft of workers in iron, wood, pottery, leather, or cotton belongs exclusively to one particular caste. As a result of their advantageous location at the crossroads of western and central Africa, the Songhai have traditionally prospered from caravan trade. Many young Songhai have left home for the coast, especially Ghana.

**Songhai empire,** also spelled SONGHAY, great trading state of West Africa (fl. 15th–16th century), centred on the middle reaches of the Niger River in what is now central Mali and eventually extending west to the Atlantic coast and east into Niger and Nigeria.

Though the Songhai people are said to have established themselves in the city of Gao about AD 800, they did not regard it as their capital until the beginning of the 11th century during the reign of the *dia* (king) Kossoi, a Songhai convert to Islām. Gao so prospered and expanded during the next 300 years that from 1325 to 1375 the rulers of Mali added it to their empire. In about 1335 the *dia* line of rulers gave way to the *sunni*, or *shi*, one of whom, Sulaiman-Mar, is said to have won back Gao's independence. The century or so of vicissitudes that followed was ended by the accession in about 1464 of Sonni 'Alī, also known as 'Alī Ber (d. 1492). By repulsing a Mossi attack on Timbuktu, the second most important city of Songhai, and by defeating the Dogon and Fulani in the hills of Bandiagara, he had by 1468 rid the empire of any immediate danger. He later evicted the Tuareg from Timbuktu, which they had occupied since 1433, and, after a siege of seven years, took Jenne (Djenné) in 1473 and by 1476 had dominated the lakes region of the middle Niger to the west of Timbuktu. He repulsed a Mossi attack on Walata to the northwest in 1480 and subsequently discouraged raiding by all the inhabitants of the Niger valley's southern periphery. The civil policy of Sonni 'Alī was to conciliate the interests of his pagan pastoralist subjects with those of the Muslim city dwellers, on whose wealth and scholarship the Songhai empire depended. His son Sonni Baru (reigned 1493), who sided completely with the pastoralists, was deposed by the rebel Muḥammad ibn Abī Bakr Ture, also known as Muḥammad I Askia (reigned 1493–1528), who welded the central region of the western Sudan into a single empire. He too fought the Mossi of Yatenga, tackled Borgu, in what is now northwestern Nigeria (1505)—albeit with little success—and mounted successful campaigns against the Diara (1512), against the kingdom of Fouta-Toro in Senegal, and to the east against the Hausa states. In order to win control of the principal caravan markets to the north, he ordered his armies to found a colony in and around Agadez in Aïr. He was deposed by his eldest son, Musa, in 1528. Throughout the dynastic squabbles of successive reigns (Askia Musa, 1528–31; Bengan Korei, also known as Askia Muḥammad II, 1531–37; Askia Ismail, 1537–39; Askia Issihak I, 1539–49), the Muslims in the towns continued to act as middlemen in the profitable gold trade with the states of Akan in central Guinea. The peace and prosperity of Askia Dawūd's reign (1549–82) was followed by a raid imitated by Sultan Aḥmad al-Manṣūr of Morocco on the salt deposits of Taghaza. The situation, which continued to worsen under Muḥammad Bāni (1586–88), culminated disastrously for Songhai under Issihak II (1588–91) when Moroccan forces, using firearms, advanced into the Songhai empire to rout his forces, first at Tondibi and then at Timbuktu and Gao. Retaliatory guerrilla action of the pastoral Songhai failed to restore the empire, the economic and administrative centres of which remained in Moroccan hands.

**Songhua Jiang** (China): *see* Sungari River.

**Songjiang** (China): *see* Sung-chiang.

**Sŏngjin** (North Korea): *see* Kimch'aek.

**Songkhla,** also called SINGORA, city, southern Thailand, located on the eastern coast of peninsular Thailand. Songkhla is a port at the outlet of Luang Lagoon. It is a regional centre for the Gulf of Thailand coastal area and is commercially oriented to Malaysia and Singapore. Rubber, tin, coconuts, peanuts (groundnuts), edible birds' nests, and forest and fish products are exported from its roadstead harbour. On a rail spur from Hat Yai, Songkhla is also served by an airport. Educational facilities include the Prince of Songkla University (1964) and the Southern Technical Institute. The city is a popular tourist centre, with beaches and parks. Pop. (1986 est.) 84,738.

**songlark,** either of the two species of the Australian genus *Cinclorhamphus*, of the songbird family Maluridae (order Passeriformes) or the subfamily Orthonychinae (*see* Muscicapidae). Both are drab and vaguely larklike; males of both species are much larger than females. The rufous songlark (*C. mathewsi*), 20 cm (8 inches) long, lives in open forests and has a lively song; the 30-centimetre (12-inch) brown, or black-breasted, songlark (*C. cruralis*) lives in open country, utters creaky chuckling notes, and has a flight song, as larks do.

**Sŏngnam,** city, Kyŏnggi *do* (province), northwestern South Korea, 12 miles (19 km) southeast of Seoul. Given the status of a municipality in 1973, it developed rapidly as a satellite city of Seoul, absorbing some of the capital's population and light industries. From 1970 to 1975 alone, Sŏngnam's popula-

tion increased nearly fivefold to more than a quarter of a million persons, the highest rate of growth in the country. The government has continued to encourage the movement of industry from Seoul to Sŏngnam. Pop. (1984 est.) 434,078.

**Songnim,** city, southwestern North Korea. It is North Korea's largest iron and steel centre, as well as a river port on the banks of the Taedong-gang (river). During the Japanese occupation (1910–45) it was named Kyŏmip'o. Formerly, it was a poor riverside village, but after the establishment of an iron foundry in 1916 it developed rapidly. During the Korean War it was destroyed by bombing, but it has been rebuilt. A plant located there processes pig iron, steel, and rolled steel. The city is served by rail and highway and also uses the Taedong and Chaeryŏng rivers to transport raw materials and finished products. The river port accommodates ships of 4,000 tons. Pop. (latest est.) 53,035.

**songshrike,** any of several birds of the family Cracticidae (order Passeriformes) including the bell-magpie, butcherbird, and currawong (*qq.v.*).

**sonic boom,** shock wave that is produced by an aircraft or other object flying at a speed equal to or exceeding the speed of sound and that is heard on the ground as a sound like a clap of thunder.

When an aircraft travels at subsonic speed, the pressure disturbances, or sounds, that it generates extend in all directions. Because this disturbance is transmitted earthward continuously to every point along the path, there are no sharp disturbances or changes of pressure. At supersonic speeds, however, the pressure field is confined to a region extending mostly to the rear and extending from the craft in a restricted widening cone (called a Mach cone). As the aircraft proceeds, the trailing parabolic edge of that cone of disturbance intercepts the earth, producing on earth a sound of a sharp bang or boom—with silence before and after. When such an aircraft flies at a low altitude, the shock wave may be of sufficient intensity to cause glass breakage and other damage. The intensity of the sonic boom is determined not only by the distance between the craft and the ground but also by the size and shape of the aircraft, the types of maneuvers that it makes, and the atmospheric pressure, temperature, and winds. If the aircraft is especially long, double sonic booms might be detected, one emanating from the leading edge of the plane and one from the trailing edge.

**Soninke,** also called SARAKOLE, SERACULEH, or SERAHULI, a people located in Senegal near Bakel on the Sénégal River and in neighbouring areas of West Africa. They speak a Mande language of the Niger-Congo family. Some Senegalese Soninke have migrated to Dakar, but the population in the Bakel area remain farmers whose chief crop is millet. The Soninke were the founders of the ancient empire of Ghana, which was destroyed after the invasions of Muslim conquerors in the 10th century. Their social structure and organization are typical of the Mande (*q.v.*) peoples.

**Sonneberg,** city, Thuringia *Land* (state), eastern Germany, on the southern slope of the Thüringer Wald (forest), southeast of Suhl city, near the border with Bavaria *Land*. Mentioned in 1207, it was chartered in 1349 and belonged to the Duchy of Saxe-Meiningen from 1735 to 1918. A rail junction, it is the centre of the Thuringian toy-making industry, based in the nearby villages, and has a toy museum. Pop. (1998 est.) 25,151.

**Sonneck, Oscar (George Theodore)** (b. Oct. 6, 1873, Jersey City, N.J., U.S.—d. Oct. 30, 1928, New York City), American musicologist, librarian, and editor.

Sonneck was mainly educated in Germany and attended the universities of Heidelberg and Munich, studying philosophy, composition, conducting, and, especially, musicology.

A significant portion of his studies on American musical life before 1800—an area of study that remained his lifelong interest—was carried out at the new Library of Congress in Washington, D.C. In 1902 he was appointed the first head of the library's music division, in which capacity he organized and developed one of the finest and most comprehensive collections of music, manuscripts, and books on music in the world.

In 1917 he resigned from the library and accepted the post of director of the publication department of G. Schirmer, Inc. (New York City), whose *Musical Quarterly* he had edited since its first issue in 1915. After his appointment as vice-president of the company (1921), he actively supported American composers and directed the publication of new music by Ernest Bloch, John Alden Carpenter, Charles Tomlinson Griffes, Rubin Goldmark, Charles Martin Loeffler, and others.

Sonneck's writings laid the foundation for the scientific study of music in the United States. His elaborate catalogs (issued by the Library of Congress) and his work on opera librettos remain the outstanding reference works in their field, and the system he devised for the classification of music collections is an invaluable contribution to music bibliography.

**sonnet,** lyric poem of 14 lines having a formal rhyme scheme; it is unique among poetic forms in Western literature in that it has retained its appeal for major poets for five centuries. The sonnet seems to have originated in the 13th century among the Sicilian school of court poets, who were influenced by the love poetry of Provençal troubadours. From there it spread to Tuscany, where it reached its highest expression in the 14th century in the poems of Petrarch. His *Canzoniere,* a sequence of poems including 317 sonnets, addressed to his idealized beloved, Laura, established and perfected the Italian (or Petrarchan) sonnet, which remains one of the two principal sonnet forms, as well as the one most widely used. The other major form is the English (or Shakespearean) sonnet.

The Italian sonnet characteristically treats its theme in two moods. The first eight lines, the octave, state a problem, ask a question, or express an emotional tension. The last six lines, the sestet, resolve the problem, answer the question, or relieve the tension. The octave is rhymed *abbaabba.* The rhyme scheme of the sestet varies; it may be *cdecde, cdccde,* or *cdedce.* The Petrarchan sonnet became a major influence on European poetry. It soon became naturalized in Spain, Portugal, and France and was introduced to Poland, whence it spread to other Slavic literatures. In most cases the form was adapted to the staple metre of the language—*e.g.,* the Alexandrine (12-syllable iambic line) in France and iambic pentameter in English.

The sonnet was introduced to England, along with other Italian verse forms, by Sir Thomas Wyat and Henry Howard, earl of Surrey, in the 16th century. The new forms precipitated the great Elizabethan flowering of lyric poetry, and the period marks the peak of the sonnet's English popularity. In the course of adapting the Italian form to a language less rich in rhymes, the Elizabethans gradually arrived at the distinctive English sonnet, which is composed of three quatrains, each having an independent rhyme scheme, and is ended with a rhymed couplet.

The rhyme scheme of the English sonnet is *abab cdcd efef gg.* Its greater number of rhymes makes it a less demanding form than the Italian sonnet, but this is offset by the difficulty presented by the couplet, which must summarize the impact of the preceding quatrains with the compressed force of a Greek epigram. Even Shakespeare sometimes failed at it.

The typical Elizabethan use of the sonnet was in a sequence of love poems in the manner of Petrarch. Although each sonnet was an independent poem, partly conventional in content and partly self-revelatory, the sequence had the added interest of providing something of a narrative development. Among the notable Elizabethan sequences are Sir Philip Sidney's *Astrophel and Stella* (1591), Samuel Daniel's *Delia* (1592), Michael Drayton's *Idea's Mirrour* (1594), and Edmund Spenser's *Amoretti* (1591). The last-named work uses a common variant of the sonnet (known as Spenserian), which follows the English quatrain and couplet pattern, but resembles the Italian in using a linked rhyme scheme: *abab bcbc cdcd ee.* Perhaps the greatest of all sonnet sequences is Shakespeare's, addressed to a young man and a "dark lady." In these sonnets the supposed love story is of less interest than the underlying reflections on time and art, growth and decay, and fame and fortune.

In its subsequent development, the sonnet was to depart even further from themes of love. By the time John Donne wrote his religious sonnets (*c.* 1610) and Milton wrote sonnets on political and religious subjects or on personal themes such as his blindness (*i.e.,* "When I consider how my light is spent"), the sonnet had been extended to embrace nearly all the subjects of poetry.

It is the virtue of this short form that it can range from "light conceits of lovers" to considerations of man, time, death, and eternity, without doing injustice to any of them. Even during the Romantic era, in spite of the emphasis on freedom and spontaneity, the arbitrary Italian and English sonnet forms continued to challenge major poets. The sonnets of Wordsworth (*e.g.,* "It Is a Beauteous Evening; Calm and Free" and "The World Is Too Much With Us") and those of Keats (*e.g.,* "When I Have Fears That I May Cease To Be" and "Bright Star, Would I Were Steadfast as Thou Art") are among the finest and best known in English.

In the later 19th century the love sonnet sequence was revived by Elizabeth Barrett Browning in *Sonnets from the Portuguese* (1850) and by Dante Gabriel Rossetti in *The House of Life* (1876). The most distinguished 20th-century work of the kind is Rainer Maria Rilke's *Sonnette an Orpheus* (1922).

**Sonni 'Alī,** Sonni also spelled SUNNI, also called SONNI 'ALI BER (Arabic: 'Alī the Great) (d. 1492), West African monarch who initiated the imperial expansion of the Western Sudanese kingdom of Songhai. His conquest of the leading Sudanese trading cities established the basis for Songhai's future prosperity and expansion.

When Sonni 'Alī ascended the Songhai throne *c.* 1464, the kingdom comprised only a small area in the upper Niger valley around its capital, the prosperous trading city of Gao. Although the Songhai people had managed to throw off the domination of the Mali Empire, they also hoped to obtain territorial benefits, like other West African peoples, from the disintegration of Mali. Sonni 'Alī saw an excellent opportunity to oblige in 1468, when Muslim leaders of the city of Timbuktu (Tombouctou), formerly one of the chief cities in the empire of Mali, asked his aid in overthrowing the Tuareg, the nomadic desert Berbers who had conquered the city when Mali control declined. After Sonni 'Alī conquered Timbuktu and drove out the Tuareg, he plundered the city and murdered many of its inhabitants, presumably in retaliation for the Muslim leader's failure to provide him with promised transport across the Niger River.

Sonni 'Ali's sack of Timbuktu established his reputation in the history of The Sudan as a cruel and capricious tyrant, alternately generous and savage. The 16th-century Muslim Sudanese historian 'Abd ar-Rahman as-Sadi, in the historical chronicle *Tar'ikh as-Sudan* ("History of the Sudan"), related several instances of Sonni 'Ali's summary executions of friend and foe alike. The antipathy of Muslim scholars toward Sonni 'Ali may be attributed in part to what they regarded as his rather unorthodox observance of Islam. He apparently combined the performance of Muslim rites with those of the traditional Songhai religion.

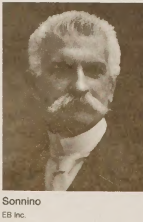
Aware of the benefits of controlling Sudanese commerce, Sonni 'Ali turned to the conquest of the wealthy trading city of Jenne (now Djenné) on the Bani River near its confluence with the Niger. His seven-year siege of the city resulted in its conquest in 1473. Sonni 'Ali spent most of his reign in the field repulsing attacks on his empire, these coming especially from the Mossi, the Fulani of the Dendi region, and the Tuareg. His fine strategic sense and his effective use of cavalry enabled him to cripple the striking power of the Mossi (although he could not annex their territory), to conquer and assimilate the Dendi area, and to discourage Tuareg raiding.

Little is known about the actual administration of Songhai during Sonni 'Ali's time except that he divided conquered territories into provinces and appointed trusted lieutenants to govern them. He died while returning from a campaign against Fulani peoples who lived west of Songhai.

**Sonnino, Sidney, Baron** (Barone) (b. March 11, 1847, Pisa [now in Italy]—d. Nov. 24, 1922, Rome, Italy), Italian statesman who as foreign minister promoted his country's entrance into World War I. He was also prime minister in 1906 and 1909–10.

Joining the diplomatic service in the 1860s shortly after the formation of a united Italy, Sonnino left it to devote time to political, social, and economic studies of Italian life. These studies led in 1876 to an important work on conditions in Sicily (*La Sicilia nel 1876* [1877]) and in 1878 to his founding of a weekly economic review, *La Rassegna Settimanale,* that he later converted into a political daily. When he was elected deputy in 1880, his knowledge of Italian economic affairs brought him first the post of under secretary of the treasury and later, in the midst of a financial crisis in 1893, that of finance minister. His energetic measures, including imposition of taxes by decree, averted possible national bankruptcy, but the military disaster of Adowa in Ethiopia brought the fall of the cabinet, and for many years he was a leader of the conservative parliamentary opposition. For brief periods in 1906 and 1909–10 he served as prime minister, in which role he proved to be unable to conciliate parliament.

In November 1914 Sonnino became foreign minister in the cabinet of Antonio Salandra. He plunged into negotiations aimed at completing Italian unification by the acquisition of territories still held by Austria-Hungary. When he found that Austria would not meet Italian aspirations, he switched to negotiating with the Allies, and, on their acceptance of his demands, he successfully urged his government to declare war, even though parliament was not in session. Sonnino remained at the Foreign Office throughout the war, despite changing ministries. In the closing months of the war and at the Versailles Peace Conference he was dismayed by the failure of the Allies, notably of the United States, to grant all of Italy's aims and by the cost of the war, which had exceeded his expectations. On the fall of the Orlando cabinet in June 1919 he retired to private life.



Sonnino
EB Inc.

**Sonntag, Gertrud Walpurgis** (singer): *see* Sontag, Henriette.

**Sonoma,** city, Sonoma county, western California, U.S., 21 miles (34 km) southeast of Santa Rosa, in the Sonoma Valley (made famous by Jack London as the "Valley of the Moon"). It was founded in 1835 by General Mariano Guadalupe Vallejo (who had been sent to investigate the Russian outpost at Fort Ross, 50 miles north-northwest) at the site of the Mission San Francisco Solano, the last (1823) and most northerly of the 21 Franciscan California missions. The name Sonoma comes from a Wintun Indian word for "nose," probably derived from a local Indian chief and tribe. Vallejo's home (1850) and the restored mission now form the main part of Sonoma State Historic Park. On June 14, 1846, a small band of American settlers invaded Sonoma and captured Vallejo and his Mexican military garrison. They raised an improvised Bear Flag of California (designed by William Todd, nephew of Mary Todd Lincoln) and declared a republic, which lasted until July 9. In the 1850s Hungarian count Agoston Haraszthy planted thousands of cuttings from European grape vines around his Buena Vista vineyard (east of the town) and laid the basis for the vast California wine industry.

Wine-making and diversified farming are the city's economic mainstays. Inc. 1900. Pop. (1990) 8,121.

**Sonora,** *estado* ("state"), northwestern Mexico, bounded on the north by the United States, on the east by Chihuahua, on the south by Sinaloa, and on the west by Baja California and the Gulf of California. The name (meaning "sonorous") is from local deposits of marble, which when struck emit a bell-like sound. Explored by Spaniards in the 1530s, Sonora became an important colonial copper-, gold-, and silver-mining district. Generally arid and semiarid climatic conditions necessitate irrigation, with which winter vegetables, cereals, cotton, tobacco, and corn (maize) can be cultivated. Sonora became a state in 1830, but the Yaqui Indian tribes were not finally subdued until the 20th century. The population is clustered around Heroica Nogales, at the Arizona border; Hermosillo, the state capital; Guaymas, a gulf port and deep-sea fishing resort; and Ciudad Obregón, in the Yaqui valley. Since the 1940s, these and other communities have flourished, their cotton-growing hinterlands developed by irrigation projects. Major highways and railroads from Mexicali and Heroica Nogales to Mexico City traverse the state. Airports are situated in the major cities. Area 70,291 square miles (182,052 square km). Pop. (1990) 1,823,606.

**Sonora, José Gálvez, Marqués de la** (Marquess of): *see* Gálvez, José.

**Sonora River,** river in Sonora state, northwestern Mexico. It rises south of Cananea, near the U.S. border, and flows southward and then southwestward through the western flanks of the Sierra Madre Occidental. Below Hermosillo, the state capital, the river crosses the coastal lowlands and empties into the Gulf of California opposite Tiburón Island. Its total course is some 250 miles (400 km) long. Many settlements, including Arizpe, Moctezuma, Ures, and Hermosillo, lie along the river, and, although it reaches the gulf only in years of heavy rainfall, it is used for irrigation, especially near Hermosillo.

**Sonoran Desert,** arid region covering 120,000 square miles (310,000 square km) in southwestern Arizona and southeastern California, U.S., and including much of the Mexican state of Baja California Norte and the western half of the state of Sonora. Subdivisions of the hot, dry region include the Colorado and Yuma deserts. Irrigation has produced many fertile agricultural areas, notably the Coachella and Imperial valleys; the warm winters attract tourists to resorts, including Palm Springs, Calif., and Tucson and Phoenix, Ariz. Indian reservations (particularly Papago and Pima) are scattered across the desert.



Oasis in the Sonoran Desert near the Santa Rosa Mountains, California
David Muench

**sonorant,** in phonetics, any of the nasal, liquid, and glide consonants that are marked by a continuing resonant sound. Sonorants have more acoustic energy than other consonants. In English the sonorants are *y, w, l, r, m, n,* and *ng. See also* nasal; liquid.

**Sonrhai** (people): *see* Songhai.

**Sons of Liberty:** *see* Liberty, Sons of.

**Sonsonate,** city, western El Salvador, on the Río Grande de Sonsonate. Founded in 1524, it served as the provisional national capital in 1833–34. During the Spanish colonial period, it conducted a thriving cacao trade. Linked by road and rail with the Pacific port of Acajutla, 12 miles (19 km) southwest, it deals in livestock products, tropical fruit, coffee, and sugarcane and exports skins and hides. Pop. (1985 est.) mun., 48,436.

**Sontag, Henriette,** original name GERTRUD WALPURGIS SONNTAG (b. Jan. 3, 1806, Koblenz, Fr. [now in Germany]—d. June 17, 1854, Mexico City, Mex.), German operatic and concert soprano who enjoyed great acclaim both before and after a 19-year hiatus in her career.

The child of actor Franz Sonntag and singer Franziska Martloff Sonntag, she received early theatrical training and played juvenile roles in both stage plays and operas in Germany and in Prague, where her mother moved after her father's death. For several years she studied at the Conservatory there, making her adult operatic debut in 1821 as the princess in François-Adrien Boieldieu's *Jean de Paris.* After hearing her perform in Gioacchino Rossini's *La donna del lago* in Vienna in 1823, Carl Maria von Weber asked her to create the title role in his *Euryanthe.* The premiere performance later that year was a triumph for both singer and composer. In 1824 she sang the premieres of Ludwig van Beethoven's *Ninth Symphony* and *Missa Solemnis* in Vienna and for the next few years toured Berlin, Paris, London, and most of the other major European centres.

In 1828 Sontag was secretly married to Count Carlo Rossi of Sardinia, whose diplomatic career as ambassador to The Hague was jeopardized by the marriage until a patent of nobility was bestowed on her by the King of Prussia. After the marriage was publicly acknowledged in 1830, she yielded to pressure from her husband's colleagues and renounced the stage. For 19 years she appeared only rarely in private and charity concerts. In 1849, however, political upheaval in Sardinia ended both her husband's diplomatic career and Sontag's retirement. She accepted a six-month contract to sing at Her Majesty's Theatre, London, and then toured Great Britain and France. In 1850 she created the role of Miranda in Fromental Halévy's *La tempesta* in London, and, after a triumphal tour of Germany, she went in 1852 to the United States. She made her last appearance, as Lucrezia Borgia in the Gaetano Donizetti opera, during a tour of Mexico, where she succumbed to cholera during an epidemic.

**Sontag, Susan** (b. Jan. 16, 1933, New York, N.Y., U.S.), American intellectual and writer best known for her essays on modern culture.

Sontag was reared in Tucson, Ariz., and in Los Angeles. She attended the University of California at Berkeley for one year and then transferred to the University of Chicago, from which she graduated in 1951. She studied English literature (M.A., 1954) and philosophy (M.A., 1955) at Harvard University, teaching philosophy at several colleges and universities before the publication of her first novel, *The Benefactor* (1963). During the early 1960s she also wrote a number of essays and reviews, most of which were published in such periodicals as *The New York Review of Books, Commentary,* and *Partisan Review.* Some of these short pieces were collected in *Against Interpretation and Other Essays* (1968). Her second novel, *Death Kit* (1967), was followed by another collection of essays, *Styles of Radical Will* (1969). Her later critical works included *On Photography* (1977), *Illness as Metaphor* (1979), *Under the Sign of Saturn* (1980), and *AIDS and Its Metaphors* (1988).

Sontag's essays are characterized by a serious philosophical approach to various aspects and personalities of modern culture. She first came to national attention in 1964 with an essay entitled "Notes on 'Camp'," in which she discussed the attributes of taste within a particular segment of society. She has written on such subjects as theatre and film and such figures as Nathalie Sarraute, Robert Bresson, and Francis Bacon. In addition to criticism and fiction, she has written screenplays and edited selected writings of Roland Barthes and Antonin Artaud.

**Sony Corporation,** Japanese SONY KK, major Japanese manufacturer of consumer electronics products. Headquarters are in Tokyo.

The company was incorporated in 1946 as Tokyo Telecommunications Engineering Corporation. Its founders were Ibuka Masaru, whose Japan Precision Instruments Company had supplied electronic devices during World War II, and Morita Akio, an applied sciences instructor. The venture, which was funded by Morita's father, was formed to apply the advanced technology developed during the war to the manufacture of consumer products. The company's present name was adopted in 1958.

Initially the company made voltmeters, electrically heated cushions, resonator sound generators, and similar devices. The first major consumer item it produced was an audio tape recorder, introduced in Japan in 1950. Since then the company, which markets its products worldwide under the Sony trademark, has continued to pioneer new technology for consumer products. In 1957 Sony introduced the world's first pocket-sized, all-transistor radio. In 1960 Sony introduced an 8-inch (20-centimetre) transistorized television set, creating a new market for television; and in 1968 it brought out colour television sets equipped with the simplified Trinitron picture tube.

The company was one of the first to recognize the potential of the consumer videotape market, and in 1969 it introduced a colour video cassette recorder for both industrial and consumer use. In 1972 it formed an affiliate to market its Betamax colour videocassette system.

Sony spearheaded Japan's drive to become the world's dominant consumer electronics manufacturer in the late 20th century. In 1987–88 Sony purchased the CBS Records Group from CBS Inc., thus acquiring the world's largest record company. It followed that purchase with the purchase in 1989 of Columbia Pictures Entertainment Inc.

**Soochow** (China): *see* Su-chou.

**Soong** FAMILY, Soong also spelled SUNG, Pinyin SONG, influential Chinese family that was heavily involved in the political fortunes of China during the 20th century. Among its best-known members were Charlie, the founder of the family, and his children T.V. Soong, financier and politician; Soong Mei-ling, who became Madame Chiang Kai-shek; and Soong Ch'ing-ling (*qq.v.*), who married Sun Yat-sen.

Charlie Soong (1866–1918), also called Charles Jones Soon, was born Han Chiao-shun and was reared until he was nine in Wench'ang, a port on the eastern coast of the island of Hainan. After a three-year apprenticeship in the East Indies, he spent eight years in the United States. He was educated and trained by the Methodists for missionary work among the Chinese. In 1886 he returned to China. He married in 1887; the following year he joined a secret society dedicated to the overthrow of the Manchu dynasty. He nevertheless continued his missionary work until 1892. About this time he became a publisher—a career he had started with the printing of inexpensive, vernacular Chinese Bibles—and, with the aid of Julian Carr, a wealthy American patron, soon became a wealthy, influential industrialist involved in a number of businesses. In 1894 Soong met Sun Yat-sen, who helped to transform him into a revolutionary. In 1906 he was officially appointed Treasurer of the Revolutionary Alliance and was responsible for financing the Nationalist Party (Kuomintang) revolution.

Soong had all of his children educated in the United States. After her return to China, his eldest child, Ai-ling (1890–1973), acted as a secretary to Sun until her marriage to banker and businessman H.H. K'ung in 1914. Ch'ing-ling, Soong's second child, replaced Ai-ling as secretary and in 1914 married Sun Yat-sen, who was 26 years her senior. Both H.H. K'ung and Charlie Soong's third child, T.V. Soong, were financially significant forces in the advancement of Sun Yat-sen and the Nationalist cause in China and the United States. After Sun's death in 1925, the Nationalist Party split into factions. The group led by Sun's widow, Ch'ing-ling, was eventually overshadowed by the faction led by Chiang Kai-shek, who in 1927 married Mei-ling Soong. Charlie Soong's fourth child. (The two youngest of Soong's children, T.L. and T.A., became bankers.) T.V. Soong became an influential member of Chiang's Nationalist government and, with his sister Mei-ling, was extremely important in Chinese foreign relations. Ch'ing-ling remained opposed to Chiang's government; when the Communists established the People's Republic in 1949, they granted Ch'ing-ling high, though largely symbolic, status. The power of the Soong family began to dissipate after this period.

**Soong, T.V.,** in full SOONG TZU-WEN, Soong also spelled SUNG (b. Dec. 4, 1894, Shanghai, China—d. April 24, 1971, San Francisco, Calif., U.S.), financier and official of the Chinese Nationalist government between 1927 and 1949, once reputed to have been the richest man in the world.

The son of a prominent industrialist, Soong was educated in the United States at Harvard University. He returned to China in 1917 and soon became active in banking and financial circles. After 1923 he began to fill the role his father had had, that of financing the Nationalist Party (Kuomintang). At the request of Sun Yat-sen, to whom his sister Ch'ing-ling was married, T.V. established at Canton in 1924 the Central Bank of China, reorganized four years later as a central bank of issue and a government treasury.

In 1925 Soong became finance minister in the new Nationalist government. After 1927 he cooperated with Chiang Kai-shek, who had become head of the Nationalists, and to whom another of the Soong sisters, Mei-ling, was married. As finance minister Soong reformed the taxation system, abolished the likin, or internal transit tariff, and readjusted foreign and domestic debts. Moreover, between 1928 and 1930 he returned tariff autonomy to China by negotiating a series of agreements with foreign powers, thus restoring China's right to set tariff rates and supervise their collection, a privilege that had been forcibly taken from China in the 19th century by the Western nations. He resigned as finance minister in 1931 though his influence—largely due to his wealth and his growing international prestige—remained great. In 1936 he rejoined the government, and, during the Sino-Japanese War, he served China in its negotiations with the foreign powers. He became minister of foreign affairs in 1942.

The following year Soong negotiated the end of extraterritoriality rights; *i.e.,* the end of the rights of foreigners to govern themselves while on Chinese soil. In 1945 he negotiated a treaty of friendship between the Nationalist government and the Soviet Union. When the Communists captured the mainland in 1949,

however, Soong moved to the United States, where he was active in business and banking.

**Soong Ch'ing-ling,** Soong also spelled SUNG, Pinyin SONG QINGLING (b. Jan. 27, 1892, Shanghai, China—d. May 29, 1981, Peking), second wife of the Chinese revolutionary leader Sun Yat-sen. She became an influential Chinese political figure after Sun's death.

Educated in the United States, Soong Ch'ing-ling married Sun Yat-sen, 26 years her senior, in 1914. After his death (1925) Soong Ch'ing-ling assumed an active role in politics, supporting the left wing of the Nationalist Party (Kuomintang, which had been founded by Sun Yat-sen) when it split with the right wing of the party, later headed by Chiang Kai-shek. In 1927, when the left-wing Nationalists purged their communist members and reunited with the right-wing Nationalists, she denounced the organization as having betrayed the ideals of Sun Yat-sen. She then left China for the Soviet Union, where she remained for two years.

After the outbreak of the Sino-Japanese War in 1937, Soong organized the China Defense League, which did medical relief and child welfare work, especially in the communist-controlled areas of the country. During this period she also briefly reunited with her sister Soong Mei-ling (the wife of Chiang Kai-shek) and her brother T.V. Soong, one of China's leading industrialists and a powerful official in the Nationalist government.

In 1948 she became honorary chairman of the Kuomintang Revolutionary Committee, a splinter group organized in Hong Kong to oppose Chiang Kai-shek's Kuomintang. After the establishment of the People's Republic of China in 1949, Soong Ch'ing-ling remained on the mainland, where she was held in great deference by the communists because she symbolized a link between the People's Republic and the older revolutionary movement of Sun Yat-sen. She became an important official within the new government, and in 1951 she was awarded the Stalin Peace Prize for her work on welfare and peace committees. In 1966 during the Cultural Revolution she was criticized by the Red Guards, but she retained her position. In 1981 she was named honorary Chairman of the People's Republic.

**Soong Mei-ling,** Soong also spelled SUNG, Mei-ling also spelled MAYLING, also called MADAME CHIANG KAI-SHEK or CHIANG MEI-LING (b. March 5, 1897, Shanghai, China—d. Oct. 23, 2003, New York, N.Y., U.S.), second wife of the Nationalist Chinese president Chiang Kai-shek. Her sister Soong Ch'ing-ling was the wife of Sun Yat-sen, and her brother T.V. Soong was a prominent industrialist and official of the Nationalist Chinese government.

Soong Mei-ling was educated in the United States from 1908 to 1917 and was thoroughly Americanized. In 1927 she married Chiang Kai-shek, and she helped introduce him to Western culture and ideas and worked to publicize his cause in the West. During World War II she wrote many articles on China for American journals, and in 1943, during a visit to the United States, she became the first Chinese and the second woman to address a joint session of the U.S. Congress. Her efforts resulted in much financial aid, and she so impressed the American public that until 1967 her name appeared annually on the U.S. list of the 10 most admired women in the world.

When Chiang Kai-shek's forces were defeated in 1949, Soong Mei-ling and her family moved to Taiwan, where her husband established his government. Still highly influential, she helped sway the U.S. government's policy toward China and Taiwan. After Chiang Kai-shek's death in 1975, Soong Mei-ling moved to New York, where she lived until her death. Her published works include *This Is Our China* (1940), *The Sure Victory* (1955), and two volumes of selected speeches.

**sooty mold,** also called BLOTCH, or BLACK MOLD, plant disease characterized by splotchy black stain or coating on leaves, stems, and fruit, composed of dark fungal threads (*Capnodium, Fumago,* and *Scorias* species) that grow in flowing sap or on honeydew excreted by aphids and other sucking insects. The condition is unsightly but usually not harmful. Control includes spraying or dusting for sucking insects, washing off sticky coatings of sap or honeydew on plant surfaces, and avoiding the wounding of plants.

**Sophar** (Old Testament): *see* Zophar.

**sopher** (Judaism): *see* sofer.

**Sophia,** also called SOPHIA OF THE PALATINATE, German SOPHIE VON DER PFALZ (b. Oct. 14, 1630, The Hague—d. June 8, 1714, Herrenhausen, Hanover), electress of Hanover and heir to the British throne, whose son became George I of Great Britain.

Sophia was the 12th child of Frederick V, elector Palatine of the Rhine, by his wife Elizabeth, a daughter of the English king James I. Residing after 1649 at Heidelberg with her brother, the restored elector Palatine, Charles Louis, she married in 1658 Ernest Augustus, who became elector of Brunswick-Lüneburg (Hanover) in 1692.

Sophia became a widow in 1698, but before then her name had been mentioned in connection with the English throne. When considering the Bill of Rights in 1689 the House of Commons refused to place her in the succession, and the matter rested until 1700, when the state of affairs in England was more serious. William III was ill and childless; William, duke of Gloucester, the only surviving child of the princess Anne, had just died. The princess was the nearest Protestant heir. Accordingly, by the Act of Settlement of 1701 the English crown, in default of issue from either William or Anne, was settled upon "the most excellent princess Sophia, electress and duchess-dowager of Hanover" and "the heirs of her body, being Protestant." Sophia watched affairs in England during the reign of Queen Anne with great interest, although her son, the elector George Louis, objected to any interference in that country, and Anne disliked all mention of her successor. An angry letter from Anne possibly hastened Sophia's death in June 1714; less than two months later her son became George I of Great Britain and Ireland, on the death of Anne.

**Sophia,** Russian in full SOFYA ALEKSEYEVNA (b. Sept. 27 [Sept. 17, Old Style], 1657, Moscow—d. July 14 [July 3, Old Style], 1704, Moscow), regent of Russia from 1682 to 1689.

The eldest daughter of Tsar Alexis (ruled 1645–76) and his first wife, Mariya Miloslavskaya, Sophia was tutored by the monk Simeon Polotsky, from whom she received an outstanding education. When her brother Fyodor III died (May 7 [April 27, Old Style], 1682), her half brother Peter, son of Alexis and his second wife, Natalya Naryshkina, was proclaimed tsar. Sophia, as leader of the Miloslavsky family, however, objected to a government dominated by the Naryshkins and incited the discontented *streltsy* (household troops) to riot. After several members of the Naryshkin family were murdered, Sophia calmed the *streltsy* by arranging for her younger brother Ivan V to be proclaimed coruler with Peter; she assumed the role of regent (June 8 [May 29, Old Style], 1682).

Ruling under the guidance of her chief adviser and lover, Prince Vasily V. Golitsyn, Sophia consolidated her regime. To prevent the unreliable *streltsy* from reversing their position and removing her, she replaced their commander (who was executed for treason) with one of her favourites. In addition, she transferred 12 of the 19 Moscow regiments from the city to guard the frontier and revoked many of the privileges she had granted the troops when she seized power.



Sophia, engraving by A. Bloteling
Novosti Press Agency

Sophia also promoted the development of industry and encouraged foreign craftsmen to settle in Russia. Despite Golitsyn's numerous plans for domestic reform, however, the regent failed to meet discontent among the peasants and religious dissidents. She also overruled several of her advisers and approved Golitsyn's plan to conclude a permanent peace with Poland (1686; which confirmed a truce of 1667), by which Russia obtained Kiev and the territory east of the Dnieper River in exchange for a promise to join a European coalition against the Turks. In 1687 and 1689 she sponsored two disastrous military campaigns, led by Golitsyn, against the vassals of the Turks, the Crimean Tatars. Although her government also concluded the favourable Treaty of Nerchinsk with China (1689), setting Russia's eastern border at the Amur River, Golitsyn's failures reinforced the increasing dissatisfaction among both the Naryshkins and the general population with her rule. Recognizing this and hoping to eliminate Peter, the figurehead of her rivals, Sophia tried once more to incite the *streltsy* against the Naryshkins (August 1689); many of the *streltsy* colonels, however, supported Peter, who overthrew Sophia and forced her to enter the Novodevichy Convent in Moscow (September 1689). In 1698 her supporters among the *streltsy* made an unsuccessful attempt to restore her to the throne; although Sophia did not initiate the plot, she was afterward tried by a special tribunal and compelled to take the veil (October 1698).

**Sophia Dorothea,** German SOPHIE DOROTHEA (b. Sept. 13, 1666—d. Nov. 23, 1726, Schloss Ahlden, Lower Saxony), wife of George Louis, elector of Hanover (George I of Great Britain), who accused her of infidelity and imprisoned her for 32 years.

The only child of George William, duke of Brunswick-Lüneburg-Celle, by a Huguenot lady named Eleanore d'Olbreuze, she was married, for dynastic reasons, to her cousin George Louis in 1682. The union was unhappy: her mother-in-law, the electress Sophia, hated her, a feeling soon shared by the prince himself. Under these circumstances Sophia Dorothea made the acquaintance of Count Philipp Christoph von Königsmark, who assisted her in futile attempts to escape from Hanover and was regarded as her lover.

In 1694 the count was assassinated, and the princess was divorced and imprisoned in the castle of Ahlden, remaining in captivity until her death. Sophia Dorothea is sometimes referred to as the "princess of Ahlden." Her two children were the English king George II and Sophia Dorothea, wife of Frederick William I and mother of Frederick the Great.

**Sophist,** in philosophy, a member of a group of itinerant professional teachers, lecturers, and writers prominent in Greece in the latter half of the 5th century BC and continuing, although declining, into the 4th. A later movement, known as the Second Sophistic school, existed in the 2nd century AD, but it consisted of Greek prose writers characterized more by nostalgia than by originality or profundity of thought.

A brief treatment of the Sophists follows. For full treatment, *see* MACROPAEDIA: Philosophical Schools and Doctrines, Western.

The name Sophist derives from the Greek *sophistes,* itself derived from *sophos,* meaning "wise," "clever," or "expert," and, in a general sense, the epithet was applied to craftsmen as well as to poets and sages and to such figures as the Athenian statesman Solon (late 6th and early 5th century BC), Pythagoras, Socrates, and Plato.

The first and most eminent representative of the so-called Sophistic school was Protagoras (*c.* 485–*c.* 410 BC). Other notable Sophists, all working in the late 5th century, include Gorgias of Leontini, Prodicus, Hippias, Antiphon, and Thrasymachus; Critias is often considered a Sophist, although he was an amateur whose main career lay in politics.

The Sophist movement arose at a time when there was much questioning of the absolute nature of familiar values and ways of life. It was recognized that while different societies expressed radically different outlooks on fundamental questions, all people everywhere—Greeks of one's own as well as of other cities, Greeks and non-Greeks, men and women, masters and slaves—shared a common human nature. An antithesis arose between nature and custom, tradition, or law. Custom could be regarded either as artificial trammels on the freedom of the natural state or as a beneficial and civilizing restraint upon natural anarchy. Both views were represented among the Sophists, although the former was the more common.

The Sophists worked independently of each other, primarily on ethical, political, and social questions. They drew their audiences partly from people with a general intellectual curiosity, but also from those seeking practical training in the arts of persuasion as preparation for political and legal careers. This led certain Sophists to specialize in logic and rhetoric and to ask questions, both theoretical and practical, about the nature of language; a common sport developed in the form of so-called dialectic, a kind of intellectual jousting subject to elaborate rules of procedure. Other Sophists lectured or wrote on subjects ranging from mathematics to wrestling.

The early Sophists enjoyed great prestige, but as challengers to orthodoxy they soon incurred unpopularity. In Athens those citizens who had the money and leisure to attend the lectures of the Sophists came from the aristocratic class, and they were constantly suspected of trying to subvert the popular democracy in the interests of the traditional enemy, Sparta. On the other hand the Sophist teachers were also regarded by some critics—most significantly, Plato—as catering to popular opinion in order to attract a larger group of pupils, and teaching those pupils to do likewise in order to advance politically.

Only fragments of the Sophists' writings have survived, and it is from Plato that they are mainly known. Plato gives a vivid picture of an assembly of Sophists in his dialogue *Protagoras,* and in another dialogue, the *Sophist,* he discusses more formally what he takes to be the essence of their thought. His attitude is generally hostile, though he does allow a tenuous intellectual link between them and his master, Socrates. But it is clear that the Sophists had an immense influence, largely via Plato himself, on a number of spheres, including the growth of logic, the philosophy of language, and epistemology, as well as on ethical and political theory.

After their decline, the reputation of the Sophists remained generally low into the 19th century, when they were defended by the English historian of Greece, George Grote. Still more recently, they have attained through some evaluations a modest esteem.

**Sophocles** (b. *c.* 496 BC, Colonus, near Athens [Greece]—d. 406, Athens), with Aeschylus and Euripides, one of classical Athens' three great tragic playwrights. The best known of his 123 dramas is *Oedipus the King.*

A brief treatment of Sophocles follows. For full treatment, *see* MACROPAEDIA: Greek Dramatists, Classical.

Sophocles' father, Sophillus, was a wealthy manufacturer of armour who gave his son a good education. It is not known when Sophocles first competed in dramatic festivals; he gained his first victory in 468, defeating Aeschylus. This began a career of unparalleled success and productivity. He wrote 123 dramas for the major dramatic competition, won perhaps as many as 24 victories, and never received less than second place at the competitions he entered.

He also distinguished himself in the public life of Athens. In 442 he was one of the treasurers responsible for receiving and managing the tribute from Athens' subject-allies in the Delian League. In 440 he was elected one of 10 strategi (military and naval commanders); his senior colleague was Pericles. All the ancient biographical sources depict Sophocles as a gracious and well-loved public figure who participated actively in his community and exercised outstanding artistic talents. Outliving Euripides by a few months, he died just before the end of the Peloponnesian War.

Only seven of Sophocles' tragedies—*Ajax, Antigone, Trachinian Women, Oedipus the King, Electra, Philoctetes,* and *Oedipus at Colonus*—survive in their entirety; all are works of his maturity. He is credited with several dramatic innovations, including some type of "scene paintings" or pictorial prop, an increase in the number of members in the chorus, and the addition of a third actor onstage. He also is noted for his supple language and superb artistry. His plays centre on the collision of defective personal judgment with an unkind fate that leads to human loss and disaster. The formal perfection and vivid characterizations in his plays make them the epitome of classical Greek drama.

**Sophonias** (Israelite prophet): *see* Zephaniah.

**Sophron** OF SYRACUSE (fl. *c.* 430 BC), author of rhythmical prose mimes in the Doric dialect. Although the mimes survive mostly in fragments of only a few words, it can be seen from their titles—*e.g., The Tunny-fisher, The Sempstress,* etc.—that they depicted scenes from daily life. One longer fragment deals with a magical ceremony. Plato thought highly of Sophron, who had some influence on Theocritus and also on Herodas.

**Sophronius** (b. *c.* 560, Damascus [Syria]—d. March 11, 638, Jerusalem), patriarch of Jerusalem, monk, and theologian who was the chief protagonist for orthodox teaching in the doctrinal controversy on the essential nature of Christ and his volitional acts.

A teacher of rhetoric, Sophronius became an ascetic in Egypt about 580 and then entered the monastery of St. Theodosius in Jerusalem. Journeying to monastic centres in Asia Minor, Egypt, and Rome, he accompanied the Byzantine chronicler John Moschus, who dedicated to him his celebrated tract on the religious life, *Leimōn ho Leimōnon* (Greek: "The Spiritual Meadow"). On the death of Moschus in Rome (619), Sophronius accompanied the body back to Jerusalem for monastic burial. He traveled to Alexandria, Egypt, and to Constantinople during 633 to persuade the respective patriarchs to renounce Monothelitism, a heterodox teaching that posited a single, divine will in Christ to the exclusion of a human capacity for choice. Sophronius' extensive writings on this question are all lost.

Although unsuccessful in this mission, Sophronius was elected patriarch of Jerusalem in 634. Soon after his enthronement he forwarded his noted synodical letter to Pope Honorius I and to the Eastern patriarchs, explaining the orthodox belief in the two natures (human and divine) of Christ, as opposed to Monothelitism, which he viewed as a subtle form of heretical Monophysitism (which posited a single [divine] nature for Christ). Moreover, he composed a *Florilegium* ("Anthology") of some 600 texts from the Greek Church Fathers in favour of the orthodox tenet of Dyotheletism (positing both human and divine wills in Christ). This document also is lost.

Sophronius noted the Saracen menace to Palestine in his Christmas sermon of 634, in which he commented that the Arabs already controlled Bethlehem. The fall of Jerusalem to 'Umar I's Saracen forces in 637 probably hastened Sophronius' death after he had negotiated the recognition of civil and religious liberty for Christians in exchange for tribute.

Beside polemics, Sophronius' writings included an encomium on the Alexandrian martyrs Cyrus and John in gratitude for an extraordinary cure of his failing vision. He also wrote 23 Anacreontic (classical metre) odes on such themes as the Saracen siege of Jerusalem and on various liturgical celebrations.

**Sophuza** (African kings): *see under* Sobhuza.

**Sopiha** FAMILY: *see* Sapieha family.

**Sopot,** German ZOPPOT, town and port, Gdańsk *województwo* (province), northern Poland. It lies on the Gulf of Gdańsk between Gdańsk (Danzig) and Gdynia. One of Poland's largest and most popular seaside and health resorts, a role it has filled since the 16th century, Sopot is situated in an area of wooded hills. There is some shipping and good road and rail connections to Gdynia and Gdańsk, with which Sopot is linked economically.

First settled in the 13th century, it was annexed to the free city of Danzig under Napoleon in 1807; it received municipal rights in 1901. It was again incorporated into Danzig in 1919 and returned to Poland in 1945. Pop. (1989 est.) 47,800.

**soprano,** the highest human vocal register, extending approximately from middle C to the second A above. A voice with a range approximately from the A below middle C to the second F or G above is termed a mezzo-soprano. Soprano generally refers to female voices, although it is also applied to boy sopranos (also called trebles) and to male castrati singers of the 16th, 17th, and 18th centuries. In music written in four parts, the soprano part is the highest part. Soprano can also designate a high-pitched member of an instrument family (*e.g.,* soprano saxophone). The term derives from Italian *sopra* ("above") and corresponds to the earlier Latin term *superius,* which in the polyphonic (multipart) music of the 13th–16th century referred to the highest part.

Soprano voices are often classified according to their colour or agility: a dramatic soprano has a rich, powerful quality; a lyric soprano, a lighter, singing tone; and a coloratura soprano possesses a high range (to the second C above middle C and higher) and extreme agility.

**Sopron,** German ÖDENBURG, town, Győr-Sopron *megye* (county), western Hungary. Occupying a salient projecting into the Burgenland of Austria, it is in the foothills of the Austrian Alps near Lake Fertő, west of

Budapest. Artifacts from the area indicate Neolithic, Bronze Age, Illyrian, and Celtic settlements prior to the town's becoming the Roman municipium of Scarabantia. It is a long-established mercantile centre at the intersection of major trade routes. The medieval inner town is oval-shaped and is surrounded by the old city walls, which largely remain intact. Many old houses with courtyards, a remarkable City Tower, and several old churches are of historical and architectural interest. After World War I the Burgenland was allotted to Austria, but in 1921 Sopron voted to remain in Hungary. Because most of Sopron's trade was in the Vienna Basin, the division of Austria-Hungary caused the town to lose much of its importance as a commercial centre. The town has some industry, including fruit preserving, sugar refining, and the manufacture of cotton goods. Sopron's architectural attractions make it a major tourist centre. The University of Forestry and Wood Sciences (1808) is in Sopron. Pop. (1994 est.) 56,324.

**Sopwith, Sir Thomas Octave Murdoch** (b. Jan. 18, 1888, London, Eng.—d. Jan. 27, 1989, Compton Manor, Kings Somborne, near Winchester, Hampshire), British aircraft designer whose firm was famous for such British World War I military aircraft as the Sopwith Camel and Triplane.



Sopwith, 1954
BBC Hulton Picture Library

Sopwith taught himself to fly in 1910 and in that year won the de Forest prize for the longest flight to the European continent. Two years later he founded Sopwith Aviation Company, Ltd., and won the first aerial derby flying a Blériot monoplane.

During World War I his firm produced many military aircraft, including the Pup, Camel, 1½-Strutter, and Triplane. Sopwith was chairman of the Society of British Aircraft Constructors from 1925 to 1927. He was chairman of the Hawker Siddeley Group, Ltd., from 1935 to 1963. During World War II this company built the Hurricane fighter and the Lancaster bomber. Sopwith's yachts *Endeavour* (1934) and *Endeavour II* (1937) were unsuccessful British challengers for the America's Cup. He was knighted in 1953.

**Sør-Trøndelag**, *fylke* (county), central Norway. It extends from the Swedish border (east) to the coast of the Norwegian Sea (west). The mouth of the deeply indented Trondheim Fjord lies in the northern part of the *fylke;* parts of the Dovre Mountains are in the south. Adjacent to the Norwegian Sea coast are the large islands of Hitra and Frøya. The *fylke*'s economy is based on fishing and agriculture in the rural areas, while shipping and manufacturing are predominant in and around Trondheim (*q.v.*), the county seat and one of Norway's principal cities. Area 7,271 square miles (18,831 square km). Pop. (1996 est.) 257,079.

**Sora** (people): *see* Savara.

**Sora,** town, Frosinone *provincia,* Lazio (Latium) *regione,* south-central Italy. In ancient times the town was the scene of fighting between the Romans and the Samnites (a warlike Italic tribe) and experienced a turbulent history during the numerous wars that ravaged the Italian peninsula before Rome's rise to dominance. The town was damaged several times by earthquakes, including one in 1915. In later times it has developed as a mountain vacation resort that also has textile, paper, and other manufacturing industries. Pop. (1993 est.) mun., 26,363.

**Sorabji, Kaikhosru Shapurji,** original name LEON DUDLEY (b. Aug. 14, 1892, Chingford, near London, Eng.—d. Oct. 15, 1988, Dorchester, Dorset), eccentric English composer known for his complex musical works combining free rhythms, elements of Asiatic melodic construction, and European polyphonic structures.

Dudley was of Parsi, Sicilian, and Spanish descent and spent most of his life in England. As a young man he became interested in his father's Parsi heritage and changed his name accordingly. He began his career as a masterly concert pianist, but he abandoned concert performing in the early 1920s. In the 1920s and '30s he was an outspoken music critic and essayist, displaying biting wit and sarcasm in his critical evaluations. He then took up composition.

Sorabji's most famous composition is *Opus Clavicembalisticum* (1930). It consists of one movement lasting nearly 5 hours and is the longest nonrepetitive piano composition ever published. He wrote several symphonies, including the "Jami" Symphony (1942–51), which was nearly 1,000 pages long. From 1940 to 1976 Sorabji prohibited the performance or further publication of his works, making them available only in his own private recordings. In 1976 he permitted only Michael Habermann and Yonty Solomon to perform his works. His books include *Around Music* (1932) and *Mi Contra Fa: The Immoralisings of a Machiavellian Musician* (1947).

**Soranus,** in Roman religion, the underworld deity worshiped on Mount Soracte in southern Etruria. As priests, the *hirpi Sorani* celebrated a rite in which they marched barefoot over burning coals. Soranus was identified with Dis, the Roman god of the underworld, or with Apollo, a Greek god adopted by the Romans, and had a female partner, Feronia, a goddess of uncertain attributes.

**Soranus** OF EPHESUS (near modern Selçuk, Turkey; fl. 2nd century AD, Alexandria and Rome), Greek gynecologist, obstetrician, and pediatrician, chief representative of the methodist school of medicine (emphasizing simple rules of practice, based on a theory that attributed all disease to an adverse state of "internal pores"). His writings set medical opinion concerning women's diseases, pregnancy, and infant care for nearly 1,500 years.

Soranus' remarkable work, *On Midwifery and the Diseases of Women,* includes numerous descriptions of contraceptive measures; he also describes the obstetric chair and podalic version (delivery of the fetus feet first)—hailed as new discoveries during the 15th century—and renders a recognizable account of rickets. His *On Acute and Chronic Diseases* contains an excellent chapter on nervous disorders, with suggested treatments resembling aspects of modern psychotherapy. A keen observer and a practitioner of unusual competence, Soranus also wrote the oldest known biography of Hippocrates and a treatise on fractures.

**Sorb,** German SORBEN, any member of a Slavic minority living in eastern Germany. The Sorbs are concentrated in the Spree River valley, in the area of Bautzen (Budyšin) and Cottbus. This area was part of the traditional region of Lusatia (*q.v.*), whose history is intimately bound up with the Sorbs. The Sorbs are descendants of two small Slavic tribes, the Lužičí and the Milčani, who were subgroups of the major tribe known as Sorbs. The latter were one of a number of Slavic tribes collectively known as Wends, who lived in the area between the Elbe and Oder rivers for centuries until they were subdued and assimilated by the Germans in the late Middle Ages. Though surrounded by Germans for centuries, the present-day Sorbs have managed to preserve their own ethnic identity, language, literature, and customs. The Sorbs are mostly Roman Catholic and use an alphabet of Latin origin. They numbered some 75,000 in the late 20th century. *See also* Wend.

**Sorbian languages,** also called LUSATIAN, or WENDISH, closely related West Slavic languages or dialects; their small number of speakers in eastern Germany are the survivors of a more extensive medieval language group. The centre of the Upper Sorbian speech area is Bautzen, near the border with the Czech Republic, while Cottbus, near Poland, is the centre for Lower Sorbian. The oldest written record of Sorbian dates from the 15th century, although the languages, differing mostly in their sound systems, are known to have begun to diverge around the 13th century. Upper Sorbian enjoyed a considerable amount of prestige in Saxony, while the kingdom of Prussia attempted to suppress Lower Sorbian. Although all Sorbs today also speak German, both Upper and Lower Sorbian have been taught in the schools of the Sorbian areas since 1948.

**Sorbon, Robert de** (b. Oct. 9, 1201, Sorbon, near Rethels, France—d. Aug. 15, 1274, Paris), French theologian, confessor to King Louis IX, and founder of the Sorbonne, a collegiate building that became identified with the University of Paris.

Born into a poor rural family, Sorbon was educated in Reims and in Paris, where his piety and diligence drew the patronage of the comte d'Artois and King Louis IX. In 1251 he became canon of Cambrai. His importance and influence with the king grew until 1258, when he was appointed canon of Paris and chaplain to the court.

Sorbon began to teach about 1253, and in 1257 he obtained property upon which, with the aid of the king, he founded the Maison de Sorbonne, a theological college for poor students. The Sorbonne received official sanction from the pope in 1259 and rapidly grew into a major European centre of learning and the core of the University of Paris. Sorbon himself was chancellor of the university from 1258 and continued to advocate widespread access to higher education and to write numerous religious tracts and commentaries.

**Sorby, Henry Clifton** (b. May 10, 1826, Woodbourne, near Sheffield, Yorkshire, Eng.—d. March 9, 1908, Sheffield), English geologist whose microscopic studies of thin slices of rock earned him the title "father of microscopical petrography."

Sorby's early investigations were concerned with agricultural chemistry, but his interests soon turned to geology. He published works dealing with the physical geography of geologic periods, rock denudation and deposition, and the formation of river terraces.

Convinced of the value of the microscope as a tool in all sciences, Sorby began to prepare thin sections of rocks (about 0.025 millimetre, or 1/1000 inch thick) for microscopic study in 1849. His subsequent findings demonstrated the value of petrography, the descriptive branch of the study of rocks. In his memoir "On the Microscopical Structure of Crystals," in the *Quarterly Journal of the Geological Society of London* (1858), he championed the use of microscopic techniques in geology.

In 1865 Sorby announced a new type of

spectrum microscope for analyzing the light of organic pigments, especially minute bloodstains. His research on meteoric geology led to studies of iron and steel, and he concluded that steel is a crystallized igneous rock. His later studies included the origin of stratified rocks, weathering, and marine biology.

**sorcery,** the use of power gained from the assistance or control of evil spirits. Sorcery is distinguished by some writers from witchcraft (*q.v.*) in that it may be practiced by anyone with the appropriate knowledge, using charms, spells, potions, and the like; whereas witchcraft is considered to result from an inherent mystical power and to be practiced by invisible means. Sorcery can be protective—for example, as a guard of property against theft. A practitioner of sorcery is called a sorcerer, or a wizard. The distinction between sorcery and witchcraft is not consistently or universally maintained. During the witch-hunts of the 16th and 17th centuries, courts frequently regarded witches and sorcerers alike as candidates for burning.

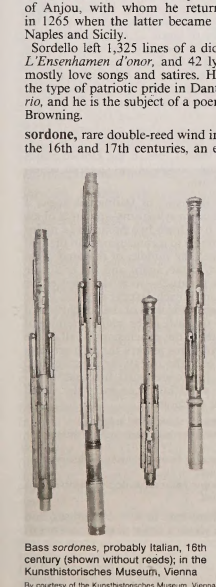
**Sordello** (b. *c.* 1200, Goito, near Mantua [Italy]—d. before 1269), most renowned Provençal troubadour of Italian birth, whose *planh*, or lament, on the death of his patron Blacatz (Blacas), in which he invites all Christian princes to feed on the heart of the hero so that they might absorb his virtues, is one of the masterpieces of Provençal poetry.

Sordello became famous when, in 1224, at the court of Richard of Bonifacio at Verona, he abducted his master's wife at the instigation of her brother. After this act (which was primarily political), he went to Treviso, married, and crossed the Alps, pursued by the hatred of several families.

He traveled as a troubadour through Spain and southern France and settled at the court of Raymond Berengar IV of Provence about 1237. He later became a companion of Charles of Anjou, with whom he returned to Italy in 1265 when the latter became Charles I of Naples and Sicily.

Sordello left 1,325 lines of a didactic poem, *L'Ensenhamen d'onor*, and 42 lyrical pieces, mostly love songs and satires. He was made the type of patriotic pride in Dante's *Purgatorio*, and he is the subject of a poem by Robert Browning.

**sordone,** rare double-reed wind instrument of the 16th and 17th centuries, an early precursor of the bassoon. It differs from the curtal, the bassoon's direct predecessor, in having a cylindrical bore (a bassoon bore is conical). The bore, cut into a single piece of wood, doubled in a narrow U-shape and emerged in a lateral hole. Finger holes were cut in the instrument wall. The *sordone* produced a muted sound and had a compass of a 13th.



Bass *sordones*, probably Italian, 16th century (shown without reeds); in the Kunsthistorisches Museum, Vienna
By courtesy of the Kunsthistorisches Museum, Vienna

**Sore, Martin:** *see* Agricola, Martin.

**sore mouth,** also called DOBY MOUTH, PUSTULAR DERMATITIS, OF CONTAGIOUS ECTHYMA (CE), viral disease of sheep and goats. Blisters, pustules, ulcers, and scabs form on the lips especially but also on the face and ears. In severe cases sores form inside the mouth. Infections occur in the spring and summer and heal in about a month. Humans who work around the sheep sometimes become infected.

*Articles are alphabetized word by word, not letter by letter*

**Sorel,** city, Montérégie region, southern Quebec province, Canada. It lies at the mouth of the Richelieu River, on the south bank of the St. Lawrence River. Fort-Richelieu (marked by a monument) was erected on the site in 1642. In 1672 a land grant was obtained by the fort commandant, Pierre de Saurel (or Sorel), for whom the settlement was named. A parish was established in 1721. In 1787 the community was renamed William Henry after the son (later William IV) of George III, but it reverted to its original name in 1845. A service centre for a farming area, Sorel is also a seaport and a wintering port for river steamships, dredges, and other craft. Steelmaking, titanium smelting, ship repairing, and the manufacture of plastics, synthetic fibres, clothing, and furniture are the chief industries. During World War II, Sorel became an important armament and shipbuilding centre. The city has a college, historical museum, two cathedrals (St. Peter's and Notre Dame), and the Gothic-style Christ Church (1842). Inc. 1848. Pop. (1991) 18,786.

**Sorel, Agnès** (b. *c.* 1422, Fromenteau, France—d. Feb. 9, 1450, Anneville), mistress (1444–50) of King Charles VII of France, sometimes known as "Dame de Beauté" from the estate at Beauté-sur-Marne, which he gave her.

Born of a family of the lesser nobility at Fromenteau in Touraine, Sorel was attached at an early age to the service of Isabel of Lorraine, queen of Sicily and wife of René of Anjou, who was the brother-in-law of Charles VII. From 1444 until her death in 1450 she was the acknowledged mistress of the king, the first woman to hold that semiofficial position which was to be of so great importance in the subsequent history of the old regime. Her ascendancy dated from the festivals at Nancy in 1444, the first brilliant court of Charles VII. There her great beauty captivated the king, whose love for her remained constant until her death. He gave her wealth, castles, and lands and secured for her the state and distinction of a queen. This first public recognition of his mistress by a king of France scandalized people and awakened jealousy and intrigue. Her sudden death from dysentery, shortly after the birth of her fourth child, was accordingly attributed to poison. Burgundian historians even openly accused the dauphin, afterward Louis XI, of her death, and later the enemies of Jacques Coeur, in their search for crimes to be brought against him, used this rumour to charge him with the one crime most likely to turn the king against him.

Legend has made an entirely different character of this first official mistress of the French kings. The date of her birth was placed at about 1409, her liaison with the king dated from 1433. Then, so the story ran, she drew him from his indolence, continuing the work of Joan of Arc, both by nerving the king to warlike enterprises—she did apparently induce him to take part personally in the conquest of Normandy—and by surrounding him with that band of wise advisers who really administered France during her ascendancy. Later investigation exploded this romantic story by simply showing that Charles VII had not met her until 10 years later than the time of the legend.

**Sorel, Georges (-Eugène)** (b. Nov. 2, 1847, Cherbourg, France—d. Aug. 30, 1922, Boulogne-sur-Seine), French Socialist and revolutionary syndicalist who developed an original and provocative theory on the positive, even creative, role of myth and violence in the historical process.

Sorel was born of a middle-class family and trained as a civil engineer. Not until he reached age 40 did he become interested in social and economic questions. In 1892 he retired from his civil-service engineering post and devoted himself to a life of meditation and study. In 1893 he discovered Marxism and began writing the analytical critiques that constitute his most original and valuable achievement.



Georges Sorel
H. Roger-Viollet

In 1897 Sorel was a passionate defender of Alfred Dreyfus, the Jewish army officer who was wrongly convicted of treason, but he became disgusted with the way the parties of the left exploited "the Affair" for their own political advancement. By 1902 he was denouncing the Socialist and Radical parties for advocating democracy and constitutionalism as a road to Socialism. Instead, he enthusiastically supported revolutionary syndicalism, a movement with anarchistic leanings that stressed the spontaneity of the class struggle. His best known work, *Réflexions sur la violence* (1908; *Reflections on Violence*), first appeared as a series of articles in *Le Mouvement Socialiste* early in 1906 and has been widely translated. Here Sorel developed his notions of myth (modeled on the syndicalist vision of the general strike) and of violence. Violence for Sorel was the revolutionary denial of the existing social order, and force was the state's power of coercion. (His theory was later perverted and utilized by the Italian Fascist dictator Benito Mussolini.)

Throughout Sorel's thought there runs a moralistic hatred of social decadence and resignation. He attacked the idea of inevitable progress, as developed by 18th-century philosophers, in his work *Les Illusions du progrès* (1908; "Illusions of Progress") and believed that the future was what men chose to make it. Departing from the intellectual tradition of European Socialism, Sorel held that human nature was not innately good; he therefore concluded that a satisfactory social order was not likely to evolve but would have to be brought about by revolutionary action. After 1909 Sorel became disenchanted with the syndicalist movement, and, with some hesitation,

he adhered, not without embarrassment and hesitation, to the monarchist movement—Action Française—which sought to reestablish a homogeneous and traditional moral order. With the outbreak of the Russian Revolution in 1917, Sorel declared himself for the Bolsheviks, who he thought might be capable of precipitating the moral regeneration of mankind.

Sorel wrote on an extraordinarily broad range of topics, including the Bible, Aristotle, and the decline of Rome, in addition to his writings on Socialism. Among his chief works are *L'Avenir socialiste des syndicats* (1898; "The Socialist Future of the Syndicalists"), *Les Illusions du progrès* (1908; "Illusions of Progress"), and *La Révolution dreyfusienne* (1909; "The Dreyfusard Revolution").

**Sørensen, Rasmus Møller** (b. March 8, 1799, Jelling, Den.—d. May 23, 1865, Copenhagen), teacher and politician who was a leading agitator for agrarian reform and for the establishment of representative government in Denmark.

In the 1820s and 1830s Sørensen, serving as tutor on the estates of several progressive landowners, developed his ideas of peasant reform. He championed the opening of folk high schools for practical secular education, the breaking up of large estates in favour of smallholders, tenant proprietorship aided by government funds, and increased political representation. In the early 1840s he founded and edited the journal *Almuevennen* ("Friend of the Common People") with J.A. Hansen, another leading peasant agitator. Leaving his teaching position, he organized the circulation of petitions calling for agrarian reform, equality of taxation, universal conscription, and political equality. With the achievement of constitutional government, Sørensen was elected to parliament (1849–52).

**Sørensen, Villy** (b. Jan. 13, 1929, Copenhagen, Den.—d. Dec. 16, 2001, Copenhagen), influential writer of modernist short stories and also a leading literary critic in Denmark after World War II.

His first collection of short stories, *Saere historier* (*Tiger in the Kitchen and Other Strange Stories*) appeared in 1953, followed in 1955 by *Ufarlige historier* ("Harmless Stories") and in 1964 by the important collection *Formynderfortaellinger* ("Guardian Stories"). His short stories are experimental and often draw their material from the Bible, legends, ballads, and world history in general. Sørensen employed the naive manner of Hans Christian Andersen and allegorical tales like those of Isak Dinesen to describe the absurdity that threatens human existence. He often treated the themes of the divided self and the loneliness of the individual in society.

Sørensen's fiction manifests in artistic form the theories of his philosophical writings, *Digtere og daemoner* (1959; "Poets and Demons") and *Hverken-eller* (1961; "Neither-Nor"). He was strongly influenced in his thinking by German existentialism, in particular the writings of Martin Heidegger. Sørensen served as an editor of the literary periodical *Vindrosen* (1959–63).

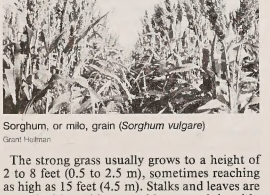
**Sorge, Richard** (b. Oct. 4, 1895, Baku, Russia [now in Azerbaijan]—d. Nov. 7, 1944, Tokyo), German press correspondent who headed a successful Soviet espionage ring in Tokyo during World War II.

After service in the German Army during World War I, he earned a doctorate in political science at the University of Hamburg, Germany, joining the Communist Party of Germany in 1919. He went to Moscow in 1924, and about five years later the Communist International sent him to China to organize a spy ring. While in China, Sorge built a reputation as an able journalist and loyal German, and in 1933 he joined the Nazi Party. The Comintern then sent him to Japan, where he became political adviser to the German ambassador, Major General Eugen Ott.

On May 12, 1941, Sorge reported to the Russians that 170 German divisions would attack along the Soviet frontier on June 20 (the attack came on June 22), proceeding in the direction of Moscow. In August 1941 Sorge reported that the Japanese Army was planning to advance southward against Pacific targets rather than northward against the U.S.S.R.; this information freed Soviet troops along the Manchurian border for service in the west.

On Oct. 18, 1941, Sorge was arrested by the Japanese, and he and Ozaki Hotsumi, another agent of Russia, were executed. In 1964 Sorge was declared a Hero of the Soviet Union.

**sorghum,** cereal grain plant of the family Gramineae (Poaceae), probably originating in Africa, and its edible starchy seeds. All types raised chiefly for grain belong to the species *Sorghum vulgare,* which includes varieties of grain sorghums and grass sorghums, grown for hay and fodder, and broomcorn, used in making brooms and brushes. Grain sorghums include durra, milo, shallu, kafir corn, Egyptian corn, great millet, and Indian millet. In India sorghum is known as jowar, cholam, or jonna; in West Africa as Guinea corn; and in China as kaoliang. Sorghum is especially valued in hot and arid regions for its resistance to drought and heat.



Sorghum, or milo, grain (*Sorghum vulgare*)
Grant Heilman

The strong grass usually grows to a height of 2 to 8 feet (0.5 to 2.5 m), sometimes reaching as high as 15 feet (4.5 m). Stalks and leaves are coated with a white waxy bloom, and the pith, or central portion, of the stalks of certain varieties is juicy and sweet. The leaves are about 2 inches (5 cm) broad and 2½ feet (0.75 m) long, and the panicles, or flower clusters, range from loose to dense, bearing 800–3,000 kernels. The seeds vary widely among different types in colour, shape, and size, but they are smaller than those of the wheat plant.

Sorghum is of a lower feed quality than corn (maize). It is high in carbohydrates, with 10 percent protein and 3.4 percent fat, and contains calcium and small amounts of iron, vitamin $B_1$, and nicotinic acid. The grain is usually ground into a meal that is made into porridge, flatbreads, and cakes. The characteristic strong flavour can be reduced by processing. The grain is also used in making edible oil, starch, dextrose (a sugar), paste, and alcoholic beverages. The stalks are used as fodder and building materials. Sweet sorghums, or sorgos, are grown mainly in the United States and southern Africa for forage and for syrup manufacture. In some countries the sweet stalks are chewed.

Sorghum, one of Africa's major cereal grains, is also cultivated in the United States, India, Pakistan, and northern and northeastern China. Substantial quantities are grown in Iran, the Arabian Peninsula, Argentina, Australia, and southern Europe.

**Soria,** province, in the *comunidad autónoma* ("autonomous community") of Castile-León, north-central Spain. Formed from part of Old Castile in 1833, it has an area of 3,972 square miles (10.287 square km). The terrain is varied: to the north are the Moncayo and Urbión mountain ranges; in the centre, around Soria city, the provincial capital, is a flat plain watered by the Duero (Portuguese: Douro) River; and in the south, this same plain gives way to rolling hills. Cereals and grapes are grown in areas irrigated by the Duero, and timbering and sheep grazing are carried on. Pop. (2000 est.) 90,911.

**Soria,** town, capital of Soria province, in the Castile-León *comunidad autónoma* ("autonomous community"), north-central Spain, on the western bank of the Duero (Portuguese: Douro) River, about 110 miles (175 km) northeast of Madrid. Restored by Alfonso I the Warrior of Aragon after the Moorish invasion, the city was later given to Alfonso VII of Castile. Medieval Soria was ruled by the unique Doce Linajes (12 noble families that governed in turn). The churches of Santo Domingo and San Nicolás, the Colegiata (collegiate church) de San Pedro, the cloister of the Convent of San Juan del Duero, and other ecclesiastical buildings are fine specimens of Romanesque architecture.

Commercial activities include food processing, sawmilling, and the manufacture of cement, soap, and tiles. Pop. (2001 est.) 36,640.

**Sorin, Edward Frederick** (b. Feb. 6, 1814, Ahuillé, Fr.—d. Oct. 31, 1893, South Bend, Ind., U.S.), Roman Catholic priest and educator, founder and first president of the University of Notre Dame.

Sorin was ordained a priest in 1838, and two years later he joined the Congregation of Holy Cross, a group of priests and brothers organized at Le Mans, Fr. Sorin and six brothers went to Vincennes, Ind., in 1841 at the invitation of Bishop Célestine Hailandière. Offered land near South Bend by the bishop, Sorin in 1843 estab-lished a community of French Sisters of Holy Cross at nearby Bertrand, Mich. The following year he obtained a charter for the University of Notre Dame, an institution of higher learning for men, where he served as president until 1865. Sorin acquired a site adjacent to Notre Dame in 1854 for the French sisters, who founded St. Mary's College there, a small liberal arts college for women and the motherhouse of the Sisters of Holy Cross. He began publishing *Ave Maria* magazine in 1865 and served as provincial superior of the Congregation of Holy Cross in the United States until 1868, after which he was superior general until his death.

**sorites,** in syllogistic, or traditional, logic, a chain of successive syllogisms—or units of argument that pass from two premises (a major and then a minor) to a conclusion—in the first figure (*i.e.*, with the middle, or repeated, term as the subject of the major and the predicate of the minor premise)—so related that either the conclusion of each (except the last) is the minor premise of the next or the conclusion of each (except the last) is the major premise of the next. If, then, the conclusions of all of the successive syllogisms (except the last) are suppressed and only the remaining premises and the final conclusion are stated, the resulting argument is a valid inference from the stated premises. For example:

> Some enthusiasts show poor judgment.
> All who show poor judgment make frequent mistakes.
> None who makes frequent mistakes deserves implicit trust.
> Therefore, some enthusiasts do not deserve implicit trust.

In general, there may be $n + 1$ premises, and analysis then yields a chain of $n$ successive syllogisms.

**Sørlandet,** geographical region, southern Norway. Occupying some 6,368 square miles

(16,493 square km), it embraces the *fylker* (counties) of Aust-Agder and Vest-Agder. Its base runs along the southern coast of Norway, and it extends inland to the Bykle Hills. Like most of Norway, Sørlandet has a strip of lowland along its coast that quickly rises into interior mountains and plateaus. These highlands are cut by deep valleys and rivers, the most important being the Setes valley containing the Otra River, which bisects the region from north to south.

Most of the population lives on the coastal lowlands. Kristiansand and Arendal, the administrative centres of Vest-Agder and Aust-Agder, respectively, are the main industrial centres and seaports in the region. The rural economy is based on farming and dairying, while fishing and the fish-processing industry are important along the coast. The southernmost point of mainland Norway is marked by the Lindesnes lighthouse in the southwest. Because of Sørlandet's southern location, the coastal areas have the warmest climate in Norway as well as fine bathing beaches, and the region is a major tourist centre. Pop. (1992 est.) 243,782.

**Sorø,** city, seat of Vestsjælland *amtskommune* (county commune), Sjælland (Zealand), Denmark. It is the home of Sorø Academy, a well-known Danish boys' school, resembling an English public (*i.e.,* "private") school. The academy was founded by Frederick II in 1586 in a former Cistercian abbey (dating from the 12th century). Its alumni include many Danish kings and princes. The magnificent abbey church, built by Bishop Absalon later in the 12th century, contains the bishop's tomb and those of two 14th-century kings. The city was chartered in 1638. Its economic mainstays are wood and meat products and machinery. Pop. (1999 est.) city, 6,728; (1995 est.) mun., 14,668.

**Sorocaba,** city, east-central São Paulo *estado* ("state"), Brazil. It lies along the Sorocaba River, a tributary of the Tietê River, at 1,804 feet (550 m) above sea level. Given town status in 1661 and made the seat of a municipality in 1842, Sorocaba is now one of the nation's major industrial centres. Manufactures include cotton and silk textiles, cement, fertilizers, lumber, aluminum products, shoes, hats, alcohol, and wines. The city is the headquarters of the electric Sorocaba Railway (arrived *c.* 1875) and of its maintenance shops. Goods from Sorocaba reach São Paulo city, 80 miles (130 km) east, and other markets by rail, road, and air. Pop. (2000 prelim.) 487,907.

**Sorokin, Pitirim Alexandrovitch** (b. Jan. 21, 1889, Turya, Russia—d. Feb. 10, 1968, Winchester, Mass., U.S.), Russian-American sociologist who founded the department of sociology at Harvard University in 1930. In the history of sociological theory, he is important for distinguishing two kinds of sociocultural systems: "sensate" (empirical, dependent on and encouraging natural sciences) and "ideational" (mystical, anti-intellectual, dependent on authority and faith).

The first professor of sociology at the University of Petrograd (1919–22; St. Petersburg), Sorokin was expelled from the Soviet Union for his anti-Bolshevism. Before going to Harvard, he was on the faculty of the University of Minnesota, Minneapolis, where he specialized in rural sociology (1924–30). Among his writings are *A Systematic Source Book in Rural Sociology,* 3 vol. (1930–32); *Social and Cultural Dynamics,* 4 vol. (1937–41); *Man and Society in Calamity* (1942); *Altruistic Love* (1950); and an autobiography, *A Long Journey* (1963).

Sorokin believed that the postmedieval Western sensate culture was in its last stages and that the study of nonsexual altruistic love as a science was needed to avert worldwide chaos. In his view, this necessity followed from his principle of polarization, according to which the moral indifference prevailing under ordinary circumstances is supplanted, for the duration of a crisis, by the extremes of selfishness and altruism.

**Sorokino** (Ukraine): *see* Krasnodon.

**Sorolla y Bastida, Joaquín** (b. Feb. 27, 1863, Valencia, Spain—d. Aug. 10/11, 1923, Cercedilla), Spanish painter. The style of his later works has been called a conservative, personal variant of Impressionism.

Sorolla began training at the Royal Academy of San Carlos in Valencia at age 15; he later studied in Rome and Paris. His works include historical and genre paintings, portraits, and landscapes. He is best known for scenes of the beach, such as "Beaching the Boat" (1903), marked by dramatic composition, sharp contrasts of light and shade, brilliant colour, and vigorous brushstrokes.

**Soromenho, Fernando Monteiro de Castro** (b. Jan. 31, 1910, Chinde, Mozambique—d. June 18, 1968, São Paulo, Brazil), white Angolan novelist writing in Portuguese who depicted African life in the interior of the country and condemned the Portuguese colonial administration there. He is known as the "father of the Angolan novel."

Soromenho was taken to Angola by his parents in 1911, was sent to school in Portugal at the age of six, and returned to Angola from 1925 until 1937. His first job, as a recruiter of African contract labour for a mining company in northeastern Angola, gave him a chance to know and respect traditional African life. He then became a journalist, first in Luanda and later in Lisbon, where in 1937 he edited the weekly *Humanidade.* In 1943 he started his own publishing house, Sociedade de Intercâmbio Luso-Brasileiro.

Soromenho's published work consists of five novels, four volumes of stories, and several sociological studies and travel books. *Nhári: O Drama da Gente Negra* (1938; "Nhari: The Drama of Black People"), his first work, contains stories about traditional African societies. In later books, such as the novel *Terra Morta* (1949; "Dead Land"), he concentrates on the conflict produced by European intrusion on the life of Africans in Luanda province. *Terra Morta,* published in Brazil, was banned by Portuguese authorities. The government subsequently prevented the distribution of other books published by Soromenho. In 1960, to escape arrest in Portugal, he fled abroad and lived in France, the United States, and Brazil.

Soromenho's other novels include *Noite de Angústia* (1939; "Night of Anguish"), *Homens sem Caminho* (1941; "Men without Direction"), *A Viragem* (1957; "Turnabout"), and *A Chaga* (1970; "The Wound").

**sororate,** marriage of a man to his wife's sister, whether in the lifetime of the first wife or after her death. The term was introduced by the British anthropologist Sir James George Frazer. Though related in principle, the levirate (marriage with a deceased husband's brother) and sororate are usually but not invariably associated and appear to be the most common of preferential secondary marriages. Either may be permissive rather than obligatory. The Maricopa Indians of Arizona traditionally insisted on a widow's marrying a husband's relative, whereas the replacement of a deceased wife by a kinswoman of hers was customary but not compulsory.

Though successive and simultaneous marriages of two or more sisters fall under the same principle, some peoples favour one while tabooing the other practice. Hence it has become necessary to distinguish between sororal polygyny and sororate. The typical rule for sororal polygyny is that the husband of the eldest girl in a family marries her juniors as they come of age; this was a practice in at least 40 North American Indian tribes during the 19th century. More recently, Navajo men often were simultaneously married to two sisters, occasionally to three. Australian Aborigines recognized the same preemptive claim, but in many tribes the husband contented himself with the two oldest girls, conveying his claims on their younger sisters to his junior brother. With remarkable unanimity Aborigines explained that in sororal polygyny sisters are unlikely to quarrel as cowives.

**sorority:** *see* fraternity and sorority.

**sorosilicate,** formerly called PYROSILICATE, any member of a group of compounds with structures that have two silicate tetrahedrons (a central silicon atom surrounded by four oxygen atoms at the corners of a tetrahedron) linked together. Because one oxygen atom is shared by two tetrahedrons, the chemical formula contains $Si_2O_7$, as in melilite or hemimorphite.

**sorrel** (tree): *see* sourwood.

**sorrel,** any of several hardy perennial herbs of the Polygonaceae, or buckwheat, family that are widely distributed in temperate regions. Sheep sorrel (*Rumex acetosella*) is a weed that is native to Europe and has become widespread in North America. It is an attractive but troublesome invader that occurs in lawns and gardens as well as meadows and grassy slopes. It sprouts from spreading rootstocks and has acid-tasting, slender triangular leaves and tiny yellow or reddish flowers. Sheep sorrel's pungent, sour leaves are used as a vegetable, as a flavouring in omelets and sauces, and as the chief ingredient of creamed sorrel soup. The young leaves are used in salads. Two related species are garden sorrel (*R. acetosa*) and French sorrel (*R. scutatus*); both are hardy perennials distributed throughout Europe and Asia. Garden sorrel, like sheep sorrel, has become naturalized in North America. The name wood sorrel (*q.v.*) is given to plants belonging to the genus *Oxalis.*

**Sorrento,** Latin SURRENTUM, town and archiepiscopal see, Napoli *provincia,* Campania *regione,* southern Italy. It lies on a peninsula separating the Bay of Naples, which it faces, from the Gulf of Salerno, south-southeast of Naples. The backbone of the peninsula is formed by the Lattari Mountains, which culminate in Mount Sant'Angelo (4,734 feet [1,443 m]). Probably of Greek origin, the town was the ancient Surrentum, a Roman resort. The seat of an autonomous duchy in the 7th century, Sorrento became part of the Norman kingdom of Sicily in 1137. The poet Torquato Tasso was born there in 1544.

Notable landmarks in the town include the frequently rebuilt cathedral, the 14th-century cloister of St. Francis of Assisi, and the Correale di Terranova Museum, containing an important collection of Campanian decorative art, medieval sculpture, paintings, and classical remains. Long popular as a resort for its climate and scenic location, Sorrento is also noted for wine, olive oil, and citrus fruit. Pop. (1991 prelim.) mun., 17,015.

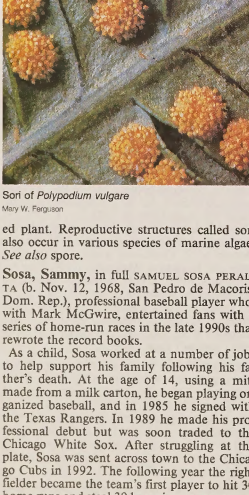
**Sorsogon,** town, southeastern Luzon, Philippines, near the southernmost tip of the Bicol Peninsula. The town of Sorsogon is a port on the northeastern shore of Sorsogon Bay. The adjacent hinterland consists of volcanic cones interspersed with broad, level farmlands that produce abaca, coconuts, rice, and sweet potatoes. Sorsogon has processing facilities for abaca and copra. Pop. (1990) 72,871.

**sortition,** election by lot, a method of choosing public officials in some ancient Greek city-states. It was used especially in the Athenian democracy, from which most information about the practice is derived. With few exceptions, all magistrates were chosen by lot,

beginning with the archons in 487–486 BC; likewise the Boule (council) of 500 and the juries of the law courts were chosen by lot. The practice of sortition obviated electoral races and provided for the regular turnover of officeholders. The operations of government were thus not in the hands of experts, but, through the system of sortition, the Athenian democracy provided at least some practical political education for its citizens.

The rationale of sortition was the equality of all citizens. Only those who had presented themselves as candidates were chosen by lot to fill public offices. Military officers (including the 10 *stratōgoi*) and some financial officials were selected by voting rather than by sortition. But for the most part executive functions were broken down into small tasks, of which each was entrusted to an annual board of 10 members chosen by lot.

**sorus,** plural SORI, in botany, brownish or yellowish cluster of spore-producing structures (sporangia) on the lower surfaces of fern leaves. A sorus may be protected during development by a scale or film of tissue called an indusium. In rust and smut fungi, a sorus is a spore mass produced on the leaf of an infected plant. Reproductive structures called sori also occur in various species of marine algae. *See also* spore.



Sori of *Polypodium vulgare*
Mary W. Ferguson

**Sosa, Sammy,** in full SAMUEL SOSA PERALTA (b. Nov. 12, 1968, San Pedro de Macoris, Dom. Rep.), professional baseball player who, with Mark McGwire, entertained fans with a series of home-run races in the late 1990s that rewrote the record books.

As a child, Sosa worked at a number of jobs to help support his family following his father's death. At the age of 14, using a mitt made from a milk carton, he began playing organized baseball, and in 1985 he signed with the Texas Rangers. In 1989 he made his professional debut but was soon traded to the Chicago White Sox. After struggling at the plate, Sosa was sent across town to the Chicago Cubs in 1992. The following year the right fielder became the team's first player to hit 30 home runs and steal 30 bases in one season, an achievement he repeated in 1994. Though Sosa was a powerful hitter, he was also undisciplined—his strikeouts (174) outnumbered his hits (161) that year.

The 1998 season, however, marked a turnaround for Sosa as he became more patient at the plate. After a slow start, he hit 20 home runs in June to set a major league record for the most homers in a single month. Though not expected to threaten Roger Maris's single-season home-run record (61), he was soon battling McGwire for a place in the record books. On September 13, five days after McGwire had passed Maris, Sosa hit his 61st and 62nd homers. He finished the year with a .308 batting average and 66 home runs. On Sept. 18, 1999, Sosa became the first player to hit 60 homers twice; he finished the year with 63.

**Sosigenes** OF ALEXANDRIA (fl. 1st century BC), astronomer and mathematician employed by Julius Caesar to devise the Julian calendar. He is sometimes confused with Sosigenes the Peripatetic (fl. 2nd century AD), an Egyptian philosopher and tutor of the Greek philosopher Alexander of Aphrodisias.

At the conclusion of the Roman civil war (49–45 BC), Caesar set out to replace the multitude of inaccurate and diverse calendars of the Roman commonwealth with a single official calendar. At the suggestion of Sosigenes, on Jan. 1, 45 BC, he adopted the Julian calendar, with a 365-day year and an extra day every fourth year (leap year). With minor modifications this calendar is the same as the modern Gregorian calendar.

Sosigenes' astronomical writings, including *Revolving Spheres,* have all been lost, except for isolated fragments. One notable fragment mentions Sosigenes' belief that Mercury revolved around the Sun.

**Sosnowiec,** town, Katowice *województwo* (province), southern Poland. It lies along the Czarna Przemsza River, which is a tributary of the Vistula. A rail junction in the Silesian Upland, Sosnowiec has numerous heavy-industrial plants, coal mines, textile mills, and glassworks.

A castle was built in Sosnowiec in the 17th century. The town was rebuilt after a disastrous fire in 1830 and began to prosper with the building of the Warsaw-Vienna rail line in 1845. It had become an industrial centre by the end of the 19th century. Town rights were acquired in 1902. Pop. (1993 est.) 251,300.

**Soso** (people): *see* Susu.

**Šostka** (Ukraine): *see* Shostka.

**Sōtatsu,** in full TAWARAYA SŌTATSU (fl. 1600–30s), Japanese artist of the Tokugawa period (1603–1867) who combined the traditional themes of the indigenous school of Japanese narrative scroll painting, known as Yamato-e, with the bold, decorative designs of the great screen painters of the Azuchi-Momoyama period (1574–1600). He pioneered the use of such painting techniques as defining shapes and forms with colour rather than with ink outlines and applying multiple layers of paint or ink on to a still-wet first layer. His use of colour, especially gold and silver, and his treatment of space also influenced later artists, notably Ogata Kōrin.

The only established facts about Sōtatsu's life are that he came from a well-to-do merchant's family and that he was active in Kyōto from approximately 1600 to the 1630s. It is further known that he was given the rank of *hokkyō,* an honorary title conferred on distinguished artists. Only a few documents and references to Sōtatsu or his work have been found. These consist largely of three letters and a colophon, or inscription, on one of his scrolls.

Based on Sōtatsu's few dated works, it generally is believed he was born about 1570 and emerged as a prominent artist by the beginning of the 17th century. Because he sometimes called himself Tawaraya Sōtatsu, it is conjectured that he was associated in Kyōto with the Tawaraya weaving factory, which is famed for its Chinese-style textiles. Probably he worked in the Tawaraya factory during the early years of his career, and only after receiving the rank of *hokkyō* did he sign his works simply Sōtatsu. A diary and a popular novel of the time refer to "Tawaraya pictures" and "Tawaraya fans," suggesting that the pictorial compositions produced by this factory enjoyed great popularity. This would explain why so many of Sōtatsu's works are fan pictures.



"Genji monogatari: 'Miotsukushi,'" centre detail of left screen of a pair of sixfold screens by Sōtatsu, colour on gold-leafed paper; in the Seikado Bunko Art Museum, Tokyo
The Seikado Bunko Art Museum, Tokyo

His style is clearly derived from the native Japanese tradition of colourful, decorative painting rather than ink painting (*sumi-e*) in the Chinese style, although he did work in monochrome, as well as colour.

Since none of Sōtatsu's art was dated, it is impossible to establish a chronology. A group of paintings, however, that he executed for the sliding doors of the Yōgen Temple in Kyōto (rebuilt in 1621 for the wife of the Tokugawa shogun, the military ruler of Japan) indicates that he was already famous at that time, and it has been suggested that he may have been given the title of *hokkyō* in connection with this commission. With the Yōgen Temple doors Sōtatsu must certainly have attained his artistic maturity and independence, and it is likely that he produced most of the works that he is celebrated for during the succeeding decade.

Among the works attributed to him, the most outstanding are a pair of sixfold screens depicting episodes from *The Tale of Genji,* the great 11th-century novel by Murasaki Shikibu. Now in the Seikado Bunko Art Museum in Tokyo, they originally came, along with several other of his most famous works, from the Sambō Temple in Kyōto. Other works of note are the twofold screen showing bugaku dancers in the Sambō Temple and the pair of twofold screens with the god of thunder and the god of wind in the Kennin Temple, also in Kyōto. (H.MA./Ed.)

BIBLIOGRAPHY. William Watson (ed.), *Sōtatsu* (1959); Elise Grilli, *Tawaraya Sotatsu, . . .* (1956); and Judith Burling and Arthur Hart Burling, *Sōtatsu* (1962), are brief introductions to the work of Sōtatsu by Western scholars. Fuller treatments are provided by Bernard Leach, *Kenzan and His Tradition: The Lives and Times of Koetsu, Sotatsu, Korin, and Kenzan* (1966); and Hiroshi Mizuo, *Edo Painting: Sotatsu and Korin* (1972).

**Sotavento, Ilhas de** (Cape Verde): *see* Leeward Islands.

**Soteria** (from Greek: "deliverance"), in Hellenistic religions, any sacrifice or series of sacrifices performed either in commemoration or in expectation of deliverance from a crisis; in

a specific sense the word was often used in reference to large-scale commemorative festivals held at planned intervals. Sixteen Soteria festivals are known; the most famous was that at Delphi, which celebrated the defeat of the Celts in 279–278 BC.

**Sotheby's,** in full SOTHEBY'S HOLDINGS, INC., also called (1864–1924) SOTHEBY, WILKINSON AND HODGE, or (from 1924) SOTHEBY AND COMPANY, art auction firm founded in London in 1744 and American-owned since 1983. Its main offices are in New York City and London, supplemented by other sales offices and auction rooms worldwide.

The founder, Samuel Baker (d. 1778), a London bookseller, held his first auction (under his own name) early in 1744, selling an estate library of 457 books. Establishing the firm in York Street and handling further libraries over the years, he went into partnership with George Leigh in 1767. Upon Baker's death, his estate was divided between Leigh and a nephew, John Sotheby (1778–1807), whose successors were to move the business to 13 Wellington Street in 1818 and were to lead the company for more than 80 years—until 1861, when the last Sotheby died. The company continued to prosper under a series of partners and in 1917 moved to the present London quarters at 34–35 New Bond Street. Throughout the 19th and early 20th centuries, Sotheby's concentrated chiefly on auctioning books, manuscripts, and prints; and, though other collectibles were occasionally offered for sale, paintings and other works of art did not begin to dominate Sotheby's sales until after World War I. After World War II, principally under the leadership (1958–80) of its chairman Peter C. Wilson, Sotheby's became established in New York City and, in 1964, acquired Parke-Bernet Galleries, the premier American auction house (founded 1883).

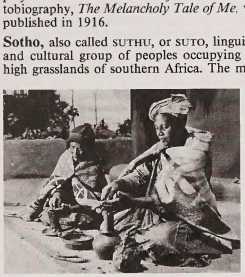
Throughout its history, Sotheby's has handled some of the most important manuscripts and library collections that have come up for sale. In the 20th century it acquired a number of estates and was noted for its 19th- and 20th-century paintings, especially by the Impressionists. Sotheby's aggressive sale of the Goldschmidt collection in 1958, which elicited (for that time) amazingly high prices, has been cited as the event heralding the late 20th-century boom in fine-art selling. One of the most spectacular auctions came three years later (1961), when Rembrandt's "Aristotle Contemplating the Bust of Homer" was purchased by New York's Metropolitan Museum of Art for $2.3 million.

In 1983 Sotheby's was purchased by A. Alfred Taubman, a shopping mall developer who led the company through an era of enormous growth but was convicted in April 2002 of organizing a price-fixing scheme with rival auction house Christie's. With offices and auction halls around the world, Sotheby's also owns businesses involved in real estate, appraisals, restoration, and repairs.

**Sothern, Edward Hugh** (b. Dec. 6, 1859, New Orleans, La., U.S.—d. Oct. 28, 1933, New York, N.Y.), American actor who was widely popular for his roles in romantic comedy and was noted as well for his performances in Shakespearean plays.

The son of the English comedian Edward Askew Sothern, he made his first stage appearance with his father's company in New York City in 1879. He toured England in 1882 and 1883 and became leading comedian in John McCullough's company. Under Daniel Frohman he was leading man at the Lyceum Theatre in New York and in 1899 formed his own company. In 1900 Sothern appeared in the title role of *Hamlet,* in 1901 in that of *Richard Lovelace,* and in 1902–03 as Villon in *If I Were King,* three of his greatest roles. In 1904 he played opposite Julia Marlowe in *Romeo and Juliet* in Chicago. Thereafter, except for 1907–09, they appeared together on the stage almost continuously until their retirement in 1924. They were married in 1911. Sothern had a repertory of over 125 parts, but he was best known as the romantic hero in plays such as *The Prisoner of Zenda.* His autobiography, *The Melancholy Tale of Me,* was published in 1916.

**Sotho,** also called SUTHU, or SUTO, linguistic and cultural group of peoples occupying the high grasslands of southern Africa. The main



Sotho women potters
By courtesy of the South African Tourists Corp.

groups are customarily classified as the Transvaal, or northern, Sotho (Pedi, Lovedu, and others); the western Sotho, or Tswana (*q.v.*); and the southern Sotho (often called Basuto) of Lesotho and adjoining areas.

Traditionally, most Sotho groups relied both on cultivation and on animal husbandry. Corn (maize) was a staple, and millet, beans, sweet potatoes, and a variety of other crops are also of importance. In modern times, a large proportion of Sotho men are often absent from home as migrant labourers.

The typical settlement pattern was characterized by scattered hamlets of circular huts with mud and wattle or stone walls surmounted by a conical, thatched roof. Towns of considerable size occur among some groups, particularly the Tswana, and among groups organized into Bantu townships in South Africa.

Polygyny was traditionally permitted, and a substantial bridewealth in cattle was paid. Descent, succession, and inheritance were patrilineal, except in the case of one group among whom descent was traced through both the male and female lines.

The advent of Christianity, urbanization, and detribalization have resulted in a progressive breakdown of the Sotho's traditional culture patterns.

**sotie,** also spelled SOTTIE, short satirical play popular in France in the 15th and early 16th centuries, in which a company of *sots* ("fools") exchanged badinage on contemporary persons and events. The *sots,* wearing the traditional short jacket, tights, bells, and dunce cap of the fool, also introduced acrobatics and farcical humour into the sketches. At first the sotie was used as an introductory piece to mystery and morality plays. Developing into an independent form, sotie were created and staged by the Clercs de la Basoche, an association of law clerks; the Enfants sans Souci, a group of nobles; and other, more permanent companies. Pierre Gringore became the preeminent sotie dramatist. The sotie was openly satirical and was used as a weapon in political battles. It was forbidden in the 16th century and replaced by more general forms of satire.

**Sōtō,** largest of the Zen Buddhist sects in Japan. It follows the method of quiet sitting and meditation (*zazen*) as a means of obtaining enlightenment.

The sect was founded in China in the 9th century by Liang-chieh and Pen-chi, where it was known as Ts'ao-tung (after its monastic centres on the mountains Ts'ao and Tung). It was transmitted to Japan by Dōgen, who founded the Eihei Temple in 1244 in what is now Fukui prefecture, and further popularized in the 13th–14th century by Keizan.

The headquarters of the sect are at the Eihei Temple and the Sōji Temple (founded in 1321 in what is now Ishikawa prefecture and in 1911 moved to Yokohama). *Compare* Rinzai.

**Soto, Hernando de,** Hernando also spelled FERNANDO (b. *c.* 1496/97, Jerez de los Caballeros, Badajoz, Spain—d. May 21, 1542, along Mississippi River [in modern Louisiana, U.S.]), Spanish explorer and conquistador who participated in the conquests of Central America and Peru and, in the course of exploring what was to become the southeastern United States, discovered the Mississippi River.

*Early years.* De Soto spent his youth in the family manor house at Jerez de los Caballeros. His parents intended him to be a lawyer, but in 1514, while still in his teens, he told his father of his desire to go to the Indies, and he left for Seville. Despite his youth, de Soto's zeal and his prowess as a horseman helped gain him a place on the 1514 expedition of Pedro Arias Dávila to the West Indies. In Panama, de Soto quickly made his mark as a trader and expeditioner, reaping high profits by his skill and daring. By 1520 he had accumulated considerable capital through his slave trading in



De Soto, engraving from *Historia general de las Indias Occidentales* by Antonio de Herrera y Tordesillas
By courtesy of the Library of Congress, Washington D.C.

Nicaragua and on the Isthmus of Panama, after successful partnerships with Hernán Ponce de León and Francisco Campañón. In 1524–27 de Soto defeated his archrival, Gil González de Ávila, in a struggle for control of Nicaragua, and he subsequently expanded his trade in Indian slaves.

In 1530 de Soto lent Francisco Pizarro two ships to investigate reports of gold located south of Darién on the Pacific coast (now in northwestern Colombia). After de Soto's patron, Dávila, died in 1531 and Pizarro's expedition confirmed the reports of gold, de Soto joined the new enterprise. In return for the use of his ships, Pizarro named de Soto his chief lieutenant, and the conquest of Peru began the next year (1532). De Soto, as the expedition's captain of horse, was the driving force in the Spaniards' defeat of the Incas at Cajamarca, and he was the first European to make contact with the Inca emperor Atahuallpa.

Following the Spaniards' capture of Atahuallpa, de Soto seized Cuzco, the Inca capital. For political reasons, he became the emperor's friend and protector, but Pizarro, fearing Atahuallpa's influence over his Inca subjects, had the emperor executed even though the latter's

subjects had raised an enormous ransom in gold in order to ensure his release. Dissatisfied with Pizarro's leadership and coveting a governorship of his own, de Soto returned to Spain in 1536. The shares that he had accumulated in the sack of Peru, though less than half of Pizarro's, made him one of the wealthiest of the returning conquistadors.

In Spain de Soto married Isabel de Bobadillo, daughter of Dávila, and was accepted into the prestigious Order of Santiago. He grew restless in Spain, however, and in 1537 he sought special permission to conquer Ecuador, with special rights to the Amazon River basin. Instead, he was commissioned by the Spanish crown to conquer what is now Florida. In addition, he was made governor of Cuba.

*Exploration of southern North America.* In April 1538 de Soto embarked from the port of Sanlúcar de Barrameda in command of 10 ships and 700 men. After a brief stop in Cuba, the expedition landed in May 1539 on the coast of Florida, at a point somewhere between his successor, led the expedition's remnants (half the original party) down the Mississippi on rafts, and they reached Mexico in 1543.

BIBLIOGRAPHY. Miguel Albornoz, *Hernando de Soto: Knight of the Americas* (1986), is an informative biography. Narratives of de Soto's Florida expedition are found in modern translations of the original conquistador histories, such as John Grier Varner and Jeannette Johnson Varner (eds.), *The Florida of the Inca* (1951, reissued 1980), after Garcilaso de la Vega; James Alexander Robertson (ed.), *True Relation of the Hardships Suffered by Governor Fernando de Soto* (1932); and Edward Gaylord Bourne (ed.), *Narratives of the Career of Hernando de Soto in the Conquest of Florida,* 2 vol. (1904, reissued 1974). Miscellaneous documents and essays, with an attempt to trace de Soto's North American route, are presented in John R. Swanton (ed.), *Final Report of the United States De Soto Expedition Commission* (1939, reprinted 1985).

**sottie** (satirical play): *see* sotie.

**sotto in su** (Italian: "from below to above"), in drawing and painting, extreme foreshortening of figures painted on a ceiling or other high surface so as to give the illusion that the figures are suspended in air above the viewer. It is an approach that was especially favoured by Baroque and Rococo painters, particularly in Italy, in the 17th and 18th centuries. Andrea Mantegna, Giulio Romano, Correggio, and Giovanni Battista Tiepolo were outstanding exponents of the technique.



"Aurora," ceiling fresco painted *sotto in su* by Guercino, 1621–23, in the Casino Ludovisi, Rome

SCALA—Art Resource

**souari nut,** souari also spelled SWARRI, also called BUTTERNUT, or PEKEA NUT, any of the seeds borne in large, clustered fruits of trees of the genus *Caryocar* (family Caryocaraceae). *C. nuciferum,* from northern South America, is typical. Its coconut-sized fruit has four nuts, surrounded by edible flesh. The warty, red, hard-shelled, kidney-shaped nuts have a rich flavour and contain a fatty oil that is extracted and used in cooking.

**Soubirous, Marie-Bernarde:** *see* Bernadette of Lourdes, Saint.

**Soubise, Benjamin de Rohan, seigneur de** (lord of) (b. 1583, La Rochelle, France—d. Oct. 9, 1642, London, Eng.), French Huguenot leader, younger brother of Henri, duc de Rohan.

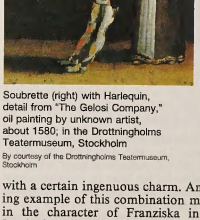
Soubise apprenticed as a soldier under Prince Maurice of Orange-Nassau in the Low Countries. In the Huguenot rebellions that rocked France in the 1620s, his elder brother chiefly commanded the Huguenots' forces on land and in the south, while Soubise commanded those in the west and along the seacoast. His exploits in the conflict have been sympathetically related by his brother, who, if he was not quite an impartial witness, was one of the best military critics of the time. Soubise's most impressive exploit was a singularly bold and well-conducted attack (in 1625) on the Royalist fleet in the River Blavet and the occupation of Oléron. He commanded the Huguenots' defense of La Rochelle during the Royalists' famous siege. When surrender became inevitable, he fled to England, which he had previously visited in quest of succour.

**Soubise, Charles de Rohan, prince de** (b. 1715, Paris, France—d. July 4, 1787, Paris), peer and marshal of France, favourite of Louis XV and Mme de Pompadour.

Soubise accompanied Louis XV in the campaign of 1744–48 and attained high military rank, which he owed more to his courtiership than to his generalship. Soon after the beginning of the Seven Years' War, through the influence of Mme de Pompadour, he was put in command of a corps of 24,000 men, and in November 1757 he sustained the crushing defeat of Rossbach at the hands of Frederick II the Great of Prussia. He was more fortunate, however, in his later military career, winning victories at the battles of Sonderhausen and Lützelburg (1758), and continued in the service until the general peace of 1763, after which he lived the life of an ordinary courtier and man of fashion in Paris.

**soubrette,** in theatre, comic female character usually in the role of a chambermaid. The soubrette role originated in French comedy, one of the earliest examples being Suzanne in Pierre-Augustin de Beaumarchais' *Le Mariage de Figaro* (1784). Still earlier, Molière's plays *Tartuffe* (1664) and *Le Bourgeois gentilhomme* (1670) contained versions of the character in the roles of Dorine and Nicole.

Most often of an independent nature, the soubrette demonstrated a nonconformist attitude coupled with a down-to-earth approach and native humour. Quick-witted and subtle, as in the character Lisette in Pierre Marivaux's *Le Jeu de l'amour et du hasard* (1730; *The Game of Love and Chance*), the soubrette developed greater popularity and recognition in comic opera and the operetta. During this period in the 18th century she became fixed as a type. The most successful soubrettes coupled the personality traits of Molière's characters with a certain ingenuous charm. An outstanding example of this combination may be seen in the character of Franziska in Gotthold Lessing's *Minna von Barnhelm* (1767).



Soubrette (right) with Harlequin, detail from "The Gelosi Company," oil painting by unknown artist, about 1580; in the Drottningholms Teatermuseum, Stockholm

By courtesy of the Drottningholms Teatermuseum, Stockholm

**Souei language,** also called SOUI, KUAY, or KUY, language of northeastern Thailand, northern Cambodia, and parts of southern Laos. It belongs to the Katuic branch of the Mon-Khmer language family, itself a part of the Austroasiatic stock. Spoken by some 630,000 people, Souei is—after Vietnamese, Khmer, and Mon—one of the most important Mon-Khmer languages because of its number of speakers, its geographic spread, and its historical role.

modern Tampa Bay and Charlotte Harbor. After spending the winter at the small Indian village of Apalache (near present-day Tallahassee, Fla.), de Soto moved northward and through present-day Georgia and then westward through the Carolinas and Tennessee, led by native guides whom he abducted along the way. Though he didn't find the gold he was looking for, he did collect a valuable assortment of pearls at a place called Cofitachequi, in present-day eastern Georgia. Near Lookout Mountain, in southeastern Tennessee, de Soto and his men turned southward into Alabama and headed toward Mobile Bay where they expected to rendezvous with their ships. But at the fortified Indian town of Mauvila (near present-day Mobile), a confederation of Indians attacked the Spaniards in October 1540. The natives were decimated, but the Spanish were also severely crippled, losing most of their equipment and all their pearls.

After a month's rest, de Soto decided to turn north once again and head inland in search of treasure. This was a fateful decision that was to have disastrous results. Moving northwest through Alabama and then west through Mississippi, de Soto's party was attacked relentlessly by Indians. On May 21, 1541, the Spaniards saw for the first time the Mississippi River, the "Father of the Water" south of what is now Memphis, Tenn. They crossed the river and made their way through Arkansas and Louisiana. Then, early in 1542, de Soto turned back to the Mississippi River. Overcome by fever, he died in Louisiana, and his comrades buried his body in the Mississippi. Luis de Moscoso, whom de Soto had named

**Soufflot, Jacques-Germain** (b. July 22, 1713, Irancy, France—d. Aug. 29, 1780, Paris), French architect, a leader in the development of Neoclassical architecture and the designer of the Church of Sainte-Geneviève (the Panthéon) in Paris.

Claiming to be self-taught, Soufflot made several sojourns in Rome during the 1730s and '50s and studied the classical monuments there. In 1738 he returned to Lyon to practice as an architect. The simplicity, spaciousness, and archaeologically accurate classical details of the principal works of his Lyon period, the extension of the Hôtel-Dieu (begun 1741) and the Loge des Changes (1751–52), presaged the movement of French taste away from the Rococo and toward Neoclassicism.

Soufflot was entrusted in 1755 with the design of Sainte-Geneviève, which was intended to be the principal church of Paris. His aim in this project was to combine the strict regularity and monumentality of Roman arched ceiling vaults with the lightness of slender supporting piers and freestanding Corinthian columns. The plan was essentially a Greek cross, the facade an enormous temple front. The freestanding columns proved inadequate to support the building's dome, which eventually had to be buttressed. Because of the predominantly classical origins of the design, it became a simple matter, when the Revolution abolished religion, for the church to be secularized and renamed the Panthéon. Unfortunately, the side windows were at that time walled up and much decoration removed. The effect of a light interior space was destroyed, resulting in the somewhat gloomy monument that the Panthéon is today.

*Consult the* INDEX *first*

**Soufrière,** also called LA SOUFRIÈRE (French: "Sulfur Mine"), active volcano on southern Basse-Terre island, Guadeloupe, in the Caribbean Sea. It rises to 4,813 feet (1,467 m) and is the highest point of Guadeloupe. It erupted in August 1976 but caused no loss of life because some 72,000 people had been evacuated from the area; other, weaker eruptions occurred in January 1977.

**Soufrière,** town on St. Lucia island in the eastern Caribbean Sea. It is situated on a bay of the island's west coast, southwest of Castries, the capital. The town is exceptionally picturesque. It is a fishing port and the centre of a coconut- and lime-producing district and is 2 miles (3 km) northwest of the boiling sulfur springs from which Soufrière takes its name. The springs and the nearby Terre Blanche and Petit Peak were born of the ancient Qualibou Caldera. Pop. (1992 est.) 7,963.

**Soufrière, Mount,** active volcano on the island of St. Vincent in the Lesser Antilles in the Caribbean Sea. It is a geometrically shaped volcano rising to peaks of 3,864 feet (1,178 m) and 4,048 feet (1,234 m) north of the crater. The volcano erupted violently in 1812 and again in 1902, when it devastated half the island and killed 2,000 people. A series of mild eruptions in 1971 caused no damage, but eruptions in April 1979 forced authorities to evacuate two-thirds of the island. There was no loss of life, but agriculture suffered considerably. The mountain's name (French: "Sulfur Mine") reflects the sulfurous odour accompanying its eruptions.

**Souk el-Arba** (Tunisia): *see* Jundūbah.

**soul,** in religion and philosophy, the immaterial aspect or essence of a human being, that which confers individuality and humanity, often considered to be synonymous with the mind or the self. In theology, the soul is further defined as that part of the individual which partakes of divinity and often is considered to survive the death of the body.

Many cultures have recognized some incorporeal principle of human life or existence corresponding to the soul, and many have attributed souls to all living things. There is evidence even among prehistoric peoples of a belief in an aspect distinct from the body and residing in it. Despite widespread and longstanding belief in the existence of a soul, however, different religions and philosophers have developed a variety of theories as to its nature, its relationship to the body, and its origin and mortality.

Among ancient peoples, both the Egyptians and the Chinese conceived of a dual soul. The Egyptian *ka* (breath) survived death but remained near the body, while the spiritual *ba* proceeded to the region of the dead. The Chinese distinguished between a lower, sensitive soul, which disappears with death, and a rational principle, the *hun,* which survives the grave and is the object of ancestor worship.

The early Hebrews apparently had a concept of the soul but did not separate it from the body, although later Jewish writers developed the idea of the soul further. Old Testament references to the soul are related to the concept of breath and establish no distinction between the ethereal soul and the corporeal body. Christian concepts of a body-soul dichotomy originated with the ancient Greeks and were introduced into Christian theology at an early date by St. Gregory of Nyssa and by St. Augustine.

Ancient Greek concepts of the soul varied considerably according to the particular era and philosophical school. The Epicureans considered the soul to be made up of atoms like the rest of the body. For the Platonists, the soul was an immaterial and incorporeal substance, akin to the gods yet part of the world of change and becoming. Aristotle's conception of the soul was obscure, though he did state that it was a form inseparable from the body.

In Christian theology, St. Augustine spoke of the soul as a "rider" on the body, making clear the split between the material and the immaterial, with the soul representing the "true" person. However, although body and soul were separate, it was not possible to conceive of a soul without its body. In the European Middle Ages, St. Thomas Aquinas returned to the Greek philosophers' concept of the soul as a motivating principle of the body, independent but requiring the substance of the body to make an individual.

From the Middle Ages onward, the existence and nature of the soul and its relationship to the body continued to be disputed in Western philosophy. To René Descartes, man was a union of the body and the soul, each a distinct substance acting on the other; the soul was equivalent to the mind. To Benedict de Spinoza, body and soul formed two aspects of a single reality. Immanuel Kant concluded that the soul was not demonstrable through reason, although the mind inevitably must reach the conclusion that the soul exists because such a conclusion was necessary for the development of ethics and religion. To William James at the beginning of the 20th century, the soul as such did not exist at all but was merely a collection of psychic phenomena.

Just as there have been different concepts of the relation of the soul to the body, there have been numerous ideas about when the soul comes into existence and when and if it dies. Ancient Greek beliefs were varied and evolved over time. Pythagoras held that the soul was of divine origin and existed before and after death. Plato and Socrates also accepted the immortality of the soul, while Aristotle considered only part of the soul, the *noûs,* or intellect, to have that quality. Epicurus believed that both body and soul ended at death. The early Christian philosophers adopted the Greek concept of the soul's immortality and thought of the soul as being created by God and infused into the body at conception.

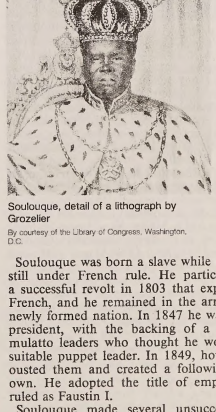
In the Hindu religion, each atman ("breath," or "soul") is considered to have been created at the beginning of time and imprisoned in an earthly body at birth. At the death of the body, the atman passes into a new body, its position in the Chain of Being determined by karma, or the cumulative consequences of actions. The cycle of death and rebirth (samsara) is eternal according to some Hindus but others say it persists only until the soul has attained karmic perfection, thus merging with the Absolute. Buddhism negates the concept of atman, asserting that any sense of the individual soul or self is illusory.

The Muslim concept, like that of the Christian, holds that the soul comes into existence at the same time as the body; thereafter, it has a life of its own, its union with the body being a temporary condition.

**Sŏul** (Korea): *see* Seoul.

**soul music,** form of popular music sung and performed primarily by black musicians, having its roots in black American gospel singing and rhythm and blues. The term was first used in the 1960s to describe music that combined rhythm and blues, gospel, jazz, and rock and that was characterized by intensity of feeling and earthiness. In its earliest stages, soul music was found most commonly in the South, but many of the young black singers who were to popularize soul migrated north to urban areas. The founding of Motown Records in Detroit and Stax-Volt in Memphis did much to encourage the form. Its most popular performers included James Brown, Ray Charles, Sam Cooke, and Aretha Franklin.

**Soulouque, Faustin-Élie,** Soulouque also spelled SOLOUQUE (b. 1782?, Petit-Goâve, Haiti—d. Aug. 6, 1867), Haitian slave, president, and later emperor of Haiti, who represented the black majority of the country against the mulatto elite.



Soulouque, detail of a lithograph by Grozelier

By courtesy of the Library of Congress, Washington, D.C.

Soulouque was born a slave while Haiti was still under French rule. He participated in a successful revolt in 1803 that expelled the French, and he remained in the army of the newly formed nation. In 1847 he was named president, with the backing of a group of mulatto leaders who thought he would be a suitable puppet leader. In 1849, however, he ousted them and created a following of his own. He adopted the title of emperor and ruled as Faustin I.

Soulouque made several unsuccessful attempts to conquer the neighbouring Domini-

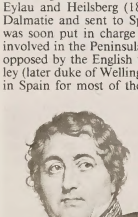
can Republic; on one occasion the United States, France, and Great Britain acted in concert to pressure him to desist. In 1859 the mulattoes rallied under the chief of the general staff and deposed him. Soulouque escaped and went into exile, where he died.

**souls, multiple:** *see* multiple souls.

**Soult, Nicolas-Jean de Dieu,** DUC (duke) DE DALMATIE (b. March 29, 1769, Saint-Amans-la-Bastide, later Saint-Amans-Soult, Fr.—d. Nov. 26, 1851, Saint-Amans-Soult), French military leader and political figure who was noted for his courage in battle and his opportunism in politics.

Upon the death of his father in 1785, Soult enlisted in the infantry. At the outbreak of the French Revolution (1789–92), he was a sergeant at Strasbourg. He served under several commanders and was made a general by François-Joseph Lefebvre for his conduct in the Battle of Fleurus (June 1794). In March 1799 he replaced the wounded Lefebvre at the Battle of Stokach.

Soult built a reputation for vigour, boldness, and method. Under Napoleon he was put in charge of the southern part of the Kingdom of Naples (1800–02) and in 1804 was made a marshal of France. His reputation was further enhanced by his significant role in French victories at Ulm, Austerlitz, and Jena in 1805–06, though he was less successful in Poland at Eylau and Heilsberg (1807). Created duc de Dalmatie and sent to Spain late in 1808, he was soon put in charge of all French armies involved in the Peninsular War, where he was opposed by the English under Arthur Wellesley (later duke of Wellington). Soult remained in Spain for most of the next five years, but



Soult, engraving by P.-L. Grévedon, 1825, after a lithograph by F.-S. Delpech

By courtesy of the Bibliotheque Nationale, Paris

eventually Wellesley forced his outnumbered troops to retreat and defeated him at Toulouse (April 1814), four days after Napoleon had abdicated.

During the First Restoration (1814) Soult declared himself a royalist, but during Napoleon's Hundred Days (1815) he again supported Bonaparte, acting as his chief of staff at Waterloo. Soult was exiled at the start of the Second Restoration (1815–30) but was recalled in 1819. Under King Louis-Philippe he presided over three ministries (October 1832–July 1834, May 1839–March 1840, and October 1840–September 1847) and was usually minister of war as well as president of the council; he was responsible for the French conquest of Algeria during the 1840s. In 1848, when Louis-Philippe was overthrown, Soult declared himself a republican. His *Mémoires* appeared in three volumes in 1854.

**Soumak,** method of brocading handmade flat-woven rugs and similar fabrics. It is one of the oldest known techniques, identified among charred 7th-century-BC fragments excavated at Gordion, near Ankara in Anatolia.



Soumak carpet from the Caucasus, 19th century; in the collection of the National Rugs and Textile Foundation, Washington, D.C.

By courtesy of the National Rugs and Textile Foundation, Washington, D.C., gift of W. Russell Pickering; photograph, Otto E. Nelson—EB Inc.

In recent times, it has been most prevalent in the Caucasus, but it is also used in various parts of Iran. In this technique, brocaded yarns, which form the pattern, lie at slight angles from the horizontal, and herringbone effects are often created by changing the angle of alternate rows. Loose ends of the pattern yarns are allowed to hang free at the back of the rug, providing a padding. For so slight an excuse as this, Soumak rugs for a long time were confusingly sold as "Cashmeres."

Many Caucasian and Persian saddlebags for use on donkeys have been Soumak-woven, as have floor-size carpets, which usually have a central repeat of large diamond- or star-shaped medallions. Soumak rugs ordinarily have borders as elaborate as those of pile rugs made in the same areas. Particular Soumak patterns are characterized as Silé and Verné.

*To make the best use of the Britannica, consult the* INDEX *first*

**sound,** a mechanical disturbance from a state of equilibrium that propagates through an elastic material medium. A purely subjective definition of sound is also possible, as that which is perceived by the ear, but it is not particularly illuminating and is unduly restrictive, for it is useful to speak of sounds that cannot be heard by the human ear, such as those that are produced by dog whistles or by sonar equipment.

Sound is treated in a number of articles in the MACROPAEDIA. For the physics of sound generation, propagation, and detection, *see* Sound. For a more general discussion of vibration and wave motion, *see* Mechanics. For a discussion of biological mechanisms of sound production and reception, *see* Speech; Sensory Reception. For a discussion of musical sounds, *see* Music, Art of; Musical Instruments. For techniques of sound recording and reproduction, *see* Sound: Sound Recording and Reproduction. For a discussion of the use of acoustical waves as a tool of research, *see* Earthquakes.

For a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part One, Division II.

Most solids, liquids, and gases of ordinary experience can serve as media for sound. A mechanical disturbance may be produced in any number of ways but will consist of a sudden increase in pressure at some point. Since the material is elastic, the compression is not permanent; once the disturbing influence is removed, the compressed region will rebound, but in doing so it will compress an adjacent region. The result of this cycle repeating itself is the generation of a compression wave, followed by a rarefaction wave as each region of elastic material rebounds. These waves are longitudinal, *i.e.*, the displacement of a particle of the medium is in the direction of wave motion (note, however, that there is no net transport of material). The waves thus generated travel through the medium at a speed that is a function of the equilibrium pressure and density of the material and, to various extents, of the specific heat (for a gas), the elasticity (for liquids and solids), and the temperature of the medium and of the frequency of the wave. In dry air (at 0° C [32° F] and a sea-level pressure of 14.7 pounds per square inch [1013.25 millibars]) the speed of sound is 331.29 m per second (741.1 miles per hour). (This calculation, made in 1986, corrected an earlier calculation made about 1942.) The speed of sound in seawater is 1,490 m (4,889 feet) per second and in steel 5,000 m (16,405 feet) per second.

A great many of the sounds encountered in daily life are periodic, that is, the sound waves associated with them occur in patterns that repeat with regularity over time. Such sounds are characterized by a dominant frequency, or pitch, which may be defined as the number of waves that pass a fixed point per unit time. The simplest form of sound wave, called a pure tone, can be represented by a sine wave; more complex but still relatively simple forms, such as notes played on various musical instruments, can be represented by more complex harmonic curves, with numbers of harmonic tones or overtones superimposed on the fundamental tone. The complexity of a sound wave can become so great that no particular pitch can be discerned; white noise, so called by analogy with white light (a mixture of all frequencies, or colours, of visible light), is an example.

Another parameter of sound, in addition to velocity and frequency, is intensity, which is defined as the average flow of energy per unit time through a unit area of the medium. Intensity is usually measured in watts per square centimetre. The standard usually used for the quietest sound audible to the human ear has an intensity of $10^{-16}$ watt per square centimetre. Closely related to the intensity of a sound is the sound pressure, or pressure excess over equilibrium caused by a sound wave. Sound pressure is measured in dynes per square centimetre or, in the SI system of units, in pascals. The sound pressure of the human voice at ordinary conversational level, measured directly in front of the mouth, is about 0.1 pascal, which may be compared with the standard pressure of the atmosphere of about $10^5$ pascals. Also related to sound intensity, although not simply, is loudness. Loudness is a subjective phenomenon and can be measured only comparatively, by means of a standard reference sound under specified conditions.

Sound waves behave in many ways as light waves do, and optical analogies are frequently useful in describing acoustical phenomena. Thus, sound waves can be reflected, refracted, diffracted, and scattered, and many of the differences in behaviour between sound and light waves reflect simply the very great difference in wavelengths ordinarily dealt with.

**Sound, The,** Danish ØRESUND, Swedish ÖRESUND strait between Sjælland, or Zealand (Denmark), and Skåne (Sweden), connecting the Kattegat Strait (northwest) with the Baltic Sea (south). Its extreme length, between

Kullen and Falsterbo (Sweden), is 70 mi (110 km). The most landlocked portion, between Helsingør (Elsinore)–Hälsingborg in the north (width 3 mi) and Copenhagen–Malmö in the south (width 9 mi), is 33 mi long. The strait has a minimum depth of 23 ft (7 m) and a surface current of up to 3 to 4 mi per hour toward the Kattegat. Ice in the almost tideless strait may impede navigation in severe winters. Three large islands lie in The Sound: Amager (partly embraced by Copenhagen), Ven, and Saltholme. These divide the waters into the channels of Drögden (west) and Flinterenden (east). Copenhagen and Helsingør are the principal ports on the Danish side, Malmö and Hälsingborg on the Swedish side.

In the past, political control of The Sound, the shortest route from the Kattegat to the Baltic, conferred great commercial benefits. Between 1429 and 1657, Denmark controlled both shores and exacted tolls from all shipping passing through. Even after Skåne was annexed by Sweden in 1658, the great Danish coastal fortress of Kronborg at Helsingør continued to levy The Sound toll until 1857. The Sound is one of the busiest sea lanes in the world.

**sound barrier,** sharp rise in aerodynamic drag that occurs as an aircraft approaches the speed of sound and that was formerly an obstacle to supersonic flight. If an aircraft flies at somewhat less than sonic speed, the pressure waves (sound waves) it creates outspeed their sources and spread out ahead of it. Once the aircraft reaches sonic speed the waves are unable to get out of its way. Strong local shock waves form on the wings and body; airflow around the craft becomes unsteady, and severe buffeting may result, with serious stability difficulties and loss of control over flight characteristics. Generally, aircraft properly designed for supersonic flight have little difficulty in passing through the sound barrier, but the effect upon those designed for efficient operation at subsonic speeds may become extremely dangerous. *See also* sonic boom.

**sound effect,** any artificial reproduction of sound or sounds intended to accompany action and supply realism in the theatre, radio, television, and motion pictures. Sound effects have traditionally been of great importance in the theatre, where many effects, too vast in scope, too dangerous, or simply too expensive to be presented on stage, must be represented as taking place behind the scenes. An offstage battle, for instance, can be simulated by such sounds as trumpet blasts, shouts, shots, clashing weapons, and horses' hooves. Certain dangerous effects, such as explosions, crashes, and the smashing of wood or glass, must also take place offstage. Sound effects must often be coordinated with actions on stage; when the hero pretends to punch the villain on the jaw, a sound technician backstage must provide a realistic "smack!"

Many ingenious methods have been devised for the faithful reproduction of various sounds; wind sounds, from a breeze to a hurricane, can be simulated when a piece of canvas is rubbed by wooden slats mounted on a revolving cylinder; thunder is imitated by shaking a large sheet of metal; rain sounds are produced by rattling dried peas in a wooden box; horses' hooves can be imitated by clattering coconut shells or suction cups against a hard surface; gunshots can be produced by slapping boards together or by firing blank cartridges.

Today most sound effects are recorded on records or tapes, which provide greater realism and allow for the production of an almost limitless range of effects with no need of bulky sound-producing devices.

**sound intensity,** amount of energy flowing per unit time through a unit area that is perpendicular to the direction in which the sound waves are travelling. Sound intensity may be measured in units of energy or work—*e.g.,* microjoules ($10^{-6}$ joule) per second per square centimetre—or in units of power, as microwatts ($10^{-6}$ watt) per square centimetre. Unlike loudness, sound intensity is objective and can be measured by auditory equipment independent of an observer's hearing.

The intensity of one sound can be compared to that of another of the same frequency by taking the ratio of their powers. When this ratio is 10, the difference in intensity of the sounds is said to be one bel, a unit named in honour of the United States inventor Alexander Graham Bell. Accordingly, the relative intensities of two sounds in bels is equal to the logarithm of the intensity ratio—*i.e.,* if $I$ is the intensity of one sound and $I_0$ is that of another, then the intensity ratio $B$ in bels is $B = \log_{10}(I/I_0)$. The unit in general use is the decibel (abbreviated db), equal to 0.1 bel. Thus the equation for relative intensities $b$ in decibels may be written $b = 10 \log_{10}(I/I_0)$. It may be calculated from this equation that one decibel corresponds to a 26 percent change in intensity. If $I_0$ is taken as a reference standard intensity equal to $10^{-16}$ watt per square centimetre, the intensity of the faintest sound that can be heard, then the intensity, or level, of any sound can be measured in decibels. Thus speech of intensity $10^{-12}$ watt per square centimetre has a sound level of $b = 10 \log_{10}(10^{-12}/10^{-16}) = 40$ decibels.

**sound-level meter,** device for measuring the intensity of noise, music, and other sounds. A typical meter consists of a microphone (*q.v.*) for picking up the sound and converting it into an electrical signal, followed by electronic circuitry for operating on this signal so that the desired characteristics can be measured. The indicating device is usually a meter calibrated to read the sound level in decibels (db), a logarithmic unit used to measure the sound intensity (*q.v.*). Threshold of hearing is about zero decibels for the average young listener, and threshold of pain (extremely loud sounds) is around 120 decibels, representing a power 1,000,000,000,000 (or $10^{12}$) times greater than zero decibels.

The electronic circuitry can be adjusted, usually by an external switch, to register the integrated level of all frequencies in the sound being measured or the intensity of selected bands of frequencies. A time lag is usually incorporated to slow down meter response and thus permit rapidly varying sounds to be averaged. The amount of time lag may vary somewhat among instruments, depending on the purpose for which the instrument was designed.

In the early 1970s, as concern about noise pollution increased, accurate, versatile, portable noise-measuring instruments were developed.

Sound level is a measure of loudness, but actual loudness is a subjective factor and depends on the characteristics of the ear of the listener. In an attempt to overcome this problem, scales have been developed to correlate loudness with objective measurements of sound. The Fletcher–Munson curve, for example, shows the relationship between loudness in decibels and subjectively judged loudness. Other variables have also been studied.

**sound production,** in animals, the initiation of sound as a means of information transmission. Sounds are termed vocal when produced in the respiratory system and mechanical when produced by mutual contact of body parts or by contact with some element in the environment. Vocal sounds are restricted to vertebrate animals; nonvocal sounds are produced by many invertebrates and by some members of all vertebrate classes.

Many animals possess special structures for producing mechanical sounds. Crickets and grasshoppers produce sound by rubbing together rasplike structures on their wings. Cicadas, which emit the loudest sounds known from insects, do so by means of a pair of membranous organs (timbal organs) at the base of the abdomen. A special muscle deadens the hearing apparatus of the insect when it is calling.

In the vertebrates many means of mechanical sound production exist. A number of birds, of widely divergent families, have feathers modified for producing sound in flight. The specially modified tail tip of the rattlesnake is another familiar example. Many animals, especially among the mammals, produce sounds with parts of the body that are specialized for other purposes; stamping or drumming on the ground with the feet is seen in many species, and slapping the water with the tail is a common means employed by aquatic mammals to warn others of danger.

Many fishes produce sounds by moving bones or teeth against each other, sometimes with the swim bladder acting as a resonating cavity. Among amphibians, the sirens (order Trachystomata), salamanders (Caudata), and caecilians (Gymnophiona) are silent or nearly so, but the frogs (Anura) are highly vocal, producing species-specific sounds by moving air between the mouth and lungs past vocal chords in the windpipe (trachea). Among reptiles, crocodilians and some turtles produce low-pitched sounds; lizards (except geckos) and snakes are usually silent, except for hissing sounds uttered under stress. Vocal sounds of birds are produced by the syrinx, a specialized region at the lower (posterior) end of the trachea. Mammalian vocalizations, on the other hand, originate in the larynx, a modification of the upper (anterior) end of the trachea. Members of both groups may use the mouth for resonating or filtering sound or may possess special outpouchings of the trachea or esophagus that serve as resonating cavities.

**sound reception,** the response of an aural mechanism, the ear, to a specific form of energy change, or sound waves. Sound waves can be transmitted through gases, liquids, or solids, but the hearing function of each species is particularly (though not exclusively) sensitive to stimuli from one medium.

A brief treatment of sound reception follows. For full treatment, *see* MACROPAEDIA: Sensory Reception.

In spiders, certain insects, and some fishes, sound reception is based on detection of a vibration's velocity, while in most animals, hearing is caused by pressure on an obstacle in a vibration's path. Members of two animal groups are capable of sound reception: arthropods (*e.g.,* insects and crabs) and vertebrates (*e.g.,* reptiles, birds, and mammals). In more primitive species, hearing can enable an animal to sense danger, locate food, and find mates, and in more complex creatures it is important for communication and emotional expression.

*Hearing in invertebrates.* Hearing organs in insects are usually located in the thorax (middle portion) or abdomen. In the mosquito, however, the sensory units, or scolophores, for auditory response are attached at one end to the base of the antenna. Inside each mosquito scolophore is a chain consisting of a base cell, a ganglion cell, a sheath cell, an extracellular cap, and a terminal cell. Out of the ganglion cell projects a hair (cilium) containing the axon, or nerve fibre, which connects with the central nervous system. Sound waves cause the shaft of the antenna to vibrate, resulting in relative motion between the ends of the scolophore and stimulation of the axon. The velocity of the sound wave determines the strength of the nerve impulse.

Another velocity type of sound receptor, the cercal organ, can be found in the abdomen of

cockroaches and crickets. It contains several hundred cilia connected to a nerve trunk and is sensitive to sound frequencies in the range of 100 to 3,000 hertz (cycles per second).

The tympanal organ is a pressure type of ear found in moths, grasshoppers, and one variety of cicada. A number of scolophores are attached both to a tympanic membrane and to an immobile part of the insect's thorax. When sound waves cause the tympanic membrane to move, pressure is exerted on the axons projecting from the scolophores, which then transmit impulses to the central nervous system.

*Hearing in vertebrates.* All vertebrates have two ears composed of a complex system of labyrinths. The labyrinths consist of three semicircular canals, which regulate equilibrium or sense of balance, attached to the upper of two connected sacs, the utricle. The derivatives of the lower sac, or saccule, are the sensory organs for hearing, which vary among and within the vertebrate classes.

The hearing mechanism in teleosts (bony fishes) consists of a lagena—a curved structure that contains a macula—which is attached to the saccule. The macula contains hair cells with their projecting cilia, which contain the ends of nerve fibres. The cilia are also connected to an otolith, a dense, calcareous structure. When sound vibrations travel through the water, most tissues vibrate in a uniform manner except for the massive otolith, thus creating relative motion between the cilia and the otolith, stimulating the auditory hair cells. In some teleosts, the efficiency of hair-cell stimulation is vastly increased by the presence of air sacs adjacent to the labyrinth. One group of fishes, the Ostariophysi, do not have air sacs but do have a connection between the swim bladder and fluid chambers adjacent to the labyrinth. A chain of tiny bones, called Weberian ossicles, lies between the air-filled swim bladder and the atrium, which connects with the labyrinths. The ear's sensitivity is heightened by discontinuity between solids (her otolith or Weberian ossicles) and gases (air sac or swim bladder).

Little is known about sound reception in most amphibians except for certain species of frog. In most frogs, a skin-covered disk of cartilage serves as an eardrum, and a thin column (columella) of bone extends through an air-filled cavity to the otic capsule, the bony case of the inner ear. The two sections are connected by an oval window and a round window. When movement is conducted from the eardrum, the end of the columella, called the stapes, moves against the oval window. Vibrations travel through the fluid within the inner ear and stimulate a tectorial membrane. The two types of auditory hair cells found in the inner ear are the amphibian papillae (found in all amphibians) and basilar papillae (found in some amphibians). These sensory hair cells are stimulated by the tectorial membrane.

There is a great diversity in reptilian ears regarding structure and level of complexity. Lizards, for the most part, have a middle ear consisting of a two-element ossicular chain extending from the tympanic membrane to the otic capsule. The auditory section of the labyrinth, the cochlea, includes a basilar membrane that, in many species, contains a thickened middle portion, or fundus. On the fundus are auditory hair cells and supporting cells. These cells are stimulated by some intermediate structure that connects to the tectorial membrane.

Auditory structure is similar to that of reptiles in most bird species. The meatus, a short external passage, leads to an eardrum, which often consists of two membranes, the outer one apparently for protection. The ossicular chain, consisting of the columella and extracolumella, leads to the otic capsule. Within the cochlea lies the basilar membrane.

The mammalian ear is a remarkably well-differentiated structure. The outer ear consists of the pinna, which is attached to the outside of the head and often serves to collect and reflect sound waves. In the middle ear, three auditory ossicles (malleus, incus, and stapes) cross an air-filled cavity between the tympanic membrane and the otic capsule. The auditory portion of the labyrinth is the cochlea, often snail-shaped, inside of which is the basilar membrane bearing the organ of Corti. The organ of Corti consists of hair cells and supporting cells that are arranged so that sound waves of different frequencies stimulate different nerve endings, thus allowing for highly specialized auditory messages to be transmitted to the central nervous system. The size of and spatial arrangement within the organ of Corti differ between mammalian species, resulting in varying degrees of specialization.

Bats have an extremely well-developed sense of hearing. One highly specialized adaptation of bats is their use of echolocation. By emitting high-frequency sound waves that are then reflected from an object, bats can gauge distance, note obstructions, and locate prey in the dark with amazing accuracy.

**sound recording,** transcription of vibrations in air that are perceptible as sound onto a storage medium, such as a phonograph disc. In sound reproduction the process is reversed so that the variations stored on the medium are converted back into sound waves. The three principal media that have been developed for sound recording and reproduction are the mechanical (phonograph disc), magnetic (recorded tape), and optical (motion-picture sound tracks and digital compact discs) systems.

The American inventor Thomas A. Edison developed the "talking machine," which could both record and reproduce sound, in 1877. The original Edison cylinder recordings used indentations embossed into a sheet of tinfoil by a vibrating stylus attached to a diaphragm. Emil Berliner, the German-born American inventor of the Gramophone, introduced the flat disc, as well as the practice of using electroforming to make a negative of the master, which then could serve to mold copies.

Early sound recording and reproduction relied entirely on acoustical means. In the early 1920s the vacuum-tube amplifier, invented by the American Lee De Forest, came into use, marking the transition from acoustical to electrical recording. Microphones replaced acoustical horns, and soon there was developed the modern electric phonograph—consisting of an amplifier, a motor-driven turntable (that often incorporated a record-changing device), a cartridge, and loudspeakers. The 78-rpm (revolutions per minute) record, originally made of shellac and later of synthetic thermoplastic resins and with a playing time of about 4½ minutes, became standard.

The long-playing (LP) record, first introduced in 1948, was designed to be played at a speed of 33⅓ rpm; it used "microgrooves," allowing up to 30 minutes of playing time per side. The 45-rpm disc, playing up to eight minutes per side, was introduced in 1949. Stereophonic recordings, with two separate channels of sound recorded in the same groove, were introduced in 1958. Quadraphonic discs, with the two additional channels often used to reproduce ambient sound, became available in the early 1970s but were not successful commercially.

Magnetic systems of recording sound date to the 1890s, when the Danish engineer Valdemar Poulsen invented a device that stored electrical information by magnetizing particles on a steel wire. American and German scientists had developed magnetic tape by the 1920s, and during the following decade recorders were further refined, but not until after World War II did the tape recorder begin to have widespread application in recording music.

In tape recording, the electrical signal to be recorded is usually applied to the tape by means of a "head," consisting of a coil wound around a core of magnetic iron, that has a gap at the point where the tape moves across its surface. The current in the coil produces a magnetomotive force across the gap, magnetizing the particles on the tape. In reproduction the tape is passed over the playback head, and the magnetized portions of the tape cause the magnetic flux in the core to change, generating a voltage. Recording tapes consist of a plastic-base film coated with a magnetic material, usually iron oxide, although chromium dioxide and pure metal particles also are used.

The principal tape-recording formats are the open-reel and the cassette. Open-reel recorders, which were the first to be developed, are now used most commonly for professional recording. They operate at several speeds and have great flexibility, including the ability to record up to 24 separate tracks. A cassette consists of a feed reel of tape and a take-up hub enclosed in a sealed rectangular package. Although the cassette is less flexible and generally has lower fidelity than the open-reel format, it became more popular, largely because of its ease of operation.

The first optical system was invented by De Forest, who by 1923 had developed techniques for transcribing sound waves into impulses of light that could be photographed on a strip of film. When the developed film was then passed between a light source and a photoelectric cell in the motion-picture projector, the images were transformed back into electrical voltages that could be converted into sound through a loudspeaker system.

A second type of optical recording is the digital compact disc (CD). Unlike all other methods of recording and reproduction, which create "analogies" of the original sound and thus are called analogue methods, digital recording samples the sound at specified intervals and converts the samples into binary (base-2) numbers that are then recorded on tape as a series of pulses. Digitally mastered tapes converted into conventional phonograph discs first appeared in the 1970s, and fully digital compact discs, which are read, or "played," by a laser, became available in the early 1980s and became the most popular mode by the beginning of the 1990s. Other digital modes being introduced were the digital audio tape (DAT) and the digital compact cassette (DCC).

**sound track,** in motion-picture technology, narrow band, usually along the margin of the film, that carries the photographic or magnetic sound record. In optical recording systems, sound waves modulate a beam of light; the sound track, which may be of variable density or of variable width, is a photographic record of the varying light. For sound reproduction, a beam of light is passed through the sound track onto a photocell connected, through an amplifier, to a loudspeaker. This optical system is the basic plan of sound reproduction in sound motion pictures. In stereophonic sound recording, a number of such bands may be used on the same film.

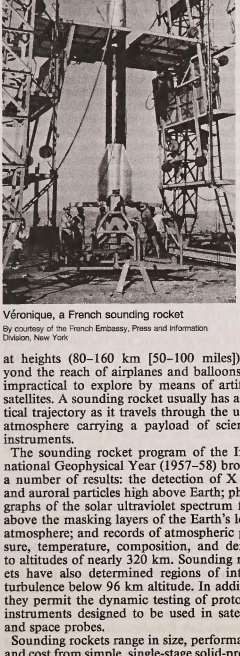
In magnetic recording systems, the narrow band of the film is coated with a magnetizable material; for the recording and reproduction of sound by this method, *see* magnetic recording.

**soundboard,** also called BELLY, a thin plate of wood or a stretched membrane lying directly under the strings of a stringed musical instrument. It vibrates in response to the vibrations of the strings (transmitted to it by the bridge, an elastic piece of wood held under pressure or tension between the strings and

soundboard), amplifying the faint sound produced by the string alone.

The soundboard's size, shape, and material have an effect on the instrument's tone quality. Low notes, for example, may suffer if a soundboard is too small.

**sounding rocket,** also called PROBE ROCKET, any unmanned rocket that is designed to probe atmospheric conditions and structure



Véronique, a French sounding rocket
By courtesy of the French Embassy, Press and Information Division, New York

at heights (80–160 km [50–100 miles]) beyond the reach of airplanes and balloons but impractical to explore by means of artificial satellites. A sounding rocket usually has a vertical trajectory as it travels through the upper atmosphere carrying a payload of scientific instruments.

The sounding rocket program of the International Geophysical Year (1957–58) brought a number of results: the detection of X rays and auroral particles high above Earth; photographs of the solar ultraviolet spectrum from above the masking layers of the Earth's lower atmosphere; and records of atmospheric pressure, temperature, composition, and density to altitudes of nearly 320 km. Sounding rockets have also determined regions of intense turbulence below 96 km altitude. In addition, they permit the dynamic testing of prototype instruments designed to be used in satellites and space probes.

Sounding rockets range in size, performance, and cost from simple, single-stage solid-propellant rockets that can lift a 5.4-kilogram (12-pound) meteorologic payload 60 km to two-stage solid-propellant vehicles capable of lifting a 22-kilogram payload to 3,000 km.

**soup,** liquid food prepared by cooking meat, poultry, fish, legumes, or vegetables with seasonings in water, stock, milk, or some other liquid medium. The cooking of soup is as ancient as the devising of vessels to hold liquid; before the development of pots that could withstand the direct heat of a fire, soups were cooked by dropping hot stones into the liquid. The long cooking of soup enabled nourishment to be drawn from meagre quantities of fish and meat too bony or tough to be otherwise utilized.

In the West lighter soups are usually served as a first course, while thicker, heartier soups constitute the entrée for informal meals. A notable exception are the fruit soups favoured in northern and eastern Europe, which are often served for dessert. In China a thin soup is consumed throughout the meal as a beverage, and elaborate soups such as the celebrated bird's nest and shark's fin may be interspersed with other courses or served near the end of the meal.

Many soups are eaten cold. French vichyssoise (potatoes and leeks), Spanish gazpacho (tomatoes and other vegetables), Polish *chłodnik* (beets, sour cream, pickles, and shellfish), Jewish *schav* (sorrel), and Danish *kærnemaelkskoldskaal* (buttermilk) are classic cold soups. Consommé can be served cold, in which case it takes the form of a jelly as a result of the natural gelatin present in the bony meats from which it is prepared.

The basis of many soups is stock, or broth, a rich liquid obtained by boiling fish, meat, poultry, game, or vegetables. Clear broths can be garnished with separately cooked vegetables, pasta or rice, quenelles or dumplings, poached eggs, or other ingredients. Chinese egg-drop and Italian *stracciatella* are enriched with beaten eggs stirred in the hot broth.

Thick soups may achieve their texture by means of a flour- or egg-thickened sauce or a puree of vegetables with or without butter or cream. Bisques and chowders are creamy soups usually made with shellfish or fish, sometimes with meat or vegetables, and cream or milk. Gumbos are spicy soups originating in the Creole cooking of Louisiana that combine African, European, and American Indian elements. Substantial stewlike soups are found in rural cuisines worldwide. They often combine root vegetables, legumes, and smoked or fresh meats. Well-known examples are Italian minestrone, French *garbure,* Swedish *ärter med flask* (yellow peas and pork), and Dutch *erwtensoep* (split green peas).

**Soupault, Philippe** (b. Aug. 2, 1897, Chaville, France—d. March 11, 1990, Paris), French poet and novelist who was instrumental in founding the Surrealist movement.

Soupault's earliest verse collection, *Aquarium* (1917), was published with the help of Guillaume Apollinaire, who introduced Soupault to André Breton. In 1919 Soupault, Breton, and Louis Aragon cofounded the review *Littérature.* Originally drawn to the antirationalism of the Dada movement, Soupault soon rejected its nihilism, and he and Breton experimented with other revolutionary techniques. One result of their experimentation was the "automatic writing" of the jointly authored *Les Champs magnétiques* (1920; *The Magnetic Fields*), known as the first major Surrealist work. Soupault soon abandoned automatic writing to produce carefully crafted verses such as those in *Westwego* (1922) and *Georgia* (1926). As the Surrealist movement became increasingly dogmatic and political, Soupault grew dissatisfied with it and eventually broke with it and Breton.

After the mid-1920s Soupault devoted himself primarily to writing novels and essays and to journalism. His novels—which include *Les Frères Durandeau* (1924; "The Durandeau Brothers"), *Le Nègre* (1927; "The Negro"), and *Les Mortsnuls* (1934; "The Dying")—centre on the concepts of freedom and revolt. *Le Temps des assassins* (1945; *Age of Assassins*), a memoir, details Soupault's six-month imprisonment by the Vichy government in Tunis, Tunisia, where he worked as a journalist and as director of Radio Tunis. A second autobiography, *Mémoires de l'oubli* ("Memoirs of Oblivion"), was published in 1981. Soupault also wrote a number of biographies, plays, and critical essays. He was awarded the Grand Prix de Poésie of the French Academy in 1972.

**soupfin shark,** North American Pacific shark species of the family Carcharhinidae. *See* carcharhinid.

**Souphanouvong** (b. July 13, 1909, Luang Prabang, Laos—d. Jan. 9, 1995, Laos), leader of the revolutionary Pathet Lao movement and first president of Communist-governed Laos.

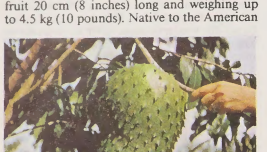
Souphanouvong, half brother of the Lao premier Souvanna Phouma, was born a prince, a son of Viceroy Boun Khong of Luang Prabang. He was trained in civil engineering in France, and, under the French Indochina administration, he built bridges and roads in Vietnam (1938–45). After World War II he opposed the reimposition of French rule in Laos and joined the nationalist provisional government in Vientiane as defense minister. After a period as foreign minister of the Free Lao government-in-exile in Bangkok (1947–48), he broke with it to ally with the Viet Minh, with whose aid he formed the Communist-oriented Pathet Lao in 1950. After more than a decade in opposition, he joined the coalition government set up by Souvanna Phouma in 1962. When it collapsed a year later, he escaped to northern provinces administered by the Pathet Lao and its political wing, the Neo Lao Hak Xat, and resumed the Laotian civil war. As the Pathet Lao was establishing control over the whole of Laos in 1974–75, Souphanouvong returned to Vientiane to head the National Political Council; and, when a republic was proclaimed in late 1975, he became president (ceremonial head of state) and served on the Politburo of the Laotian Communist Party. He resigned from the presidency for reasons of health in 1986.

**Souris,** town, southwestern Manitoba, Canada. It lies at the confluence of Plum Creek and the Souris River, 20 miles (32 km) southwest of Brandon. Settled about 1880, it developed as a retailing and service centre for a grain-growing district. Souris (French for "mouse" or "mice") also became a divisional point on the Canadian Pacific Railway, and railroad shops are a main source of employment. The town is known for its Gravel Pits (a popular rock-collecting site with an abundance of petrified wood, jasper, agates, and dendrite) and for its swinging footbridge (one of Canada's longest, 582 feet [177 m]) across the Souris River. Inc. 1904. Pop. (1991) 1,662.

**Souris,** town, Kings county, eastern Prince Edward Island, Canada. It is situated along Colville Bay, an inlet of the Gulf of St. Lawrence, at the mouth of the Souris River, 48 miles (77 km) northeast of Charlottetown. Originally settled by French Acadians in 1748, the town was named via the river for the *souris* ("mice") that once plagued crops in the area. Souris is a regional service centre noted for its beaches and trout fishing. One of the province's main commercial-fishing centres, it has a large deepwater harbour with steamer connections to the Magdalen Islands, 70 miles (113 km) north. Inc. 1910. Pop. (1991) 1,333.

**Souris River,** tributary of the Assiniboine River, in Saskatchewan and Manitoba (Canada) and North Dakota (U.S.). Rising in southeastern Saskatchewan, it receives drainage from Moose Mountain and Coteau du Missouri and flows southeastward into North Dakota. It then bends northward to reenter Canada and finally joins the Assiniboine near Brandon in Manitoba, after a course of 600 miles (966 km), which is only partly navigable. Much of its drainage basin of 22,000 square miles (57,000 square km) is floored with silt and clay deposited on the bottom of what was once glacial Lake Souris; this fertile soil forms the basis of a productive agricultural area known for its hard, red spring wheat. The Souris (French: "mouse") flows through a region that is also rich in minerals. Coal is mined near Estevan and Bienfait (Saskatchewan) and Minot (North Dakota), while oil is extracted from the vicinity of Midale (Saskatchewan) and Virden (Manitoba).

**soursop,** also called GUANABANA (species *Annona muricata*), tree of the family Annonaceae (order Magnoliales) that produces an edible fruit 20 cm (8 inches) long and weighing up to 4.5 kg (10 pounds). Native to the American



Soursop (*Annona muricata*)
W.H. Hodge

tropics, the tree has been widely introduced in the Old World tropics. Reaching about 8 m (26 feet), it has broad-ended, oval evergreen leaves about 12.7 cm long. The fruits are oval, spiny, green-skinned, and aromatic. The fibrous white flesh, which combines the flavours of mango and pineapple, is strained to make custards, ice creams, and drinks. *See also* custard apple.

**sourwood,** also called SORREL (species *Oxydendrum arboreum*), ornamental tree, of the heath family (Ericaceae), native to southeastern North America. It grows to about 23 m (75 feet) in height. The bitter-tasting leaves



Sourwood (*Oxydendrum arboreum*)
A to Z Botanical Collection—EB Inc

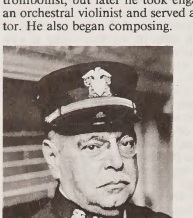
are alternate, stalked, rather oblong, and 12–20 cm (5–8 inches) long. In the autumn the leaves turn a brilliant red. The fragrant white flowers, about 1 cm long, grow in clusters 20–25 cm in length.

**Sous, Wadi,** river of southern Morocco, rising from several headstreams in the Haut (High) Atlas mountains and flowing westward for 112 miles (180 km) to the Atlantic Ocean south of Agadir. Its alluvial basin, protected from the Sahara by the Anti-Atlas mountains, is one of Morocco's most fertile regions. Fruits, cotton, vegetables, sugar, and olives are grown, much of them for export. Chief towns are Taroudant, a market centre, and Agadir, a fishing base and commercial port.

**Sousa** (Tunisia): *see* Hadrumetum; Sūsah.

**Sousa, John Philip,** byname THE MARCH KING (b. Nov. 6, 1854, Washington, D.C., U.S.—d. March 6, 1932, Reading, Pa.), American bandmaster and composer of military marches.

The son of an immigrant Portuguese father and a German mother, Sousa grew up in Washington, D.C., where from the age of six he learned to play the violin and later various band instruments and studied harmony and musical theory first with John Esputa and then with George Felix Benkert. In 1867 he began to follow the career of his father as a trombonist, but later he took engagements as an orchestral violinist and served as a conductor. He also began composing.



John Philip Sousa
By courtesy of RCA Records

In 1868 he enlisted in the U.S. Marine Corps as an apprentice in the Marine Band. He began building his formidable reputation as a bandmaster of great precision through his leadership (1880–92) of this group, which he raised to the highest standard of performance. In 1892 he formed his own band, a carefully selected group capable of equal virtuosity in both military and symphonic music; with it he toured the United States and Europe (1900–05) and finally made a world tour (1910–11).

Sousa composed 136 military marches, remarkable for their rhythmic and instrumental effects. They include the famous "Semper Fidelis" (1888), which became the official march of the U.S. Marine Corps, "The Washington Post" (1889), "The Liberty Bell" (1893), and "The Stars and Stripes Forever" (1897).

Between 1879 and 1915 he wrote 11 operettas, of which *El Capitan* (1896), *The Bride Elect* (1897), and *The Free Lance* (1906) were particularly successful. He wrote at least 70 songs, 11 waltzes, 12 other dance pieces, 11 suites, 14 humoresques, and 27 fantasies. In the 1890s he also redeveloped a type of bass tuba called the helicon (*q.v.*), made to his specifications and eventually called the sousaphone.

During World War I he enlisted in the U.S. Navy and took charge of the band-training centre at Great Lakes Naval Base, in Illinois. For the U.S. Department of the Navy he compiled *National, Patriotic and Typical Airs of All Lands* (1890). He wrote three novels, an instruction book for trumpet and drum, and an autobiography, *Marching Along* (1928).

**Sousa, Luís de,** original name MANOEL DE SOUSA COUTINHO (b. 1555, Santarém, Port.—d. May 5, 1632, Bemfica, near Lisbon), monastic historian whose prose style in his chronicle of the Dominican order earned him an important position in the history of Portuguese literature.

Sousa may have studied law at the University of Coimbra. About 1576 he became a novice in the Knights of Malta but did not continue his religious affiliation at that time. Between 1584 and 1586 he married Madalena de Vilhena, widow of a Portuguese military hero.

In 1613, however, Sousa and Madalena decided to take religious vows and thereby separate for the rest of their lives. According to some, they were motivated by grief over the death of their young daughter; according to others, it was the discovery, or at least the rumour, that Madalena's first husband was still alive. Sousa entered the Dominican monastery at Benfica, where he spent the rest of his life, changing his name to Friar (Frei) Luís de Sousa and taking vows in 1614.

Sousa soon took over the order's chronicle begun by Friar Luís Cácegas, the *História de São Domingos,* 3 vol. (1623, 1662, 1678; "History of Santo Domingo"). Its publication brought him immediate recognition as a master stylist of Portuguese prose. In addition, he completed the *Vida do Arcebispo D. Frei Bartolomeu dos Mártires* (1619; "Life of Archbishop D[ominican] Friar Bartholomeu dos Mártires"), a biography of a 16th-century Portuguese Dominican friar who became archbishop of the see of Braga, Port. The biography is considered a literary masterpiece, as well as a valuable historical record.

Nevertheless, Sousa might have remained an obscure monastic chronicler known only to scholars had his own life not been dramatized and popularized by the 19th-century Portuguese writer João Baptista de Almeida Garrett. Garrett's romantic play *Frei Luís de Sousa* (1843), emphasizing the personal struggles of the man, made Sousa a legendary and heroic figure in Portuguese history.

**Sousa, Martim Afonso de** (b. *c.* 1500, Vila Viçosa, Port.—d. July 21, 1564, Lisbon), Portuguese admiral who commanded the first colonizing expedition to Brazil (1530–33).

After destroying a French trading post in the territory of Pernambuco, Sousa founded the first two permanent Portuguese settlements in Brazil in 1532. One was São Vicente, near the present port of Santos, and the other was Piratininga, now São Paulo. He set up a municipal government and legal and economic systems, thereby laying the basis for future colonial social organization. He also established friendly relations with the Indians and obtained information from a group of shipwrecked Spanish sailors about the location of gold and silver in the interior of Brazil. Sousa was later governor of the Portuguese colony in Goa, India.

**Sousa, Tomé de,** also spelled THOMÉ DE SOUZA (b. *c.* 1515—d. 1573), Portuguese nobleman and soldier who became the first governor-general (1549–53) of the Portuguese colony of Brazil.

After military service in Africa and India, Sousa led a 1,000-man expedition to Brazil, where he built the fortified capital of Salvador. He assisted the Jesuits in converting the native population and helped to reestablish the king's authority throughout the colony. In 1552 he recommended Rio de Janeiro as a site for settlement and fortification. Sousa returned to Portugal in 1553 and spent his remaining years as the king's adviser on Brazilian affairs.

**sousaphone** (musical instrument): *see* helicon.

**Sousse** (Tunisia): *see* Hadrumetum; Sūsah.

**Soussou** (people): *see* Susu.

**Soustelle, Jacques (-Émile)** (b. Feb. 3, 1912, Montpellier, Fr.—d. Aug. 7, 1990, Neuilly-sur-Seine), French anthropologist and politician who was instrumental in the return to power of General Charles de Gaulle in 1958 but afterward broke with de Gaulle over the issue of Algeria.

The son of a railway worker, Soustelle studied at the École Normale Supérieure and received his doctorate from the Sorbonne in 1937. He took part in several anthropological missions to Mexico (1932–39), became assistant director of the Museum of Man in Paris (1937–39), and was a professor at the Collège de France and the Colonial School (1938–39).

Beginning as a strong leftist, Soustelle in 1938 became secretary-general of the Vigi-

lance Committee of Antifascist Intellectuals. After the fall of France to Germany in 1940, he joined the Free French forces of General de Gaulle in London. He was Free French commissioner of information (1942) and directed intelligence operations in Algiers (1943–44).

A member of the Constituent Assembly of 1945–46, Soustelle was successively minister of information and minister of colonies during 1945 in the government headed by de Gaulle. As secretary-general (1947–52) of de Gaulle's Rally of the French People, he led the party in the National Assembly after his election in 1951. In 1955 he was appointed governor-general of Algeria. Initially viewed with suspicion by the Algerian French community, Soustelle soon came to be regarded as its principal spokesman. He was recalled in February 1956 by the Guy Mollet government.

As the leader of the Gaullist group in the National Assembly in 1956–58, Soustelle became known as the "destroyer of ministries"; his intensive attacks on their Algerian policies led to the downfall of three governments. He returned to Algeria in May 1958 and became a leader of the rebel Committee of Public Safety. In company with the Algerian French rebels, the mutinous army, and other sectors of French society, he helped force the May 28 resignation of Premier Pierre Pflimlin and his replacement by de Gaulle. He was appointed minister of information on July 7, 1958, and, after de Gaulle's election to the presidency, he became minister for Sahara and atomic affairs in January 1959. In February 1960 he left the government, increasingly in disagreement with de Gaulle's policies toward Algeria, and went into exile in 1961. In December 1962 a warrant was placed for his arrest on grounds of plotting against the state. Following a general amnesty in 1968, he returned to France and became director of studies at the École Pratique des Hautes Études. He was elected to the National Assembly (1973–78) and served on the city council of Lyon (1971–77). In 1973 he served as the French representative to the Council of Europe. He was elected to the French Academy in 1983.

Soustelle's publications include *La Vie quotidienne des Aztèques* (1955; "The Daily Life of the Aztecs"), *Aimée et souffrante Algérie* (1956; "Beloved and Suffering Algeria"), *L'Art du Mexique ancien* (1966; *Arts of Ancient Mexico*), *Vingt-huit ans de Gaullisme* (1968; "Twenty-eight Years of Gaullism"), *La Longue Marche d'Israël* (1968; *The Long March of Israel*), *Lettre ouverte aux victimes de la décolonisation* (1973; "Open Letter to the Victims of Decolonization"), *Archéologie et anthropologie* (1976; "Archaeology and Anthropology"), *L'Universe des Aztèques* (1979; "The Universe of the Aztecs"), *Les Olmèques, la plus ancienne civilisation du Mexique* (1979; "The Olmecs, the Most Ancient Civilization of Mexico"), and *Les Maya* (1982; "The Mayans").

**Soutar, William** (b. April 28, 1898, Perth, Perthshire, Scot.—d. Oct. 15, 1943, Perth), Scottish poet, second in importance to Hugh MacDiarmid among the writers of the Scottish Renaissance movement.

Soutar was educated at Perth Academy and the University of Edinburgh. During World War I he served for two years in the navy and contracted osteoarthritis, from which he suffered thereafter. From October 1923 he was a semi-invalid, and, after the failure of an operation in May 1930, he was bedridden. He was saved from apathy and despair by his delight in the variety of nature and his devotion to the craft of letters. His "bairn-rhymes" in Scots, *Seeds in the Wind* (1933), are beast fables that express a mature insight into the life of things viewed with the "innocent eye" of childhood. In *Poems in Scots* (1935) he developed the ballad style toward the objective expression of individual lyricism. During his last 10 years his principal output in Scots consisted of "whigmaleeries," humorous poems full of comic exaggeration, interweaving the fantastic and the familiar. He was fond of miniatures, publishing *Riddles in Scots* (1937), while as a poet in English he was at his best in the pointed epigrams of *Brief Words* (1935) and the short nature lyrics of *The Expectant Silence* (1944).

**Souter, David Hackett** (b. Sept. 17, 1939, Melrose, Mass., U.S.), associate justice of the U.S. Supreme Court from 1990.

Souter spent his early childhood in a Boston suburb before his family moved to rural East Weare, N.H., in 1950. He attended Harvard University, from which he graduated magna cum laude in 1961. He then spent two years at Magdalen College, Oxford, on a Rhodes scholarship. Upon his return to the United States in 1963, he entered Harvard Law School, receiving his law degree in 1966.

After graduation, Souter spent two years in private practice in Concord, N.H., before joining the state attorney general's office. He was appointed state attorney general in 1976 and associate justice of the state Superior Court two years later. In 1983 Souter was elevated to the state Supreme Court. He was considered tough on crime, favouring prosecutors and resisting reversals of criminal convictions.

In February 1990 Pres. George Bush nominated Souter to the U.S. Court of Appeals for the First Circuit in Boston. In July he was nominated by Bush to the U.S. Supreme Court, easily winning confirmation (90–9). Souter's judicial record indicated that he would be ideologically compatible with the conservative justices appointed by Bush's predecessor, Ronald Reagan. From his early tenure on the court, however, Souter gradually emerged as a moderate liberal, routinely aligning himself with the court's more liberal members. Although Souter was expected to favour the overturning of *Roe* v. *Wade*, the 1973 ruling that established the legal right to abortion, he instead supported in 1992 a new "undue burden" standard that restricted abortion rights but did not eliminate them. Souter also adopted left-of-centre positions in cases involving school desegregation and race-conscious electoral districting. By the late 1990s, Souter was recognized for his intellectual leadership among the court's moderate members and for his skill at building consensus.

(B.P.S.)

**South, the,** region, southeastern United States, generally, though not exclusively, considered to be south of the Mason and Dixon Line, the Ohio River, and the 36°30′ parallel. It includes, as defined by the U.S. federal government, Alabama, Arkansas, Delaware, the District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. The South was historically set apart from other sections of the country by a complex of factors: a long growing season, its staple-crop patterns, the plantation system, and black agricultural labour, whether slave or free. White racial domination of blacks characterized Southern politics and economics from the 17th century and began to yield only after World War II.

The warm climate of the South affords a period of 200–290 frost-free days per year, enabling such profitable crops as tobacco, rice, sugarcane, and cotton to grow. This climate, coupled with abundant rainfall, offered 17th- and 18th-century European settlers a superb opportunity to raise crops for export if an adequate permanent labour supply could be found. The source proved to be African slaves, made available for purchase through the international slave trade. From this unique situation of supply and demand arose the system of plantation slavery, which above all other factors distinguished the South from other U.S. regions. By 1790 blacks constituted about one-third of the Southern population and almost the entire work force on the plantations. At the beginning of the American Civil War (1861), more than four million blacks remained in bondage, though less than one-sixth of the white population actually owned slaves.

Economically the antebellum and cotton-oriented South looked to the British textile industry for its market and opposed the growing politico-economic power of the industrializing North. The Southern social philosophy presented a sharp contrast with that of the North, for it stressed a genteel, aristocratic life-style rather than one based on the earnest accumulation of money.

In the period between the American Revolution (1775–83) and about 1830, the North, spurred by the abolitionists, passed from mild opposition to strong condemnation of slavery. In response, the white South rose to an unqualified defense of its "peculiar institution," supporting it on the grounds of biblical sanction, economic justification, the supposed racial inferiority of blacks, and the necessity for a well-ordered society. Southern separatism in defense of slavery and states' rights culminated in 1860–61, when 11 Southern states (South Carolina, Mississippi, Florida, Alabama, Georgia, Louisiana, Texas, Arkansas, North Carolina, Virginia, and Tennessee) seceded from the Union and formed the Confederate States of America. The ensuing Civil War (1861–65) wrought immense destruction on much of the South, which emerged the loser in the conflict. In many areas cropland was ruined, livestock lost, railroads destroyed, and billions of dollars in slave-related investments wiped out. Recovering slowly from this destruction, much of the South continued to rely largely on a one-crop economy—cotton, tobacco, or rice—and to cultivate the crops with the labour of black freedmen. The white-dominated South's continuing insistence on the inferiority and subordination of African Americans through a system of legalized racial-control measures known as Jim Crow laws resulted, after Reconstruction ended (1877), in the replacement of slavery with three institutions: the economic system of sharecropping (tenant farming), the political system of one-party politics (Democratic), and the social system of racial segregation, supported by law and custom.

Until 1932 the South remained an impoverished and undiversified region. The growth of a textile industry in the Carolinas and the movement to develop a "New South" after the Civil War had not seriously qualified the region's commitment to cotton, to agriculture, and to a rural way of life. African Americans remained poor, and the income of the South was less than half that of the rest of the country. Chronic overproduction of cotton, with its attendant low prices, forced more and more farmers, both black and white, into sharecropping. The Great Depression of the 1930s caused a total bankruptcy of the cotton economy, which was not relieved until federal New Deal legislation intervened to provide payments for reducing cotton acreage and for unemployment relief. Both of these devices encouraged migration to the cities, a trend that was accelerated during World War II by a heavy influx of Southern blacks to Northern industrial centres.

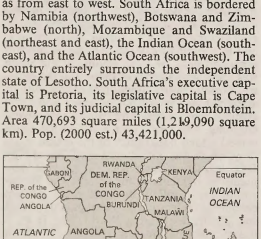
The New Deal, however, was ultimately to benefit the South. The cotton acreage quota system led to improvements in productivity and to diversification of the agricultural base. The Tennessee Valley Authority, a vast river-development scheme created in 1933, brought electricity to many rural families, further increased farmland productivity through flood control and improved soil management, and laid the groundwork for new industry.

After World War II the South began to experience sustained growth and industrialization, particularly in the lumber, paper, petrochemical, and aerospace industries. The cultivation of citrus and other fruits, peanuts (groundnuts), and soybeans eradicated the Deep South's historic dependence on cotton, which fell below livestock, poultry, and textiles in production value. By the 21st century, manufacturing had become the largest sector of the economy in most Southern states.

During the second half of the 20th century the population of the South boomed, exceeding 100 million by the end of the century, when the increasingly urban region contained two-fifths of the nation's 50 largest metropolitan areas. By the 2000 census, Texas surpassed New York as the second most populous state. Moreover, Florida's population more than doubled in the final three decades of the 20th century. As the demographic balance of the country shifted southward, the South consistently gained Congressional representation. Meanwhile, the region's political profile changed dramatically. A split in the Democratic Party in response to its postwar civil rights platform led to the ascendancy of George Wallace (*q.v.*) and caused many segregationist Southern conservatives to flee to the Republican Party. This split was so exacerbated by the growing Civil Rights Movement (*q.v.*) of the 1960s that by the 1980s the Democratic monopoly of the South was fully broken. Ever wealthier, the South played an increasing role in national politics beginning in the final quarter of the 20th century. Democrats Jimmy Carter of Georgia and Bill Clinton of Arkansas, as well as Republicans George Bush and George W. Bush of Texas, were elected president, and Southern patronage became pivotal to successful presidential campaigns. The controversial continued use of the Confederate Battle Flag by some Southern states remains a hotly debated political issue.

Culturally, the South boasts a literary tradition stretching from Sidney Lanier and Kate Chopin in the 19th century to William Faulkner, James Agee, and Eudora Welty in the 20th. It also has been the crucible of jazz, blues, rock, and country and western music.

**South Africa,** officially REPUBLIC OF SOUTH AFRICA, formerly UNION OF SOUTH AFRICA, the southernmost country on the African continent. The country extends for about 1,000 miles (1,600 km) from north to south, as well as from east to west. South Africa is bordered by Namibia (northwest), Botswana and Zimbabwe (north), Mozambique and Swaziland (northeast and east), the Indian Ocean (southeast), and the Atlantic Ocean (southwest). The country entirely surrounds the independent state of Lesotho. South Africa's executive capital is Pretoria, its legislative capital is Cape Town, and its judicial capital is Bloemfontein. Area 470,693 square miles (1,219,090 square km). Pop. (2000 est.) 43,421,000.



South Africa

A brief treatment of South Africa follows. For full treatment, *see* MACROPAEDIA: Southern Africa.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*The land.* South Africa can be divided into three major physiographic zones: the broad interior plateau; the surrounding mountainous, semicircular Great Escarpment; and a narrow belt of coastal plain. The plateau, ranging in elevation from 2,000 feet (610 m) above sea level in the west to 8,000 feet (2,440 m) in the east, consists of undulating to flat landscapes. The Great Escarpment, ranging in elevation from 5,000 to nearly 11,000 feet (1,500 to 3,350 m), is known by a variety of names, such as Transvaal Drakensberg in the far northeast and Roggeveld Mountains in the southwest. The fertile region of the narrow, up to 50-mile- (80-kilometre-) wide coastal plain lies in the west, south, and east. The Orange and the Limpopo are the principal rivers.

South Africa has a temperate subtropical climate. The average daytime temperatures are between 70° and 90° F (21° and 32° C) in summer (December–February) and between 50° and 70° F (10° and 21° C) in winter (June–August). Mean annual rainfall varies from less than 8 inches (200 mm) in the arid northwest to more than 40 inches (1,000 mm) along the KwaZulu/Natal coast in the southeast. Natural vegetation varies from Mediterranean shrub type in the Cape of Good Hope region to the drought-resistant bush type of the semidesert western part of the country; some temperate forests are found along the Cape coast east of George, and grassland (veld) covers the rest of the republic. The Kruger National Park is one of a number of wildlife reserves that protect species such as lions, elephants, rhinoceroses, and antelopes.

South Africa is richly endowed with mineral resources such as coal, asbestos, copper, manganese, gold, chromite, uranium, platinum, iron ore, diamonds, and natural gas.

*The people.* Black Africans make up three-fourths of the country's total population, whites about one-eighth, and people of mixed race (including Cape Malay) and of Indian descent most of the remainder. The black population is composed of four main linguistic groups, all of whom speak Bantu languages belonging to the Benue-Congo subgroup of the Niger-Congo language family. The Nguni group is the largest and includes various Xhosa, Zulu, Swazi, and Ndebele peoples, who together constitute more than half of the total black population. The Sotho-Tswana group includes numerous Sotho, Pedi, and Tswana peoples. The Tsonga and Venda constitute the other two major linguistic groupings. The country's whites are either Afrikaans or English speakers and are mostly descended, respectively, from Dutch settlers or from later British immigrants. Afrikaans and English, together with nine Bantu languages, hold official status. South Africa's major religious groups include African Christian, Dutch Reformed, Roman Catholic, Hindu, and Muslim.

Almost half of South Africa's population is urban. Population density varies from 5 persons per square mile (2 persons per square km) in the arid western part of the country to 239 persons per square mile (92 persons per square km) on the eastern coast around Durban. The population growth rate is higher for blacks and persons of mixed race than it is for whites. Infant mortality, although it is declining, continues to be high among blacks and moderate among whites. Life expectancy in South Africa is 52 years for males and 54 years for females, but it is highest for the white population and lowest for the black.

*The economy.* South Africa has a market economy, with state participation in a number of ways, that is based largely on services, manufacturing, and mining. Economic policy has been aimed primarily at sustaining economic growth and achieving a measure of industrial self-sufficiency. The gross national product (GNP) is the largest in Africa.

Agriculture accounts for about 5 percent of the gross domestic product (GDP) and employs nearly one-tenth of the workforce. Arable land is limited to about one-tenth of the total land area, and productivity is low. Droughts are frequent, and annual harvests of corn (maize), the chief staple and chief farm export, fluctuate sharply. Irrigation is inadequate, though the Orange River Project was initiated in 1962 to greatly expand the land under irrigation. Other major crops include sugarcane, wheat, potatoes, peanuts (groundnuts), citrus fruits, grapes, and tobacco. Pastures cover two-thirds of the land and support sheep, cattle, and other livestock.

Forests cover less than 7 percent of the land; removals of roundwood meet nearly all of domestic demand. There are rich fisheries off the coast, and annual landings include anchovy, stockfish (Cape hake), and herring.

Mining, once the mainstay of South Africa's economy, now accounts for only about 5 percent of the GDP. South Africa remains the world's largest producer of gold, although the importance of gold in the nation's total mineral output has declined significantly since 1946. Coal is widely mined, and large quantities are exported. South Africa must import petroleum, and the South African Coal, Oil and Gas Corporation (SASOL) produces some oil from coal. Significant quantities of uranium are mined and subsequently enriched. A nuclear power station began operating at Koeberg near Cape Town in 1984.

South Africa is also a leading producer and exporter of chromite, gem diamonds, platinum, and vanadium. Antimony, industrial diamonds, fluorite, manganese, and vermiculite are also produced in large quantities.

Manufacturing accounts for one-fifth of the GDP and employs one-tenth of the workforce. Principal manufactures include metal products, chemicals, food and beverages, electrical machinery, motor vehicles, textiles, and printing and publishing. Electricity is generated mostly from domestic coal.

The most important trade union federation is the Congress of South African Trade Unions, a nonracial but mainly black body that includes the country's largest unions.

South Africa's chief import sources are Germany, the United States, the United Kingdom, and Japan. Machinery, transport equipment, chemicals, and foodstuffs are the major imports. Switzerland, the United Kingdom, the United States, Japan, and Germany are the chief markets for South African exports. Gold, the country's largest export commodity, is followed by gem diamonds and other minerals.

*Government and social conditions.* From 1948 to 1993–94 South Africa's political and social structure was based on apartheid, a system of legalized discrimination that maintained the political and economic dominance of the white minority and legally enshrined the complete segregation of whites, Coloureds (persons of mixed race), Asians (mostly Indians), and Africans (blacks). Under apartheid the government established 10 Bantu (African) national homelands to which it assigned specific tribal groups, and in 1970 all blacks were made citizens of one or another of these small polities. The black majority was thus effectively stripped of South African citizenship.

A new constitution adopted in 1983 granted limited political rights to the country's Coloured and Asian minorities while continuing to exclude blacks from the franchise; there was no parliamentary representation for the country's black majority. The 1983 constitution also increased the powers of South Africa's chief executive, the state president. The dominant white party during the

apartheid era was the National Party. The principal black political organization was the African National Congress (ANC), although at that time it was illegal in South Africa.

Under the leadership of President F.W. de Klerk, the South African government in 1990 began to dismantle the apartheid system by releasing the ANC leader Nelson Mandela from prison and lifting the ban against the ANC and other antiapartheid political groups. From 1991 the government undertook negotiations with the ANC and other groups on the establishment of a constitution that would enfranchise the country's nonwhite majority. The government also systematically dismantled the legal basis of apartheid by repealing a large body of racially discriminatory legislation. In 1993 the government and the black opposition agreed on the mechanisms for a transition to democratic government in South Africa. The interim constitution of 1993 called for a bicameral parliament consisting of a National Assembly elected by proportional party representation and a Senate elected by the provincial legislatures.

All-race elections for the new parliament were held in April 1994. Upon the start of the elections (April 26) the interim constitution went into effect, the country's four historic provinces (Cape of Good Hope, Transvaal, Natal, and the Orange Free State) were replaced by nine new provinces, and the 10 black homelands were dissolved and reincorporated into South Africa. The elections were won by the ANC under the leadership of Mandela, who became South Africa's first black president. He promptly formed a government of national unity whose vice presidents and cabinet ministers were drawn from the ANC, the National Party, and other moderate political parties.

The constitution of 1996 provides for a bicameral legislature. The National Council of Provinces consists of nine delegations (of 10 delegates each) elected by the legislatures of the nine provinces. Members of the 350- to 400-seat National Assembly are elected by proportional party representation to five-year terms. The National Assembly chooses from among its members the president of the republic, who may serve no more than two five-year terms in that capacity. The judiciary is headed by the Constitutional Court and includes the Supreme Court of Appeal, the High Courts, and the Magistrates' Courts.

South Africa's social-welfare services include social pensions; family allowances; care for the elderly, handicapped, and children in need; and unemployment compensation. Urban areas have modern health facilities rarely found in rural areas. Hospitals located in the formerly segregated African areas tend to be overcrowded, and the incidence of infectious disease and malnutrition among nonwhites remains high. The proportion of the population infected with HIV, the virus that causes AIDS, increased sharply during the 1990s.

One consequence of the three separate educational systems built up under apartheid has been a disparity in literacy rates among races. Literacy rates range from nearly universal among the white population to about one-third among the black population. Education is compulsory for all children between the ages of 7 and 15. In the late 1990s the government began to develop a single nonracial educational system that aimed at overturning the educational disparities of the apartheid era.

Apartheid-driven censorship before 1990 has given way to a more open and free press. Although most television and radio stations remain state-owned, private ownership is becoming more common, and Internet access in South Africa is the highest in the continent.

*Cultural life.* The numerous languages spoken by the South African population reflect the country's cultural diversity. The largest group, the blacks, is the most eclectic, and, though many have adopted European customs, African traditions in music, dance, and the visual arts remain strong. South Africa's literary tradition consists of writings in English, Afrikaans, and various African languages, chief among them Zulu and Xhosa. Among the country's noted writers have been the poets N.P. van Wyk Louw and Breyten Breytenbach in Afrikaans; and the novelists Alan Paton, Nadine Gordimer, and J.M. Coetzee and the playwright Athol Fugard in English. (*See* South African literature.)

*History.* In the late Stone Age, about 10,000 years ago, the San and Khoikhoin roamed South Africa as hunters and gatherers, with the latter group developing a pastoralist culture by the time of European contact. Bantu-speaking peoples (to about the 15th century) migrated southward and developed more complex societies, gold- and copper-mining industries, and an active East African trade.

The Portuguese navigator Bartolomeu Dias sailed around the southern tip of the country in 1488. In 1652 the Dutchman Jan van Riebeeck established a colony at the Cape of Good Hope to serve as a stopping point for Dutch East India Company trading vessels. Dutch settlers became known as Boers and later as Afrikaners—named for their Afrikaans language, which had derived from the settlers' native Netherlandic (Dutch). Intermarriage among San, Khoikhoin, and Afrikaners produced an ethnic group known as Cape Coloureds. Afrikaners ventured inland from the Cape, becoming seminomadic pastoral farmers called trekboers. They encountered the populous and settled agricultural Xhosa people in the area of the Fish River. In the last quarter of the 18th century, minor cattle raids developed into frontier wars between the Afrikaners and Xhosa that were to last intermittently for almost 100 years.

In 1795 British forces captured the Cape; they relinquished control in 1802 and recaptured the colony in 1806. The British initiated a policy of subduing Bantu-speaking tribes along the frontier. In the 1830s began the "Great Trek," during which Afrikaners with their slaves migrated north in large numbers across the Orange and Vaal rivers to escape British rule. The Boer republics of the Orange Free State (1854) and the South African Republic (1838; later the Transvaal region) were established during that period. Both gained independence from British colonial rule in the 1850s.

The discovery of diamonds (1868) and gold (1886) caused the economy to boom during the late 19th century. The Boer republics resisted British attempts to include them in a South African confederation, leading to the South African (Boer) War between the republics and Britain beginning in 1899. By 1902 Boer resistance had been destroyed, and Britain had annexed the republics as new colonies.

In 1910 the South Africa Act (1909) unified the British colonies of Cape Colony, Transvaal, Natal, and Orange River into the new Union of South Africa. South Africa sided with Britain in World War I, and by 1915 its soldiers had defeated German troops occupying South West Africa (modern Namibia); in 1919 the League of Nations mandated the former German colony to South Africa.

Throughout the 20th century South African politics was dominated by the question of maintaining white supremacy over the country's black majority. In 1948 the new government of the white National Party introduced enforced segregation—apartheid—as a formal segregation policy; its built-in racial hierarchy fixed whites and blacks at opposite ends of the economic and political spectrum, with whites holding virtually all political power and owning most of the country's wealth. In the middle were the Asians and the Coloureds. Unrest among nonwhites increased from the 1950s, resulting in occasional violent conflicts with police over apartheid policy. These protests were frequently met with brutal suppression.

In 1966 Lesotho (Basutoland) and Botswana (Bechuanaland) became independent. In 1968 South West Africa was renamed Namibia by the United Nations; it became independent in 1990. Meanwhile, the white government of South Africa, faced by worldwide condemnation, inaugurated policies to conciliate the black population and to eliminate the barriers of apartheid. Negotiations toward a new, nonracial constitution began between the white-dominated government and black political organizations in 1991. The apartheid system was dismantled, and the government and the leading black political party, the ANC, cooperated in a transition to majority rule signaled by the holding of all-race democratic elections in April 1994. The ANC won an outright majority of seats to the new Parliament in these elections, and the ANC leader Nelson Mandela became the country's first black president and promptly formed a government of national unity with the National Party. A much-heralded nonracial constitution was formally adopted in 1996, at which time the Nationalists resigned from the government. The ANC retained its majority in elections held in 1999, despite the retirement of Mandela.

**South Africa, Church of the Province of,** independent church that is part of the Anglican Communion. It developed from the work of British clergy among the British soldiers and settlers in the Cape of Good Hope in the late 18th and 19th centuries. The bishop of Calcutta, India, was at first responsible for the area, but in 1847 Robert Gray was consecrated the first bishop of Cape Town. Through his work the church grew, and additional dioceses were established. In 1853 he became metropolitan (archbishop) of South Africa.

Gray had been influenced by the Oxford Movement in the Church of England, which emphasized the Roman Catholic heritage of the church. Anglicanism in South Africa reflected this influence.

In modern times the church has attempted to minister to the country's black population. It actively opposed the government's policy of apartheid (racial segregation and disfranchisement) until the policy was abolished.

**South Africa Act** (1909), act that unified the British colonies of Cape Colony, Natal, Transvaal, and Orange River and thereby established the nation of South Africa. It was the work of white delegates to a national convention at Durban, Natal, in 1908, who represented white electorates, less than one-fifth of the population of South Africa.

The constitution agreed upon at Durban was largely the work of Jan Smuts, colonial secretary of the Transvaal (and of his English secretary, R.H. Brand), and was modeled on the Australian constitution of 1900. Most power was to be concentrated in the all-white union Parliament, effectively disfranchising blacks. Before the convention Smuts and John X. Merriman, prime minister of the Cape Colony, had agreed that a "colour-blind" franchise (*i.e.,* one not excluding nonwhites) should be confined to the Cape Province and, even there, should be subject to constitutional amendment. The amendment procedure—two-thirds majority of both houses sitting together—also applied to the clause guaranteeing equal status to whites of either English or Dutch descent. Cape African and Coloured (persons of mixed race) voters also lost their right (never exercised) of electing people of their own class to Parliament. The political colour bar was thus enshrined in the constitution. One of the political issues that most vexed the delegates was that of the capital of the new union; finally a compromise was reached, with Preto-

ria becoming the administrative, Cape Town the legislative, and Bloemfontein the judicial capital.

The draft constitution was passed as an act of the British Parliament in 1909, and the union was inaugurated on May 31, 1910, with Louis Botha as the first prime minister. Many British members of Parliament and some white South African politicians were aware of the discriminatory nature of the new act, but it was argued that the political and economic advantages of union would outweigh the disadvantages.

**South African literature,** the body of writings in either Afrikaans or English produced in what is now the Republic of South Africa. For writings in the African languages of the country's black majority, *see* African arts.

South Africa was colonized by Europeans against the resistance of Africans and was for some time afterward a battlefield between Briton and Boer. Although South Africa became independent in 1910, the nation's varied ethnic and racial constituents have not yet been unified in a harmonious whole, and the tension arising from the unequal relations between blacks and whites is the authentic note of much South African literature. Indigenous South African literature effectively began in the late 19th century and became fairly copious in the 20th century. Much of the work by persons born in South Africa was limited in its viewpoint; often these writers only dimly apprehended the aspirations, perceptions, and traditions of South Africans belonging to a race other than their own. English-speaking South African writers are mainly urban and cosmopolitan; their culture is English, and they often have a wider audience among English-speaking communities abroad. By contrast, Afrikaans writers belonged for many decades to a close-knit community—born of a defensive posture—with shared experiences (including rural roots), shared aspirations and religion, and a strong sense of nationhood. Only in the 1960s did a major break with this tradition become apparent.

The twin 20th-century phenomena of urbanization and the separation of the black and white races by government policy have greatly affected the psychological makeup and thus the literary expression of English- and Afrikaans-speaking whites, as well as of Africans. The moral and artistic challenges inherent in South Africa's situation stimulated writing up to a point, but the South African preoccupation with race problems may ultimately have proven inimical to the creation of an authentic national literature.

*In Afrikaans.* Although Afrikaans had diverged sufficiently from its parent Dutch by about 1750 to be considered a language on its own, the first Afrikaans texts were not published until more than a century later. In 1875 a group of nationally conscious men established the Association of True Afrikaners, which eventually published the first newspaper, the first magazine, and the first literary texts in Afrikaans. The leader of the so-called First Afrikaans Language Movement was S.J. du Toit, a Dutch Reformed pastor and a versatile and prolific author. The writings of the First Language Movement were propagandist, aiming to break down prejudice against the new language and to prove that it could be used effectively as a means of communication.

Out of the Boers' defeat in the South African War (1899–1902) came a new upsurge to establish Afrikaans as a national language. The Second Afrikaans Language Movement spread north from Cape Province, and Afrikaans gradually won ascendancy over Dutch, replacing Dutch as the medium of instruction in schools, as the language of the Dutch Reformed churches, and finally as an official language of the (then) Union of South Africa in 1925. Poets were the outstanding writers of the second movement, which spanned the first two decades of the 20th century. Chief among them were Eugène Marais, with his disillusioned and compassionate verse on human suffering; Jan F.E. Celliers, a pastoral poet; Jakob Daniel du Toit (Totius), who wrote some of the best elegiacs in Afrikaans; and C. Louis Leipoldt, whose poetry expressed the suffering inflicted by the South African War, and whose short lyric poems called *Slampamperliedjies* ("songs of a reveler") express a sensuous appreciation of nature.

Afrikaans prose writing made important strides in the 1920s and '30s. In the genre of local realism, two novelists achieved success with their delineations of the folk of farms and villages—Jochem van Bruggen and Jan van Melle. The two foremost Romantic novelists were D.F. Malherbe, who wrote numerous prolix narratives on Biblical themes and South African pioneering history; and C.M. van den Heever, whose work is based mostly on the Afrikaner's conflicts in the transition from a rural to an urban society and implies a natural bond between the farmer and the soil. Toon van den Heever was the outstanding new poet of the 1920s, and his anticonformist verse foreshadowed the great upsurge of "new" Afrikaans poetry in the 1930s.

The supreme event in Afrikaans literature was the appearance of a group of talented poets, the Dertigers ("Poets of the '30s"), begun by W.E.G. Louw with *Die ryke dwaas* (1934; "The Rich Fool"). This sensitive poet, with his searing conflicts between God and Eros, exemplified qualities soon to become the new generation's hallmark. He was followed by his elder brother, N.P. van Wyk Louw, the principal creative artist and theoretician of the new movement. Van Wyk Louw achieved mastery in every form, writing the finest odes, sonnets, modern ballads, and love lyrics in Afrikaans. His dramatic monologue "Die Hond van God" (1942; "The Hound of God") was unsurpassed in the Dutch literatures, his epic poem *Raka* (1941) became a classic, and in the poetry collection *Tristia* (1962) he mourned the exile of the individual searching for signs of God in earthly existence.

Another poet of the 1930s was Elisabeth Eybers, whose verse dealt initially with the intimate confessions of women but broadened out to a penetrating, objective approach to love, exile, old age, and the poetical craft. Besides writing vivid romantic poetry, Uys Krige was also a short-story writer and playwright and a fine translator from the Romance languages. The poet D.J. Opperman came into prominence in 1945. His technique superimposes different historical levels intermingled with a fascinating mosaic of themes, images, and allusions from both Africa and a common Western heritage. Ernst van Heerden, another major poet who emerged in the 1940s, veered from tightly structured, rather impersonal verse to freer forms expressive of human vulnerability. Of the poets writing in the vernacular of the Cape Coloureds, Adam Small was the most talented.

By mid-century Afrikaans was changing from an essentially pastoral language to an urban one, expressing the frustrations and stresses of the city dweller. Among the new writers were the poet Peter Blum and the short-story writer Jan Rabie. They were followed by the Sestigers ("Writers of the '60s"), a disparate group of writers loosely united by their interest in formal experimentation, their existential view of life, and their dissatisfaction with apartheid and the authoritarian character of Afrikaner society under the ruling National Party. The most important of the Sestigers were the novelists Etienne Leroux and André P. Brink and the poet Breyten Breytenbach. In a series of thematically linked novels published in the 1960s, Leroux explored the dilemma of modern Afrikaners in search of a myth, the inexhaustible fantasy and satire of his work making it unique in Afrikaans. In the 1970s Brink wrote a series of novels depicting the evils and injustices of apartheid. As the most important poet of the 1960s, Breytenbach combined surrealism and Zen Buddhism in free verse packed with original imagery. And finally, in the 1960s the short story emerged as an important genre in Afrikaans with the works of Chris Barnard, Abraham H. de Vries, and Hennie Aucamp.

The apartheid system and its tensions and moral failures continued to be explored in Afrikaans literature after the 1960s. Two impressive documentary novels were Elsa Joubert's *Die swerfjare van Poppie Nongena* (1978; "The Long Journey of Poppie Nongena"), which records the experiences of an Afrikaans-speaking black woman up to 1976; and John Miles's *Kroniek uit die doofpot* (1991; "Chronicle From the Wastepaper Basket"), a novel about a political assassination. Etienne van Heerden's *Toorberg* (1986; "The Magic Mountain") is at once a family novel, an exercise in magic realism, and an allegory of South African history. In Karel Schoeman's masterpiece, *'n Ander land* (1984; "Another Country"), the melancholy experience of individual desolation is combined with a probing depiction of South African political realities.

Afrikaans poets of note since the 1960s have been mostly women: Wilma Stockenström, who displays impressive technical abilities in bleak depictions of desolate landscapes and personal alienation; Sheila Cussons, who describes in her poetry the transcendence of human suffering through Roman Catholic mysticism; and Antjie Krog, whose search for an individual language within tradition is recorded in *Lady Anne* (1989).

Afrikaans drama lagged behind poetry and prose. In the 1960s and '80s there were upsurges of playwriting by younger authors, notably by Bartho Smit, André P. Brink, and Pieter Fourie, but the most impressive achievements in the genre probably remain N.P. van Wyk Louw's *Germanicus* (1956) and Opperman's *Periandros van Korinthe* (1954), both of which make use of classical themes.

*In English.* South African literature in English effectively began in the late 19th century in the states preceding the Republic of South Africa and became fairly copious in the 20th. During the early 1900s, Africans, largely cut off from tribal customs and values (including the oral literary tradition), began to write in English. In the middle decades many talented Africans served literary apprenticeships on popular English newspapers and periodicals, such as *Drum,* aimed at the African reader in his poverty-stricken but lively "township." At about that time, too, English-speaking writers, both black and white, began to mix on a limited scale, a cross-fertilization that may have had seminal value for literature. Regrettably, it was short-lived; from 1948, many African and white writers went into exile for political reasons.

Olive Schreiner, a liberal and a powerful writer on local and international affairs, composed the first great South African novel, *The Story of an African Farm* (1883). Other English writers include William Plomer, who pioneered race relations as material for fiction in the novel *Turbott Wolfe* (1925), and Pauline Smith, whose stories in *The Little Karoo* (1925) dealt sympathetically with rural Afrikaners. Laurens van der Post, in a novel, *In a Province* (1934), dealt with the African-coming-to-town theme.

Alan Paton and Nadine Gordimer both achieved international reputations with their novels and short stories. *Cry, the Beloved Country* (1948) established Paton as the most eloquent voice of South African liberal humanism, and his later writing, such as the

novel *Too Late the Phalarope* (1953) and the stories in *Debbie Go Home* (1961), further enhanced his reputation. Paton's work is characterized by rhythmic prose, a compassionate view of South Africa's tormented race relations, and irony. Gordimer made an impact abroad with her first novel, *The Lying Days* (1953). A meticulous observer of the physical world and of nuances in human relationships, she writes astringently and without sentimentality, her talent at its best perhaps in such short-story collections as *Not for Publication* (1965). In 1991 Gordimer became the first South African to receive the Nobel Prize for Literature.

The early novels of Dan Jacobson were also deservedly praised, providing as they did a peculiarly incisive view of racially divided South African society. Restraint and wry humour are characteristic of his best works, which include the short-story collection *Beggar My Neighbour* (1964) and the novel *The Beginners* (1965). Perhaps the most important novelist to emerge after Gordimer was J.M. Coetzee, whose books mark a decisive break with South African traditions of realism and naturalistic description. In such novels as *In the Heart of the Country* (1977), *Waiting for the Barbarians* (1980), and *Life and Times of Michael K* (1983), Coetzee uses allegory, black humour, and stream-of-consciousness narrative techniques to depict the brutality and injustice of unnamed but clearly exploitative modern societies.

Some of the finest works of black and Coloured writers in English are autobiographical depictions of the frustrations and deprivation experienced by young black intellectuals in South African society. Peter Abrahams was a prolific expatriate Coloured novelist who explored this vein in his novel *Tell Freedom: Memories of Africa* (1954). In his short stories and novellas (*e.g., A Walk in the Night* [1962]), Alex La Guma used a racy Coloured English vernacular that owes much to Afrikaans. His other writings include *And a Threefold Cord* (1964), *The Stone-Country* (1967), and *In the Fog of a Season's End* (1972). Other writers of protest include Lewis Nkosi, author of a collection of essays, *Home and Exile* (1965), and Ezekiel Mphahlele, whose autobiographical *Down Second Avenue* (1959) has become a South African classic. Nkosi and Mphahlele, both Africans, worked for *Drum* magazine, which provided an important forum for their ideas. The two went into exile.

Warm humour, rare in South African writing, is abundant in the work of H.C. Bosman, who deals affectionately with Afrikaners of the old school in *Mafeking Road* (1947) and *A Cask of Jerepigo* (1957). The only drama of note in English is that of Athol Fugard, particularly *The Blood Knot* (1963) and *Hello and Goodbye* (1966). Fugard's penetrating and pessimistic analyses of the South African situation in such later plays as *Boesman and Lena* (1969) and *Sizwe Bansi is Dead* (1972) secured his reputation as a dramatist of international importance.

Early South African poets writing in English tried to describe the African landscape within the romantic conventions of 19th-century English poetry. But in the 1920s came the work of major poets Roy Campbell and William Plomer. As satirists they debunked much of the shallowness and sentimentality that characterized South African verse of the period. Campbell wrote vigorously extroverted verse that often sounded a note of menace. His most famous work was his long symbolic poem *The Flaming Terrapin* (1924). The acutely observant Plomer wrote with more restraint and experimented with rhythm and diction in such works as *Notes for Poems* (1927) and *Visiting the Caves* (1936).

Campbell's work stimulated the emergence of a new generation of English poets in the decades after World War II. Guy Butler, in his fine poem "Home Thoughts" (1956), expressed a sense of the English being aliens as people as well as poets. F.C. Slater often evoked by image and rhythm a uniquely South African experience, as in "Lament for a Dead Cow" (*Collected Poems* [1957]). Sydney Clouts was another important poet who came to prominence after World War II, but it was Douglas Livingstone who became the leading English-language poet of the latter 20th century. He emerged in the 1960s with his powerful descriptions of African landscapes and animals, but his poetry subsequently broadened in scope to touch upon various aspects of modern society. An African poet of merit is O.M. Mtshali, whose *Sounds of a Cowhide Drum* (1971) received acclaim.

(E.v.H./M.V.F./G.Ol./Ed.)

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**South African Party,** former political party in South Africa, founded by Louis Botha in conjunction with the creation of the Union of South Africa in 1910. It strove to conciliate British South Africans and Boers within the framework of the British Commonwealth. The party was formed from the coalition that won control of the government in the elections of 1910, making Botha the first prime minister of the Union. Before long the party lost J.B.M. Hertzog, a member of Botha's first Cabinet, who in 1914 founded the opposition National Party to express a more stridently Afrikaner perspective. The South African Party, a strong supporter of the Allies in World War I, stayed in power for 14 years. Jan Smuts became prime minister after Botha died in 1919. The party, led by Smuts, was strengthened in 1920–21 with the addition of members from the defunct Unionist Party, the strongly pro-British party of Cecil Rhodes and Leander Jameson.

A crisis in the mining industry, with resultant discontent among white labourers, contributed to the South African Party's defeat in the elections of 1924. The victory went to the National Party; Hertzog became prime minister. The South African Party remained in opposition until 1933, when it formed a coalition with and then merged with the National Party—in difficulties because of economic depression—to form the United Party (in full, the United South African National Party).

**South African Republic,** either of two 19th-century Boer states in what is now South Africa. The first was established in the Potchefstroom area of the Transvaal, by Voortrekkers (Afrikaner migrants from the Cape) in 1838. In 1860 the name was applied to the amalgamated Boer republics in the area bounded by the Vaal, Hartz, and Limpopo rivers. Annexed by Britain in 1877, this South African Republic became the Crown Colony of the Transvaal. In December 1880 rebellious Boers in the Transvaal again proclaimed a South African Republic; and after its conquest by Britain in 1900 during the South African War, it once again became the Crown Colony (and after 1910, the Province) of the Transvaal.

**South African War,** also called BOER WAR, or ANGLO-BOER WAR (Oct. 11, 1899–May 31, 1902), war fought between Great Britain and the two Boer (Afrikaner) republics—the South African Republic (Transvaal) and the Orange Free State. Although it was the largest and most costly war in which the British engaged between the Napoleonic Wars and World War I, it was fought between wholly unequal protagonists. The total British military strength in South Africa reached nearly 500,000 men, whereas the Boers could muster no more than about 88,000. But the British were fighting in a hostile country over difficult terrain, with long lines of communications, while the Boers, mainly on the defensive, were able to use modern rifle fire to good effect, at a time when attacking forces had no means of overcoming it.

The war began on Oct. 11, 1899, following a Boer ultimatum directed against the reinforcement of the British garrison in South Africa. The crisis was caused by the refusal of the South African Republic, under President Paul Kruger, to grant political rights to the Uitlander (foreigners; *i.e.,* non-Dutch and primarily English) population of the mining areas of the Witwatersrand, and the aggressive attitudes of Alfred Milner, 1st Viscount Milner, the British high commissioner, and of Colonial Secretary Joseph Chamberlain, in response to this obduracy. An underlying cause of the war was the presence in the Transvaal of the largest gold-mining complex in the world, beyond direct British control, at a time when the world's monetary systems, preeminently the British, were increasingly dependent upon gold.

The course of the war can be divided into three periods. During the first phase, the British in South Africa were unprepared and militarily weak. Boer armies attacked on two fronts, into Natal from the Transvaal and into the northern Cape from the Orange Free State; the northern districts of the Cape Colony rebelled against the British and joined the Boer forces. In the course of Black Week (December 10–15) the Boers defeated the British in a number of major engagements and besieged the key towns of Ladysmith, Mafeking, and Kimberley; but large numbers of British reinforcements were being landed, and slowly the fortunes of war turned. Before the siege of Ladysmith could be relieved, however, the British suffered another reverse at Spion Kop (January 1900).

In the second phase, the British, under Lord Kitchener and Frederick Sleigh Roberts, 1st Earl Roberts, relieved the besieged towns, beat the Boer armies in the field, and rapidly advanced up the lines of rail transportation. Bloemfontein was occupied by the British in February 1900, and Johannesburg and Pretoria in May and June. Kruger left the Transvaal for Europe. But the war, which until then had been largely confined to military operations, was by no means at an end, and at the end of 1900 it entered upon its most destructive phase. For 15 months Boer commandos, under the brilliant leadership of generals such as Christiaan Rudolf de Wet and Jacobus Hercules De la Rey, harried the British army bases and communications; large rural areas of the Transvaal and the Orange Free State (which the British annexed as the Orange River Colony) remained out of British control.

Kitchener responded with barbed wire and blockhouses along the railways, but when these failed he retaliated with a scorched-earth policy. The farms of Boers and Africans alike were destroyed and the Boer inhabitants of the countryside were rounded up and held in segregated concentration camps. The plight of the Boer women and children in these camps became an international outrage—more than 20,000 died in the carelessly run, unhygienic camps. The commandos continued their attacks, many of them deep into the Cape Colony, General Jan Smuts leading his forces to within 50 miles (80 km) of Cape Town.

But Kitchener's drastic and brutal methods slowly paid off. The Boers had unsuccessfully sued for peace in March 1901; finally, they accepted the loss of their independence by the Peace of Vereeniging (*see* Vereeniging, Peace of) in May 1902.

**South America**, fourth largest continent and southernmost of the two main New World landmasses. It covers about one-eighth of Earth's land area. The continent, broad in the north and tapering to a point in the south at Tierra del Fuego, extends about 4,700 miles (7,600 km) from Point Gallinas, Colom., in the north to Cape Horn, Chile (and the nearby Diego Ramírez Islands), in the south. At its broadest point, near where it is crossed by the Equator, South America extends about 3,300 miles (5,300 km) from east to west; four-fifths of its landmass lies within the tropics. Bounded by the Caribbean Sea to the north-northwest, the Atlantic Ocean to the northeast, east, and southeast, and the Pacific Ocean to the west, the continent is separated from Antarctica by the Drake Passage. In the northeast it is joined to North America by the Isthmus of Panama, which forms a land bridge narrowing to about 50 miles (80 km) at one point. Area 6,878,000 square miles (17,814,000 square km). Pop. (1993 est.) 308,770,000.

A brief treatment of South America follows. For full treatment, *see* MACROPAEDIA: South America; American Peoples, Native; Pre-Columbian Civilizations.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*The land.* The continent may be divided into three topographic sections: the geologically young mountain chains of the Andes in the west, the ancient, crystalline Guiana and Brazilian continental shields in the east and north-centre, and the sedimentary basins peripheral to the shields. The Andes Mountains stretch north-south for about 5,500 miles (8,800 km) and are second in average height only to the Himalayas of Asia. They border the Pacific Ocean for the entire length of the continent and rise in the Central Andes along the Chilean-Argentine border to Mount Aconcagua (22,831 feet [6,959 m]), the highest peak in the Western Hemisphere. The Andes region is seismically active and prone to earthquakes.

The continental-shield region in the east, which is separated into two unequal sections (the Guiana Highlands and the Brazilian Highlands) by the Amazon lowlands, contains the oldest rocks in South America. The smaller Guiana Highlands are a low, sparsely settled plateau constituting a considerable portion of present-day Venezuela and Guyana. The Brazilian Highlands, covering an area of 580,000 square miles (1,502,200 square km) and constituting virtually all of eastern and southern Brazil, slope gently down toward the Atlantic Ocean in the east; in the southeast they drop more abruptly, sometimes by as much as 2,600 feet (790 m) at the Serra do Mar. Patagonia, which is located in southern Argentina, consists of a succession of arid plateaus that rise terracelike from the Atlantic to the eastern slopes of the Andes.

Extending southward down the middle of the continent is a series of lowlands and river basins peripheral to the shields that separate the highlands and the Andes from one another. Prominent among these lowlands is the Amazon River basin, the world's largest drainage basin, having an enormous area of about 2,722,000 square miles (7,050,000 square km). The Pampas of eastern Argentina consists of an immense accumulation of loose sediment brought down from the Andes by rivers or by dust storms. Covering an area of about 300,000 square miles (777,000 square km), the Pampas and its fertile soils constitute one of South America's most productive agricultural areas.

South America's hydrology is dominated in the north by the Amazon River basin, which drains more than a third of the continent's land area into the Atlantic Ocean. Second in length after the Nile River, the Amazon has a discharge rate four times that of the Congo River in Africa. Three other important river systems, the Orinoco, the Paraná–Paraguay–Río de la Plata, and the São Francisco, also empty into the Atlantic Ocean; no rivers of similar size empty into the Pacific Ocean. Most of the lakes of South America are mountain lakes in the Andes or along their foothills. Lake Titicaca, lying at an elevation of about 12,500 feet (3,810 m) between Peru and Bolivia, is the highest freshwater lake in the world.

South America can be divided into four well-marked climatic regions: tropical, temperate, arid, and cold. The tropical climate zone is subdivided into two types: the tropical-rainy, or rain-forest, type occurs on the Pacific coast of Colombia, in the Amazon basin, on the coast of the Guianas, and on parts of the coast of Brazil; the tropical wet-dry, or savanna, type is found in drier areas peripheral to the tropical-rainy belt, in the Orinoco basin, on the Brazilian Highlands, and in part of western Ecuador. Temperate climates, characterized by greater temperature ranges and lower winter temperatures, are found in parts of Chile, Argentina, Paraguay, and southern Brazil. Arid climates are found principally in Patagonia east of the Andes, portions of the Pacific coast, and in northeastern Brazil. Cold climates, with average annual temperatures of less than 50° F (10° C), occur only in the southernmost parts of Argentina and Chile and in the high Andes. Over most of South America rainfall is plentiful, averaging between 40 and 80 inches (1,016 and 2,032 mm) per year, with heavier rainfalls in the Amazon basin. The largest arid area is in Patagonia, while the driest region is the Atacama Desert of northern coastal Chile.

About 7 percent of South America is arable; much of this is devoted to producing corn (maize), wheat, and rice. Roughly one-fourth of the continent is under permanent pasture. About half the total land area is covered by forest, principally the enormous but steadily diminishing Amazon Rain Forest. About 2,500 different species of trees grow in the rain forests of the Amazon alone. Almost one-fourth of all the world's known species of animals live in the rain forests, plateaus, rivers, and swamps of South America. They include such rare or indigenous forms as the llama, jaguar, alpaca, capybara, sloth, giant anteater, rhea, manatee, and piranha.

*The people.* Four main ethnic components have contributed to the present-day population of South America: American Indians, who were the continent's pre-Columbian inhabitants; the Iberians, Spanish and Portuguese who conquered and dominated the continent until the beginning of the 19th century; the Africans, imported as slaves by the colonizers; and, finally, the post-independence immigrants from overseas, mostly Germans and southern Europeans but also Lebanese, South Asians, and Japanese.

Spanish is the official language throughout South America except for Portuguese in Brazil, French in French Guiana, English in Guyana, and Dutch in Suriname. Less than 10 percent of South America's total population are speakers of Indian languages, and of these more than three-fourths are in the Central and Northern Andes. South America is predominantly Christian in religious affiliation (about 90 percent), and about 85 percent of these are Roman Catholic. Syncretic sects (combining Christian and pagan beliefs), Protestantism, and traditional indigenous practices account for most of the non-Catholics.

The population growth rate of tropical South America (the countries north of Argentina, Chile, and Uruguay), long one of the highest in the world, peaked at 3 percent annually in 1955–65, but has declined substantially since then. Brazil, with more than 150 million people, has nearly half of South America's total population.

Temperate South America has lower growth rates, mostly because of decreased fertility starting in the 1950s. Family-planning programs were introduced in most countries during the 1960s, and adherence to Roman Catholic church prohibitions against the use of artificial birth-control methods subsequently declined. Birth rates are lower in urban areas and among more educated women. In most South American countries, however, children younger than 15 years constitute more than one-third of the national population; the only exceptions are Argentina, Chile, and Uruguay.

South America is densely settled along the coast but has a relatively sparsely populated interior. The coastal areas have become highly urbanized in the 20th century. In Uruguay, Argentina, Chile, and Venezuela, more than 80 percent of the population lives in urban areas. Altogether more than 35 million people live in the huge metropolitan areas of only three cities (Rio de Janeiro, São Paulo, and Buenos Aires).

*The economy.* Brazil accounts for almost three-fifths of South America's economic output and is the dominant economic power of the continent, followed by Argentina, Venezuela, Colombia, and Chile. Industrialization is farthest advanced in Brazil, Argentina, and Uruguay. Income tends to be unevenly distributed in South America between large numbers of poor people and a small number of wealthy families, with the growing middle classes still a minority in most countries. Most countries have free market or mixed state and private enterprise economies.

South America possesses abundant reserves of several important minerals. Its deposits of iron, found mainly in Brazil and Venezuela, represent almost one-eighth of the world's total. Chile and Peru possess one-fourth of the world's copper reserves, while tin is found in major quantities in Bolivia and in Brazil's western Amazon basin. Significant deposits of columbium (niobium), molybdenum, bauxite, lead, and zinc are also located throughout the continent. The most important of the continent's reserves of petroleum and natural gas are located in Venezuela.

Agriculture employs less than one-third of the overall South American workforce. Despite the continent's reputation as a food producer, agricultural productivity is generally low, and land utilization is inefficient. Many countries are not self-sufficient in agricultural production, only just self-sufficient, with no useful surplus.

The Bolivian and Peruvian Andes and parts of Ecuador and Colombia are characterized by small-scale, subsistence farming of crops such as beans, corn (maize), and potatoes, interspersed with large haciendas (ranches) devoted to cattle and sheep production. In the tropical lowlands of Brazil, Paraguay, Peru, Colombia, and Venezuela, there is more commercial production of bananas, citrus fruits, and vegetables, as well as such staples as cassava, beans, and rice. Sugar, cocoa, and coffee are other major agricultural products. The natural grasslands of the Pampas in Argentina, Uruguay, and southern Brazil are used for a combination of cattle and grain farming. Patagonia is also an important region for livestock, producing sheep for wool and some meat. Chile and Peru have excellent fishing resources along their long coastlines and the total catch for each country is among the world's largest.

The concentration of land in large holdings is a continuing problem in South America, and land reform has been a recurrent promise of many governments. Land reforms have been undertaken most extensively in Chile, Bolivia, and Peru, while over the rest of the continent the rate of reform has been much slower. Despite its vast timber resources, the commercial exploitation of forest resources is difficult in South America, largely because tropical forests contain such a wide variety of species that exploitation of any one species is relatively uneconomical. The process of the destruction of habitats, in particular that of the Amazon Rain Forest, has continued to accelerate throughout the continent, where previously primeval conditions had remained stable for centuries.

Mineral production, primarily for export, is important in many regions of South America. Chile produces almost one-fifth of the world's copper; Brazil produces one-sixth of the world's tin and one-seventh of the world's iron ore. Brazil is also a leading producer of gold, manganese ore, chromite, and steel, while Peru is a leading producer of zinc, lead, and copper. Venezuela is South America's dominant producer of crude petroleum, ranking among the major world producers. Three-fourths of the continent's electrical power is generated from hydroelectric sources, two-thirds of which originates in Brazil.

In most South American countries the manufacturing sector is relatively underdeveloped and dominated by light industries or the processing of raw materials for export. The exceptions are Argentina and Brazil, which are industrialized with well-diversified manufacturing sectors producing iron and steel, refined petroleum, petrochemicals, and capital goods such as automobiles. Nearly all the continent's manufacturing is concentrated in the great metropolitan centres such as São Paulo, Rio de Janeiro, and Buenos Aires. Many South American countries have nationalized major, formerly foreign-owned, industries.

South America suffers from an inadequate transportation network throughout much of the interior, as roads and railroads are concentrated primarily along the peripheries of the continent. Except for the Orinoco River, the continent's principal rivers are not readily navigable by large vessels. Most important long-distance movement has been by sea, and the ports remain the chief centres of population and trade, supplemented by air service and some newer highways.

South America's imports substantially outweigh exports, and many countries suffer chronic balance-of-trade deficits. Most export trade is with the United States and members of the European Community (EC); imports are largely supplied by the United States, the EC, and Middle Eastern countries. Intra-regional trade within the continent is slowly increasing.

*Social conditions.* Large populations in Bolivia, Ecuador, Peru, and Colombia suffer from poverty and poor nutrition. These countries also had lower life expectancy rates and higher infant mortality rates than the rest of the continent.

Guyana, Argentina, Uruguay, Suriname, and Chile have the highest literacy rates in South America. Females are generally less literate than males in most South American countries. Elementary school enrollment is gradually becoming more evenly distributed between the sexes, however. Freedom of the press has been fragile. Censorship of the news media, either imposed by a military government or self-imposed in order to avoid closure or other sanctions by a military regime, has been easing only slowly.

*Cultural life.* The cultural life of South America is based on a fusion of Iberian values and Indian and African folklore, music, and oral traditions. The Indian influence is especially strong in the Andes and Amazon basin; the African influence is strong in Brazil. Cultural life is also admixed with German and Italian immigrant traditions and with aspects of more recent Western (particularly U.S.) popular culture. The basic European cultural orientation of Argentina, Uruguay, Chile, and, to a lesser extent, Brazil is reflected in their art galleries, museums, and concert halls. The northern Andean countries have been more strongly influenced by their Indian and Spanish colonial heritages.

*History.* Archaeological discoveries indicate that people originally of Asiatic origins first arrived in South America at least 20,000 years ago. These early migrants were primarily hunters and gatherers. The growth of agriculture about 2600 BC initiated a period of rapid cultural evolution that attained varying levels in different parts of South America. The greatest cultural development occurred in the central Andes region and culminated with the Inca empire, which at its height encompassed about 1,000,000 square miles (2,600,000 square km) and had a population of about 6,000,000. The Chibcha in Colombia were probably the next most developed culture, and at the arrival of the Europeans at the beginning of the 16th century the others varied from Paleolithic to late Neolithic stages of development.

European exploration began when Christopher Columbus, on his third voyage to the New World in 1498, landed on the South American continent at the mouth of the Orinoco River, now in modern Venezuela. In 1499 Alonso de Ojeda, a Spanish lieutenant serving the Italian navigator Amerigo Vespucci (for whom the New World continents were named), landed on the northern coast called Guiana by the Indians. Spain officially took possession of the northern coast in 1593. By 1520 the Atlantic coast of South America had been substantially explored. The Treaty of Tordesillas (1494) divided South America between Portugal and Spain. Portugal received the eastern part of the continent to about 50° W longitude, while Spain received the rest.

Lured by rumours of great wealth, Spanish and Portuguese adventurers moved inland to explore the new lands. Francisco Pizarro conquered the Inca by about 1535. In 1538 Jiménez de Quesada subdued the Chibcha and founded Bogotá in Colombia. Settlers from Spain and Portugal began arriving in sizable numbers in the mid-16th century, and by the end of the century the foundations of cities had been laid.

Immense amounts of gold and silver were mined in South America in the 16th and 17th centuries by the Spanish to enrich their national treasury. In the 17th century all of Spain's territory in South America, except for Venezuela, was included in the Viceroyalty of Peru. In the 18th century other Spanish viceroyalties were created. In many cases the Indian populations, already decimated by European diseases, were reduced to a form of serfdom, serving as agricultural labourers on large plantations and working in the mines for their Spanish or Portuguese overlords. The Spanish colonies were governed from Spain by the Council of the Indies. The governors appointed by the council were landowners who had almost absolute authority.

The Napoleonic Wars in Europe set the stage for the revolt of the increasingly restive colonists against their Spanish- or Portuguese-appointed viceroys. In 1808 Napoleon I of France invaded Spain and Portugal. Spain, occupied with its own defense, left the colonies almost uncontrolled, allowing them to take the first steps toward independence. The colonies set up their own juntas. The Portuguese monarch John VI sailed for Brazil shortly before the French invasion of his country and transferred the Portuguese government to the colony. In 1811 Venezuela, under the leadership of Francisco de Miranda, declared its independence; other Spanish colonies soon followed. In 1812 the new republic under Miranda was overthrown by Spanish forces, and Miranda was sent in chains to Spain. In 1817 the revolution continued with the start of military campaigns by General Simón Bolívar, in the north, and General José Francisco de San Martín, in the south. Aided by General Bernardo O'Higgins, San Martín freed Chile from Spain by 1818 and liberated southern Peru by 1822. Bolívar freed Venezuela from Spain in 1821 and freed other Spanish colonies in the north. After the fall of Callao, Peru, in 1826, the Spanish presence in South America was at an end. Brazil declared independence from Portugal in 1822 and proclaimed Dom Pedro I, the Portuguese prince regent, its emperor. The South American continent was free of European rule, except for the Guianas, which were still occupied by England, France, and The Netherlands.

Argentina, Uruguay, Paraguay, and Bolivia arose out of the Viceroyalty of La Plata; and Colombia, Venezuela, and Ecuador were created out of the Viceroyalty of Peru. Most of the South American countries adopted a republican form of government with strong executive power. The semifeudal economic conditions of these countries caused antagonism between the conservative landowners and liberals who sought industrial progress and social reform; this situation gave rise to periodic revolutions. Vaguely defined national boundaries were often the subject of territorial disputes and eventually led to such major conflicts as the Paraguayan War (1864/65–70) and the War of the Pacific (1879–84). Brazil became a republic in 1889.

During World War I most of the South American countries broke off relations with Germany. After the war the South American countries joined the League of Nations. Among the territorial disputes in the interwar period was the Chaco War (1932–35) between Bolivia and Paraguay, which resulted in the loss of considerable Bolivian territory to Paraguay. Inter-American relations were strengthened between the wars particularly under the U.S. president Franklin D. Roosevelt's Good Neighbor Policy. In 1938 the Declaration of Lima was signed, which committed the governments of the Americas (north and south) to unite in defense against outside attacks on their countries.

When the United States entered World War II all the South American countries except Argentina broke relations with the Axis powers. After the war all the South American countries joined the United Nations. In 1945 the Act of Chapultepec strengthened inter-American unity, cooperation, and defense against foreign aggression. This agreement was made a permanent treaty at a conference at Rio de Janeiro in 1947. In 1948 the Organization of American States (OAS) was established, which all South American countries but Guyana joined. In 1960 the Treaty of Montevideo established the Latin-American Free Trade Association (LAFTA) to which Argentina, Brazil, Chile, Mexico, Paraguay, Peru, and Uruguay were signatories. Later efforts at regional economic cooperation included the establishment of such organizations as the Andean Group (1969) and the Amazon Pact (1978). LAFTA was superseded in 1982, when the Latin-American Integration Association, established in 1980 to replace it, was fully ratified.

**South American fox,** also called SOUTH AMERICAN DOG, OF SOUTH AMERICAN JACKAL, any of several South American carnivores of the genus *Dusicyon,* family Canidae. One member of the genus, the small-toothed dog, is sometimes considered to comprise a dis-

tinct genus called *Lycalopex*. Although these canids are not actually foxes, they resemble true foxes. There are about 6 to 11 species, depending on the authority consulted. In general, South American foxes are long-haired, rather grayish animals growing about 0.5–1 m (1.6–3.3 feet) in length, excluding the bushy tail, which is 30–35 cm (12–14 inches) long. They are found in open and forested areas, depending on species; they feed on small animals, birds, fruit and other plant material, and insects. They are generally nocturnal and live in abandoned burrows or in dens among rocks or trees. Both parents care for the litters of three to six young. South American foxes can attack domestic livestock. They are, however, helpful in controlling rodent and bird populations. The Antarctic, or Falkland Island, wolf (*D. australis*) was hunted to extinction in the late 1800s.

**South Arabic language,** Semitic language of southern Arabia and the island of Socotra. South Arabic belongs to the Southern Peripheral group of Semitic languages, along with Ge'ez, Amharic, Tigré, Tigrinya, and the other Semitic languages of Ethiopia, Eritrea, and The Sudan. Modern dialects of the language include Mahrī, Shaḥrī (or Eḥkalī), Ḥarsūsī, and Baṭḥarī on the Arabian shore of the Indian Ocean and Suquṭrī on Socotra. Ḥarsūsī has been influenced by Arabic to a greater extent than have the other dialects.

Minaean, Sabaean, Qatabanian, and Ḥaḍramawtian were the four known South Arabic dialects of ancient times. The earliest South Arabic inscriptions, dating from the 8th century BC, are in the Minaean dialect. Sabaean is the dialect of the majority of South Arabic inscriptions; the latest inscriptions are from the 6th century AD. The type of Semitic alphabet in which the ancient inscriptions are written has 29 consonant signs but does not indicate vowels.

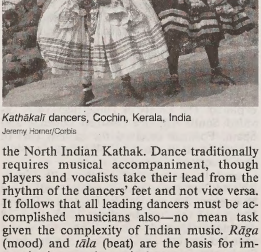
**South Asian arts,** the literary, performing, and visual arts of India, Pakistan, Bangladesh, and Sri Lanka. Despite a history of ethnic, linguistic, and political fragmentation, the Hindu majority population of the Indian subcontinent share a cultural tradition of great antiquity. The coexistence of a sophisticated courtly culture alongside relatively uncorrupted folk and tribal tradition, and the interaction between the two, has given rise to the complexity and fascination of South Asian arts.

A brief treatment of South Asian arts follows. For full treatment, *see* MACROPAEDIA: South Asian Arts.

The encyclopaedic quality of Hindu scriptures has ensured that virtually every aspect of Indian life is pervaded by religious assumptions; this is nowhere more obvious than in the arts. Myths of the popular gods, Vishnu and Śiva, in the *Purāṇas* (ancient tales) and the *Mahābhārata* and *Rāmāyaṇa* epics supply material for representational and dramatic arts.

*Literature.* The *Rāmāyaṇa* is often considered the first *kāvya,* a poetic style best illustrated in the works of Kālidāsa. *Rasa* is the outstanding feature of classical Sanskrit culture. In *kavya* compositions the poet must convey different *rasa* (sentiments) and also induce the appropriate *rasa* in his audience. The Dravidian languages of the south, including Tamil and Telegu, provided some enduring works, particularly the devotional poems of the Tamil Alvars and Nayannars from the 7th through the 9th century. *Bhakti* (devotion) was a great stimulus to vernacular poetry in the north also: the *Rāmcarita* of Tulsidas is an outstanding example of the late medieval style. The introduction of Persian by Muslim conquerors led to the development of Urdu. Urdu poets follow the Persian tradition, particularly favouring the *ghazal,* a love poem of great metric and rhythmic subtlety. The Urdu poet Muḥammad Iqbal and the Bengali poet, playwright, and philosopher Rabindranath Tagore attained the status of national poets in Pakistan and India, respectively.

*Music.* The *Nāṭya-śāstra* established the rules for classical dance and drama, the most popular form of which was the *nāṭaka,* or heroic tale. From the 14th century onward the *nāṭaka* lost ground to popular folk theatre, such as the *Rāmlīla* of Varanasi, but elements of classical drama persist, particularly in the notion of *rasa;* dancers and actors test their ability against audience response, and enthusiastic onlookers often demand, and receive, encores in mid-performance. Dance is of two types: *tāṇḍava,* or fierce, following the destructive *tāṇḍava* dance of Śiva Naṭarāja, patron deity of dance, and *lasya,* or gentle, generally performed by women in emulation of Śiva's consort, Pārvatī, and exemplified by classical *Bhārata Nāṭyam* preserved in Tamil Nadu. The Keralan *kathākalī* is *tāṇḍava,* as is



*Kathākalī* dancers, Cochin, Kerala, India
Jeremy Horner/Corbis

the North Indian Kathak. Dance traditionally requires musical accompaniment, though players and vocalists take their lead from the rhythm of the dancers' feet and not vice versa. It follows that all leading dancers must be accomplished musicians also—no mean task given the complexity of Indian music. *Rāga* (mood) and *tāla* (beat) are the basis for improvisation, and musical arrangements are rare. The classical music and dance tradition is passed down from *guru* (teacher) to pupil, accounting for the high standards observable today. Unfortunately the same cannot be said of the folk tradition, though the extravagant theatrical expression of regional "folk operas" has influenced the Indian cinema.

*Visual arts.* The South Asian architectural tradition begins with the Buddhist cave temples of eastern and western India, notable for the persistence of wooden construction forms in stone, but the first free-standing temple dates from the Gupta period. A major distinction can be made between the northern temple, where the towering *śikhara* ("mountain peak") dominates the shrine, and the evolved southern temple, where the *gopuras* (gateways) tower over the central *śikhara.* Both represent Mount Meru, the mythical centre of the universe. Sculptures and bas-reliefs are carved in profusion on the exterior, and manifold themes underline their cosmic significance.

The carved railings of Sāñcī, Bhārhūt, and Amarāvatī are good examples of naturalistic styles of early Indian sculpture, as are the later Mathurā and Gandhāra Buddhist schools. Indian sculpture has its own aesthetic standards, which, again, hinge on *rasa*—the sentiment evoked by the visual arts should be spiritual elevation. Realism and anatomical veracity had little value for an artistic tradition that evolved in response to philosophical complexities played out through the mythology of an ever-expanding pantheon. Moreover, realism was deliberately eschewed in the Gupta period—often considered the classical era of Indian art—with the application of iconometry to the plastic arts. Figures were constructed according to a series of standard measurements intended to produce a regularity of composition typical of the sublime appearance of supramundane beings. Tantra stimulated the intricate Pāla bronzes of northeastern India.

Excepting the frescoes of Ajanta and Ellora, little early painting survives. Painting flourished under the Mughals, and contemporary Rajput schools were influenced by the Perso-Mughal style, though the Mewar, Kotah, and Bundi schools were more original. They were far outclassed by the 17th-century Basohli school, characterized by bold colouring, vigour of outline, and a naive expression of emotion. The Basohli gave way to the 18th-century Kangra school, in which the colours are softer and the style more lyrical. Though the Delhi sultanate and the provincial sultanates of Gujarat, Malwa, and the Deccan utilized some indigenous motifs in their fine mosques, usually from ransacked Hindu temples, it was only under the Mughals that Islāmic architecture transcended its Persian origins. The marble and sandstone tomb of Humayun in Delhi is the first real expression of this synthesis of Persian and Indian styles; its sombre magnificence heralded the sublime composition of the Tāj Mahal. Akbar's Agra fort and the city of Fatehpur Sikri are the best examples of the harmonious principles of Mughal secular architecture.

*Sri Lanka.* The arts of Buddhist Sri Lanka follow the trends of the mainland. The beautiful 6th-century frescoes of Sigiriya echo the naturalism of contemporary Indian painting while the Kandyan dance-drama is courtly in the *kathak* tradition. There are noteworthy divergences, however. Pre-Buddhist traditions remained strong and are evident in Sri Lankan devil dances. Indian artistic genres often persisted long after their decline in India, as revealed in the stupas at Anurādhapura and Polonnaruwa. The bell-shaped stupa, or *dagoba,* is a singularly Sri Lankan adaptation of an Indian Buddhist construction.

**South Asian Association for Regional Cooperation** (SAARC), organization of South Asian nations, founded in 1985 and dedicated to economic, technological, social, and cultural development emphasizing collective self-reliance. Its seven founding members are Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka. Meetings of heads of state are usually scheduled annually; meetings of foreign secretaries, twice annually. Headquarters are in Kathmandu, Nepal.

The 11 stated areas of cooperation are education, culture, and sports; health, population, and child welfare; environment and meteorology; rural development (including the SAARC Youth Volunteers Program); tourism; transport; science and technology; communications; women in development; and the prevention of drug-trafficking and drug abuse. The charter stipulates that decisions are to be unanimous and that "bilateral and contentious issues" are to be avoided.

**South Australia,** state of south-central Australia, occupying one of the dryest, most barren parts of the continent.

A brief treatment of South Australia follows. For full treatment, *see* MACROPAEDIA: Australia.

South Australia is bounded by Western Australia on the west, the Northern Territory on the north, Queensland to the north and east, and New South Wales and Victoria on the east. On the south it fronts the Great Australian Bight of the Antarctic Ocean. Two-

thirds of the vast interior receives too little rainfall to support significant human or animal population. Yet in the northeast is a portion of the Great Artesian Basin, the world's largest region of natural springs.

More than four-fifths of the land lies at elevations below 1,000 feet (300 m) above sea level. The coastline is indented by two large navigable gulfs: the Gulf St. Vincent is about 100 miles (160 km) in length, and the state capital, Adelaide, is on its eastern shore; Spencer Gulf, twice as long, has near its northern limits the industrial towns of Port Pirie, Port Augusta, and Whyalla.

No vegetation at all grows in the stretches of sand and pebble desert, and only scrub grasses and saltbush are hardy enough to survive in the dry regions of the north and west. Eucalyptus and native pines are scattered in the Flinders Ranges. The Mount Lofty Ranges near Adelaide are more heavily wooded, mainly with eucalyptus. In the southeastern part of the state, many thousands of acres of manmade forest, most of it softwood, have been created since the late 19th century to assure forest preserves.

Most Australian faunal species are represented in the state, and some species are unique to it. Their populations are sparse, however, in comparison with the eastern states because of the climate and the use of better land for farming. Some species have become extinct. The kangaroo and wallaby are still common, as are the wombat and bush rat. There are many kinds of birds, lizards, and snakes. The coastal sea has a rich variety of fish, but few are found in inland waters except in the Murray River.

Maintaining and transporting fresh water are important in South Australia. The need to ensure a regular flow of high-quality water in the Murray River basin led in 1970 to disputes between South Australia and its partners in the River Murray Agreement—the national government, New South Wales, and Victoria—over the location of additional dams.

South Australia's rate of economic growth was uneven during the late 20th century, but the standard of living is on a par with the rest of Australia. Less than one-tenth of the state's work force is engaged in primary production, including mining and quarrying. The Middleback Ranges produce a large part of Australia's iron ore; some of this is processed at the Whyalla blast furnaces. The state is a major world source of opals. It also produces most of the nation's salt and gypsum. Pipelines connect large natural-gas fields in the north with Adelaide and population centres in New South Wales.

Motor-vehicle manufacture is a large component of secondary industry and employs one-fifth of the state's labour force. Consumer durable goods, metal pipes and tubes, chemicals, and textiles are produced in or near Adelaide. A soda-ash plant near Port Adelaide is the major producer in the Australian alkali industry. Whyalla has the country's largest shipyards. Sawmills and factories producing particleboard and paper are located near the softwood plantations in the southeast.

South Australia is a major producer of wheat and barley for export abroad, and it also excels in its vineyards, producing most of the wine and brandy consumed in the nation. Coastal fishing of tuna and crayfish is for export both to other states and abroad.

More than three-fourths of South Australia's population was born in Australia (of British or continental European descent), and nearly all the others were born in the British Isles or continental Europe. About 1 percent have some Aborigine ancestry.

The main social matters under state authority are education, hospitals, housing, police and prisons, and railways and roads. The two primary political parties are the Australian Labor Party (ALP) and the Liberal Party of Australia (LP). The ALP usually receives a majority of the votes and usually seats a majority in the House of Assembly.

Education is compulsory and free from ages 6 to 15. Apprenticeships are controlled by a state commission. The institutions of higher learning include the University of Adelaide (founded 1876), Flinders University of South Australia (opened 1966), and the University of South Australia (1991).

The state provides facilities for its citizens to participate in the arts. The Art Gallery of South Australia has a collection of Australian, European, and Asian art. A professional symphony orchestra is maintained by the Australian Broadcasting Commission, and several theatres provide amateur and professional drama. Every second year an Adelaide Festival of arts is held. Area 379,900 square miles (984,000 square km). Pop. (1998 est.) 1,487,300.

**South Ayrshire,** council area, southwestern Scotland. It stretches along the shores of the Firth of Clyde and includes the steep rock of Ailsa Craig at its mouth. In the south it includes a section of the hilly Southern Uplands. South Ayrshire lies entirely within the historic county of Ayrshire.

Cattle are raised on the Kyle plain in the north, and cattle and sheep on the Carrick uplands in the south, which are also extensively forested. The mild climate favours market gardening of vegetables. Ayr, Prestwick, and Troon are seaside resorts and are known for their golf courses. The three towns form a contiguous urban area in the northwest that houses most of South Ayrshire's population. Their industries include electronics, food processing, aircraft construction, and services. Prestwick is the site of Scotland's international airport. Robert Burns, Scotland's national poet, was born at Alloway, just south of Ayr. Prestwick and Ayr are the administrative centres. Area 464 square miles (1,202 square km). Pop. (1999 est.) 114,250.

**South Bedfordshire,** district, administrative county of Bedfordshire, south-central England. The district lies within the historic county of Bedfordshire, except for the town of Linslade, which is part of the historic county of Buckinghamshire. It nearly encircles the unitary authority of Luton in the east. South Bedfordshire district is an area of low, rolling terrain at the headwaters of several river systems. It extends across the northernmost scarps of the Chiltern Hills (nearly 800 feet [245 m] in elevation) in the south. Its varied geologic composition includes the chalk of the Chilterns, greensand in the west near Leighton Buzzard (the district seat), and clay beds in the northeast. Sand, used in brick production and glassmaking, is extensively extracted at Leighton Buzzard. Chalk quarries around Houghton Regis and Dunstable supply cement manufacturers outside the region. Mixed farming is practiced, with an emphasis on dairy products. Dunstable, in the centre of the district, has industrial works associated with motor vehicle manufacturing at nearby Luton.

The district was an area of ancient settlement. Defensive works and barrows were built by various peoples of the Neolithic and Iron ages. Whipsnade (opened 1931), the large open-air display area of the Zoological Society of London, is located in the Chiltern Hills south of Dunstable. Area 82 square miles (213 square km). Pop. (1998 est.) 110,100.

**South Bend,** city, seat (1831) of St. Joseph county, northern Indiana, U.S. It lies along the St. Joseph River, adjacent to Mishawaka (east) and 94 miles (151 km) east-southeast of Chicago. René-Robert Cavelier, sieur de La Salle, the French explorer, visited the locality in 1679, and under the old Council Oak Tree (still standing in Highland Cemetery) he parleyed in 1681 with the chiefs of the Miami and Illinois Indian confederation. In 1820 Pierre Freischütz Navarre, an agent of the American Fur Company, established a trading post at the site (his cabin has been restored). Three years later the post was bought by Alexis Coquillard and his business partner, Francis Comparet; Coquillard named the place Big St. Joseph Station and promoted European settlement. In 1828 the Michigan Road, the state's first north-south highway, was built nearby, and the next year the settlement became known as Southold. The community was subsequently renamed (1830) for the great bend in the St. Joseph River.



The Hesburgh Memorial Library, University of Notre Dame, South Bend, Ind.
Mit and Joan Mann from CameraMann

Former (pioneer) industries of South Bend were the Studebaker Brothers Manufacturing Company (1852, later auto plant), the Oliver Chilled Plow Works (1855), and the Singer Sewing Machine Company cabinet works (1868). Despite the closure of these companies in the 1950s, '60s, and '70s, South Bend's economy remained highly industrialized. As the centre of trade and finance for the southern Michigan and northern Indiana region, the metropolitan area is known as Michiana.

The University of Notre Dame (1842) is situated just outside South Bend. Also near South Bend are St. Mary's College (1844), Indiana University South Bend (1933), and Holy Cross (junior) College (1966). Inc. town, 1835; city, 1865. Pop. (2000) city, 107,789; South Bend MSA, 265,559.

**South Bucks,** district, administrative and historic county of Buckinghamshire, England. The River Misbourne drains the district's northeastern part. South Bucks's boundary with Greater London in the east follows roughly the Grand Union Canal, and the River Thames separates it from the county of Berkshire in the south. The district also borders the unitary authority of Slough to the south.

South Bucks has scenic areas, with beech woods on gentle chalk hills, including Burnham Beeches and Stoke Park. The district contains a mix of rural landscapes, modern residential development, and historic villages. Beaconsfield in the north is a main tourist attraction with the Bekonscot model village, the timber-framed Lloyds Bank, the five-bay mid-18th-century Rectory and the Wycombe House, the parish church where Edmund Burke is buried, and Hall Barn (1660), which was the home of the poet Edmund Waller. Area 56 square miles (144 square km). Pop. (1998 est.) 63,700.

**South Cambridgeshire,** district, administrative county of Cambridgeshire, east-central England. The district lies almost entirely within the historic county of Cambridgeshire, except for the area around Great Chishill, which belongs to the historic county of Essex. It encircles the administratively independent city of Cambridge. South Cambridgeshire lies generally within the drainage basins of the Cam and Granta rivers and is an area of low, rolling terrain that extends into the Fens, an extensive region of reclaimed marshland northeast of Cambridge. The villages and small towns of the district base their economic livelihood on the cultivation of cereals, sugar beets, and fruits, although many residents commute to work in Cambridge. Jams and leather products are manufactured respectively at Histon and Sawston. Girton, a women's college of the University of Cambridge, is located in South Cambridgeshire. Cambridge is the district seat. Area 349 square miles (904 square km). Pop. (1998 est.) 132,500.

**South Carolina,** constituent state of the United States of America, lying in the South Atlantic region of the country.

A brief treatment of South Carolina follows. For full treatment, *see* MACROPAEDIA: United States of America: *South Carolina.*

Roughly triangular in shape, South Carolina faces the Atlantic Ocean along the southeast and is bounded by North Carolina on the north and northeast and by Georgia on the southwest. The capital is Columbia. The state extends about 225 miles (362 km) from north to south and 285 miles (459 km) from east to west.

At the time of initial European settlement, South Carolina was inhabited by Yamasee Indians. Spanish and French settlements were established and abandoned along the coast in the 16th century. A 1629 land grant by Charles I of England was settled, and in 1663 Charles II rechartered it to a group of eight proprietors. The first permanent European settlement was made in 1670 by 143 whites and 5 black slaves at Charles Town on the Ashley River. The settlers moved their town to the present site of Charleston in 1680. The colony reverted to British crown rule in 1729. In spite of constant threats from the Spanish, French, pirates, and Indians, the settlements thrived from a trade in pelts, rice, and indigo. Charleston became the commercial and cultural centre of the southeastern coast.

During the American Revolution there were several military campaigns in the state, notably the British defeats at Kings Mountain and Cowpens. In 1788 South Carolina was the eighth state to ratify the Constitution.

Even before the Revolution, a fundamental rivalry had developed between the wealthy plantation aristocrats of the coastal lowlands and the more numerous frontier settlers inland. As a compromise the capital was moved inland to Columbia in 1786. With the invention of the cotton gin, slavery also moved inland, and up-country people grew wealthy raising cotton. In spite of lingering cultural differences, the state's white population was unified by proslavery sentiments, and a strong states' rights movement developed out of objection to high federal tariffs that were harmful to Southern commerce. South Carolina was the first Southern state to secede from the Union (Dec. 20, 1860), and the engagement with federal troops at Fort Sumter in Charleston harbour in April 1861 led the nation into the Civil War. The state's readmission to the Union occurred in 1868. After black participation in government during a severely administered Reconstruction period, white South Carolinians in 1876 regained control of the government. Constitutional revisions in 1895 disenfranchised almost all the state's blacks, and a rigid policy of racial segregation developed that rendered blacks almost powerless until the mid-1960s. At the turn of the 21st century controversy arose over the flying of the Confederate flag at the state capitol.

Physiographically, South Carolina can be divided into two main regions: the broad Coastal Plain and the rolling Piedmont farther inland. Along the coast is a fringe of sandy islands separated from the mainland by marshes and lagoons. The state drains generally southeastward through parallel river systems, the largest of which are the Pee Dee, Santee, Cooper, Edisto, and Savannah.

The South Carolina climate is subtropical with long, hot, humid summers and mild winters. Average January temperatures range from 38° to 50° F (3° to 10° C). Mean July temperatures vary from 71° to 81° F (22° to 27° C). Most of the state receives about 49 inches (1,245 mm) of rain per year. The growing season varies from 200 days inland to 300 days on some coastal islands. Soils are well-suited for agriculture, but forests cover about two-thirds of the land.

The early white settlement of South Carolina was primarily by English-speaking peoples. Immigrants from southern and central Europe largely bypassed the state. The black population exceeded the white population between 1810 and the 1920s. By 1980, however, the percentage of blacks had declined to about 30. The state was mostly rural until the 1970s, but by 1980 more than half of the population lived in urban areas. The population is generally clustered in small portions of the state, leaving vast areas almost uninhabited.

South Carolina is a leader in American textile manufacturing. Cotton fabrics make up much of the output, but synthetics and wool are also important. Chemicals, clothing, and paper and allied products are other leading manufactures. Nearly all the giant industrial firms in the country have plants in South Carolina, and it has been among the most successful in the nation in encouraging foreign investments. Tourism is the state's second largest industry. Agriculture contributes significantly to the economic base, with the main crops being tobacco, soybeans, cotton, peaches, peanuts (groundnuts), and watermelons; poultry and cattle are also important. Clays, cement, stone, and sand and gravel are the most valuable mining products. Reforestation and other forest-management programs have caused a rapid increase in the state's supply of timber. Shrimp, crabs, and oysters are the main products of the coastal commercial-fishing industry. The state is easily accessible to the nation's highway and railroad systems, airways, and sea-lanes.

Charleston is notable for its atmosphere and architecture, reflecting the antebellum heritage that pervades many parts of the state. Beaufort, Georgetown, and Columbia also provide examples of early American architectural design. The University of South Carolina, Clemson University, and The Citadel are noted institutions of higher learning. Area 31,117 square miles (80,593 square km). Pop. (2000) 4,012,012.

**South Caucasian languages:** *see* Kartvelian languages.

**South Celebes** (Indonesia): *see* Sulawesi Selatan.

**South Charleston,** city, Kanawha county, western West Virginia, U.S. It lies across the Kanawha River from Charleston. South Charleston was founded in 1916, and its development began with the establishment of several chemical companies and a U.S. naval ordnance plant (1917). The ordnance plant was shut down after World War II and sold in 1961 to the Food Machinery Chemical Corporation; the area was more recently converted into an industrial park. The manufacture of chemicals remains the city's economic mainstay, although there is also a plant that produces automobile parts. The graduate college (1958) of Marshall University is in South Charleston. An earthen mound built by the Adena people, 33 feet (10 m) high and 550 feet (168 m) in circumference, and Little Creek Park are within the city limits. Kanawha State Forest lies just to the south. Inc. 1917. Pop. (2000) 13,390.

**South China Sea,** Chinese NAN HAI, arm of the Pacific Ocean and part of the China Sea. Extending for about 1,800 miles (2,900 km) north to south and for 600 miles (950 km) east to west, it is bounded by the Malay Peninsula and the Southeast Asian mainland (west through north) and by the islands of Taiwan (northeast), the Philippines (east), and Borneo (south). The total area is 1,300,000 square miles (3,400,000 square km). Its Chinese name means "Southern Sea."

**South Chölla** (South Korea): *see* Chöllanam.

**South Ch'ungch'ŏng** (South Korea): *see* Ch'ungch'ŏng-nam.

**South Dakota,** constituent state of the United States of America, lying in the western north-central region of the country. The capital is Pierre.

A brief treatment of South Dakota follows. For full treatment, *see* MACROPAEDIA: United States of America: *South Dakota.*

South Dakota is bounded by North Dakota on the north, Minnesota and Iowa on the east, Nebraska on the south, and Wyoming and Montana on the west. Roughly rectangular in shape, the state extends about 380 miles (610 km) from east to west and 245 miles (395 km) from north to south.

The state's name is derived from the Dakota, or Sioux, Indians who roamed the plains before the arrival of Europeans. A lead plate discovered at Fort Pierre records the earliest-known presence of French explorers in the area in 1742–43. South Dakota was acquired by the United States as part of the Louisiana Purchase from France in 1803. The Lewis and Clark expedition spent about seven weeks in South Dakota on its way to the Pacific Northwest in 1804, but trappers and fur traders were virtually the only Europeans in the area until the mid-1850s, when Fort Randall was built on the Missouri River. The Dakota Territory was created in 1861, but settlement was confined to the extreme southeast until the Black Hills gold rush of 1875–76 swelled the population. South Dakota was admitted to the Union as the 40th state in 1889.

Physiographically South Dakota can be divided into three main regions: (1) the eastern smoothed-out glaciated Prairie Plains; (2) the western unglaciated Great Plains, characterized by high buttes, high canyons, and level tablelands and containing the Badlands; and (3) the Black Hills, an eroded dome-shaped uplift in the state's western part that rises to 7,242 feet (2,207 m) above sea level at Harney Peak. The Missouri River bisects the state from north to south. In the east-river area the principal tributaries of the Missouri—the Big Sioux, Vermillion, and James—flow southward into valleys formed by glaciation. The main rivers of the unglaciated west-river region, the Grand, Moreau, Cheyenne, Bad, and White, flow eastward.

The South Dakota climate is temperate but continental, exhibiting great extremes between summer and winter temperatures. The climate is also marked by persistent winds, low precipitation, and low humidity. The mean annual temperature for the entire state is about 45° F (7° C). At Rapid City in the Black Hills, average January and July temperatures are 24° F (−5° C) and 72° F (22° C), respective-

ly. At Sioux Falls on the state's eastern border, the respective average temperatures are 14° F (−10° C) and 74° F (23° C). Annual precipitation, which averages from 14 inches (356 mm) or less in the northwest to about 24 inches (610 mm) along the eastern border, falls primarily as rain during the spring and summer months.

Early white settlement of South Dakota was primarily by farmers in the east-river area and primarily by cattle ranchers and miners in the west-river area. Immigrants came mainly from Norway, Sweden, Denmark, Germany, and Russia. Indians, mainly descendants of the original Dakota, now comprise about 7 percent of the state's population and are the largest nonwhite group. Today most of the land is used for farming and ranching, and more than half of the population lives in areas classified as rural. Sioux Falls is the largest city. Because of insufficient economic opportunities, South Dakota loses a considerable number of its young people to other states.

The economy of South Dakota is based largely on farming, which provides the basis for related manufacturing, trade, and service industries. Cash income from livestock and meat processing is several times that from crops. The state is among the leaders in cattle and hog production, and the main crops are wheat, corn (maize), rye, flaxseed, and alfalfa (lucerne) seed. The Homestake Mine near Lead in the Black Hills was long a leading producer of gold in the United States. Tourism, largely focused on the scenic attractions, mining and frontier traditions, and recreational opportunities of the Black Hills, accounts for a large portion of retail sales and service income.

South Dakota is served by several railways that provide freight transportation and by two federal interstate highways. The Missouri River, dammed at four locations in the state, is a major source of electric power.

Traditions of pioneer life pervade the art and culture of South Dakota. Education was given high priority by the early farmers, and the state supports a number of public institutions of higher learning and vocational schools. Summer theatres in the Black Hills are known worldwide. The National Park Service administers Mount Rushmore, Wind Cave, and Badlands national parks and Jewel Cave National Monument. Area 77,121 square miles (199,743 square km). Pop. (2000) 754,844.

**South Derbyshire,** district, administrative and historic county of Derbyshire, England. Undulating arable land is interspersed with meadowland in the valleys of the Rivers Derwent, Dove, and Trent, although the Trent valley also has electric-power stations and gravel-extraction sites. Swadlincote is the principal town in the district; using local coal and clay, it manufactures stoneware pipes, pottery, and bricks. The village of Repton is known for its public school and its medieval church. Area 127 square miles (330 square km). Pop. (1998 est.) 80,700.

**South-Eastern** (state, Nigeria): *see* Cross River.

**South Georgia,** mountainous, barren island in the South Atlantic Ocean, 800 miles (1,300 km) east of the British Falkland Islands, of which it is a dependency. It has an area of 1,450 square miles (3,756 square km), is 100 miles (160 km) long by 20 miles (32 km) wide, and rises to Mount Paget (9,625 feet [2,934 m]). The island's bleak Antarctic climate, with perpetual snow covering three-fourths of the island, supports only hardy grasses and other tundra plants. Reindeer were introduced on to the island shortly after 1900 and have survived. Marine life is abundant offshore, and there are a number of species of penguins and seals. Whaling ceased in the area in 1965. About 20 scientists and support personnel maintain the British Antarctic Survey station at Grytviken on King Edward Point.

Captain James Cook visited and claimed South Georgia for Britain in 1775. Sir Ernest Shackleton first crossed it in 1916 while in search of aid for his ill-fated trans-Antarctic expedition. He died later on the island and was buried there. It was not until 1964–65 that the island's interior was further explored, including the first ascent of Mount Paget. The island was the site of military occupation during Argentina's unsuccessful attempt to annex the Falkland Islands and their dependencies in 1982.



Bay of Isles, South Georgia
Frans Lanting/Minden Pictures

**South Glamorgan,** former county (1974–96) of South Wales. The region is now incorporated in the unitary council areas of Cardiff and Vale of Glamorgan (*qq.v.*).



St. Donat's Castle, Glamorganshire, Wales
Barry Webb © Celtic Picture Agency

**South Hadley,** town (township), Hampshire county, south-central Massachusetts, U.S. It lies along the Connecticut River. Settled in 1684 as part of Hadley, it was recognized as a separate precinct in 1732, incorporated as a district in 1753, and reincorporated as a town in 1775. South Hadley prospered briefly as a manufacturing centre (producing textiles, paper, buttons, and leather) during the 1830s, but it is now primarily a residential locality with a service-based economy. The town is best known as the seat of Mount Holyoke College, founded by Mary Lyon in 1837 as one of the first institutions of higher learning for American women. Pop. (2000) 17,296.

**South Hams,** southernmost district in the administrative and historic county of Devon, England. It extends from Dartmoor in the north to the English Channel in the south. Its scenery and rural character attract holiday visitors, retired people, and purchasers of second homes (especially in Stokenham, Salcombe, and Marlborough).

Part of Dartmoor National Park extends into the northern portion of South Hams. The moor is mainly heathland used extensively for the grazing of sheep, cattle, and ponies. The moor's common grazing land is fringed by irregular fields that have extended up the main river valleys from the ancient peripheral villages. Dartmoor's formerly drier, warmer climate brought considerable settlement during the Bronze Age, and old hut circles, enclosures, field boundaries, and stone monuments still remain.

The land falls from Dartmoor toward the coast in a series of steps, deeply incised by rivers flowing south from the moor. The steep sides of the valleys are generally wooded, and the floors form rich meadows. In the hedged fields between the rivers, dairying predominates, and Totnes is a centre for collecting, processing, and distributing milk products. Barley is the main crop; fruit, vegetables, and flowers are also cultivated.

The coastline extends for 51 miles (82 km) of picturesque headlands, cliffs, estuaries, and bays, forming the South Devon Area of Outstanding Natural Beauty. Ports have grown up on the sheltered river mouths. Dartmouth, a historic port on the River Dart, is a yachting centre with marine and light engineering. Area 342 square miles (887 square km). Pop. (1998 est.) 80,200.

**South Herefordshire,** former district (1974–98) of the former county of Hereford and Worcester, western England. The region is now incorporated in the unitary council area and historic county of Herefordshire (*q.v.*).

**South Holland,** district, administrative and historic county of Lincolnshire, east-central England, occupying an area of reclaimed marshland within the Fens. It borders the Wash, a shallow bay of the North Sea, to the northeast. The dry flatlands in the north along the Wash were formed as islands of silt interspersed with marshes when large stretches of silt penned in by glaciers of the Pleistocene Epoch piled up on the shores of a shallow inland sea. Flat plains of peat farther inland were formed as plants decayed on the shallow sea bottom. Throughout the Middle Ages piecemeal encroachment upon the edges of the silt land took place for agricultural use, but the whole expanse of peat land remained virtually undrained until the mid-17th century. Spalding, an ancient market town and now the administrative centre of the district, is a headquarters for the elaborate drainage and flood-control system of the Fens.

This very fertile area grows fruit trees, cereals (mainly wheat and barley), potatoes, and market-garden produce. The largest bulb-growing area in England, specializing in tulips, is in the vicinity of Spalding. Agricultural implements, tractors, and canned food are produced at Spalding. Area 286 square miles (742 square km). Pop. (1998 est.) 73,400.

**South Holland** (The Netherlands): *see* Zuidholland.

**South Holland,** village, southern suburb of Chicago, Cook county, northeastern Illinois, U.S. Founded in 1847 by Dutch farmers, it was first called de Laage Prairie ("the Low Prairie"); it was renamed South Holland in 1870. The community developed after 1853, when the Illinois Central Railroad came through. Originally a truck-farming community, noted especially for its onion sets, South Holland has become mainly residential but also has meatpacking facilities and manufactures window blinds, hardware, and packaging. The area was the setting for Edna Ferber's novel *So Big* (1924). South Holland was the first Northern community against which federal action was brought under the 1964 Civil Rights Act to force desegregation of the public schools. South Suburban College (1927) is located in the town. Inc. village, 1894. Pop. (2000) 22,147.

**South Hwanghae Province** (North Korea): *see* Hwanghae-namdo.

**South India, Church of,** Christian denomination formed in 1947 by merger of part of the Anglican Church of India, Burma (Myanmar), and Ceylon (Sri Lanka); the South India province of Methodism; and the South India United Church, itself a 1908 merger of Presbyterian, Dutch Reformed, and Congregationalist groups. Other smaller groups joined later. By the end of the 20th century membership was almost 4,000,000.

The Church of South India was the first union since the Reformation between episcopal and non-episcopal churches, and this aroused passionate and continuing controversy. Conversations with Baptists aimed at extending the union lapsed, but agreement was reached with Lutherans on doctrinal points, though not on all questions of organization. The church is in full communion with the non-episcopal bodies from which in part it sprang but not with all Anglicans.

The union was based on the acceptance of the Holy Scriptures as the supreme authority in faith and life, of the Nicene Creed as the authorized summary of the faith, of the sacraments of Baptism and Holy Communion, and of the historic episcopate as the basis for church government. Provision was made for a 30-year period of growing together, in the course of which it was hoped that the union would become complete. On the day of the merger, nine new bishops, drawn from all the traditions, were consecrated to serve with the five Anglican bishops already in office.

No attempt was made to impose uniformity at once on all the local churches, which were to continue to use their accustomed liturgical forms until genuinely Indian forms of worship could be worked out. The church later issued orders for Holy Communion, Baptism, and other services. These were not mandatory, but use of them expanded steadily.

**South Indian bronze,** any of the cult images of Hindu divinities that rank among the finest achievements of Indian visual art. The images were produced in large number from the 8th to the 16th century, principally in the Thanjāvūr and Tiruchchirāppalli districts of modern Tamil Nadu, and maintained a high standard of excellence for almost 1,000 years.

During the Pallava period, metal sculpture closely followed the canons of contemporary stone sculpture, and the images were almost invariably frontal, though modelled fully in the round, with arms held symmetrically to either side. A greater fluidity of movement is apparent in images of the early Cōla period (10th–11th century AD), and the movements and hand gestures of dance are frequently employed. The Cōla images are unsurpassed in their elegance, sensitive modelling, and balanced tension. During the Vijayanagar period (1336–1565) the ornamentation tended to become more elaborate, interfering with the smooth rhythm of the body, and the postures became more rigid.



The god Śiva in the garb of a mendicant, South Indian bronze from Tiruvengādu, Tamil Nadu, early 11th century; in the Thanjāvūr Museum and Art Gallery, Tamil Nadu

P. Chandra

The icons range from small household images to almost life-size sculptures intended to be carried in temple processions. A few Buddhist and Jaina images were produced, but the figures mostly represent Hindu divinities, especially various iconographic forms of the god Śiva and Lord Vishnu, together with their consorts and attendants. Also of outstanding quality are the many images of Śiva and Vaiṣṇava saints (the Āḻvārs).

The images are cast by the cire-perdue (*q.v.*), or "lost wax," process. Final sculptural touches are added to the image after it is cast, with the result that the images are "carved" as well as "modelled." Important collections of South Indian bronzes are housed in the Thanjāvūr Museum and Art Gallery, in Tamil Nadu, and at the Government Museum in Madras, but the largest number of fine images are in the various temples of southern India.

**South Indian temple architecture,** also called DRĀVIḌA STYLE, architecture invariably employed for Hindu temples in modern Tamil Nadu from the 7th to the 18th century, characterized by its pyramidal, or *kūṭina*-type, tower. Variant forms are found in Karnataka (formerly Mysore) and Andhra Pradesh states. The South Indian temple consists essentially of a square-chambered sanctuary topped by a superstructure, tower, or spire and an attached pillared porch or hall (*maṇḍapa,* or *maṇṭapam*), enclosed by a peristyle of cells within a rectangular court. The external walls of the temple are segmented by pilasters and carry niches housing sculpture. The superstructure or tower above the sanctuary is of the *kūṭina* type and consists of an arrangement of gradually receding stories in a pyramidal shape. Each story is delineated by a parapet of miniature shrines, square at the corners and rectangular with barrel-vault roofs at the centre. The tower is topped by a dome-shaped cupola and a crowning pot and finial.



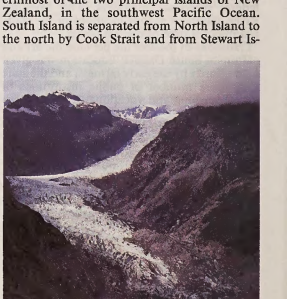
Coliśvara temple at Kilaiyūr, Tamil Nadu, India, late 9th century AD

P. Chandra

The origins of the Drāvida style can be observed in the Gupta period. The earliest extant examples of the developed style are the 7th-century rock-cut shrines at Mahābalipuram and a developed structural temple, the Shore Temple (*c.* 700), at the same site.

The South Indian style is most fully realized in the splendid Bṛhadīśvara temple at Thanjāvūr, built about 1003–10 by Rājarāja the Great, and the great temple at Gaṅgaikoṇḍacōḷapuram, built about 1025 by his son Rājendra Cōla. Subsequently, the style became increasingly elaborate—the complex of temple buildings enclosed by the court became larger, and a number of successive enclosures, each with its own gateway (*gopura*), were added. By the Vijayanagar period (1336–1565) the *gopuras* had increased in size so that they dominated the much smaller temples inside the enclosures.

**South Island,** island, the larger and southernmost of the two principal islands of New Zealand, in the southwest Pacific Ocean. South Island is separated from North Island to the north by Cook Strait and from Stewart Island to the south by Foveaux Strait. Mountainous terrain occupies almost three-quarters of South Island, with a central mountain chain, the Southern Alps, trending southwest to northeast and culminating at Mount Cook (12,349 feet [3,764 m]). The Southern Alps separate the narrow coastal strip of the Westland Plain (west) from the broad Canterbury Plains (east). Fiordland in the southwest is a distinctive area with its numerous coastal

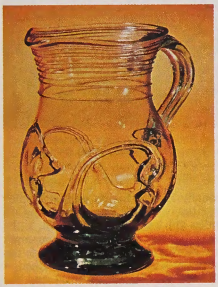


Terminus of Fox Glacier on the western slopes of the Southern Alps, South Island, New Zealand

G.R. Roberts, Nelson, New Zealand

fjords (inlets) and high lakes. The island was sighted by the Dutch navigator Abel Tasman in 1642. Although South Island has several large urban areas, including Christchurch, Dunedin, and Invercargill, all coastal, its population grew less rapidly than that of North Island in the 20th century. Area 58,384 square miles (151,215 square km). Pop. (1998 est.) 925,000.

**South Jersey glass,** glass made at American factories in southern New Jersey, New England, and New York state from about 1781 to about 1870, following the example of Caspar Wistar. Though Wistar's factory had closed in 1780, it had provided the impetus for the "South Jersey tradition." The workmen were descendants of Wistar's own German and Polish workers or new immigrants from Europe,



Lily-pad pitcher, South Jersey glass, c. 1800–25; in the Toledo Museum of Art, Ohio

By courtesy of the Toledo Museum of Art, Toledo, Ohio, gift of Edward Drummond Libbey

and their style had its roots in the glass made for centuries in central Europe. Tableware, such as jugs and sugar bowls, was made in bottle and window glass, these latter being the staple products of most factories. The use of this glass dictated the range of natural colours: green and amber for bottle glass and aquamarine for window glass, though other colours were sometimes added. Decoration was of a kind long established in European glass: applied blobs of glass, variously fashioned, and "threads" of molten glass drawn around and around the vessel. Another technique, with no European ancestry and peculiar to South Jersey, was the "lily pad" ornament, in which an extra coating of molten glass was given to the bottom of the vessel and worked with a tool into a series of points up its sides, giving an effect that was at once artless and controlled. The best period of South Jersey was between 1820 and 1850; after that, the increasing mechanization of the American glass industry and other factors caused a decline in individual glassblowing.

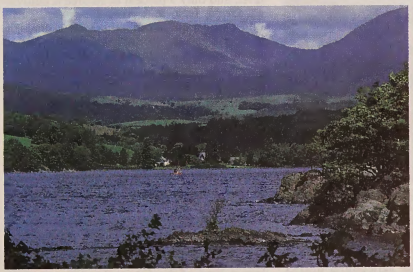
**South Kesteven,** district, administrative and historic county of Lincolnshire, east-central England, lying in the southwestern part of the county. There are fertile pasturelands on the western border with Nottinghamshire, but the bulk of South Kesteven district is a limestone plateau oriented north-south. Lying at an elevation of 200 to 400 feet (60 to 120 m), the plateau has a steep western scarp and descends gradually eastward, crossing a treeless expanse before touching the outer limits of the Fens, an extensive area of reclaimed marshland near sea level that produces wheat, barley, and sugar beets and other root crops. Bourne and, especially, Stamford are well-preserved ancient market towns at the edge of the Fens and have textile, footwear, and stone-trade industries. Agricultural implements and machinery are manufactured at Grantham, the district's administrative centre, in the northwest; sheep are pastured in the nearby limestone uplands. The adjacent parishes (towns) of Market Deeping and Deeping St. James are expanding agricultural communities within the Fens. Sir Isaac Newton and Margaret Thatcher, the first woman to be prime minister of the United Kingdom, spent their formative years around Grantham. Area 364 square miles (943 square km). Pop. (1998 est.) 122,700.

**South Kingstown,** town (township), Washington county, southern Rhode Island, U.S. It lies west of Point Judith Pond and extends northward from Block Island Sound. The area was settled in 1641 and incorporated in 1674 as Kings Towne. Called Rochester in 1686–89, it was divided in 1722–23 into North Kingstown and South Kingstown. The township includes the villages of Kingston, West Kingston, Peace Dale, Wakefield (administrative centre), Matunuck, Green Hill, Perryville, and Tuckertown. The Great Swamp in western South Kingstown was the scene (December 1675) of the Narraganset Indians' final defeat by the colonists in King Philip's (Indian) War. The University of Rhode Island, founded in 1892 near the village of Kingston, plays a major role in the economic and cultural life of the town. Diversified small manufacturing has replaced the textile industry, which was formerly the economic mainstay; summer tourism also is significant. Pop. (2000) 27,921.

**South Kyŏngsang** (South Korea): *see* Kyŏngsang-nam.

**South Lakeland,** district, administrative county of Cumbria, northwestern England, in the southern part of the county, bordering the shallow Morecambe Bay of the Irish Sea to the south. The western part of the district, west of the River Winster and the northern Windermere (lake), is in the historic county of Lancashire. The eastern part of the district, including the Pennine uplands, Garsdale, Dentdale, and the area around Sedbergh, forms part of the Yorkshire Dales in the historic county of Yorkshire. The central part of the district, including Kendal, the administrative centre and largest town, is in the historic county of Westmorland.

South Lakeland is generally an upland district that is a popular vacation area. Central South Lakeland has lower hills and dales of the fertile Kent and Lune river valleys. The western and eastern uplands encompass parts of the Lake District and Yorkshire Dales national parks, respectively, and rise to elevations of 1,500 to 3,000 feet (450 to 900 m). One of the narrow, lake-filled valleys contains Windermere, England's largest freshwater lake. The Yorkshire Dales are rolling uplands of bleak moors. The rough grazing of sheep predominates in all the uplands, and dairy cattle as well as oats and fodder crops are raised in the valleys. Kendal, the district seat, and Ulverston are local agricultural and light industrial centres. Grasmere, Windermere, and Coniston are resorts in the Lake District. The Romantic poet William Wordsworth and the children's writer Beatrix Potter found creative inspiration through observation of the district's landscape. Area 599 square miles (1,551 square km). Pop. (1998 est.) 103,200.



Coniston Water in the Lake District, South Lakeland district, Cumbria, England

David Endersbee from TSW—CLICK/Chicago

**South Lanarkshire,** council area, south-central Scotland, encompassing Clydesdale—the valley of the River Clyde—and the surrounding lowlands and uplands. South Lanarkshire extends from the heavily urbanized southern periphery of the Glasgow metropolitan area, where most of the population live, to the extensive agricultural countryside of the south, which accounts for most of the area. It lies entirely within the historic county of Lanarkshire.

Clydesdale supports intensive cultivation of fruits and vegetables for the Glasgow market and soft fruits for the jam-making industries of Carluke. Other important crops include barley, turnips, and fodder for the considerable numbers of beef and dairy cattle, sheep, and pigs that are raised in the surrounding valleys and uplands. Lanark is a market centre for this large agricultural hinterland. During the 19th century Hamilton developed as an industrial town based initially on lace and textile manufacture and later on coal mining, but these industries have since shut down, and it is now primarily a commercial centre and a residential suburb of Glasgow. East Kilbride houses the National Engineering Laboratory and several electronics firms. East Kilbride, Hamilton, and Lanark are the administrative centres. Area 686 square miles (1,777 square km). Pop. (1999 est.) 307,520.

**South Manchurian Railway,** railway line connecting the South Manchurian sea towns of Lü-shun (Port Arthur) and Lü-ta (Dairen) with the Chinese Eastern Railway, which runs across Manchuria (Northeast provinces) from Chita in Siberia to the Russian port of Vladivostok. The line has been a source of friction between the Chinese, Japanese, and Russians throughout the 20th century.

In March 1898 the Russians forced China to give them control of the Liaotung Peninsula, in southern Manchuria; shortly after that, they began construction of the South Manchurian Railway. Following the Russian defeat in the Russo-Japanese War (1904–05), the Liaotung Peninsula was transferred to Japan. In 1906 the Japanese made the South Manchurian

Railway Company their chief instrument for the economic exploitation of Manchuria, and the company developed the enormous open-pit Fu-shun coal mine and the An-shan steelworks. Lower-echelon Japanese employees harboured ultranationalistic feelings, which encouraged the Japanese to invade Manchuria in 1931 and rule it as the puppet state of Manchukuo.

At the Yalta Conference in 1945, U.S. President Franklin D. Roosevelt agreed to restore the railway to the Soviet Union as a partial reward for Joseph Stalin's agreement to enter the war against Japan. A treaty between the Chinese Nationalists and the Soviet Union on August 14 of the same year gave China and the Soviet Union joint control over the South Manchurian Railway for 30 years. When the Chinese Communists came to power in 1949, the Soviets were obliged to return the railway to full Chinese control.

**South Mountain,** northernmost section of the Blue Ridge in the Appalachian Mountains, extending southwestward for 65 miles (105 km) from southern Pennsylvania to northern Virginia, U.S. Quirauk Mountain (2,145 feet [654 m]) in Maryland is the highest point. It is crossed by the Appalachian Trail (for hikers). The American Civil War Battle of South Mountain took place near Burkittsville, Md., on Sept. 14, 1862.

**South Norfolk,** district, administrative and historic county of Norfolk, eastern England, occupying an area directly south of the city of Norwich. South Norfolk is principally an agricultural district extending across low-lying open countryside. Soils are generally fertile, and the old market centres (including Wymondham, Diss, Harleston, and Loddon) have small populations. A wide variety of crops, including barley, wheat, sugar beets, oats, and vegetables, are grown. Dairy cattle, pigs, and poultry are raised. Several parishes (towns) and villages have imposing churches ranging in date from the Norman to the Perpendicular Gothic periods (11th to late 15th century). The district's southern boundary, the River Waveney, is popular with anglers. Freshwater marshlands abounding in waterfowl are commonplace in the northeast. Long Stratton is the district seat. Area 350 square miles (907 square km). Pop. (1998 est.) 107,700.

**South Northamptonshire,** district, administrative and historic county of Northamptonshire, south-central England, characterized by



Sulgrave Manor, in the village of Sulgrave, South Northamptonshire district, Northamptonshire, England
Barry Hicks—Britain on View (BTA/ETB)

rolling hills in the west of the county. In the north this predominantly agricultural district is bordered by the upper reaches of the River Nene and the town of Northampton and is crossed by the (disused) Grand Union Canal. Clay uplands at elevations of 300 to 500 feet (60 to 90 m) in the centre and south ascend to above 700 feet (210 m) in the extreme west. Covered by fertile glacial drift, the land is predominantly used for pasture, but cereals (wheat and barley) are also grown.

The old market town of Towcester, in the centre of the district, is the administrative headquarters, and Brackley, in the extreme south, is the largest town; both have expanding light industrial bases. Conspicuous village churches, stone and thatched cottages, and distinctive country manors typify the architecture of the district. The latter are perhaps best exemplified by the Baroque Easton Neston House (1700), designed by Nicholas Hawksmoor, and Sulgrave Manor, an Elizabethan building completed about 1560 by Lawrence Washington, a direct ancestor of George Washington. The Talbot Inn in Towcester was immortalized in Charles Dickens's novel *The Pickwick Papers.* Area 244 square miles (632 square km). Pop. (1998 est.) 77,300.

**South Orange Village,** also called SOUTH ORANGE, township (town), Essex county, northeastern New Jersey, U.S., immediately west of Newark. Following the American Civil War, many residents of New York City were attracted by the natural beauty of the open, rolling country and moved into the area. It was originally the Orange Dale section of Orange township, but it separated from Orange and was incorporated in 1869. Seton Hall University (1856) is located there. Although the township is largely a residential suburb, it also has some light manufacturing. Pop. (2000) 16,964.

**South Orkney Islands,** island group lying between the Scotia Sea to the north and the Weddell Sea to the south in the South Atlantic Ocean. It is composed of two large islands (Coronation and Laurie) and a number of smaller islands and rocky islets and forms part of the British Antarctic Territory. The islands (total area about 240 square miles [620 square km]) are barren and uninhabited, but Signy Island is used as a base for Antarctic exploration. George Powell (British) and Nathaniel Palmer (American), both sealers, sighted and charted the islands in December 1821.

**South Ossetia,** Russian YUZHNAYA OSETIYA, region, north-central Georgia, on the southern slopes of the Greater Caucasus mountains. The region is populated largely (about two-thirds) by the Ossetes, a Caucasian people (many Ossetes live in the neighbouring republic of North Ossetia [Severnaya Osetiya] in Russia as well); most of the remainder are Georgians. The area is deeply intersected by rivers, which are harnessed for hydroelectric power. About 90 percent of the region lies more than 3,300 feet (1,000 m) above sea level, and only 9 percent of its area is cultivated. Grain, fruit, and vines are grown, partly under irrigation. Sheep are raised on the higher slopes, and the considerable forest wealth is exploited. The major city is Tskhinvali.

**South Oxfordshire,** district, administrative county of Oxfordshire, south-central England, occupying an area in the southeastern part of the county between the cities of Oxford (northwest) and Reading (south). Most of the district lies within the historic county of Oxfordshire, but the areas to the west of the Thames, including Wallingford, form part of the historic county of Berkshire. The district is generally a clay valley drained by the River Thames and is dominated by the beech-forested Chiltern Hills in the southeast. South Oxfordshire's economy is largely agricultural, primarily based on corn (maize), potatoes, cereals, and dairy cattle. Henley-on-Thames, the largest town of the district (located east of the Chilterns in its southeastern corner), has iron foundries and malt breweries and has become



Henley Royal Regatta on the River Thames at Henley-on-Thames, South Oxfordshire district, Oxfordshire, England
Britain on View (BTA/ETB)

internationally known for its annual Henley Royal Regatta (rowing). The village of Culham, 7 miles (11 km) south of Oxford, is the site of an important atomic-energy research laboratory. Nearby Dorchester was founded as a Roman town; later it became the cathedral city of Wessex (in the 7th century) and the cathedral city of Mercia (from the late 9th to the late 11th century). District offices are located at Crowmarsh Gifford, a settlement across the Thames from Wallingford. Area 259 square miles (671 square km). Pop. (1998 est.) 127,400.

**South Pacific Commission,** also called (from 1998) SECRETARIAT OF THE PACIFIC COMMUNITY (SPC), organization founded in 1947 by the governments of Australia, France, New Zealand, The Netherlands, Great Britain, and the United States to advise them on economic, social, and health matters affecting the South Pacific island territories they administered. It is the oldest regional organization in the Pacific and is headquartered in Nouméa, New Caledonia. Guam and the Trust Territory of the Pacific Islands joined the SPC in 1951, extending the organization's membership to the North Pacific, but The Netherlands withdrew after it transferred administration of Netherlands New Guinea (Irian Jaya) to Indonesia in 1962. Britain withdrew its membership in 1996 but rejoined two years later. By 2000 the SPC had 27 members. As most of the territories gained independence, the organization was transformed into an agency for providing technical advice, assistance, training, and research to address economic, biological, medical, educational, and social problems.

Originally, all founding members of the SPC were entitled to one vote each. However, with the admission of the newly independent Western Samoa in 1965, voting rules were changed to give Australia five votes; France, Britain, New Zealand, and the United States four; and Western Samoa one. Membership rules also were altered to allow other independent states, as well as nonindependent territories, to apply for membership, resulting in the admission of Nauru in 1969 and Fiji in 1971. The SPC revised its rules again in 1983, granting each member—regardless of its status—equal voting rights. The annual South Pacific Conference, attended by two delegates from each member country, approves the organization's budget and determines its Work Programme

of technical assistance through local and regional seminars and workshops. About nine-tenths of the SPC's budget is contributed by Australia, France, Britain, New Zealand, and the United States.

**South Pacific Forum,** also called (from 2000) PACIFIC ISLANDS FORUM, organization established in 1971 to provide a setting for heads of government to discuss common issues and problems facing the independent and self-governing states of the South Pacific. Headquartered in Suva, Fiji, the forum includes Australia, the Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, Nauru, New Zealand, Niue, Palau, Papua New Guinea, the Solomon Islands, the Republic of the Marshall Islands, Tonga, Tuvalu, Vanuatu, and Western Samoa.

At its first meeting, senior officials of the forum recommended that a permanent bureau be established to deal with economic matters. The measure was approved the following year. The resulting group, the South Pacific Bureau for Economic Co-operation, was established in April 1973 and worked to facilitate member cooperation on trade, tourism, transportation, and economic development.

The forum holds an annual meeting of heads of government, which is followed by ministerial discussions with the forum's 10 dialogue partners: Canada, China, the European Union, France, Great Britain, Japan, South Korea, Malaysia, the Philippines, and the United States.

**South Pasadena,** city, Los Angeles county, Calif., U.S., about 2 miles (3.2 km) south of Pasadena and 10 miles (16 km) northeast of the centre of the city of Los Angeles via the Pasadena Freeway. It is principally a residential community, but it has some light manufacturing, chiefly in electronics. The city was incorporated in 1888. Pop. (2000) 24,292.

**South Pembrokeshire,** former district (1974–96) of the former county of Dyfed,



Ruins of the Norman castle at Pembroke, Pembrokeshire, Wales
Britain on View (BTA/ETB)

southwestern Wales, now incorporated in the county of Pembrokeshire (*q.v.*).

**South Platte River,** one of the two main arms of the Platte River (*q.v.*), rising in the Mosquito Range of central Colorado, U.S., and flowing southeast. West of Divide, Colo., the river turns sharply northeast, flows through the Front Range via the Platte River Canyon, and emerges on the flatland of the Colorado Piedmont southeast of Denver. Continuing its northeastern course, it flows through Denver to Greeley, Colo., where it bends eastward via Sterling to North Platte, Neb. There it joins the North Platte River to form the Platte River, after a course of 442 miles (711 km). From Greeley east, the South Platte Valley is 2 to 10 miles (3 to 16 km) wide. Reservoirs and dams, notably around Denver, include Cheesman, Cherry Creek, Eleven Mile Canyon, and Antero; all are part of the Missouri River Basin project for flood control, irrigation, and power. Chief tributaries of the South Platte are Clear Creek and Boulder Creek and the Big Thompson, St. Vrain, and Cache La Poudre rivers.

**South Pole,** southern end of the Earth's axis, lying in Antarctica, about 300 miles (480 km) south of the Ross Ice Shelf. This geographic South Pole does not coincide with the magnetic South Pole, from which magnetic compasses point and which lies on the Adélie Coast (at about 66°00′ S, 139°06′ E; the magnetic pole moves about 8 miles [13 km] to the northwest each year). Nor does it coincide with the geomagnetic South Pole, the southern end of the Earth's geomagnetic field (this pole also moves; during the early 1990s it was located about 79°13′ S, 108°44′ E). The geographic pole, at an elevation of some 9,300 feet (2,830 m; the elevation also changes constantly) above sea level, has six months of complete daylight and six months of total darkness each year. Ice thickness is 8,850 feet (2,700 m). First reached by the Norwegian explorer Roald Amundsen on Dec. 14, 1911, the pole was reached the following year by the British explorer Robert F. Scott and in 1929 by the American explorer Richard E. Byrd. In the early 1970s the South Pole was the site of a U.S. station and landing strip (Amundsen-Scott); owing to the movement of the polar ice cap, the station now lies west of the pole.

**South Ribble,** borough (district), administrative and historic county of Lancashire, northwestern England, occupying an area south of the borough of Preston. The borough is part of the Lancashire coastal plain bordering the Pennine uplands to the east. It was covered by glacial moraine deposited by the Irish Sea ice sheet, which has given the eastern part of the borough a rolling, occasionally drumlin-like landscape. The River Ribble forms the northern boundary.

Most industry is associated with the BL Public Limited Company (formerly British Leyland Ltd.), the motor-vehicle-manufacturing enterprise established at the town of Leyland in 1896 and now headquartered in London. Leyland is the administrative centre, and the borough also includes part of the town of Preston. Other light industrial centres include Walton-Le-Dale, Bamber Bridge, and Farington. Reclaimed peat fens in the west are intensively cultivated, and dairy cattle are grazed. Area 44 square miles (113 square km). Pop. (1998 est.) 103,600.

**South Saint Paul,** city, Dakota county, southeastern Minnesota, U.S., on the Mississippi River, adjacent to the city of St. Paul. It was settled in the 1850s on the site of a Sioux Indian village (Kaposia, 1826–53). Until 1889 the South St. Paul area included West St. Paul. The St. Paul Union Stockyards opened in 1886, bringing large numbers of primarily Central and Eastern European immigrants to the city to work in the yards and associated meatpacking plants. During the 1970s, however, most of the large plants closed and the stockyard decreased dramatically in size. During the 1990s the former site of a major plant was turned into an industrial park. Inver Hills Community College is located in Inver Grove Heights. The eastern section of South St. Paul is part of the Mississippi National River and Recreation Area. Inc. 1887. Pop. (2000) 20,167.

**South San Francisco,** city, San Mateo county, Calif., U.S., about 3 miles (5 km) south of San Francisco on U.S. Highway 101 Bypass. Situated at the southern base of San Bruno Mountain, South San Francisco is heavily industrialized, with meat-packing, steel and other metal fabrication, chemical processing, and other manufacturing. The city also has an attractive residential section with a view of San Francisco Bay. San Francisco International Airport lies just to the south. Pop. (2000) 60,552.

**South Sandwich Islands,** group of actively volcanic islets in the South Atlantic Ocean, north of the Weddell Sea and 470 miles (760 km) southeast of the island of South Georgia. They extend for 190 miles (305 km), occupy 120 square miles (310 square km), and are covered with glaciers. They are included within the British Falkland Islands as a dependency. In 1775 Captain James Cook, the British explorer, sighted the islands, which were uninhabited until 1976, when Argentine personnel, despite protests from the British government, occupied the Southern Thule group of islands. The Argentine personnel were removed by British forces in June 1982.

**South Sea Bubble,** the speculation mania that ruined many British investors in 1720. The bubble, or hoax, centred on the fortunes of the South Sea Company, founded in 1711 to trade (mainly in slaves) with Spanish America, on the assumption that the War of the Spanish Succession, then drawing to a close, would end with a treaty permitting such trade. The company's stock, with a guaranteed interest of 6 percent, sold well, but the relevant peace treaty, the Treaty of Utrecht made with Spain in 1713, was less favourable than had been hoped, imposing an annual tax on imported slaves and allowing the company to send only one ship each year for general trade. The success of the first voyage in 1717 was only moderate, but King George I of Great Britain became governor of the company in 1718, creating confidence in the enterprise, which was soon paying 100 percent interest.

In 1720 there was an incredible boom in South Sea stock, as a result of the company's proposal, accepted by Parliament, to take over the national debt. The company expected to recoup itself from expanding trade, but chiefly from the foreseen rise in the value of its shares. These did, indeed, rise dramatically, from 128½ in January 1720 to more than 1,000 in August. Those unable to buy South Sea stock were inveigled by overly optimistic company promoters or downright swindlers into unwise investments. By September the market had collapsed, and by December South Sea shares were down to 124, dragging other, including government, stock with them. Many investors were ruined, and the House of Commons ordered an inquiry, which showed that at least three ministers had accepted bribes and speculated. Many of the company's directors were disgraced, but the company itself survived until 1853, having sold most of its rights to the Spanish government in 1750.

**South Semitic alphabet,** any of a group of minor scripts originating in the Arabian Peninsula about 1000 BC, possibly related to the writing system used in the Sinaitic inscriptions. These scripts, most of which were used only in the Arabian Peninsula, are of note because of their great age and because of the lack of any clear link between them and the North Semitic alphabet, which dates from about 1100 BC and is probably ancestral to all subsequent alphabetic scripts except the South Semitic group. South Semitic alphabets generally have 28 letters, all representing consonants, and were usually written from right to left. Seven (possibly eight) of the letters resemble North Semitic letters of the same phonetic value.

Of nine distinct scripts, only Safaitic, Sabaean, and Ethiopic occur outside the Arabian Peninsula; the Ethiopic alphabet, developed from Sabaean in Ethiopia, is the only one still in use. Its modern form is sometimes called Amharic. *Compare* North Semitic alphabet.

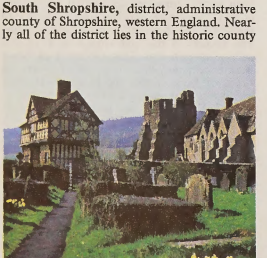
**South Seymour Island** (Galápagos Islands): *see* Baltra Island.

**South Shetland Islands,** island group forming part of the British Antarctic Territory in the Drake Passage of the South Atlantic Ocean. Lying 90 miles (150 km) north of the Antarctic Peninsula, Antarctica, the islands extend for 320 miles (510 km) and have a total area of 1,800 square miles (4,700 square km). Their main use has been for whaling and sealing activities (1906–31) and for Antarctic exploration bases (notably on Deception Island). Barren and snow-covered, the islands were sighted by the sealer William Smith in 1819 and are uninhabited.

**South Shields,** town and North Sea port, South Tyneside district, metropolitan county of Tyne and Wear, historic county of Durham, northeastern England. It lies on the south side of the mouth of the River Tyne near the site of a Roman fort. The town, founded by the Convent of Durham in the 13th century, was a centre of the salt and glass industries in the 17th and 18th centuries. The first British self-righting lifeboat (for aiding ships in distress in the region) was launched there in 1790. Shipbuilding and coal mining fueled the town's growth during the 19th century, but by the late 20th century these traditional industries had given way to services and newer manufacturing sectors, such as electronics. Pop. (2001) 82,854.

**South Shropshire,** district, administrative county of Shropshire, western England. Nearly all of the district lies in the historic county of Shropshire, but a small area south of Ludlow is part of the historic county of Herefordshire. Wales borders the mostly rural district to the west. The Shropshire Hills, a series of ridges oriented southwest to northeast, including the Stiperstones, Long Mynd, and Clee Hills, rise to elevations of 1,600 to 1,700 feet (475 to 500 m) and are separated by deep valleys; they occupy most of the district. Officially designated an Area of Outstanding Beauty, the ridges contain forests at their summits, except the Long Mynd, which is heather-covered.

The development of castle building is well illustrated in South Shropshire through extensive remains at Ludlow in the southeast and nearer the Welsh border at Clun, Hopton, and Stokesay. Ludlow, the administrative centre and largest town, is known for its many half-timbered 14th- and 15th-century homes. Cattle, cereals, and fodder crops are raised in the valleys, and sheep are grazed at higher elevations. Area 397 square miles (1,028 square km). Pop. (2001) 40,389.



(Left) Elizabethan half-timbered gatehouse and (right) 13th-century tower and great hall of Stokesay Castle, South Shropshire district, Shropshire, Eng.

Martin Page from TSW—CLICK/Chicago

**South Somerset,** district, administrative county of Somerset, England, encompassing the southeastern part of the county. It lies almost entirely within the historic county of Somerset, except for a few small areas along its southern border that belong to the historic counties of Dorset or Devon. The district is predominantly rural and has many villages scattered over an agricultural landscape. The district's largest town and administrative centre is Yeovil. Its rapidly developing industries include food processing, light engineering, and the manufacture of helicopters and aircraft equipment, in addition to its traditional glovemaking and leather-dressing trades. Area 370 square miles (959 square km). Pop. (2001) 150,974.

**South Spitsbergen National Park,** Norwegian SØR-SPITSBERGEN NASJONALPARK, national park and bird sanctuary established by Norway in 1973 in the southern corner of the island of Spitsbergen, in the Svalbard archipelago in the Arctic Ocean. With an area of 1,804 square miles (4,673 square km), the park has four separate bird sanctuaries located off the southern and western coasts: Sørkapp, Dunøyane, Isøyane, and Olsholmen.

**South Staffordshire,** district, administrative and historic county of Staffordshire, central England, immediately west of the West Midlands metropolitan area centred on Birmingham. A greenbelt area of rolling terrain, South Staffordshire contains both rich agricultural farmland and residential suburbs housing commuters working in the West Midlands metropolitan area. The district is a source of sand and gravel for the heavy industries of the West Midlands, and modern industrial estates are dispersed throughout. Codsall is the administrative centre. Area 158 square miles (409 square km). Pop. (2001) 105,896.

**South Tyneside,** metropolitan borough, metropolitan county of Tyne and Wear, northeastern England. It lies just southeast of the city of Newcastle upon Tyne and is bordered by the River Tyne to the north and the North Sea to the east. South Tyneside's towns—South Shields, Jarrow, Hebburn, and Boldon—have played a prominent role in the industrial development of the Tyne and Wear (or Tyneside) metropolitan area. Light industries were established after World War II in an attempt to mitigate the area's reliance on heavy industries such as shipbuilding and repairing, coal mining, and iron and steel production. While ship repair continues in Jarrow, coal mining has ceased, and heavy industry has nearly disappeared. The borough's economy now depends mainly on services and light industry. Stretches of scenic grassland and beach are found along the North Sea coast south of South Shields, the administrative centre, at the mouth of the Tyne. A metro rapid-transit system connects South Shields and Jarrow with Newcastle upon Tyne and North Tyneside. Area 25 square miles (64 square km). Pop. (2001) 152,785.

**South Uist,** island of the Outer Hebrides, Western Isles council area, historic county of Inverness-shire, Scotland. It lies west of the island of Skye, from which it is separated by about 25 miles (40 km) of water. The island is 20 miles (30 km) north to south and 7 miles (11 km) wide and is connected by road bridges northward to the islands of Benbecula and North Uist. The east side of South Uist is mountainous—Beinn Mhor reaches an elevation of 2,033 feet (620 m)—and much indented. It has poor soil with peat bogs and heather. The western side, however, has a belt of arable land derived from shell sand. Stock raising is the chief occupation, but islanders also engage in crofting (small-scale tenant farming, mainly for subsistence), fishing, and seaweed processing. Tweeds are woven on the island. Lochboisdale, on the east coast, is the main village. About four-fifths of the people speak Scottish Gaelic.

**South West Africa People's Organization** (SWAPO), party in Namibia (formerly South West Africa) that advocated immediate Namibian independence from South Africa and became the country's leading party following independence in 1990.

It was founded in 1960, and, after South Africa refused a United Nations order to withdraw from the trust territory in 1966, SWAPO turned to armed struggle. SWAPO's greatest political strength lay among the Ovambo people in the northern part of the territory. Led by Sam Nujoma and backed by the Angolan ruling party, the Popular Movement for the Liberation of Angola, and the Soviet Union, SWAPO used Angola as a base for guerrilla warfare on Namibian soil; operations were carried out by SWAPO's guerrilla force, the People's Liberation Army of Namibia (PLAN). Beginning in 1978, South Africa made periodic retaliatory strikes into Angola. Herman Toivo ja Toivo, the founder of SWAPO, was imprisoned in South Africa for a 20-year term in 1968 but was released in 1984.

In 1978 the UN recognized SWAPO as the sole representative of the people of Namibia. Both SWAPO and South Africa agreed to a UN plan for a cease-fire, withdrawal of South African troops, and free elections to be guaranteed by UN security forces. After years of diplomatic maneuvering, South Africa finally accepted a UN resolution to that effect in December 1988. Sporadic fighting continued. In 1989 Nujoma was elected president and took office the following year. SWAPO continued to dominate the political scene into the 21st century, transforming itself from a liberation movement into a governing party.

**South-West National Park,** national park in southwestern Tasmania, Australia. The initial park was created in 1968 out of the amalgamation of the Lake Pedder National Park (created in 1955) and the Huon Serpentine Impoundment, which had inundated Lake Pedder owing to hydroelectric construction. In 1976 the park was almost doubled when the Port Davey Foreshore Preserve and the Precipitous Bluff were both added to it. In 1981 it was enlarged again, with lands about the headwaters of the Davey River. The park now covers 1,092,700 acres (442,200 hectares). The park, together with the adjacent Franklin-Lower Gordon Wild Rivers National Park (proclaimed in 1981), is perhaps the best-known wilderness area in Australia.

Situated in an area of rugged terrain and cold, wet climate, the park consists of several parallel highland ranges, divided by wide valleys marked by rivers and lakes. The flora is a combination of rainforest, sedgeland, and eu-

calyptus. Fauna is limited compared with eastern Tasmania, but the Maatsuyker group of islands, forming part of the park, is rich in seabirds and seals.

**South Wight,** former district (1974–95) of the former county of Isle of Wight, England. The region is now part of the unitary authority of Isle of Wight, historic county of Hampshire (*qq.v.*).

**South Yorkshire,** metropolitan county in north-central England. It comprises four metropolitan boroughs: Barnsley, Doncaster, Rotherham, and the city of Sheffield. South Yorkshire lies within the historic county of Yorkshire, except for three areas. In the metropolitan borough of Doncaster, the parish of Finningley and the area west of Bawtry are part of the historic county of Nottinghamshire, and in the city of Sheffield the area around Beighton and Mosborough belongs to the historic county of Derbyshire. From 1974 to 1986 South Yorkshire was an administrative unit. In 1986 the metropolitan county lost its administrative powers, and its constituent boroughs became autonomous administrative units, or unitary authorities. South Yorkshire is now a geographic and ceremonial county without administrative authority.

South Yorkshire's physical geography is diverse. In the west the high Pennine moorlands, composed of limestone and millstone grit, descend to the valleys of the Rivers Don and Dearne, which flow into a lowland around Doncaster in the east. Much of the lowland, including the marshes of Hatfield, Thorne, and Humberhead, has been drained. The Don rises in the Pennines and flows eastward through the Rivers Aire and Ouse to the River Humber.

In the 19th century the proximity to coal supplies and the arrival of railways stimulated the region's industrial growth. The Don valley became the focus of a belt of ironworks and steelworks extending eastward from Sheffield. Today South Yorkshire includes most of England's main coalfield, but mining declined dramatically in the late 20th century. A few highly mechanized mines still operate around Doncaster, the headquarters of Britain's remaining coal industry. The iron and steel industry, based in Sheffield and Rotherham, also declined during the late 20th century, but Sheffield, located in the Pennine foothills, is still known for its production of special steels and cutlery. Light manufactures, research and development, food processing, and services have compensated somewhat for the loss of employment in mining and heavy industry. Sheffield is South Yorkshire's largest city and main service centre and the site of the University of Sheffield. The metropolitan county encompasses areas of open countryside and part of the Peak District National Park. Area 612 square miles (1,585 square km). Pop. (1998 est.) 1,304,100.

**Southampton,** city and English Channel port, a unitary authority in the historic county of Hampshire, England. It lies near the head of Southampton Water, on a peninsula between the estuaries of the Rivers Test and Itchen.

In AD 43 there was a Roman settlement, Clausentum, on the east bank of the Itchen, and inscribed stones, coins, pottery, and other artifacts have been found. Southampton (Suhamptun) superseded the Saxon Hamtun and was a royal borough before 1086. The earliest town charter was given by King Henry II, probably in 1154–55, but the borough was not incorporated until 1445. Henry VI, in 1447, created Southampton a county in itself. A charter that remained in force until 1835 was granted by Charles I in 1640.

In the European Middle Ages Southampton became one of England's major ports, exporting wool and hides from the hinterland and importing wine from Bordeaux. For the Norman and Plantagenet kings, it was the chief link with their domains across the Channel in France. Remnants of the city's medieval prosperity include St. Michael's Church (11th century and later); King John's Palace (12th century), one of England's oldest domestic buildings; and parts of the city walls, built of Caen limestone from Normandy and featuring the guildhall over the archway of Bargate, the north gate.

The port and city declined in the 17th and 18th centuries but revived in the 19th with the introduction of railways, especially the London-Southampton railway of 1840. New dock development took advantage of the spacious harbour and the prolonged high-water period, which results from a double tide caused by the presence of the Isle of Wight off the coast. A major oil-tanker terminal and refinery were established on the western shore in 1951 and began to use North Sea oil in 1978. By 1980 Southampton had become Britain's second largest port. The city centre was rebuilt after it incurred extensive damage during World War II. New manufactures—aircraft, automobiles, cables, electrical-engineering products, and petrochemicals—have joined the port's traditional industries of shipbuilding and repairing, grain milling, and tobacco processing. Construction of major new commercial and industrial development took place in the late 20th century. The university (1862) is in the northern suburbs. Pop. (1998 est.) city and unitary authority, 216,000; (1991) Southampton Urban Area, 276,752.

**Southampton,** village and town (township), Suffolk county, southeastern New York, U.S., lying along the south shore of eastern Long Island. Settlers from Lynn, Mass., landed at Conscience Point in 1640, founding the first English community in New York. The original Shinnecock Indian land deed (Dec. 13, 1640) is preserved. Many colonial buildings in Southampton town have been restored, including the Halsey Homestead (1648; the state's oldest English saltbox house) and the Old Water Mill (1644). Within the town is the Shinnecock Indian Reservation (1703) and Sag Harbor, once a whaling port. The Southampton campus of Long Island University was founded in 1963. The Parrish Art Museum is in Southampton village. Pop. (2000) village, 3,965; town, 54,712.

**Southampton,** EARLS, COUNTESS, AND DUKES OF, titled English nobility of multiple creations, grouped below chronologically and indicated by the symbol •.

**•Southampton, William Fitzwilliam, Earl of** (b. *c.* 1490—d. October 1542, Newcastle upon Tyne, Northumberland, Eng.), English admiral during the reign of Henry VIII.

A son of Sir William Fitzwilliam of Aldwarke, near Rotherham, Fitzwilliam was a companion in boyhood of Henry VIII and was knighted for his services at the siege of Tournai in 1513. Later he was treasurer of Thomas, Cardinal Wolsey's household and was sent several times to France on diplomatic business. As vice admiral he commanded a fleet when England and France were at war in 1523. He was comptroller of the royal household, chancellor of the duchy of Lancaster, and keeper of the privy seal. In 1537 he became lord high admiral and Earl of Southampton. He went to Calais to conduct Anne of Cleves to England and wrote in flattering terms to Henry about his bride. He died while marching with the English army into Scotland. He left no sons, and his title became extinct.

**•Southampton, Thomas Wriothesley, 1st Earl of,** BARON WRIOTHESLEY OF TITCHFIELD (b. Dec. 21, 1505, London, Eng.—d. July 30, 1550, London), influential minister of state during the last years of the reign of King Henry VIII of England.

The son of one herald, William Writh, or Wriothesley, and nephew and cousin to two others, Thomas Wriothesley was well-placed for a career in the royal service. He was educated at the University of Cambridge, where he made the acquaintance of Stephen Gardiner, later master of Trinity Hall, bishop of Winchester, and a leading councillor to Henry VIII. Wriothesley subsequently married Gardiner's niece Jane Cheyne. Gardiner appointed him a clerk of the signet in 1530, but, when Thomas Cromwell rose to power (1532–33) as Henry VIII's chief minister, Wriothesley transferred to his service, finally becoming Cromwell's chief clerk and personal secretary. His promising connections not only got him possession of extensive monastic properties in Hampshire and elsewhere but also moved him upward in the king's service. In 1538 he went on embassy to the Netherlands; in 1539 he sat in Parliament as one of the knights for Hampshire; in April 1540 he succeeded Cromwell as one of two joint principal secretaries of state. In the same month, he was knighted. Cromwell's fall (June 1540) did not interrupt Wriothesley's career; indeed, even before the final crisis he had almost certainly reestablished contact with Cromwell's enemy Gardiner and had worked against his master. Wriothesley was a true Henrician who would have nothing to do with the pope and welcomed the dissolution of the monasteries, but he remained a conservative in religion and viewed with apprehension Cromwell's negotiations with the Lutheran states. After Cromwell's fall, Wriothesley was one of Henry VIII's leading councillors, rewarded with a barony in January 1544 and with the lord chancellorship, the senior office of state, in April that year.

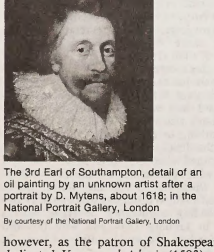
Very ambitious, he hoped to profit from the accession of the minor Edward VI after Henry VIII's death (January 1547), but the ensuing political struggles proved that he should have remained the senior civil servant that the discerning Cromwell had meant him to be. In February 1547 the Protector, Lord Somerset, bought his support with the earldom of Southampton; a month later, ready to promote the Reformation in England, Somerset deprived him of the chancellorship. Naturally, therefore, Wriothesley supported the conspiracy that Somerset's rival, John Dudley, Earl of Warwick (later Duke of Northumberland), led against Somerset in October 1549. But once again he was outmaneuvered: so far from restoring Roman Catholicism and the fallen minister, Warwick proved more Protestant still and in February 1550 excluded Wriothesley from the Council. The earl died in London five months later.

**•Southampton, Henry Wriothesley, 2nd Earl of,** BARON WRIOTHESLEY OF TITCHFIELD (baptized April 24, 1545—d. Oct. 4, 1581, Itchel Manor, near Farnham, Hampshire, Eng.), one of the Roman Catholic English nobles who conspired for the release of Mary, Queen of Scots.

Henry Wriothesley was the third and only surviving son of the 1st Earl of Southampton and was born into great privilege (King Henry VIII himself was one of the sponsors at his baptism). During the reign of the Protestant Elizabeth I, however, he gained a reputation as a zealous Roman Catholic. In June 1570, at age 25, he was arrested for alleged complicity in the proposed marriage of Thomas Howard, 4th Duke of Norfolk, to Mary, Queen of Scots, and was imprisoned from July to November 1570 and from October 1571 to May 1573—during the latter period, in the Tower of London. Thereafter, he held a minor post in the county of Southampton and apparently withdrew from politicking.

**•Southampton, Henry Wriothesley, 3rd Earl of,** BARON WRIOTHESLEY OF TITCHFIELD (b. Oct. 6, 1573, Cowdray, Sussex, Eng.—d. Nov. 10, 1624, Bergen op Zoom, Neth.), English nobleman and William Shakespeare's patron.

Henry Wriothesley succeeded to his father's earldom in 1581 and became a royal ward under the care of Lord Burghley. Educated at the University of Cambridge and at Gray's Inn, London, he was 17 when he was presented at court, where he was favoured by Queen Elizabeth I and befriended by Robert Devereux, 2nd Earl of Essex. Southampton became a munificent patron of writers, including Barnabe Barnes, Thomas Nashe, and Gervase Markham. Southampton is best known,



The 3rd Earl of Southampton, detail of an oil painting by an unknown artist after a portrait by D. Mytens, about 1618; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

however, as the patron of Shakespeare, who dedicated *Venus and Adonis* (1593) and *The Rape of Lucrece* (1594) to him. It has also been argued, albeit inconclusively, that the sonnets were addressed to him. If so, the earlier sonnets, urging marriage, must have been written before the beginning (in 1595) of Southampton's intrigue with Elizabeth Vernon, one of the queen's waiting women, which culminated with their hasty marriage in 1598, incurring the queen's wrath and leading to their brief imprisonment.

In 1596 and 1597 Southampton accompanied Essex on his expeditions to Cádiz and to the Azores. In 1599 he went to Ireland with Essex, but the queen insisted that Southampton return to London. He was deeply involved in the Essex rebellion (February 1601), on the eve of which he induced players at the Globe Theatre to revive *Richard II*, a play dealing with the deposition of a king, in order to stir up the populace. He was tried for treason on Feb. 19, 1601; his titles were forfeited and he was condemned to death, but his sentence was commuted to life imprisonment through the intervention of Sir Robert Cecil.

On the accession of James I, Southampton resumed his place at court. He was made a Knight of the Garter and captain of the Isle of Wight in 1603 and was restored to the peerage by act of Parliament. In 1603 he entertained Queen Anne with a performance of *Love's Labour's Lost* by Richard Burbage and his company, to which Shakespeare belonged.

Southampton was an active member of the Virginia and East India companies. He was a volunteer in support of German Protestants in 1614 and in 1617 proposed fitting out an expedition against the Barbary pirates. He became a privy councillor in 1619 but fell into disgrace through his determined opposition to the royal favourite, the Duke of Buckingham. In 1624 he and his elder son volunteered to fight for the United Provinces against Spain, but on landing in the Netherlands they were attacked with fever, and Southampton died a few days after the death of his son.

BIBLIOGRAPHY. A.L. Rowse, *Shakespeare's Southampton* (1965), is a biography.

**•Southampton, Thomas Wriothesley, 4th Earl of,** BARON WRIOTHESLEY OF TITCHFIELD (b. 1607—d. May 16, 1667, London, Eng.), major supporter of both Charles I and Charles II of England.

The only surviving son of the 3rd Earl, Thomas attended St. John's College, Cambridge. When the dispute began between Charles I and Parliament, he took the side of the latter, but soon the violence of its leaders drove him to support Charles, one of whose most loyal advisers he remained thereafter. He was, however, eager for peace and negotiated with the representatives of Parliament in 1643 and again at Uxbridge in 1645. Having paid more than £6,000 to the state, Southampton was allowed to live unmolested in England during the Commonwealth period, and on the restoration of Charles II he was made lord high treasurer. As treasurer he was remarkable for his freedom from any taint of corruption and for his efforts in the interests of economy and financial order. He died without surviving sons, and his titles became extinct. The name of the 4th Earl is perpetuated in London in Southampton Row and Southampton Street, Holborn, where his London residence stood.

**•Southampton, Barbara Villiers, Countess of:** *see* Cleveland, Barbara Villiers, Duchess of.

**•Southampton, Charles Fitzroy, 1st Duke of,** DUKE OF CLEVELAND, EARL OF SOUTHAMPTON, EARL OF CHICHESTER, BARON NONSUCH OF NONSUCH PARK, BARON NEWBURY, original name CHARLES PALMER, LORD LIMERICK (baptized June 18, 1662—d. Sept. 9, 1730), the natural son of Charles II by Barbara Villiers, Countess of Castlemaine. When his mother became Duchess of Cleveland and Countess of Southampton in 1670, he was allowed to assume the name of Fitzroy and the courtesy title of Earl of Southampton. In 1675 he was created Duke of Southampton and Earl of Chichester in his own right and became Duke of Cleveland on his mother's death in 1709, succeeding to her titles.

His life was fairly uneventful, but he was suspected of intriguing to restore James II to the throne in 1691. From 1710 he sat in the House of Lords—but infrequently. Upon his death, the titles went to his eldest son, William Fitzroy, who died without surviving issue in 1774; the titles then became extinct.

**Southampton Island,** island in Keewatin region, Northwest Territories, Canada. It lies at the entrance to Hudson Bay and is separated from the mainland by Roes Welcome Sound. Roughly triangular, it is about 210 miles (340 km) long and 220 miles (355 km) wide and has an area of 15,913 square miles (41,214 square km). The terrain consists of a plateau about 2,000 feet (600 m) high in the northeast (with 1,000-foot [300-metre] coastal cliffs), gradually sloping to lowlands in the south. In the interior, swift streams cut through deep gorges. Coral Harbour, at the head of South Bay, is the only trading post, but a Royal Canadian Mounted Police base and an airfield and meteorologic station are at Munn Bay, 5 miles (8 km) northwest. The coastal waters are noted for Arctic char fishing. The island was discovered in 1613 by Thomas Button and was named after the 3rd Earl of Southampton.

**Southdown,** breed of medium-wool, dark-faced, hornless sheep originating in the Sussex hills of England. The oldest of all British breeds of sheep, it has an ideal body conformation for meat production. Its fleece is close and is the finest of the British breeds; but, though white and of good quality, the wool is short and the fleeces relatively light in weight. The colour of its face and legs is brown to light brown or gray. Southdowns are popular in many parts of the world, especially in The Commonwealth and the United States.

**Southeast Asia,** region of Asia lying roughly between the Indian and the Pacific oceans and between the Asian landmass and Australia. It consists of two portions: mainland, or peninsular, Southeast Asia, comprising Myanmar (Burma), Thailand, Cambodia, Laos, Vietnam, and Singapore, and insular, or archipelagic, Southeast Asia, comprising Indonesia, Brunei, and the Philippines; Malaysia lies on both mainland (the southern portion of the Malay Peninsula) and insular (the northern part of Borneo) Southeast Asia. Although Indonesia and the Philippines are discussed in this article in their regional context, these two countries are treated separately in *Encyclopædia Britannica*. Area (land and sea) 5,000,000 square miles (13,000,000 square km), of which about 1,736,000 square miles (4,496,000 square km) is land. Pop. (1993 est.) 462,000,000.

A brief treatment of Southeast Asia follows. For full treatment, *see* MACROPAEDIA: Southeast Asia.

*The land.* Southeast Asia stretches some 4,000 miles (6,400 km) at its farthest extent (northwest to southeast). The region lies mostly between the Tropic of Cancer and 10° S latitude and is almost wholly within the humid tropics. The mainland is broken up topographically by an intricate and often rugged relief, where ridges typically attain heights of 6,000–9,800 feet (1,800–3,000 m). The pattern of relief is usually a continuation of larger continental landforms. An abundance of rainfall has added an elaborate network of rivers, in whose great deltas extensive regions of cultivable land exist, some of them major granaries of the peninsula. These natural features have influenced the human geography of the mainland. The difficulty of entry from the north has restricted overland human migration in the region, which is one of the reasons why, despite China's presence to the north, mainland Southeast Asia as a whole is relatively underpopulated.

Insular Southeast Asia's topography is typified by numerous volcanoes and short, swift-flowing rivers. Proximity to the sea has facilitated considerable waterbourne communication, although rugged interior areas are highly isolated.

The outlines of the region have been shaped geologically by recent flooding of the continental shelves, and wide estuaries were formed by the drowning of river mouths. The process of drowning led to an increase in rates of sedimentation, and, along many of the shallower and less-disturbed shores, vast belts of swamps were built up, such as in the deltas of the Red, Mekong, Irrawaddy, and Chao Phraya rivers.

Except in northern Vietnam and northern Myanmar, annual average sea-level temperatures in Southeast Asia are remarkably close to 80° F (27° C), and the degree of seasonal variation depends upon proximity to the sea and elevation. Snow falls only in extreme northern Myanmar. Most of the region receives more than 60 inches (1,500 mm) of rainfall annually, and considerable areas receive two to three times this amount.

In general, weather patterns are dictated by the monsoons. The southwest monsoon (May to September) accounts for most of the mainland's precipitation. The northeast monsoon (November to March) is a period of relatively cool and dry air for the mainland. Cyclonic disturbances occur during the intermonsoonal periods, and some of them grow into mature tropical-cyclonic storms, bringing torrential rain and destruction to the areas over which they pass.

The region is remarkable for the richness of its animal, vegetational, and microorganic life, which thrives in its hot, humid climate. The equatorial lowlands and much of the wet-

ter tropical zone to the north contain tropical evergreen rain forest. Palms of many kinds extend over wide areas behind the mangrove zone along the coasts of much of Malaysia. On nonsedimenting and exposed shores are found stretches of sandy beach, with various salt-tolerant plants, such as the grass *Spinitex squarrosus*. More common still is the coconut palm, which thrives in dense coastal margins. The rain forests in general support a lighter animal population than do the more open monsoon forests. Tigers and rhinoceroses are endemic in many parts, though their numbers are dwindling. The elephant and the water buffalo, the latter indigenous to Southeast Asia, are found in all parts of the region. There is also a tremendous profusion and diversity of birds and insects throughout the region.

*People.* The earliest-known inhabitants of mainland Southeast Asia were from the Asian continental interior and were displaced by successive waves of migrants from the north; insular Southeast Asia contains a mixture of descendants of Proto-Malay (Nesoit) and Pareoean peoples, influenced by Malayo-Polynesian and other groups. The ethnic pattern was complicated during the era of European dominance by the influx of Chinese and, to a lesser extent, of Indians and Arabs, which resulted in considerable intermixture.

The region has a comparatively low level of urbanization, excluding Singapore and Brunei. Immigration, however, has played a major role in the population increase of such cities as Singapore, Bangkok, and Jakarta, where the rate of increase is often double the national growth rate.

Elements of most earlier religious influences are found in varying degrees throughout the region. Animism has survived in many of the more isolated areas. The dominant Buddhist and Hindu religions suffered from the encroachment of Islām in much of Indonesia and Malaysia, while the limited adoption of Christianity in the region dates from the later stages of the spread of Islām.

*Economy.* Agriculture continues to dominate the economy of much of Southeast Asia. A great number of people are farmers or are engaged in extraction industries. The principal crops include rice, cassava, corn (maize), tobacco, sugarcane, rubber, coffee, tea, fruits, spices, peanuts (groundnuts), and soybeans. The region as a whole is self-sufficient in cereals. Animals raised include water buffalo, cattle, goats, sheep, and pigs. Fisheries are important, particularly in Malaysia, Indonesia, and Thailand.

Manufacturing has come to contribute an increasing share of the region's economic output, especially in the countries of the Association of Southeast Asian Nations (ASEAN). Industries having mainly rural locations include rubber and palm-oil processing, small-scale rice milling, and brick- and tileworks. The range of urban industries, which is much wider, includes large-scale rice milling, rubber remilling, tin smelting, spinning and weaving, the assembly of motor cars and electronic components, the processing of tobacco and dairy products, canning, petroleum refining, and heavy-metal fabrication. International transportation systems in the region are relatively well developed, but most national systems are predominantly local and often discontinuous. The well-developed road network of the western part of peninsular Malaysia is an exception. Internal air routes are generally focused on one or two major cities from which branches radiate.

*History.* The history of Southeast Asia is remarkable for the succession of outside influences that shaped its course. The Dong Son culture passed into Southeast Asia from China as early as 1000 BC. In the period that followed, Hinduism and Buddhism from India penetrated the region and had great cultural and political impact upon the imperial powers, such as the Śrīvijaya, Ava, and Majapahit, that rose and fell there. The Khmer kingdom was founded in the late 8th century, and from the 10th through the 12th century it flourished at Angkor. The exposed position of Cambodia between Siam (Thailand) and Vietnam, however, eventually led to its destruction. Theravāda Buddhism spread through the area between the 11th and the 15th century, leading to the establishment of Theravāda Buddhist monarchies in Pagan, Myanmar, and in Ayutthaya (or Ayudhya), north of present-day Bangkok. Islām became a dominant force in the 15th century, which also was when the Portuguese, Dutch, English, French, and Spanish arrived. The Islāmic states gradually came under the sway of these powers, and within a span of 300 years these foreigners colonized nearly the entire region. Only Siam remained free of colonial occupation. In the late 19th and early 20th centuries there was a growth of nationalist movements, which received further impetus during World War II, when much of the region was under Japanese occupation. Independence came to most of the countries in the region by the 1950s. Despite independence, political stability has eluded the region as a whole, mainly because of ethnic strife, socioeconomic inequities, and a plethora of economic difficulties. Many countries, such as Cambodia, Vietnam, and Laos, were plagued by open conflicts between various communist and noncommunist factions. The establishment of ASEAN in 1967 was an attempt to advance the economic and political integration of the region.

**Southeast Asia Treaty Organization** (SEATO), regional-defense organization from 1955 to 1977, created by the Southeast Asia Collective Defence Treaty, signed at Manila on Sept. 8, 1954, by the representatives of Australia, France, New Zealand, Pakistan, the Philippines, Thailand, the United Kingdom, and the United States. The treaty came into force on Feb. 19, 1955. Pakistan withdrew in 1968, and France suspended financial support in 1975. The organization held its final exercise on Feb. 20, 1976, and formally ended on June 30, 1977.

The formation of SEATO was a response to the demand that the Southeast Asian area be protected against communist expansionism, especially as manifested through military aggression in Korea and Indochina and through subversion backed by organized armed forces in Malaysia and the Philippines. Vietnam, Cambodia, and Laos (the successor states of Indochina) were not considered for membership in SEATO for reasons that related to the Geneva agreements of 1954 on Vietnam. These states were, however, accorded military protection by a protocol. Other nations of South and Southeast Asia preferred to retain their foreign policies of nonalignment.

The treaty defined its purposes as defensive only and included provisions for self-help and mutual aid in preventing and countering subversive activities from without and cooperation in promoting economic and social progress. SEATO had no standing forces but relied on the mobile striking power of its member states, which engaged in combined military exercises.

**Southeast Asian arts,** the literary, performing, and visual arts of Myanmar (Burma), Thailand, Laos, Cambodia, Vietnam, Malaysia, Singapore, and the Philippines. Though the cultural development of Southeast Asia was dominated by Indian influence, some prehistoric cohesive traits predate "Indianization." Wet-rice (or *padi*) agriculture, metallurgy, navigation, ancestor cults, and worship associated with mountains were indigenous and widespread; nor were *batik* textiles, *gamelan* orchestras, or *wayang* puppet theatre—three art forms still popular throughout the region—derived from India.

A brief treatment of Southeast Asian arts follows. For full treatment, *see* MACROPAEDIA: Southeast Asian Arts.

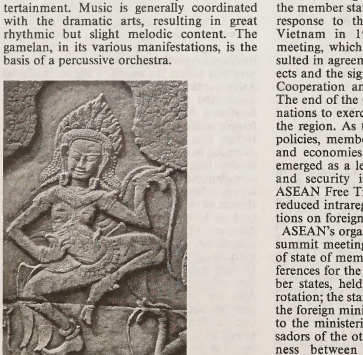
The 3rd-century-BC Dong Son culture of Vietnam produced bronze artifacts of technical and decorative sophistication. The navigational skills of the Dong Son people are evinced by their representations of large boats and the wide dispersal area of their beautifully crafted drums. Southeast Asian archaeological and historical studies are still in their infancy; excavation may yet reveal similar Metal Age sites associated with bronze drums found in Malaysia and Indonesia. Dong Son motifs recur at a later date in the architectural ornamentation of Old Java and the ancient Cambodian kingdom of Champa and are echoed in the decorative arts of the present-day Dyak of Borneo. Hinduism and Buddhism were transplanted to Southeast Asia from India but were transformed in conformity with the archaic beliefs and religious practices of Southeast Asia. Indian architectural and decorative motifs were similarly reworked to suit Southeast Asian requirements, a process to which local traditions contributed. Purely derivative styles generally reflect the earliest stage of Southeast Asian contact with India; indigenous elements dominated the late phases of Hindu art in Southeast Asia. In the final phase of Hindu temple construction in East Java, for example, Indian and local mythological themes were executed in a style taken from the indigenous shadow theatre. These *wayang* relief panels are complemented at Caṇḍi Sukuh by a terraced layout echoing the ancient megalithic terrace-shrines of the Yang Plateau. Sinicized regions such as Vietnam are generally the product of conquest. Chinese literature (and written characters), art, and ideas were imposed on Vietnam along with Han-dynasty administration. Despite commercial and diplomatic contact, few artistic elements elsewhere in Southeast Asia are overtly Chinese, yet Chinese ideas possibly had a formative influence—assumptions underlying the emperor cult have many points of comparison with the regal symbolism that pervades the visual arts of Southeast Asia.

Trade with South Asia existed long before Hinduism and Buddhism were adopted in Southeast Asia. It seems unlikely, however, that small mercantile colonies were the centres for dissemination of Indian ideas and art forms. On the contrary, Southeast Asian princes certainly took the initiative by inviting to court Brahman priests, some of whom had already brought their Sanskrit language and culture to the coastal areas of both insular and mainland Southeast Asia. Indian art forms flourished because these potentates found in the highly evolved ritual, mythology, and theology of India a means of legitimating and extending their rule. In a sense, they were importing a superior magic—displayed in the monumental architecture and colourful ceremonial so prominent in Southeast Asian societies.

Religious art and architecture did not simply further temporal power; the two were intimately connected. The Khmer temple-cities of Angkor Wat and Angkor Thom were centres of a royal cult. Aligned along the cardinal points and dominated by "temple-mountains," they were microcosms of both the universe and the kingdom. The unearthly faces of the bodhisattva Lokeśvara crowning the Bayon were equally representative of the all-seeing eye of the emperor. Regal narcissism was widespread in Southeast Asia, and many sculptures of divinities were in fact royal portrait statues giving a sophisticated and novel veneer to archaic notions of power and spiritual potency. In Java the *caṇḍi* combined temple and royal mausoleum. The complex symbolism of

Borobudur marries Buddhist cosmology to an ancestral cult of kings. Temple reliefs illustrate excerpts from Indian texts, mostly *Mahābhārata* and *Rāmāyaṇa* epic episodes and *Jātaka* tales of the Buddha's previous lives.

The *Mahābhārata*, *Rāmāyaṇa*, *Jātakas*, and local legendary tales—the Pandji cycle of stories of Java and the Thai king Abhai, among many others—are also expounded in the performing arts of the region. *Bhārata-nāṭya* is the model for a distinct dance technique that has minimized the mudras (gestures) of Indian classicism to emphasize grace of movement over theme. Regional variations of temple and court dance vie with local developments; Bali, a living museum of popular idiosyncratic Hinduism, sports the *barong* and *legong*. Numerous theatrical forms are vehicles for social criticism; most remarkable is wayang, or shadow play, in which puppetry has been fused with dance and drama in a unique form of entertainment. Music is generally coordinated with the dramatic arts, resulting in great rhythmic but slight melodic content. The gamelan, in its various manifestations, is the basis of a percussive orchestra.



Bas-relief of an *apsara* (celestial dancer) from an ancient Khmer temple in Angkor, Cambodia
Wolfgang Kaehler—Corbis

Myanmar and Thailand share the common performance tradition of Southeast Asia, but their adoption of Theravāda Buddhism forged strong ties with Sri Lanka, evident in their visual arts (the Thai *cheddi* [or *chedi*] and Myanmar pagoda are versions of the Sri Lankan bell stupa). Thai sculpture and architecture were often highly derivative of Indian and Khmer forms, though the walking Buddhas of Sukhothai are innovative. The temples of Pagan (Myanmar) are distinctive, and the outstanding Borobudur complex in central Java, though influenced by Indian art, provides a unique and impressive example of architectural adaptation.

Islām made no impact on these kingdoms, and elsewhere it tended to contribute little more than a Muslim veneer to evolved art traditions. Similarly, the cultural influence of Europe was minimal outside the Philippines, yet nationalist agitation against colonial rule gave impetus to the development of vernacular literatures, which had been slow to develop because of the regional hegemony of Sanskrit. Chronicle, epic, and romantic compositions rarely predate the 15th century.

**Southeast Asian Nations, Association of** (ASEAN), international organization established by the governments of Indonesia, Malaysia, the Philippines, Singapore, and Thailand on Aug. 8, 1967, to accelerate economic growth, social progress, and cultural development and to promote peace and security in the Southeast Asia region. Brunei became a member in 1984, and Vietnam was admitted in 1995. Laos and Myanmar (Burma) became members of ASEAN in 1997, and Cambodia was admitted to full membership in 1999. ASEAN replaced the Association of South East Asia (ASA), which had been formed by the Philippines, Thailand, and the Federation of Malaya (now part of Malaysia) in 1961. ASEAN's chief projects involve economic cooperation, promotion of trade both among ASEAN nations and between ASEAN nations and the rest of the world, and programs for joint research and technical cooperation between member nations.

Held together somewhat tenuously in its early years, ASEAN achieved a new cohesion in the mid-1970s in the face of the changed power balance in Southeast Asia following the end of the Vietnam War. Greater self-confidence was also a factor, born of the dynamic economic growth experienced by the member nations during the 1970s. Thus, for example, the member states were able to make a unified response to the takeover of Cambodia by Vietnam in 1979. ASEAN's first summit meeting, which was held in Bali in 1976, resulted in agreement on several industrial projects and the signing of a Treaty of Amity and Cooperation and a Declaration of Concord. The end of the Cold War allowed the ASEAN nations to exercise greater political latitude in the region. As they began to implement new policies, member nations saw their influence and economies grow. In the 1990s ASEAN emerged as a leading voice on regional trade and security issues. Members created the ASEAN Free Trade Area (AFTA), a pact that reduced intraregional tariffs and eased restrictions on foreign investment, in 1992.

ASEAN's organizational structure consists of summit meetings, which bring together heads of state of member countries; ministerial conferences for the foreign ministers of the member states, held annually in each country in rotation; the standing committee, consisting of the foreign minister of the country that is host to the ministerial conference and the ambassadors of the other five, which conducts business between ministerial conferences; a permanent secretariat in Jakarta, Indonesia, headed by a secretary-general (which position rotates among member nations every three years); and a number of other committees, subcommittees, and ad hoc groups. The organization publishes an annual report, as well as the semimonthly *ASEAN Newsletter*.

**Southeast Celebes** (Indonesia): *see* Sulawesi Tenggara.

**Southeast Svalbard Nature Reservation,** Norwegian SØRAUST-SVALBARD NATURRESERVAT, nature reserve established in 1973 by Norway. One of several protected areas in the Svalbard archipelago, it is bordered on the east by Olga Strait and on the west by Stor Fjord. With an area of 2,463 square miles (6,380 square km), the reserve encompasses the islands of Barents and Edge and has a number of small glacial caps that extend across a substantial portion of each island. Animal life on the reserve includes the Svalbard reindeer, which feeds on the sparse vegetation of the area.

**Southeastern Conference,** American collegiate athletic association that grew out of the Southern Conference. Members are the University of Alabama, the University of Arkansas (Fayetteville), Auburn University, the University of Florida, the University of Georgia, the University of Kentucky, Louisiana State University, the University of Mississippi, Mississippi State University, the University of South Carolina, the University of Tennessee, and Vanderbilt University. The University of the South in Sewanee, Tenn., an original member, dropped out of the conference in 1940, and both the Georgia Institute of Technology and Tulane University left in the 1960s. The conference was formed in 1932 when its members left the 11-year-old Southern Conference, believing that it had grown too large for competitive balance. In 1990 Arkansas and South Carolina joined the conference.

**Southend-on-Sea,** unitary authority, England. It lies on the Thames estuary and the North Sea. The nearest seaside resort to London, 40 miles (64 km) away, it attracts millions of visitors, and there are many resident commuters. It is noted for its pier (1.5 miles [2 km] long) as well as its beaches, gardens, yachting, open-air theatre, carnival celebration, and seafront illuminations. The parish of Prittlewell, now a part of Southend, has a 12th-century priory that houses a museum. Southend became fashionable as a seaside resort when visited in 1801 by Princess Charlotte of Wales and by her mother, Princess Caroline, in 1803. Area 16 square miles (42 square km). Pop. (1998 est.) 176,000.

**southern Africa,** southern region of the African continent, comprising the countries of Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe. The island nation of Madagascar is excluded from this region because of its distinct language and cultural heritage. Area 2,316,000 square miles (5,999,000 square km). Pop. (2000 est.) 110,555,000.

A brief treatment of southern Africa follows. For full treatment, *see* MACROPAEDIA: Southern Africa.

The interior of the region consists of a series of undulating plateaus, which extend from western South Africa and central Angola to Zambia, Zimbabwe, and western Mozambique. The plateau region is divided altitudinally from east to west into three subregions: the Highveld, lying above 4,000 feet (about 1,200 m); the Middleveld, averaging between 2,000 and 4,000 feet (600 to 1,200 m); and the Lowveld, below 2,000 feet (600 m). The Kalahari basin is the central depression of the plateau region. It is flanked by the Great Escarpment, a series of mountain ranges that run in an almost unbroken arc southward from the Zambezi River and around the Cape of Good Hope before turning north toward Angola. These ranges characterize the coastal margins throughout much of the region, though coastal plains lie along the Indian Ocean in Mozambique and on the Atlantic in parts of Angola and Namibia.

Southern African climates range from temperate to tropical. Its temperatures are somewhat lower than those of equatorial Africa, Fahrenheit temperatures in the 70s and 80s (20s Celsius) being the norm. Most of southern Africa receives a moderate annual rainfall of about 30 to 50 inches (760 to 1,270 mm). Much of southern Angola, Namibia, Botswana, and western South Africa have a more arid climate and higher mean temperatures, however; these are especially marked in the Namib and Kalahari deserts. Most of southern Africa is covered with either savannas or subdesert scrublands. Wooded grasslands are somewhat more common to the east.

The indigenous inhabitants of southern Africa can be conventionally classed into two major divisions, based primarily on linguistic distinctions: the Khoisan-speaking peoples, including the San and the Khoikhoin (formerly known, derogatorily, as Bushmen and Hottentots, respectively), and Bantu-speaking peoples. The San are now found primarily in the Kalahari and in surrounding areas. The Khoikhoin are located in the southern half of Namibia. The far more numerous and widespread Bantu constitute the vast majority of the people living in southern Africa. Among the larger ethnic groups of the Bantu are the Xhosa, Tembu, and Zulu peoples of South

Africa; the Ndebele of Zimbabwe; the Tsonga of Mozambique; the Tswana of Botswana; the Shona peoples of Zimbabwe and Mozambique; and the Herero and Ambo of Namibia.

Culturally the history of most of the peoples of the region is comparatively recent. The oldest inhabitants are probably the San and Khoi peoples, who have occupied parts of the area since Paleolithic times. They were succeeded (and often displaced) by the arrival of Bantu-speaking peoples from the north and east beginning sometime during the first half of the 1st millennium AD. The Bantu-speaking peoples' Iron Age cultures were based primarily on the keeping and milking of cattle, although there was some scattered farming using iron implements.

By the 8th century AD Arab traders had begun to visit the region's inhabitants, who traded ivory, copper, and gold for the Arabs' wares. In the 14th and 15th centuries there arose a stone-building culture represented in the present day by the walled ruins of Great Zimbabwe in Zimbabwe. This and several other cultures before and after it were based on great wealth in cattle, which in turn gave them preferential access to the coastal trade with the Arabs. However, the arrival of Portuguese traders and colonizers on the coast in the 16th century led to the economic and cultural decline of the African cultures in the region. The Portuguese pushed inland during the 17th century, establishing themselves in the Zambezi River valley and into present-day Mozambique and Angola.

The second half of the 17th century saw increasing numbers of Dutch colonists arriving at the Cape of Good Hope (in present-day South Africa). The immediate consequences of Dutch settlement were the decimation of the indigenous Khoi peoples of the Cape area. During the first half of the 19th century, much of southern Africa underwent great political and economic dislocations. These were due partly to the pressures of Dutch settlement as it spread northward from the Cape, but a more important cause was the rise to power in the 1820s of the Zulu kingdom under Shaka. He created a highly centralized military kingdom in what is now southeastern South Africa, and his armies pushed many other neighbouring peoples northward into Zimbabwe, Botswana, and Mozambique. The resulting migrations of peoples largely determined the current ethnic geography of the eastern half of southern Africa, with its patchwork of different Bantu subgroups.

The imposition in the early 19th century of British rule over the Dutch at the Cape had far-reaching consequences; the white settlement of the area expanded rapidly thereafter; many descendants of the Dutch, called Boers, migrated northward to escape British rule; and the British during the late 19th and early 20th centuries established a number of protectorates, territories, and colonies that came to constitute virtually all of southern Africa north of the Union (later the Republic) of South Africa. These British possessions were flanked on the east and west by the Portuguese colonies of Mozambique and Angola, respectively, and by German-held South West Africa (now Namibia) on the southwest. Out of the remaining British colonies in southern Africa there eventually emerged in the 1960s the independent African nations of Zambia, Malawi, Botswana, Lesotho, and Swaziland. Zimbabwe came under the rule of its black African majority in 1980. Mozambique and Angola achieved independence from Portuguese colonial rule in the 1970s. In 1988 South Africa accepted a UN resolution granting free elections in Namibia and the withdrawal of South African troops; the country officially gained its independence in 1990. In 1994 democratic elections in South Africa resulted in the ascendancy of the country's black majority. Pop. (1996 est.) 108,300,000.

**Southern African Development Community** (SADC), originally (1979–92) SOUTHERN AFRICAN DEVELOPMENT COORDINATION CONFERENCE, regional organization of southern African countries that works to promote economic cooperation and integration among the member states and to preserve their economic independence. The member states are Angola, Botswana, Lesotho, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe. The first conference was held in 1979, on the eve of Zimbabwe's (Rhodesia's) independence under black majority rule. The SADC's activities are coordinated at annual conferences of the heads of government and of a council of ministers from all the member states. The SADC plans, coordinates, and finances various projects in agriculture and animal husbandry, energy, mining, disease control, telecommunications, and regional trade.

Among the SADC's earliest priorities were projects to improve the existing rail and road networks between the member states so they could reduce their dependence on South African ports and transport routes for the shipment of their imports and exports. These projects greatly improved the region's transportation infrastructure. With the advent of majority black rule in South Africa and that country's membership in the SADC (1994), however, the focus of the organization shifted toward greater regional economic integration.

**Southern Alps,** mountain range on South Island, New Zealand. It is the highest range in Australasia. Making up the loftiest portion of the mountains that extend the length of the island, the Alps extend from Haast Pass, at the head of Wanaka Lake, northeastward to Arthur's Pass. They vary in elevation from



Southern Alps, New Zealand
Werner Stoy from Camera Hawaii

3,000 feet (900 m) to 16 peaks above 10,000 feet (3,050 m) and culminate in Mount Cook (12,349 feet [3,764 m]). Glaciers descend from the permanently snow-clad top of the range, and major rivers, including the Rakaia, Rangitata, and Waitaki, drain eastward across the Canterbury Plains. The Alps divide the island climatically, the forested western slopes and narrow coastal plain of Westland being much wetter than the eastern slopes and the wide Canterbury Plains. The Southern Alps have great hydroelectric potential, and, since the 1930s, power stations have been built on the Waitaki River and its tributaries and at Lake Coleridge. The Alps are crossed by a rail line passing through the Otira Tunnel (5.3 miles [8.6 km] long) at Arthur's Pass. Sighted by the Dutch navigator Abel Tasman in 1642, the Alps' first European traversal (1857) was accomplished by Leonard Harper.

**Southern and Antarctic Lands, French:** *see* Terres Australes et Antarctiques Françaises.

**Southern Asian languages:** *see* Semelaic languages.

**Southern Baptist Convention,** largest Baptist group in the United States, organized at Augusta, Ga., in 1845 by Southern Baptists who disagreed with the antislavery attitudes and activities of Northern Baptists.

Like Baptists in the North, Baptists in the South trace their history back to the Baptist churches established in the American colonies in the 17th century. The number of Baptist churches increased and spread throughout the colonies in the 18th century, primarily because of the missionary work of the Philadelphia Baptist Association, which was organized in 1707 by five Baptist churches in Pennsylvania, New Jersey, and Delaware. Early associations of Baptist churches in the South included the Charleston Association (1751) in South Carolina, the Ketochton Association (1765) in Virginia, and the Kehukee Association (1765) in North Carolina.

In the 19th century, the Baptist churches and associations in the North and South cooperated in organizing national organizations concerned with foreign and home missions and religious publications. The slavery question, however, soon caused disagreements between Southern and Northern Baptists, and in 1845 the Southern Baptists set up their own organization. About 300 churches joined the new group.

From its beginnings the Southern Baptist Convention was a more centralized denominational organization than had been usual among the Baptists. It developed its own missions, publications, and educational and other boards that functioned under the direction of the convention. The centralized organization has been credited with aiding the amazing growth of the convention following a period of recovery after the devastation of the American Civil War (1861–65).

Generally considered more conservative than the American Baptist Churches in the U.S.A., the Southern Baptist Convention has not taken an active part in ecumenical activities. Though joining in the Baptist World Alliance, it has not joined the National Council of the Churches of Christ in the U.S.A. or the World Council of Churches. In a historic reversal, the convention adopted a resolution in 1995 denouncing racism and repudiating its past defense of slavery and opposition to the civil rights movement. The Southern Baptist Convention has become a national rather than a regional church, and it has long been by far the largest American Protestant body and one of the most rapidly growing. Its membership, more than 15 million in the late 20th century, now includes a substantial fraction of ethnic minorities. There are state conventions, and a general convention is held annually. Headquarters are in Nashville, Tenn.

**Southern Bihār Plains,** southern part of the Middle Ganges Plain, Bihār state, eastern India. Bounded by the Chota Nāgpur plateau on the south, the Ganges River and the North Bihār Plains on the north, the Ayodhya (Oudh) Plains on the west, and the Bengal Basin on the east, the Southern Bihār Plains extend across central Bihār state and have an area of about 17,330 square miles (44,900 square km).

The plains are a segment of the flat Indo-Ganges trough, with an elevation gradually decreasing from 500 feet (150 m) in the south to 100 feet (30 m) in the north. The Ganges is the major river in the plains and is the recipient of other rivers crisscrossing the region; the Son River divides the plains into two physiocultural units comprising the Ganges-Son Divide in the west and the Magadha-Anga Plain in the east. Historically, the rivers have shifted

their courses several times. Soils are alluvial, and dense forests of sal (*Shorea*), teak, Java plum, mahua, and jujube are found on the plains. Agriculture dominates the economy; rice, wheat, and oilseeds are the chief crops. Irrigation, principally from the Ganges River, plays an important role in farming operations. Copper, apatite, kyanite, and other minerals are mined. Cottage industries produce textiles, sugar, paper, and vegetable oil.

Patna and Gaya are educational centres. Monghyr (Munger) has a cigarette factory, and Jamālpur has the country's major railway-engineering workshops. Bhāgalpur is noted for its production of tussah silk. The region has a well-developed network of roads, railways, and inland waterways.

**Southern Buh,** Ukrainian PIVDENNYY BUH, Russian YUZHNY BUG, Yuzhny also spelled IUZHNYI, or JUŽNYJ, river, southwestern and south-central Ukraine. The Southern Buh is 492 miles (792 km) long and drains a basin of 24,610 square miles (63,740 square km). It rises in the Volyn-Podilsk Upland and flows east and southeast, first through a narrow valley with rapids and then across rolling steppe (largely under cultivation), to enter the Black Sea by a winding estuary 29 miles (47 km) long. The flow of the river shows great seasonal variation. The Southern Buh is navigable to Voznesensk, and on its estuary is the port of Mykolayiv.

**Southern Carpathians** (Romania): *see* Transylvanian Alps.

**Southern Christian Leadership Conference** (SCLC), American nonsectarian agency with headquarters in Atlanta, Ga., established by the Reverend Martin Luther King, Jr., and his followers in 1957 to coordinate and assist local organizations working for the full equality of blacks in all aspects of American life. The organization worked primarily in the South and some border states, conducting leadership-training programs, citizen-education projects, and voter-registration drives. The SCLC played a major part in the civil-rights march on Washington, D.C., in 1963 and in anti-discrimination and voter-registration drives, notably at Albany, Ga., and Birmingham and Selma, Ala., in the early 1960s—campaigns that spurred passage of the federal Civil Rights Act of 1964 and the Voting Rights Act of 1965.

After King's assassination in April 1968, his place as president was taken by the Reverend Ralph David Abernathy. While the SCLC maintained its philosophy of nonviolent social change, it soon ceased to mount giant demonstrations and confined itself to smaller campaigns, predominantly in the South. The organization was further weakened by several schisms, including the departure in 1972 of civil-rights leader Jesse L. Jackson and his followers who had staffed Operation Breadbasket in Chicago, which was directed at economic goals.

**Southern Cross, The** (constellation): *see* Crux.

**Southern Dynasties,** Chinese (Wade-Giles) NAN-CH'AO, or (Pinyin) NAN CHAO (AD 420–589), four succeeding short-lived dynasties based at Chien-k'ang (now Nanking), which ruled over a large part of China south of the Yangtze River during much of the period of the Six Dynasties (*q.v.*). The four dynasties were the Liu-Sung (420–479), the Nan (Southern) Ch'i (479–502), the Nan Liang (502–557), and the Nan Ch'en (557–589). Although it was a time of comparative political weakness, Chinese culture flourished during this period.

**Southern Karoo** (South Africa): *see* Little Karoo.

**southern lights,** also called AURORA AUSTRALIS, luminous atmospheric display visible in the Southern Hemisphere. *See* aurora.

**Southern Ocean:** *see* Antarctic Ocean.

**Southern Overland Mail Company,** organization awarded (1858) the U.S. government contract to deliver mail to the Pacific coast. The company operated a 25-day, semiweekly stagecoach run along a route from St. Louis, Mo., through El Paso, Texas, and Tucson, New Mexico Territory, to San Francisco.

With the outbreak of the American Civil War in 1861, the southern route was abandoned, and the government contract was awarded to the Central Overland California and Pikes Peak Express, which operated through Salt Lake City, Utah. The Central Overland was purchased in 1862 by Ben Holladay, and the Holladay Overland Stage Company was sold to Wells, Fargo and Company in 1866. The company's stagecoach operations were maintained until the completion of the first transcontinental railroad in 1869.

**Southern Pacific Railroad,** one of the great American railroad systems, established in 1861 by the "big four" of western railroad building—Collis P. Huntington, Leland Stanford, Mark Hopkins, and Charles Crocker. After completing the Central Pacific from California to Utah in 1869, they started the Southern Pacific as a branch line into southern California. It reached the Arizona border in 1877, and in 1883 it was joined to other railroads built west from New Orleans across Texas and New Mexico. These lines were collectively known as the Central Pacific system. In 1884 the Southern Pacific Company was incorporated, and the railroads making up the Central Pacific system were leased to it a year later. The Central Pacific thus became the nucleus from which the Southern Pacific system developed.

The Southern Pacific serves 15 states in the West and Southwest, including the Pacific and Gulf coasts, with the network dipping south from northwestern Oregon to swing in a wide arc up into Illinois. The railroad served 35 international points of entry. About half the railroad's freight revenues came from food products, lumber, chemicals, and motor vehicles.

In 1971, along with many other railroads, the Southern Pacific gave up operating intercity passenger trains of its own account, although it continued to operate several long-distance trains for the federally sponsored National Railroad Passenger Corporation (Amtrak). It also continued a commuter service between San Francisco and San Jose, Calif.

The Southern Pacific Transportation Company, a holding company for the railroad, was incorporated in 1969. In 1983 the Southern Pacific Transportation Company agreed to merge with Santa Fe Industries, but in 1987 the Interstate Commerce Commission rejected the proposed merger, and the Southern Pacific was sold to Rio Grande Industries, owner and operator of the Denver and Rio Grande Western Railroad system, in 1988. The Southern Pacific was acquired by the Union Pacific Corporation in 1996. The merged firm was the largest railroad company in the United States and controlled most of the rail-based shipping in the western two-thirds of the country.

**Southern painting** (Japanese painting style): *see* Nan-ga.

**Southern Railway Company,** railroad system in the southern United States incorporating almost 150 prior railroads. It was organized in 1894 by the financier J.P. Morgan to take over a number of other railroads, including the Richmond and Danville, formed in 1847, and the East Tennessee, Virginia, and Georgia, formed in 1887.

The company's earliest antecedent, the South Carolina Canal and Railroad Company, was chartered in 1827 and operated the country's first regularly scheduled passenger train, on Christmas Day, 1830. In three years the line became the world's longest railway. Many of the predecessor lines played a strategic role in the American Civil War, although a number of them suffered destruction by Northern troops. The current system grew out of the reorganization following the war.

The company acquired a number of other railroads over the years until by the 1970s it served all the states south of the Ohio and Potomac rivers and east of the Mississippi except West Virginia. It extended from Washington, D.C., and St. Louis, Mo., to Brunswick, Ga., and Jacksonville, Fla., on the Atlantic, and to Mobile, Ala., and New Orleans, La., on the Gulf of Mexico.

From the 1940s, the Southern followed a policy of simplifying its organization until by the late 20th century the system included a number of separately operated subsidiaries that operated over 10,000 miles (16,100 km) of track. Much of their freight revenue came from coal, pulp and paper, and chemicals. In 1982 the Southern was merged with the Norfolk and Western Railway Company and thereafter was operated by Norfolk Southern Corporation, a holding company.

**Southerne, Thomas** (b. 1660, Oxmantown, Dublin, Ire.—d. May 26, 1746, London, Eng.), Irish dramatist, long famous for two sentimental tragedies that were acted until well into the 19th century—*The Fatal Marriage* (performed 1694; adapted 1757 by the actor-manager David Garrick as *Isabella, or the Fatal Marriage*) and *Oroonoko* (performed 1695).

Southerne was educated at Trinity College, Dublin, but spent his life after about 1680 in London, where he began to study law. His



Southerne, stipple engraving after a portrait by J. Worsdale

BBC Hulton Picture Library

first play, *The Loyal Brother,* was produced at London's Drury Lane Theatre in 1682. From 1685 to 1688 he was soldiering, but he wrote several other plays and contributed prologues and epilogues to John Dryden's plays.

Both of Southerne's principal works were based on novels by Aphra Behn, a popular 17th-century novelist and poet. In their mingling of pathos with a sometimes flaccid rhetoric, they owed much to the 17th-century dramatist Thomas Otway, as well. *The Fatal Marriage* anticipated 18th-century domestic tragedy, and *Oroonoko* showed affiliations with the earlier heroic plays of Dryden. The role of Isabella, which was first played by the great English actress Elizabeth Barry, gave Sarah Siddons one of her major successes a century later. The character of Oroonoko, an African prince enslaved in the English colony of Surinam, marked one of the first literary appearances of the "noble savage," and the play was a notably early English condemnation of the slave trade. As well as writing several other plays—lively comedies of manners and frigid tragedies in Roman settings—Southerne also revised and finished Dryden's tragedy *Cleomenes* (1692).

**Southey, Robert** (b. Aug. 12, 1774, Bristol, Gloucestershire, Eng.—d. March 21, 1843, Keswick, Cumberland), English poet and writer of miscellaneous prose who is chiefly remembered for his association with Samuel Taylor Coleridge and William Wordsworth, both of whom were leaders of the early Romantic movement.



Southey, detail of a pencil and watercolour portrait by R. Hancock, 1796; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

The son of a linen draper, Southey spent much of his childhood at Bath in the care of his aunt, Elizabeth Tyler. He began to write while attending Westminster School in London, from which he was expelled for criticizing in a school magazine the practice of excessive whipping. His expulsion roused the rebellious side of his nature and confirmed his enthusiasm for the ideals of the French Revolution. When he entered Balliol College, Oxford, in 1792, soon after his father's bankruptcy and death, Southey expressed his ardent sympathy for the revolution in the long poem *Joan of Arc* (published 1796). He first met Coleridge, who shared his views, in 1794, and together they wrote a verse drama, *The Fall of Robespierre* (1794). After leaving Oxford without a degree, Southey planned to carry out Coleridge's project for a pantisocracy, or utopian agricultural community, to be located on the banks of the Susquehanna River, in the United States. But his interest in pantisocracy faded, causing a temporary breach with Coleridge.

In 1795 he secretly married Edith Fricker, whose sister, Sara, Coleridge was soon to marry. Southey's marriage created an irreparable breach between himself and his aunt, and late in 1795 he went to Portugal with his uncle, who was the British chaplain in Lisbon. While in Portugal he wrote the letters published as *Letters Written During a Short Residence in Spain and Portugal* (1797), studied the literature of those two countries, and learned to "thank God [he was] an Englishman." So began the change from revolutionary to Tory. He also began to study law but found himself unsuited for it. In 1797 he began to receive an annuity of £160 that was paid to him for nine years by an old Westminster school friend, Charles Wynn. In 1797–99 he published a second volume of his collected *Poems*.

Southey by this time had decided to earn his living as a writer. In these years he composed many of his best short poems and ballads, and he became a regular contributor to newspapers and reviews. Southey also did translations, edited the works of Thomas Chatterton, and worked on the epic poem *Madoc* (1805) and completed the epic *Thalaba the Destroyer* (1801).

In 1803 the Southeys visited the Coleridges, then living at Greta Hall, Keswick. The Southeys remained at Greta Hall for life, partly so that Sara and Edith could be together. Southey's friendship with Wordsworth, then at nearby Grasmere, dates from this time. The Southeys had seven children of their own, and, after Coleridge left his family for Malta, the whole household was economically dependent on Southey for a time. He was forced to produce unremittingly—poetry, criticism, history, biography, journalism, translations, and editions of earlier writers. During 1809–38 he wrote, for the Tory *Quarterly Review*, 95 political articles, for each of which he received £100. Of most interest today are those articles urging the state provision of "social services." He also worked on a projected history of Portugal that he was destined never to finish; only his *History of Brazil*, 3 vol. (1810–19), was published.

In 1813 Southey was appointed poet laureate through the influence of Sir Walter Scott, and in 1835 his government pension of £160, which had been secured for him by Wynn in 1807, was increased to £300 in recognition of his services to literature. He thus gained economic security, but the unauthorized publication (1817) of *Wat Tyler*, an early verse drama reflecting his youthful political opinions, enabled his enemies to remind the public of his youthful republicanism. About this time he became involved in a literary imbroglio with Lord Byron, who disliked him. Byron had already attacked Southey in *English Bards and Scotch Reviewers* (1809) and had dedicated to him (1819) the first cantos of *Don Juan*, a satire on hypocrisy. In his introduction to *A Vision of Judgement* (1821), Southey continued the quarrel by denouncing Byron as belonging to a "Satanic school" of poetry, and Byron replied by producing a masterful parody of Southey's own poem under the title *The Vision of Judgment* (1822). Southey's last years were clouded by his wife's insanity, by family quarrels resulting from his second marriage after her death (1837), and by his own failing mental and physical health.

Except for a few lyrics, ballads, and comic-grotesque poems—*e.g.*, "My days among the Dead are past," "After Blenheim," and "The Inchcape Rock" (considered a masterpiece of comic invention)—Southey's poetry is little read, but his prose style has been long regarded as masterly in its ease and clarity. These qualities are best seen in his *Life of Nelson* (1813), still a classic; in the *Life of Wesley; and the Rise and Progress of Methodism* (1820); in the lively *Letters from England: By Don Manuel Alvarez Espriella,* the observations of a fictitious Spaniard (1807); and in the anonymously published *The Doctor*, 7 vol. (1834–47), a fantastic, rambling miscellany packed with comment, quotations, and anecdotes (including the well-known children's classic "The Story of the Three Bears"). His less successful epic poems are verse romances having a mythological or legendary subject matter set in the past and in distant places. In his prose works and in his voluminous correspondence, which gives a detailed picture of his literary surroundings and friends, Southey's effortless mastery of prose is clearly evident, a fact attested to by such eminent contemporaries as William Hazlitt and Scott and even by such an enemy as Byron.

**Southington,** town (township), Hartford county, west-central Connecticut, U.S., on the Quinnipiac River. It originated as the South Society of Farmington (1726) and was incorporated as a separate town in 1779. The Borough of Southington (incorporated 1889), the town's central community, was consolidated with the town in 1947. Since the early 19th century Southington has been both an agricultural and a manufacturing community. Pop. (1992 est.) 38,445.

**Southland,** local government region, southwestern South Island, New Zealand. Bordering the Tasman Sea to the west, the Southland region stretches for 120 miles (190 km) from the vicinity of Milford Sound in the northwest to Preservation Inlet in the south; eastward it includes Gore and the city of Invercargill. Fiordland National Park, one of the world's largest national parks, with a total land area of more than 3,000,000 acres (1,200,000 hectares), makes up the western part of Southland region.

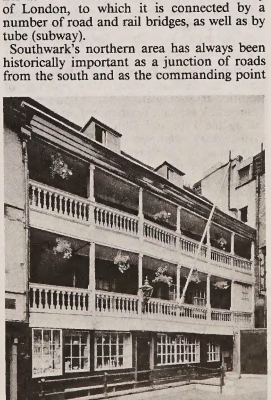
The region, which includes Stewart Island to the south, is known for its coastal inlets, or fjords, in the west; these are U-shaped valleys, often with several branches and excavated by glaciers, that have become flooded by the sea to a distance of 10–20 miles (16–32 km) inland. The valley's steep walls plunge almost vertically below the water to reach great marine depths. On the nearby highlands, which rise some 3,600 feet (1,100 m) above sea level, glaciers also carved many large valleys that, dammed by morainal (glacial) debris, have become flooded to form lakes. The largest of these lakes are Te Anau, Manapouri, Monowai, Hauroko, and Poteriteri. The highland part of the region receives as much as 250 inches (6,350 mm) of rain annually and is densely forested. Stewart Island is an offshore outlier of Southland. Invercargill, which is located across the Foveaux Strait from Stewart Island, is the centre of a sheep- and dairy-farming area.

The region was sighted by the Dutch navigator Abel Tasman in 1642 and by Captain James Cook in 1770 but was not explored until the 1850s. The rugged western landscape, basically untouched, is accessible via the Homer Tunnel road (1954). Pop. (1991) 103,442.

**Southport,** locality in Sefton district, metropolitan area of Merseyside, England. It is a residential community and Irish Sea coastal resort about 20 miles (32 km) north of the major port of Liverpool. It grew rapidly in the 19th century on coastal dunes, with spacious gardens and golf courses, including Royal Birkdale. These amenities lie along the seafront and the shopping thoroughfare, Lord Street. Pop. (1981) 90,962.

**Southwark,** inner borough, metropolitan area of Greater London, with an area of 11 square miles (29 square km) and extending south from the River Thames to Sydenham Hill. It was formed in 1965 by the amalgamation of three former metropolitan boroughs, Bermondsey, Camberwell, and Southwark. It lies across the Thames from the central City of London, to which it is connected by a number of road and rail bridges, as well as by tube (subway).

Southwark's northern area has always been historically important as a junction of roads from the south and as the commanding point



The George Inn, Southwark, London

A.F. Kersting

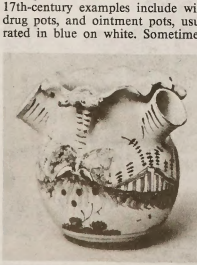
to the approach to London Bridge. Southwark itself dates from the Roman construction of a bridge across the Thames, from which main Roman roads (now the A2 and A3 highways) radiated. The crossroads, known as the Elephant and Castle (the name of an inn), is a major traffic approach for the four road bridges.

Because of its position, Southwark has long been a busy commercial area. Commercial activities in the borough include food processing and newspaper publishing and printing. Bankside was formerly the location of houses of the bishop of Winchester and other ecclesiastics. Among the borough's educational and cultural institutions are Dulwich College (founded 1619) and the Imperial War Museum. Where not of post-World War II date, Southwark's architecture is predominantly Victorian; wartime destruction and large-scale redevelopment schemes have completely changed parts of the borough, notably the Elephant and Castle area.

Old Southwark, known traditionally as "The Borough," was from 1295 to 1547 the only town besides the City in the present Greater London area to be represented in Parliament. Southwark was granted to the citizens of London in 1327 by Edward III, and it became known as the "Bridge Ward Without." From the 15th century on, Southwark was known for its many inns, theatres, spas, country resorts, and other places of entertainment and recreation. The Canterbury pilgrims, as imagined by the poet Geoffrey Chaucer, started from the Tabard Inn in Borough High Street. The George, now owned by the National Trust, is the last surviving galleried inn in London. Many of William Shakespeare's plays were first produced at the Globe Theatre on Bankside.

After the Reformation, the Augustinian priory of St. Overie, by the southern end of London Bridge, became the parish church of St. Saviour Southwark. Since 1905 it has been the cathedral church of the Southwark diocese. Guy's Hospital, one of London's major teaching hospitals, was opened nearby in 1725. Two former Southwark landmarks have given rise to popular phrases: to be "in the clink" (*i.e.,* imprisoned), derived from the prison in Clinke Street; and a state of "bedlam" (*i.e.,* animated confusion), derived from the disorder at Bethlehem Royal Hospital for the mentally ill. Pop. (1992 est.) 227,400.

**Southwark and Lambeth delftware,** tin-glazed earthenware made at a number of factories at Southwark, London, and nearby Lambeth, Vauxhall, Bermondsey, and Aldgate during the 17th and 18th centuries. Typical 17th-century examples include wine bottles, drug pots, and ointment pots, usually decorated in blue on white. Sometimes the decoration consists of bold horizontal lines and freehand lettering, sometimes of arms, shells, masks, or cupids. Large dishes in blue, green, yellow, orange, and purplish black, with biblical and other scenes, belong to this period.



Lambeth delftware flowerpot painted with a manganese tin glaze, about 1680; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London

In the 18th century several new styles arose; the plates of this period show sketchy scenes in the Chinese manner, with figures, trees, and architectural details executed sometimes in blue only (on a white ground) but often in various combinations of the colours mentioned. The keynote of the style was free and almost slapdash brushwork: effects were achieved by hatching and bold horizontal or vertical brushstrokes. Abstract rather than naturalistic floral festoons, bunches, and sprays were similarly rendered.

**Southwell, Robert** (b. 1561, Horsham St. Faith, Norfolk, Eng.—d. March 4, 1595, London), English poet and martyr remembered for his saintly life as a Jesuit priest and missionary during a time of Protestant persecution and for his religious poetry.

Southwell was educated at Jesuit colleges in France and in Rome. In 1585 he was ordained priest and made prefect of studies at the English College at Rome. He returned to England as a missionary in 1586, when he became chaplain to Anne Howard and spiritual adviser to her husband, the 1st Earl of Arundel, a recusant imprisoned in the Tower of London. Southwell lived in concealment at Arundel House, writing letters of consolation to persecuted Roman Catholics and making pastoral journeys. His *An Epistle of Comfort* was printed secretly in 1587; other letters circulated in manuscript.

Southwell was arrested in 1592 while celebrating mass. He was tortured in an attempt to make him reveal the whereabouts of his fellow priests and imprisoned in the Tower of London in solitary confinement. In 1595 he was tried for treason under the anti-Catholic penal laws of 1585 and executed. Southwell's devotional lyrics and prose treatises and epistles reflect the ardent piety of his life. His best works achieve an unusual directness and simplicity, and his use of paradox and striking imagery is akin to that of the later Metaphysical poets. He is the foremost representative of Roman Catholic letters in Elizabethan England.

**Southwest,** region, southwestern United States, historically denoting several geographic areas in turn and changing over the years as the nation expanded. After the War of 1812, the Southwest generally meant Missouri, Arkansas, and Louisiana; after Texas was annexed, it, too, was included. In the wake of the war with Mexico, the Southwest embraced most, but not all, of the territory that was acquired under the Treaty of Guadalupe Hidalgo (1848), including land often considered part of the "West"—*i.e.,* New Mexico, Arizona, and all or parts of Oklahoma, Colorado, Utah, and Nevada, as suited the convenience of the user of the term. It ordinarily excludes California.

The common denominator of the modern Southwest is aridity. The high, dry plains of Texas extend westward to the Pecos valley of New Mexico. Although the southern spurs of the Rocky Mountains beyond the Pecos River are cool and are dotted with evergreens, farther west are vast highly coloured sandstone deposits. Occasional mesas or buttes rise above the peneplain through which the Colorado River has cut such spectacular gorges as the Grand Canyon. Stretching westward from Arizona are the true deserts with their growth of cacti and gaunt, parallel chains of mountains almost devoid of vegetation.

Most crops can be grown in the Southwest only with irrigation, the water for which is taken mostly from the Colorado River and the Rio Grande. Prior to the Reclamation Act of 1902 and the subsequent building of Theodore Roosevelt Dam (completed 1911) near Phoenix, Ariz., Hoover Dam (1936) on the Colorado River, and the Glen Canyon Dam (1966) upriver from Hoover, the dryness of the land enforced a pastoral economy. During the period of Spanish ascendancy in the early 1800s, sheep ranches grew to great size. The Pueblo Indians even began to use wool instead of native cotton in their weaving. Although the importance of sheep ranching has declined in the 20th century, cattle raising has increased and is economically important in New Mexico, Arizona, Oklahoma, and Texas; the latter leads all other states in the raising of beef cattle as well as sheep. Long-staple cotton, alfalfa, citrus fruit, grain, and sorghum are the Southwest's main crops.

Copper mining, particularly in Arizona, where open-pit operations account for about two-thirds of the nation's total annual production, has been important since the 19th century. The discovery of petroleum and natural-gas deposits in the early 20th century in Oklahoma and Texas resulted in oases of prosperity from local oil booms. Along the Gulf Coast a flourishing industrial region developed around Houston and other Gulf of Mexico ports, largely based on petrochemical industries. Also, since World War II and particularly in Arizona and Texas, manufacturing has become important, notably in the electrical, communications, aeronautical, automobile-assembly, and aluminum industries. The growth of population and industry in the region also brought water shortages and, following the building of dams, disputes between states over the allocation of water resources, such as the diversion of water from the Colorado River.

Although the Southwest's dry, crisp climate and scenic landscapes were a curse to agriculture, they have been a boon to businesses catering to tourists and health seekers. These visitors had a lively interest in the Indian and Spanish-American cultures, including the native architecture, Indian dances, Spanish fiestas, and rodeos. The Southwest has also become a popular retirement area.

**Southwest Airlines Co.,** American airline incorporated in 1967 as Air Southwest Company. The current name was adopted in 1971. The company features low-fare, no-frills air service with frequent flights of mostly short routes. Costs are kept down by the exclusive use of Boeing 737 aircraft, which allows for low maintenance costs and quicker turnaround times for flights, and by an emphasis on ticketless travel. Headquarters are in Dallas, Texas.

It was founded in 1966 and envisioned as a commuter air service between Dallas, Houston, and San Antonio. The airline was incorporated the following year but, owing to several lengthy legal battles, was unable to begin commercial flights until 1971. Expansion began in 1975 with new routes to cities throughout Texas. The airline expanded conservatively into new markets following the federal deregulation of the airline industry in 1978, at first stretching its operations only into neighbouring southwestern states. In the 1990s Southwest added service to California, the Midwest, and the East and Southeast.

**Southwest Indian,** any American Indian who inhabits what is now the southwestern United States, including the southern portion of Colorado, most of Utah, Arizona, and New Mexico, and northwestern Mexico. Though highly diversified culturally and linguistically, the Southwest Indians divide roughly into four groupings: the Yuman tribes (Yuma, Mohave, Havasupai, Hualapai, Cocopa, Maricopa, and Yavapai); the Pima and Papago; the Pueblo (Hopi, Hano, Zuni, Acoma, Laguna, Jemez, Santa Ana, Zia, Cochiti, Santo Domingo, San Felipe, San Juan, Santa Clara, San Ildefonso, Nambe, Tesuque, Taos, Picuris, Isleta, and

Sandia); and the Navajo and Apache. They speak Yuman, Aztec-Tanoan, and Athabascan languages.

A brief treatment of Southwest Indians follows. For full treatment, *see* MACROPAEDIA: American Peoples, Native.

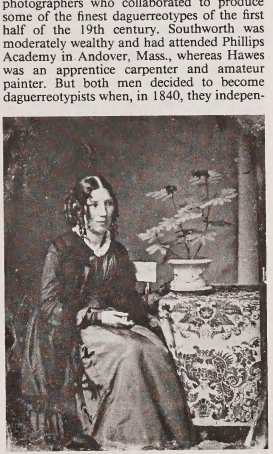
The best known of the Southwest Indians are the Pueblo Indians (*q.v.*), whose ancestors built great cliff villages now seen in ruins and equally remarkable multiple apartment houses of adobe and stone masonry. Some of the latter are still occupied, and the Pueblo Indian inhabitants speak languages and observe ceremonies that are at least pre-Spanish in origin. The Hopi and Zuni are among the largest groups of Pueblo Indians.

Whether the Navajo (*q.v.*) and Apache (*q.v.*) entered the area as a disruptive force or as peaceful neighbours is not definitely known. It is possible that hostility characterized their early relations, but in time the Pueblos and their Navajo-Apache neighbours accommodated to each other. The Navajo evidently joined the Pueblos in driving the Spanish out of New Mexico in 1680; and, following that, some Rio Grande Pueblo families joined the Navajo and were incorporated into the tribe. It is believed that the Navajo and Apache, who speak languages belonging to the Athabascan family, came down from the north, possibly from as far as Canada, where the bulk of the Athabascan linguistic stock was still located in the 20th century. They were already in the Southwest when Francisco Vásquez de Coronado entered the region in 1540, and the assumption is that the original immigration occurred at the close of the 13th century, coincidental with the abandonment of the great Pueblo communities in the San Juan River area. When they reached the Southwest, the Navajo were nomadic hunters and food gatherers, but in time they adopted agriculture from the Pueblos and made some pottery. By the beginning of the 18th century agriculture was the basic economy, and livestock raising (sheep and goats) had become established. Weaving of woolen blankets had also begun by that time. The Apache bands, with the exception of the Jicarilla and the Western Apache, seem to have borrowed less from the sedentary peoples of the Southwest and more from the Plains Indians.

On the Colorado River a group of tribes belonging to the Yuman language family combined agriculture with wild-seed gathering and hunting. Three of these tribes were in the vicinity of the Grand Canyon: Yavapai, Havasupai, and Hualapai. The tribes at the lower end of the Colorado River, the Cocopa, Yuma, Mohave, and Maricopa, were primarily agriculturists, utilizing flood irrigation. Their excellent pottery was derived from Pueblan types.

Although some progress has been made in recent years in alleviating the conditions facing most Southwest American Indians, many problems remain. Unemployment is high among the tribes, in some cases reaching 10 times the U.S. national average, and alcoholism has also been cited as one of the more serious problems. Because most of the tribes are not economically self-sufficient, they are, in greater or lesser degree, dependent on outside help. The U.S. federal government has tried to supply that help. Roads, schools, and hospitals have been built, and assistance has been given not only by the government but by private industry to develop such natural resources as coal, uranium, and oil, which have been found on tribal lands. Indian tribal councils have fostered Indian language schools and Indian-owned businesses, and scholarships have been formed to help train Indian professionals. Beliefs and traditions have been revived in an attempt to develop a viable Indian cultural identity, and Indian arts and crafts have found a ready market among tourists and collectors.

**Southworth, Albert Sands; and Hawes, Josiah Johnson** (respectively b. March 12, 1811, West Fairlee, Vt., U.S.—d. March 3, 1894, Charlestown, Mass.; b. Feb. 20, 1808, East Sudbury, now Wayland, Mass.—d. Aug. 7, 1901, Crawford's Notch, N.H.), American photographers who collaborated to produce some of the finest daguerreotypes of the first half of the 19th century. Southworth was moderately wealthy and had attended Phillips Academy in Andover, Mass., whereas Hawes was an apprentice carpenter and amateur painter. But both men decided to become daguerreotypists when, in 1840, they independently viewed the first daguerreotype brought to the United States. They learned the process from the U.S. agent of Jacques Daguerre, the inventor, and in 1841 opened a portrait studio together in Boston.



Daguerreotype portrait of Harriet Beecher Stowe, about 1856, by Southworth and Hawes

By courtesy of the Metropolitan Museum of Art, New York, gift of I.N. Phelps Stokes, Edward S. Hawes, Alice Mary Hawes, Marian Augusta Hawes, 1937

Unlike most portrait daguerreotypists of the mid-19th century—who were often more concerned with the quantity of their sales than with the quality of their portraits—Southworth and Hawes avoided contrived poses and painted backdrops. Instead, they gave each customer personal attention, making spontaneous portraits that revealed the personality of the sitter. Lemuel Shaw, then chief justice of the Massachusetts Supreme Court, was portrayed, for example, in a pose he happened to assume in a shaft of light that brought out the rugged features expressive of his character. The high quality of the work of Southworth and Hawes attracted many of the most prominent Americans of the day to their studio, including Senators Daniel Webster and Henry Clay and the writer Harriet Beecher Stowe.

The two men also made daguerreotypes of landscapes, cityscapes, and scenes such as hospital operating rooms that were not then accepted as proper subjects of photography.

In 1849 Southworth went to California in a futile attempt to find gold. When he returned to Boston, his failing health prevented him from working actively. In 1861 he ended his partnership with Hawes, who continued to photograph until his death.

**Southworth, Emma,** *née* EMMA DOROTHY ELIZA NEVITTE, also called MRS. E.D.E.N. SOUTHWORTH (b. Dec. 26, 1819, Washington, D.C., U.S.—d. June 30, 1899, Georgetown, Washington, D.C.), one of the most popular of the 19th-century American sentimental novelists. For more than 50 years, her sentimental domestic novels reached a wide audience in the United States and Europe.

After teaching school for five years, Emma Nevitte married Frederick Southworth, an itinerant inventor. When the couple separated in 1844, she turned to writing to support her family. Her first novel, *Retribution* (1849), sold 200,000 copies. Southworth went on to write 66 more novels, many of them first published serially in such magazines as the *Saturday Evening Post* and the *New York Ledger*. Her stories contributed two new character types to American fiction: the self-made man and the independent woman; her works also relied on sentimental plots of the Gothic genre that reflected prevailing values of piety and domesticity.

Emma Southworth's *Ishmael* (1876) and its sequel, *Self-Raised* (1876), were both huge successes. Among her other successful novels were *The Curse of Clifton* (1852), *The Hidden Hand* (1859), and *The Fatal Marriage* (1863).

**Soutine, Chaim** (b. 1893/94?, Smilovichi, near Minsk, Russian Empire [now in Belarus]—d. Aug. 9, 1943, Paris, Fr.), Russian-born French painter whose highly individualistic style, characterized by the use of thick impasto, agitated brushwork, convulsive compositional rhythms, and the presence of disturbing psychological content, is closely related to early 20th-century Expressionism.

Soutine was born the 10th child of a poor Jewish tailor in Belorussia. At age 16 he went to Vilna (now Vilnius) in Lithuania, where a friendly doctor helped him attend the school of fine arts for three years. In 1913 he emigrated to Paris, where he met Marc Chagall, Amedeo Modigliani, and Jacques Lipchitz, and attended the École des Beaux-Arts. Modigliani introduced Soutine to the art dealer Leopold Zborowski, who enabled him to spend three years (1919–22) painting at Céret in the south of France. The feverish, visionary landscapes Soutine painted there marked the emergence of his mature style. Soutine spent most of the remainder of his life in Paris. He exhibited little during his lifetime and relentlessly reworked or destroyed old canvases, but his paintings nevertheless found their way into French and American private collections and museums. Soutine died in France in 1943 during the wartime German occupation.



"Side of Beef," oil on canvas by Chaim Soutine, *c.* 1925; in the Albright-Knox Art Gallery, Buffalo

By courtesy of the Albright-Knox Art Gallery, Buffalo, Room of Contemporary Art Fund; photograph, Sandak, Inc.

Soutine is most popularly associated with his studies of choirboys and cooks and his series of

pageboys (*e.g.*, "Page Boy at Maxim's," 1927; Albright-Knox Art Gallery, Buffalo). Also well known are his paintings of hung poultry and carcasses of beef, which convey the colour and luminosity of putrescence. He obtained these effects by painting in as many as 40 different hues with as many brushes.

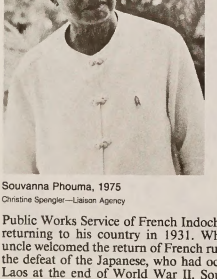
Soutine's portraits from the 1920s, distinguished by their subjects' twisted faces and distorted limbs and by the emphasis in each canvas on one brilliant colour, frequently red, are among his most expressive works.

**Soútsos, Aléxandros** (b. 1803, Constantinople—d. 1863), Greek poet who founded the Greek Romantic school of poetry.

Soútsos studied in Chíos (Khíos) and later in Paris, where he was influenced by the French Romantics and by liberal political opinion. His verse satires are his liveliest writings and inspired the early development of modern political liberalism in Greece. His dramas and one long prose work, the *Exóristos* ("The Exile"), were considered cold and artificial, but his numerous lyrics were admired by his contemporaries in spite of their lack of originality and their rhetorical exuberance. Lord Byron's *Childe Harold* was the model for his longest poem, *Periplanoménos* ("The Wanderer"). His collected works were published in 1916.

**Souvanna Phouma** (b. Oct. 7, 1901, Luang Prabang, Laos—d. Jan. 10, 1984, Vientiane), premier of Laos known for having sought, throughout several terms in office, to maintain Laotian neutrality in Southeast Asian affairs.

Souvanna was the nephew of King Sisavangvong of Laos. He studied architectural engineering in France and then entered the



Souvanna Phouma, 1975
Christine Spengler—Liaison Agency

Public Works Service of French Indochina on returning to his country in 1931. When his uncle welcomed the return of French rule after the defeat of the Japanese, who had occupied Laos at the end of World War II, Souvanna and his half brother Souphanouvong joined the Lao Issara (Free Laos) movement and its provisional Vientiane government (1945–46). When the French reoccupied Laos, Souvanna fled to exile in Bangkok, but returned to Laos in 1949 as France began conceding autonomy to Laos. In 1951 he was elected premier and held that office until 1954.

He returned to the premiership in 1956 as the head of a coalition government that included both rightist representatives and members of the Communist Pathet Lao, which Souphanouvong headed. The coalition collapsed in 1958, and civil war broke out between the two groups. Souvanna served briefly as premier in 1960 and again returned during a brief truce in 1962. During the 1960s and early 1970s Souvanna struggled to retain a neutral position; with the proximity of the war in Vietnam, his efforts were in vain, and he came to depend upon U.S. military assistance. After the United States began to withdraw from that struggle, however, the Vientiane government and the Pathet Lao agreed on a cease-fire (February 1973), and in April 1974 a coalition government was formed. Souvanna retained the premiership until December 1975, when the People's Democratic Republic of Laos was established. He remained an adviser to the government until his death.

**Sovereign Council,** governmental body established by France in April 1663 for administering New France, its colony centred in what is now the St. Lawrence Valley of Canada.

The council's power included the naming of judges and minor officials, control of public funds and commerce with France, regulation of the fur trade with the Indians, and the right to issue policy decrees on colonial affairs. The powers of the council, however, were not absolute. It could order military expenditures, for example, only with the authority of the governor; moreover, its decisions were subject to the governor's veto. As originally established, the council consisted of the governor, the bishop (or, in his absence, the senior ecclesiastic), five councillors, an attorney general, and a clerk. The governor and the bishop, acting "jointly and in agreement," appointed the other members, who, at the end of a year, could be changed or continued in office.

In 1664 some of the council's powers were transferred to the Company of the West Indies; that company, however, did not exercise them fully, and the council continued to be the dominant force in the colony. The company was permitted to name the council members, but it did not do so until 1674, a year before its own dissolution.

In June 1675 a royal edict increased the number of councillors to seven, with vacancies to be filled by the king. After 1685 the intendant, a French administrative official, gradually took over many of the council's functions. In 1702 the Sovereign Council was renamed the Superior Council.

**sovereignty,** in political theory, the ultimate overseer, or authority, in the decision-making process of the state and in the maintenance of order. The concept of sovereignty, one of the most controversial ideas in political science and international law, is closely related to the difficult concepts of state and government, of independence and democracy. Originally, as derived from the Latin term *superanus* through the French term *souveraineté*, sovereignty was meant to be the equivalent of supreme power. It has departed, however, quite often from this traditional meaning.

*History.* In 16th-century France, Jean Bodin used the new concept of sovereignty to bolster the power of the French king over the rebellious feudal lords; the transition from feudalism to nationalism was thus facilitated. The theories of John Locke at the end of the 17th century and of Jean-Jacques Rousseau in the 18th century, that the state is based upon a compact of its citizens, through which they entrust such powers to a government as may be necessary for common protection, led to the development of the doctrine of popular sovereignty that found expression in the U.S. Declaration of Independence in 1776. Another twist was given to this concept by the statement in the French constitution of 1791 that "Sovereignty is one, indivisible, unalienable and imprescriptible; it belongs to the Nation; no group can attribute sovereignty to itself nor can an individual arrogate it to himself." The idea of popular sovereignty exercised primarily by the people became thus combined with the idea of national sovereignty exercised not by an unorganized people in the state of nature, but by a nation embodied in an organized state. Going one step further and investigating who in the name of the people or of the state exercises sovereignty, the English jurist John Austin came to the conclusion that sovereignty was vested in a nation's parliament. This was the supreme organ that enacted laws binding upon everybody else but that was not itself bound by the laws and could change these laws at will. This particular description again fitted only a particular system of government, such as prevailed in Great Britain in the 19th century.

When this idea of legislative sovereignty crossed the Atlantic Ocean, it did not really fit the American situation. The Constitution of the United States, being the fundamental law of a federal union, did not endow the national legislature with supreme power but imposed important restrictions upon it. A further complication was added when the Supreme Court of the United States asserted successfully its right to declare laws unconstitutional. While this development did not lead to a concept of judicial sovereignty, it seemed to vest the sovereign power in the fundamental document itself, the Constitution. This system of constitutional sovereignty was made more complex by the fact that the authority to propose changes in the Constitution and to approve them was vested not only in Congress but also in the several states and special conventions called for that purpose. It could be argued, therefore, that sovereignty continued to reside in the states or in the people, who, under the terms of the 10th Amendment to the Constitution, retained all powers not delegated to the United States by the Constitution or expressly prohibited by it. Consequently, the claims by the states' rights advocates that states continued to be sovereign were bolstered by the difficulty of finding a sole repository of sovereignty in a complex federal structure; and the concept of dual sovereignty of both the union and the component units found a theoretical basis. Even if the competing theory of popular sovereignty were accepted, vesting sovereignty in the people of the United States, it still might be argued that this sovereignty need not be exercised on behalf of the people solely by the national government, but could be divided on a functional basis between the federal and state authorities.

Another assault from within on the doctrine of state sovereignty was made in the 20th century by those political scientists (*e.g.*, Léon Duguit, Hugo Krabbe, and Harold J. Laski) who developed the theory of pluralistic sovereignty exercised by various political, economic, social, and religious groups that dominate the government of each state. According to this doctrine, sovereignty in each society does not reside in any particular place but shifts constantly from one group (or alliance of groups) to another. This pluralistic theory went even so far as to contend that the state is but one of many examples of social solidarity and possesses no special authority in comparison with other components of society.

*Sovereignty and international law.* While the doctrine of sovereignty has had an important impact on developments within states, its greatest influence has been in the relations between states. The difficulties here can be traced back to Bodin's statement in 1576 that the sovereign who makes the laws cannot be bound by the laws he makes (*majestas est summa in cives ac subditos legibusque soluta potestas*). This statement has been often interpreted as meaning that a sovereign is not responsible to anybody and is not bound by any laws whatever. But closer reading of Bodin's writings does not support this interpretation. He emphasizes that even with respect to his own citizens a sovereign is bound to observe certain basic rules derived from the divine law, the law of nature or reason, and the law that is common to all nations (*jus gentium*)—as well as the fundamental laws of the state that

determine who is the sovereign, who succeeds to sovereignty, and what limits the sovereign power. Thus, Bodin's sovereign was restricted by the constitutional law of the state and by the higher law that was considered as binding upon every human being. In fact, Bodin discussed as binding upon states many of those rules that were later woven into the fabric of international law. Nevertheless, his theories have been used as justifying absolutism in the internal political order and irresponsible anarchy in the international sphere.

This interpretation was developed to its logical conclusion by Thomas Hobbes in the *Leviathan* (1651), in which the sovereign was identified with might rather than law. Law is what the sovereign commands, and it cannot limit his power; sovereign power is as absolute as men can make it. In the international sphere this condition led to a perpetual state of war, one sovereign trying to impose his will by force on all other sovereigns. This situation changed but little over the next two centuries; and sovereign states have continued to claim the right to be judges in their own controversies, to enforce by war their own conception of their rights, to treat their own citizens in any way that suited them, and to regulate their economic life with complete disregard for possible repercussions in other states.

During the 20th century important restrictions on the freedom of action of states started to appear. The Hague Conferences of 1899 and 1907 established detailed rules governing the conduct of wars on land and at sea. The Covenant of the League of Nations restricted the right to wage war, and the Briand-Kellogg Pact of 1928 condemned recourse to war for the solution of international controversies and its use as an instrument of national policy. They were followed by the Charter of the United Nations (Article 2), which imposed the duty on member states to "settle their international disputes by peaceful means in such a manner that international peace and security, and justice, are not endangered" and supplemented it with the injunction that all members "shall refrain in their international relations from the threat or use of force. . . ." However, the Charter listed as one of the basic principles of the UN "the principle of sovereign equality of all its Members."

In consequence of such developments, sovereignty ceased to be considered as synonymous with unrestricted power. States have accepted a considerable body of law limiting their sovereign right of acting as they please. Those restrictions on sovereignty are usually explained as deriving from consent or autolimitation, but it can be easily demonstrated that in some cases states have been considered as bound by certain rules of international law despite the lack of satisfactory proof that these rules were expressly or implicitly accepted by them. On the other hand, new rules cannot ordinarily be imposed upon a state, without its consent, by the will of other states. In this way a balance has been achieved between the needs of the international society and the desire of states to protect their sovereignty to the maximum possible extent.

*Nonsovereign states.* The 19th-century distinction between fully sovereign states and several categories of less sovereign units lost its importance under the law of the United Nations. Emphasis was placed not on legal differences among colonies, protected states, protectorates, and states under the suzerainty of another state, but on the practical distinction between self-governing and non-self-governing territories. Non-self-governing territories became under the charter of the UN "a sacred trust," and the states administering them promised to develop them toward self-government. Some of these territories were placed under a UN trusteeship that resulted in a closer supervision of their administration by the UN and in their speedier progress toward self-government or independence. Once a territory achieved self-government, as defined in resolutions of the General Assembly, supervision by the UN ceased, even though independent status was not reached.

*Divided sovereignty.* The concept of absolute, unlimited sovereignty did not last long after its adoption, either domestically or internationally. The growth of the democratic form of government imposed important limitations upon the power of the sovereign and of the ruling classes. The increase in the interdependence of states restricted the principle that might is right in international affairs. The peoples of the world have recognized that there can be no peace without law and that there can be no law without some limitations on sovereignty. They have started, therefore, to pool their sovereignties to the extent needed to maintain peace, and sovereignty is being increasingly exercised on behalf of the peoples of the world not only by national governments but also by organs of the world community. Thus, the theory of divided sovereignty, first developed in federal states, has become applicable also in the international sphere.

**Sovetsk,** formerly (until 1946) TILSIT, river port, Kaliningrad *oblast* (province), western Russia, on the Neman River. The city was founded by the Teutonic Knights in 1288 and was the site of the treaty negotiated between Napoleon and Tsar Alexander I in 1807. Until 1945 the city belonged to Prussia. Today it has wood and food industries and teacher-training and handicraft schools. Pop. (1991 est.) 42,300.

**Sovetskaya Gavan,** seaport, Khabarovsk *kray* (region), eastern Russia. Situated on the southeastern shore of a deep, narrow gulf of the Tatar Strait, the port has one of the best natural harbours of far-eastern Russia. Its development began only on the eve of World War I, and city status was achieved in 1941. Its principal economic activities include woodworking and fishery industries. The city received a great impetus when it became the terminus of a railway from Komsomolsk-na-Amure. Further growth followed the completion in 1980 of the BAM (Baikal–Amur Magistral) railroad because of Sovetskaya Gavan's location near its Pacific terminus. Pop. (1991 est.) 35,400.

**soviet,** council that was the primary unit of government in the Union of Soviet Socialist Republics and that officially performed both legislative and executive functions at the all-union, republic, province, city, district, and village levels.

The soviet first appeared during the St. Petersburg disorders of 1905, when representatives of striking workers acting under socialist leadership formed the Soviet of Workers' Deputies to coordinate revolutionary activities. It was suppressed by the government. Shortly before the abdication of Tsar Nicholas II in March 1917 and the creation of a Provisional Government, socialist leaders established the Petrograd Soviet of Workers' and Soldiers' Deputies, composed of one deputy for every 1,000 workers and one for each military company. A majority of the 2,500 deputies were Socialist Revolutionary Party members, claiming to represent peasant interests. This Petrograd Soviet stood as a "second government" opposite the Provisional Government and often challenged the latter's authority. Soviets sprang up in cities and towns across the Russian Empire. Much of their authority and legitimacy in the public eye came from the soviets' role as accurate reflectors of popular will: delegates had no set terms of office, and frequent by-elections gave ample opportunity for quick exertion of influence by the voters.

In June 1917 the first All-Russian Congress of Soviets, composed of delegations from local soviets, convened in Petrograd (now St. Petersburg). It elected a central executive committee to be in permanent session, with this committee's presidium at the head of the congress. The second congress met right after the radical Bolshevik faction of the Petrograd Soviet, having gained a majority in this body, had engineered the overthrow of the Provisional Government by the Red Guards and some supporting troops. In protest of this coup (the Russian Revolution of October 1917), most of the non-Bolshevik members of the congress walked out, leaving the Bolsheviks in control; an all-Bolshevik Council of People's Commissars was established as Russia's new government. Soviets across the empire assumed local power, though it took some time for the Bolsheviks to achieve a dominant position in every soviet.

At the fifth All-Russian Congress of Soviets, in 1918, a constitution was drawn up that established the soviet as the formal unit of local and regional government and affirmed the All-Russian Congress of Soviets as the highest body of the state. Later, the 1936 constitution provided for the direct election of a two-chamber Supreme Soviet—the Soviet of the Union, in which membership was based on population, and the Soviet of Nationalities, in which members were elected on a regional basis. Nominally, the deputies and presiding officers of the soviets at all levels were elected by the citizenry, but there was only one candidate for any office in these elections, and the selection of candidates was controlled by the Communist Party.

**Soviet Encyclopedia, Great:** *see* Bolshaya Sovetskaya Entsiklopediya.

**Soviet-German Nonaggression Pact** (1939): *see* German-Soviet Nonaggression Pact.

**Soviet law,** also called SOCIALIST LAW, the law that developed in the Soviet Union after the Russian Revolution of October 1917 and which, after World War II, was assimilated by other communist states. Although it had many of the characteristics of civil-law systems, including similar rules of procedure and legal methodologies, socialist law was distinguished from other legal systems by the influence of state ownership of the means of production, the pervasive influence of the Communist Party, the ties between the legal system and national economic planning, the denial of a distinction between public and private law, and the underlying conception of the law as a force for restructuring society and advancing the nation toward communism.

The legal system of the Soviet Union was the principal model followed by other members of the socialist family of legal systems (*e.g.*, Mongolia, China, eastern Europe, Cuba, Vietnam). Developed after the Russian Revolution of 1917, the origins of the legal system date back to the 10th century in Kievan Rus and reflect the influence of Byzantine secular and canon law and of Roman law via the civil-law tradition of western Europe.

The Soviet authorities formally repealed all tsarist legislation in 1918 and undertook thereafter to establish a social system leading toward communism. Socialist law was based on the writings of Karl Marx and Friedrich Engels, who proposed several general guidelines that were adopted by the founders of the new socialist legal system. First, the new legal system should eliminate the political power of the bourgeoisie (property-owning middle class); second, law should be the instrument of the state, not a limitation upon those who make policy; third, law should establish rules of public order that facilitate the transition of the state to socialism and eventually to the ideal of communism; and fourth, law should

educate citizens on how they can help achieve the communist social order.

Legislation was the principal source of law in the socialist legal system; custom was relied upon only in isolated commercial situations. Leading court decisions were published, but they constituted merely a guide to the application of law rather than a set of precedents. The basic law was the U.S.S.R. constitution—the latest constitution being that of 1977, augmented in 1978 by constitutions of the 15 union republics and 20 autonomous republics. Under the U.S.S.R. constitution, certain matters were reserved exclusively for federal, or "all-union," jurisdiction, and others were left to the union republics. In the principal branches of law, the all-union authorities enacted sets of "fundamental principles" of legislation binding throughout the land; these were then elaborated in codes of statutes by each respective union republic, which adapted the fundamental principles to its special circumstances. The principal republic codes included the criminal, civil, criminal procedure, civil procedure, family, labour, forestry, water, land, and correctional-labour codes. The Air Code and the Merchant Shipping Code were all-union codes exclusively.

In 1922 the Russian republic established a three-tiered system of civil and criminal courts that remained basically unchanged throughout the history of the Soviet Union. The courts of first instance in the Soviet Union were the people's courts, which heard 95 percent of all civil and criminal cases. In all cases heard at first instance, at whatever level, the judge had to sit with two laymen, called people's assessors, elected for 2½-year terms. The assessors served two weeks per year and had equal rights with the judge. Cases were decided by majority vote. Appeals were handled by provincial courts headed by professional judges, and the highest level of court, the Supreme Court of the republic, coordinated policy in all of the provinces. Soviet courts did not have the power of judicial review over the constitutionality of Supreme Soviet enactments. A separate system of military tribunals heard cases involving servicemen.

A legal agency of exceptional importance was the Procuracy of the U.S.S.R. The Procuracy was a highly centralized institution, dating conceptually back to Tsar Peter I the Great in the early 18th century. The U.S.S.R. procurator-general was appointed by and accountable only to the U.S.S.R. Supreme Soviet. In turn, the procurator appointed subordinate procurators. The Procuracy had responsibility for overseeing the investigation of most criminal cases, for prosecuting on behalf of the state, and for exercising sweeping powers of supervision over judicial decisions and over the legality of administrative actions and draft normative acts. The Procuracy also supervised the administration of correctional-labour institutions.

The socialist legal system produced many novel institutions. Because private ownership of most productive wealth had been abolished in many socialist states, legal codes tended to reflect the importance of state-owned property by imposing more severe penalties for theft of state-owned property than that of private, nonproductive property. While laws pertaining to sales, contracts, and property damage of consumer goods followed civil-law traditions, new laws were developed to govern transactions involving state property.

In the U.S.S.R. a vast category of offenses did not come within the purview of the criminal law or the courts at all. These were administrative offenses, punishable summarily by a fine, disciplinary sanction, or, in some instances, administrative detention for up to 15 days. Fines frequently were imposed on the spot by the apprehending official or inspector. Other aspects of the legal system demonstrated how socialist law endorsed the intervention of the state in social relationships. Employers were compelled to follow strict guidelines in executing labour contracts; property owners were subjected to numerous restrictions on the use of their land, farms, or dwellings, which, in some countries, could be confiscated if they were not thought to be used productively; and marriage and divorce were secularized in nearly all socialist law countries in order to reduce the power of religion and to consolidate control of marital relationships within the purview of the state.

**Soviet Union:** *see* Union of Soviet Socialist Republics.

**sovkhoz,** abbreviation of Russian SOVETSKOE KHOZYAYSTVO ("soviet farm"), plural SOVKHOZY, or SOVKHOZES, state-operated agricultural estate in the U.S.S.R. organized according to industrial principles for specialized large-scale production. Workers were paid wages but might also cultivate personal garden plots. Its form developed from the few private estates taken over in their entirety by the state in the original Soviet expropriations. The number of sovkhozy increased during the period of collectivization beginning in 1929 and spurted again during the 1950s when a number of kolkhozy, or collective farms, the more prevalent form of agricultural enterprise, were converted to sovkhozy. The Virgin and Idle Lands Campaign initiated in 1953 relied mainly on the sovkhozy. In 1973 the total area of sovkhozy was greater than that of kolkhozy for the first time. In 1990 the Russian government began encouraging the gradual conversion of sovkhozy to private farms.

**Sovremennik** (1836–66; "The Contemporary"), Russian literary and political journal founded in 1836 by the poet Aleksandr Pushkin. In its first year, the journal established its literary prestige by publishing Pushkin's novel *Kapitanskaya dochka* (1836; *The Captain's Daughter*) and Nikolay Gogol's story "Nos" (1836; "The Nose"). Pyotr Pletnev was editor from 1837 to 1847. Nikolay Nekrasov, editor from 1847 to 1866, published works by Ivan Turgenev and Leo Tolstoy and guided the journal into radical politics. Between 1857 and 1860 it was a leading voice in the movement to abolish serfdom. The journal's open criticism of the ruling class led to its suppression by tsarist authorities in 1866.

**sow bug,** any of certain small, terrestrial crustaceans of the order Isopoda, especially members of the genus *Oniscus.* Like the related pill bug, it is sometimes called the wood



Sow bug (*Oniscus asellus*)
Hugh Spencer

louse. *O. asellus,* which grows to a length of 18 mm (0.7 inch), is widely distributed in Europe and has also been introduced into North America. The oval, gray body, which is rather flattened and arched, is covered with broad, armourlike plates. Two elbowed antennae extend about half the length of the body, and there are seven pairs of limbs. This species is found under stones, in moist leaf litter, and in cellars.

**Sower, Christopher,** Sower also spelled SAUR, or SAUER (b. 1693, Ladenburg Palatinate of the Rhine [Germany]—d. Sept. 25, 1758, Germantown, Pa. [U.S.]), German-born American printer and Pietist leader of the Pennsylvania Germans.

Sower migrated with his wife and son Christopher to Germantown, Pa., in 1724. He was an artisan skilled in many crafts, was profoundly religious, and found his true career in 1738 as the first successful printer to the numerous Germans in colonial America. The output from his large and prolific press included a newspaper, *Der Hoch-Deutsch Pensylvanische Geschicht-Schreiber,* retitled *Pensylvanische Berichte* in 1748; an almanac, *Der Hoch-Deutsch Americanische Calender;* and more than 150 other imprints, mostly religious and in German, from broadsides to the first European-language colonial Bible (1743).

Sower's Pietism was evident in all his activities. He urged the politically apathetic Pennsylvania Germans to go to the polls to maintain pacifist and oath-denying Quakers in power. He worked for legislation to stop mistreatment of immigrants, dissemination of medical knowledge, building of hospitals, and maintenance of the German culture. He opposed defense measures, compulsory Anglicization of Germans, slavery, higher education, and traditional religions, with their forms, sectarianism, and professional clergy. Both his press and his principles were continued by his son Christopher (1721–84) after his death.

**Sowerby, Leo** (b. May 1, 1895, Grand Rapids, Mich., U.S.—d. July 7, 1968, Port Clinton, Ohio), American composer, organist, and teacher, whose organ and choral works provide a transition between 19th- and 20th-century American church-music styles.



Sowerby
By courtesy of the Cathedral of St. James (Episcopal), Chicago

Sowerby studied in Chicago and in Rome as the first American winner of the Prix de Rome. He taught composition and theory at the American Conservatory of Music in Chicago (1925–62) and was organist at St. James Church (now Cathedral) there from 1927 to 1962. He became director in 1962 of the College of Church Musicians in Washington, D.C., where he also was associated with the National Cathedral (Episcopal).

Sowerby combined a fine melodic talent with a use of modern harmonies. His *Canticle of the Sun* for chorus and orchestra, based on Matthew Arnold's translation of a canticle by St. Francis, won the Pulitzer Prize in 1946. In *Syncopata* (1924) and *Monotony* he experimented with jazz. His orchestral works include tone poems, notably *Prairie* (1929), and four symphonies. He also wrote chamber music, concerti for piano, cello, and organ, and extensive choral and organ works.

**Soweto,** urban complex in Gauteng province, South Africa. It was originally set aside by the South African white government for residence by blacks. It adjoins Johannesburg on the southwest, its name being an acronym derived from *South-Western Townships.* It is the country's largest black urban complex.

The townships constituting Soweto grew out of shantytowns and slums that arose with the arrival of black labourers from rural areas, in particular in the period between World Wars I and II. Slum clearance and permanent-housing programs began in 1948, and local as well as national authority was established.

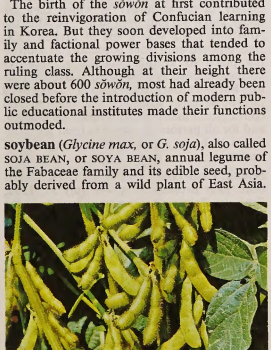
The population comprises a number of black ethnic groups, and Soweto residents have been in the forefront of demands for the development of black equality. In 1976 Soweto was the site of a massive uprising known as the Soweto Rebellion, which began as a political protest against the government's insistence that the Afrikaans language be used as the medium of instruction in Soweto's high schools.

In 1978 the first Community Council of black residents was elected to administer municipal affairs. Considered a powerless institution by most residents of Soweto, the Community Council was nominally responsible for development of transport, roads, water supply, sewerage, electricity, and housing. Under the postapartheid 1994 South African constitution, these municipal services came under the jurisdiction of the Greater Johannesburg Metropolitan Board (an elective body that includes representatives from Soweto and other black townships) or are provided by various provincial or national authorities. There is little industrial development, and most of Soweto's residents commute to Johannesburg for employment. Pop. (1985) 521,948.

**sŏwŏn,** private Confucian academies of the Korean Yi dynasty (1392–1910), founded by the members of the ruling class who did not hold official posts; their purpose was the educating of local *yangban,* or aristocratic youth. *Sŏwŏn* were usually built on sites associated with famous Confucian scholars of the past. They had their origin in the Paekundong Sŏwŏn, established in 1543 by Chu Sebung, a county magistrate in Kyŏngsang province, in honour of the Korean scholar An Yu.

The birth of the *sŏwŏn* at first contributed to the reinvigoration of Confucian learning in Korea. But they soon developed into family and factional power bases that tended to accentuate the growing divisions among the ruling class. Although at their height there were about 600 *sŏwŏn,* most had already been closed before the introduction of modern public educational institutes made their functions outmoded.

**soybean** (*Glycine max,* or *G. soja*), also called SOJA BEAN, or SOYA BEAN, annual legume of the Fabaceae family and its edible seed, probably derived from a wild plant of East Asia.



Soybeans (*Glycine max*)
J.C. Allen and Son

The soybean is economically the most important bean in the world, providing vegetable protein for millions of people and ingredients for hundreds of chemical products.

The origins of the soybean plant are obscure, but many botanists believe it to have derived from *Glycine ussuriensis,* a legume native to central China. The soybean has been used in China for 5,000 years as a food and a component of medicines. Soybeans were introduced into the United States in 1804 and became particularly important in the South and Midwest in the mid-20th century.

The most nutritious and most easily digested food of the bean family, the soybean is one of the richest and cheapest sources of protein. It is a staple in the diet of people and animals in numerous parts of the world today. The seed contains 17 percent oil and 63 percent meal, 50 percent of which is protein. Because soybeans contain no starch, they are a good source of protein for diabetics. In East Asia the bean is extensively consumed in the forms of soybean milk, a whitish liquid suspension, and tofu (*q.v.*), a curd somewhat resembling cottage cheese. Soybeans are also sprouted for use as a salad ingredient or as a vegetable and may be eaten roasted as a snack food. Soy sauce, a salty brown liquid, is produced from crushed soybeans and wheat that undergo yeast fermentation in salt water for six months to a year or more; it is a ubiquitous ingredient in Asian cooking.

The soybean is an erect, branching plant ranging in height from several centimetres to more than 2 m (6.5 feet). The self-fertilizing flowers are white or a shade of purple. Seeds can be yellow, green, brown, black, or bicoloured. In the United States, commercial varieties have brown or tan seeds, with one to four seeds per pod. The soybean may be cultivated in most types of soil, but it thrives in warm, fertile, well-drained, sandy loam. The crop is planted after all danger of frost is past. Maturing during September and October, soybeans are usually harvested mechanically in the United States, after the leaves have fallen off the plant and the moisture content of the seed has dropped to 13 percent, permitting safe storage.

In the 1980s the United States was the world's principal producer, followed by Brazil and China. Illinois is the leading producer among U.S. states. Ninety-eight percent of the U.S. crop is used for livestock feed.

Modern research has led to a remarkable variety of uses for the soybean. Its oil can be processed into margarine, shortening, and vegetarian cheeses. Industrially, the oil is used as an ingredient in paints, adhesives, fertilizers, sizing for cloth, linoleum backing, insect sprays, and fire extinguisher fluids, among other products. Soybean meal serves as a high-protein meat substitute in many food products, including baby foods, and can be imparted with a meatlike texture for increasing the cooked yield of such products as ground meat and bologna. In the late 20th century, the versatile, nutritious soybean, widely cultivable and readily exportable, played an integral role in attempts to alleviate world hunger.

**Soyinka, Wole,** in full AKINWANDE OLUWOLE SOYINKA (b. July 13, 1934, Abeokuta, Nigeria), Nigerian playwright, poet, novelist, and critic who received the Nobel Prize for Literature for 1986. He wrote of modern West Africa in a satirical style and with a tragic sense of the obstacles to human progress.

A member of the Yoruba people, Soyinka attended Government College and University College in Ibadan before graduating in English in 1958 from the University of Leeds, in England. Upon his return to Nigeria he founded a national theatre, The 1960 Masks (later the Orisun Theatre), and wrote his first important play, *A Dance of the Forests* (produced 1960, published 1963), for the Nigerian independence celebrations. The play satirizes the fledgling nation by stripping it of romantic legend and by showing that the present is no more a golden age than was the past.

In plays of a lighter vein he made fun of pompous, Westernized schoolteachers, as in *The Lion and the Jewel* (first performed in Ibadan, 1959; published 1963), and he mocked the clever preachers of upstart prayer-churches who grow fat on the credulity of their parishioners, as in *The Trials of Brother Jero* (1960)



Soyinka
Vernon L. Smith

and *Jero's Metamorphosis* (1972). But his more serious plays, such as *The Strong Breed* (1963), *Kongi's Harvest* (1965; opened the first Festival of Negro Arts in Dakar, 1966), *The Road* (1965), and *From Zia, With Love* (1992), reveal his disillusionment with African authoritarian leadership and with Nigerian society as a whole.

Other notable plays include *Madmen and Specialists* (1971; later retitled *Madmen and Scientists*) and *Death and the King's Horseman* (1975), which examines the clash of the colonial authorities' mores with the more demanding ones of traditional Yoruba society. In these and Soyinka's other dramas, Western elements are skillfully fused with subject matter and dramatic techniques deeply rooted in Yoruba folklore and religion. Symbolism, flashback, and ingenious plotting contribute to a rich dramatic structure. His best works exhibit humour and fine poetic style as well as a gift for irony and satire and for accurately matching the language of his complex characters to their social position and moral qualities.

From 1960 to 1964 Soyinka was coeditor of *Black Orpheus,* an important literary journal. From 1960 onward he taught literature and drama and headed theatre groups at various Nigerian universities, including those of Ibadan, Ife, and Lagos.

Soyinka's novels are *The Interpreters* (1965), in which a group of young intellectuals function as artists in their talks with one another as they try to place themselves in the context of the world about them, and *Season of Anomy,* which appeared in 1973.

Soyinka's volumes of poetry include *Idanre and Other Poems* (1967), *Poems from Prison* (1969; republished as *A Shuttle in the Crypt,* 1972), and *Mandela's Earth and Other Poems* (1988). His verse is characterized by a precise command of language and a mastery of lyric, dramatic, and meditative poetic forms. He wrote a good deal of *Poems from Prison* while he was jailed in 1967–69 for allegedly conspiring to aid the attempted secession of Biafra from Nigeria. *The Man Died* (1972) is his prose account of his arrest and imprisonment. Soyinka's principal critical work is *Myth, Literature, and the African World* (1976), a collection of essays in which he examines the role of the artist in the light of Yoruba mythology and symbolism.

Soyinka was the first black African to be awarded the Nobel Prize for Literature. His autobiography, *Aké: The Years of Childhood,* was published in 1981 and a companion piece, *Isara: A Voyage Around Essay,* in 1989.

**Soyot** (people): *see* Tuvinian.

**Soyuz**, any of several versions of Soviet/Russian manned spacecraft launched since 1967 and the longest-serving manned spacecraft design in use. The Soyuz design was originally conceived in Sergey Korolyov's design bureau for the U.S.S.R.'s Moon-landing program, which was canceled in 1974. Comprising orbital and service modules and a reentry capsule, the craft has served mainly as a crew ferry to and from Earth-orbiting space stations, specifically the Salyut stations, Mir, and the International Space Station (ISS).

The first version of Soyuz accommodated three persons without pressure suits. After accidental depressurization of the reentry capsule killed the crew of Soyuz 11 (1971), the spacecraft was modified for a crew of two to make room for additional life-support equipment. Soyuz T, introduced in 1979, had advanced equipment and capabilities and restored the third crew seat. Soyuz TM, an upgrade featuring a variety of new systems, made its first manned flight in 1987 when it carried Mir's second crew to the then-embryonic station. The Soyuz TMA debuted in 2002 with a manned flight to the ISS; its design incorporated changes to meet certain NASA requirements as an ISS "lifeboat," including eased height and weight restrictions for crew members. After the in-flight explosion of the U.S. space shuttle *Columbia* in February 2003 and the consequent grounding of the shuttle fleet, Soyuz spacecraft for a time provided the only means for ISS crew exchanges.

**Sōzen, Yamana** (15th-century Japanese clan head): *see* Yamana Mochitoyo.

**Sozini, Fausto (Paolo),** Sozini also spelled SOZZINI: *see* Socinus, Faustus.

**Sozini, Lelio (Francesco Maria),** Sozini also spelled SOZZINI: *see* Socinus, Laelius.

**Sozomen,** Greek SALAMANES HERMEIOS SOZOMENOS (b. *c.* 400, Bethelea, near Gaza, Palestine—d. *c.* 450, Constantinople, Byzantine Empire [now Istanbul, Tur.]), Christian lawyer in Constantinople whose church history, distinguished for its classical literary style, its favouring of monasticism, and its greater use of western European sources, rivaled that of his elder contemporary Socrates Scholasticus.

Dedicating the project to the reigning Byzantine emperor, Theodosius II (408–450), Sozomen compiled his work in nine books to cover the period 324 to 439. The surviving text, however, ends at 425, raising the question of whether the final part was suppressed by the emperor or lost.

Sozomen possibly intended to recast Socrates' work in a superior literary style for an audience not only of ecclesiastics but also of the cultured laity. Although he demonstrated an inferior critical method and little theological comprehension, Sozomen's unique inclusion of certain sources makes his chronicles valuable; they are corrective of Socrates' text and with it provided the medieval church with most of its knowledge of early Christianity.

**Spa,** municipality, Liège *province,* eastern Belgium. It is situated in the wooded hills of the northern Ardennes, southeast of Liège. Its popular mineral springs, known locally as *pouhons,* have caused the name spa to be given to all such health resorts.

Known in Roman times and mentioned by Pliny the Elder, the springs were rediscovered in 1326 and have been frequented since the 16th century. Spa reached its zenith in the 18th century, when it was visited by European royalty. It was the general headquarters of the German army in 1918 and was the site of the



The Baths at Spa, Belg.
Authenticated News

Conference of the Allied Supreme Council in 1920.

Now the health centre of Belgian state medicine, it is also a winter sports centre and a tourist resort with amusement facilities, including horse and auto (Francorchamps) racing, and a small airport. There are some metallurgical industries and a soft-drink bottling plant. Landmarks include the Casino (1919–21; original building, 1763), the Baths (1866–68), and the Parc de Sept-Heures. Pop. (2004 est.) 10,491.

**spa,** spring or resort with thermal or mineral water used for drinking and bathing. The name was taken from a town near Liège, Belg., to which persons traveled for the reputed curative properties of its mineral springs.

The practice of "taking the waters" for therapeutic purposes reached its heyday in the 19th century, but springs have been considered places of healing at many times and in all parts of the world. The founding of Bath in England is attributed in legend to Bladud, son of Lud Hudibras and father of King Lear, who in 863 BC was cured of disease by immersion in the steaming swamps. Roman colonists developed a considerable spa there and also at Buxton, Derbyshire. After the departure of the Romans the baths seem to have been long neglected, but many churches were built on sites of ancient places of healing throughout Europe, and cures were attributed to immersion in fonts fed by the springs beneath the sanctuary. In the early 18th century some Roman baths were rebuilt, many new "watering places" were established, and spas became fashionable secular centres of resort for the upper classes at the most seasonable times of the year. For the ill and infirm many spas provided year-round treatment centres under varying degrees of medical supervision.

Spa therapy is based on both the drinking of and the bathing in certain waters containing properties believed to be of medicinal value. Mineral springs usually contain noticeable quantities of salts in solution—including carbonate and sulfate of lime, common salt, iron, and sulfur. Magnesia and many trace minerals, notably lithium, also constitute medicinal waters. In addition to solid constituents, gas is present in many waters in considerable quantities. There is a little oxygen and a good deal of nitrogen in some of them. The quantity of hydrosulfuric acid, even in strong sulfuric waters, is small, but the volume of carbonic acid present is often large, giving a noticeable effervescence. Thermal springs are derived from two sources: meteoric waters that rise from considerable depths along fissures of penetration; and volcanic waters, which reach the surface in the form of either geysers or hot springs. Most thermal water contains mineral substance in solution.

The spas of Europe and the United States with the greatest popularity were those with thermal springs. Bathing in warm water has an undoubted therapeutic effect as an aid to relaxation, although the skin does not absorb any of the salts or gases. Sulfurated waters such as those at Aachen, Ger., Baden, Austria, and White Sulphur Springs, W.Va., are used for some skin conditions. Drinking mineral waters may, at the least, provide a general washing out of the digestive system, and the alkaline waters of Vichy, Fr., Ischia, Italy, and Mariánské Lázně, Czech Republic, may act as purgative agents. The highly carbonated salt springs at Saratoga Springs, N.Y., and at Wiesbaden and Baden-Baden, Ger., have long been used for rheumatic and neuralgic conditions. Drinking mineral water, carbonated or not, has become so popular that a considerable business of bottling and exporting has grown up on both sides of the Atlantic; it has a practical importance in aiding digestion that is much greater than one would expect from its small mineral content.

It is likely, however, that most of the medicinal effects of spa therapy result from the environmental factors of the location and facilities of the spa. The beautiful town of Bath has the only thermal springs in England, which usually yield more than 500,000 gallons daily at a temperature of 120° F (49° C). The waters are drunk medicinally and used for hydrotherapy treatments, and the Georgian Pump Room, with its fountain, has long been a rendezvous for visitors who are "taking the waters." Many European spas are located in forested alpine settings such as Sankt Moritz, Switz., Évian-les-Bains, Fr., Badgastein, Austria, and Bormio, Italy. Japan has several thousand hot springs, many of which have been converted into spas or public baths.

An individual who goes to a spa usually finds a different climate, diet, and style of living than he is used to. In a new and probably cheerful society, a person is more relaxed and may take more exercise in the open air. For many persons the therapy of the waters is secondary to the company in which they are taken, and it has long been so at spas. After the American Civil War a spa at French Lick, Ind., enjoyed enormous popularity as a meeting place to arrange marriages. Saratoga Springs declined as a spa in the early 20th century but still attracts thousands of visitors to its racecourse each year. For the diseased and convalescent many spas offer medical therapy, and for all persons the spa has been and continues to be in a variety of ways a place of healing.

**Spaak, Paul-Henri** (b. Jan. 25, 1899, Schaerbeek, near Brussels, Belg.—d. July 31, 1972, Brussels), Belgium's foremost statesman in the decades following World War II and a leading advocate of European cooperation. He played



Spaak
Camera Press

a major role in forming the European Economic Community (EEC), the North Atlantic Treaty Organization (NATO), and Benelux, the customs union of Belgium, The Netherlands, and Luxembourg.

After practicing as a lawyer (1921–31), Spaak became a Socialist member of the Chamber of Deputies in 1932. As foreign minister (1936–38), he won acceptance by Great Britain and France of Belgium's independent foreign policy in the years before World War II. He became Belgium's first Socialist prime minister (1938–39) and again served as foreign minister (1939–45) in Hubert Pierlot's government, which was exiled in London (1940–44). In London in 1944 Spaak helped form the Benelux customs union, which took effect in 1948. He helped draft the United Nations Charter in 1945 and served as president of the organization's first General Assembly in 1946.

After a term as foreign minister (1945–47), Spaak became prime minister in the Social Christian–Socialist coalition government (1947–50) that introduced woman suffrage (1948) and brought the National Bank under state control. In 1948 he signed the Brussels Treaty establishing a regional defense alliance among Britain, France, and the Benelux countries, and he helped align those nations with the United States the following year to form NATO. Spaak's counsel was influential in persuading King Leopold III to abdicate the Belgian throne in 1951.

Between 1948 and 1952 Spaak presided over several organizations for European political and economic cooperation, including the European Coal and Steel Community. He played a leading role in the negotiation of the Treaty of Rome (March 1957), which created the Common Market and the European Atomic Energy Community (Euratom). After again serving as Belgian foreign minister (1954–57), Spaak became secretary general of NATO (1957–61) and then Belgian deputy premier and foreign minister in the coalition government of Théo Lefevre (1961–66). He retired from the Socialist Party in 1966 to work in private business.

**Spaatz, Carl,** byname TOOEY SPAATZ (b. June 28, 1891, Boyertown, Pa., U.S.—d. July 14, 1974, Washington, D.C.), the leading U.S. combat air commander in World War II and first chief of staff of the independent U.S. Air Force.



Spaatz
By courtesy of the U.S. Army

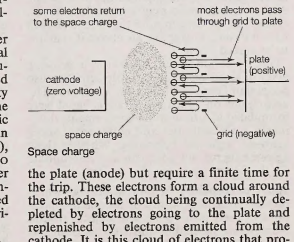
A graduate (1914) of the U.S. Military Academy at West Point, N.Y., Spaatz served as a combat pilot during World War I and then acquired extensive staff and command experience between 1919 and 1942. He went to England in 1940 to evaluate German military power, and, after the United States' entry into the war, in July 1942 he took command of the 8th Air Force in England. Spaatz initiated the U.S. daylight bombing offensive against German-occupied Europe in 1942. In January 1944 he became commander of the U.S. Strategic Air Forces in Europe and directed the daylight strategic bombing of Germany from both England and Italy until the end of the war in Europe.

Spaatz moved to the Pacific theatre in July 1945, and, though personally opposed to the use of atomic bombs against Japanese cities, he directed the final strategic bombing of Japan that included, under orders of Pres. Harry S. Truman, the dropping of atomic bombs on Hiroshima and Nagasaki. He became chief of staff of the newly independent U.S. Air Force (September 1947), but, not enjoying the administrative work, he retired in 1948.

**space,** a boundless, three-dimensional extent in which objects and events occur and have relative position and direction.

Space is treated in a number of articles in the MACROPAEDIA. For a philosophical consideration of the subject, *see* Metaphysics. For a discussion of the relativity of space and time, *see* Relativity. For a description of space as the region of the universe beyond the Earth and its atmosphere, *see* Cosmos. For coverage of the scientific investigation of this region, *see* Exploration.

**space charge,** electrical charge distributed through a three-dimensional region. In an electron tube, for example, a negative charge results because electrons that are emitted from the cathode do not travel instantaneously to




Space charge

the plate (anode) but require a finite time for the trip. These electrons form a cloud around the cathode, the cloud being continually depleted by electrons going to the plate and replenished by electrons emitted from the cathode. It is this cloud of electrons that produces the negative space charge.

**space contraction:** *see* Lorentz–FitzGerald contraction.

**space exploration,** the investigation of the reaches of the universe beyond Earth's atmosphere by means of manned and unmanned spacecraft.

A brief treatment of space exploration follows. For full treatment, *see* MACROPAEDIA: Exploration.

Scientific studies on the use of rockets for spaceflight appeared early in the 20th century. Most notable were the works of Konstantin Tsiolkovsky (1903), Robert Goddard (1919), and Hermann Oberth (1923). By the early 1930s Germany was conducting extensive research on rocket propulsion, which led to the development of the V-2 ballistic missile. After World War II the United States and the Soviet Union, with the aid of relocated German scientists, made substantial progress in high-altitude rocket technology. On Oct. 4, 1957, the U.S.S.R. launched the first artificial satellite, Sputnik 1, into orbit around Earth. Nearly four months later, on Jan. 31, 1958, the United States sent up its first satellite, Explorer 1. Over the next few years both countries launched a variety of unmanned spacecraft including scientific, reconnaissance, and communications satellites and lunar probes.

The next major step in space exploration was the launch of a manned space vehicle. This was first accomplished by the U.S.S.R. on April 12, 1961, when cosmonaut Yury Gagarin completed a single orbit around Earth in the space capsule Vostok 1. Less than a month later, on May 5, the United States launched its first manned spacecraft, a Mercury capsule in which astronaut Alan Shepard made a 15-minute suborbital flight. A succession of one-person Soviet and U.S. manned orbital missions of increasing duration and complexity soon followed. The U.S. Gemini and the Soviet Voskhod programs of the mid-1960s marked a great advance in their use of two- and three-person crews, in their development of in-orbit rendezvous and docking techniques, and in the first human excursions outside orbiting spacecraft (spacewalking, or extravehicular activity).

The succeeding U.S. Apollo program culminated in the first manned lunar landing in 1969. On July 20 of that year, astronauts Neil Armstrong and Edwin Aldrin exited the Apollo 11 Lunar Module to become the first humans to set foot on the Moon. A total of six successful Apollo lunar landing missions were carried out (1969–72), during which 12 astronauts explored the Moon, collected rock and soil samples, and performed a variety of experiments. Although the U.S.S.R. did not land humans on the Moon, it launched a series of robotic lunar probes (Luna and Zond) that returned important data and soil samples.

The Soviet space program in the 1970s and '80s concentrated on the development of a series of Earth-orbiting Salyut space stations equipped for extended missions of scientific research or military reconnaissance. The stations were launched vacant; Soyuz spacecraft then ferried up cosmonaut crews who remained aboard on space missions lasting weeks or months rather than a few days. In 1986 the Soviet Union launched the core element of a modular space station called Mir. This facility was expanded with five additional laboratory and life-support elements over the next 10 years, and it ultimately hosted more than 100 different people until it was abandoned in 2000. After the dissolution of the U.S.S.R. in 1991, its space program was continued by Russia, but on a much-reduced basis owing to economic constraints.

After the Apollo lunar landings, much of the U.S. space program was devoted to developing the space shuttle, a partially reusable transport system designed to lift off like a rocket and glide to a landing like a winged aircraft. First launched in 1981, the shuttle was used extensively as a launch vehicle for satellites and probes and as a space platform for repairing spacecraft in Earth orbit and conducting research in weightlessness for as long as two weeks. In 1998 a multinational consortium led by the United States, with Russia as a major partner, began the in-orbit construction of the International Space Station (ISS) using the shuttle and Russian expendable rockets to transport the facility's components and crews into space. The overall plan for the ISS included specialized laboratories supplied by the European Space Agency (ESA) and Japan.

Beginning in the 1960s, the U.S. and Soviet Union, followed by a number of other countries, carried out unmanned space science missions. Among significant accomplishments of early space-probe missions to the planets were the U.S. Viking landings on Mars in 1976, the U.S. Voyager flybys of Jupiter, Saturn, Uranus, and Neptune between 1979 and 1989, and the Soviet Venera explorations of the atmosphere and surface of Venus from the mid-1960s to the late 1970s. Some later planetary missions were designed for extended studies; the U.S. Galileo spacecraft, for example, went into orbit around Jupiter in late 1995, where it observed the planet and its moons into the early 21st century. Smaller solar system bodies were also targets of space probes. The ESA's Giotto spacecraft made a close flyby of Halley's Comet in 1986 and photographed its nucleus, and the U.S. Near Earth Asteroid Rendezvous (NEAR) spacecraft landed on Eros in 2001 after a year in orbit around the asteroid.

Crucial, too, in space science have been space-based astronomical observatories, which

permit observations of near and distant cosmic phenomena above the filtering and distorting effects of Earth's atmosphere. Developed by a number of countries, they ranged from large instruments such as the U.S. Hubble Space Telescope (launched 1990) and Chandra X-Ray Observatory (1999) to smaller, specialized spacecraft such as Japan's Yohkoh solar observatory (1991). Other satellites have allowed scientists to view Earth itself from the unique vantage of space.

Manned spacecraft also have been used to conduct scientific research. In 1973–74 astronauts aboard the U.S. Skylab space station made valuable observations of solar phenomena and served as both experimenters and subjects in studies of how the human body responds to extended periods of weightlessness. A variety of research, including astronomy, Earth observation, and biological and materials-sciences studies, was conducted on the Salyut stations and then on Mir. Plans called for early scientific work aboard the ISS to focus on life-sciences and materials-sciences research in the weightless environment.

**space group,** in crystallography, any of the ways in which the orientation of a crystal can be changed without seeming to change the position of its atoms. These changes may involve displacement of the whole structure along a crystallographic axis (translation), as well as the point group operations of rotation about an axis, reflection in a plane, inversion about a centre, or sequential rotary inversion. As demonstrated in the 1890s, only 230 distinct combinations of these changes are possible; these 230 combinations define the 230 space groups. A crystal can be assigned to one of these groups after the arrangement of its atoms is studied, as by X-ray crystallography. *See also* symmetry (in crystallography).

**space law,** the body of regulations that governs international conduct in and related to areas of space above Earth's lower atmosphere.

A brief treatment of space law follows. For full treatment, *see* MACROPAEDIA: International Law.

The evolution of space law began with U.S. Pres. Dwight D. Eisenhower's introduction of the concept into the United Nations in 1957, in connection with disarmament negotiations. Following the first successful satellite launches by the U.S.S.R. and the United States in 1957–58, both countries took an active interest in the development of international space policy. It was established that traditional laws of sovereignty that allow any nation to claim uninhabited and uncivilized lands are not viable in space territories and that countries cannot extend the boundaries of their dominion indefinitely into the space regions above them. In 1959 a permanent Outer Space Committee was formed to maintain the UN Charter and other international law in space, which opened the way for peaceful exploration. In 1963 the Nuclear Test Ban Treaty was signed, followed by an Outer Space Committee resolution to prohibit nuclear weapons testing in space. Later that same year a UN General Assembly declaration acknowledged a free international interest in space development and outlined rules assigning each nation individual responsibility for dealing with transgressions of international law and for any resulting destruction. International cooperation was recommended for the safeguarding of all astronauts in crisis situations.

In 1967 an Outer Space Treaty was ratified by 63 participants in the United Nations. This agreement reasserted all earlier guidelines for international space conduct. In addition, it banned certain military activities, such as the deployment of weapons of mass destruction in space and on celestial bodies; established each state's ownership of and responsibility for its space projectiles and components; urged common participation in the protection of space and terrestrial environments; and provided for the open observation and inspection of each state's activities and installations by others. This document, noted as a landmark in the development of international space law, remains effective today among participating countries. This treaty was followed in 1968 by an Agreement on the Rescue and Return of Astronauts and the Return of Objects Launched into Space, which reinforced international commitment to the safety of humans in space, assigned economic responsibility to each nation for the recovery of its equipment, and confirmed the control of each space power over the vehicles that it launches.

Although international diplomacy continues to play an active role in the codification of acceptable space conduct, several issues remain subjects of debate. Because nations are prohibited from laying claim to space territories, for instance, there is a need to establish regulations governing the apportionment of usable resources that space may eventually provide. A method for determining the extent of each nation's control over the air above it remains to be agreed upon.

The development of space for a growing array of government and private activities also poses significant challenges for space law. The agreements on which space law is based were formulated at a time when governments dominated space activities and commercial space ventures were just beginning. Whether these agreements remain adequate and appropriate for the 21st century requires review.

**space perception,** the process through which organisms become aware of the relative positions of their own bodies and objects around them. Space perception provides cues, such as depth and distance, that are important for locomotion and orientation to the environment.

A brief treatment of space perception follows. For full treatment, *see* MACROPAEDIA: Perception, Human.

Detailed understanding of space perception has only come in the last hundred years. In the 18th century the British philosopher George Berkeley proposed that since the image on the retina is two-dimensional, an individual must learn to interpret visual data so as to deduce the spatial relations between objects of sight. Psychologists now believe, however, that there are certain innate elements in the ability to perceive space. The current study of space perception is concerned with a variety of complex issues, including the ability to judge the full shape of objects of which only one side is visible, and how pilots can compensate for unusual perceptual cues while navigating airplanes or spacecraft.

Space perception is thought to serve the general purpose of orientation, *i.e.,* of aiding an individual to grasp his position in relation to the objects around him. Perceiving one's spatial relation to a given object is more important the more relevant the object is to one's needs. For example, organisms are particularly sensitive to stimuli that warn them of dangers along their paths. Thus, space perception involves, in a central role, the selection of relevant sense data. Sense data that do not bear on one's needs are excluded, so that the incoming flow of information is not overwhelming.

Another important feature of space perception is its ability to account for motion. When an object moves in relation to the perceiver, or vice versa, the stimuli presented to his senses are changed. However, he interprets the change in shape of an image on the retina, for example, not as a change in the shape of the given object, but as evidence that the object has changed its position in space, relative to the eye. That is, space perception relies on perceptual constancy (*q.v.*), without which the world would seem inconceivably chaotic.

The perception of space makes use of data from all five outer senses, as well as the inner senses of balance and of the arrangement of the body. Using the stimuli to which it responds, each of the outer senses, in a manner of speaking, constructs its own version of spatial arrangement around the perceiver. Under normal circumstances one's perception of space results from the interweaving of all these sensory "spaces" with each other, and with the data of the inner senses.

Nonetheless, the sense of sight plays a preeminent role in space perception because it is a so-called distance sense—it can receive stimuli from over a vast range of space. There are a variety of cues by which data from sight are converted into perceptions of distance. Some of these cues are not, in fact, visual—instead they are produced by the muscles that control the movements of the eyes. One learns to judge distances in part by learning to interpret the slight contractions of these muscles as they adjust the eyes to see objects that are nearer or farther away.

Purely visual cues to spatial relations are given by what is called the binocular disparity. Since a person's two eyes are in slightly different positions, the images of an object on the two retinas are not exactly the same. The brain combines the two retinal images and converts their difference into the experience of three-dimensionality—*i.e.,* the scene is perceived to have depth. Visual movement parallax is a similar visual cue, but it acts even on one eye alone. If a person changes position, the retinal images of objects in different positions move by different amounts, indicating their distance from the viewer. When vision is impaired or totally lacking (*e.g.,* in blindness), the sense of hearing commonly becomes a major means of space perception, and aural acuity is generally highly developed in the blind.

The sense of balance is also important in orienting oneself in space. Closely related are the kinesthetic sensations of the arrangement of one's own body; combined with sensations of touch, these help one to determine the spatial relationships of nearby objects. In fact, the senses of touch and sight interact quite closely as young children begin to develop their capacities for space perception.

**space shuttle,** partially reusable rocket-launched vehicle designed to go into Earth orbit, to transport people and cargo between Earth and orbiting spacecraft, and to glide to a runway landing on Earth. The first vehicle of this type was developed by the U.S. National Aeronautics and Space Administration (NASA). Formally called the Space Transportation System (STS), it lifted off into space for the first time on April 12, 1981.

The U.S. space shuttle consists of three major components: a winged orbiter that carries both crew and cargo; an external tank containing liquid hydrogen (fuel) and liquid oxygen (oxidizer) for the orbiter's three main rocket engines; and a pair of large, solid-propellant, strap-on booster rockets. At liftoff the entire system weighs two million kilograms (4.4 million pounds) and stands 56 metres (184 feet) high. During launch the boosters and the orbiter's main engines fire together, producing about 31,000 kilonewtons (7 million pounds) of thrust. The boosters are jettisoned about two minutes after liftoff and are returned to Earth by parachute for reuse. After attaining 99 percent of its orbital velocity, the orbiter has exhausted the propellants in the external tank. It releases the tank, which disintegrates on reentering the atmosphere. Although the orbiter lifts off vertically like an expendable rocket launcher, it makes an unpowered descent and landing similar to a glider.

The space shuttle can transport satellites and other craft in the orbiter's cargo bay for de-

ployment in space. It also can rendezvous with orbiting spacecraft to allow astronauts to service, resupply, or board them or to retrieve them for return to Earth. Moreover, the orbiter can serve as a space platform for conducting experiments and making observations of Earth and cosmic objects. On some missions it has carried a European-built pressurized facility called Spacelab, in which shuttle crew members have conducted research in weightless conditions.

Designed to be reflown as many as 100 times, the space shuttle had been expected to reduce the high cost of spaceflight into low Earth orbit. After the system became operational, however, the vehicle's operating costs and the time needed for refurbishment between flights proved to be significantly higher than early projections. Between 1981 and 1985 a fleet of four orbiters—*Columbia, Challenger, Discovery,* and *Atlantis*—was put into service. On Jan. 28, 1986, *Challenger,* carrying seven astronauts, exploded shortly after liftoff, killing all aboard including a private citizen, schoolteacher Christa McAuliffe. In 1992, *Endeavour,* a replacement orbiter for the destroyed *Challenger,* flew its first mission.

Between 1995 and 1998, NASA conducted a series of shuttle missions to the orbiting Russian space station Mir to give the agency experience in station operations in anticipation of the construction of the modular International Space Station (ISS). Beginning in 1998, the shuttle was used extensively to take components of the ISS into orbit for assembly and to ferry astronaut crews and supplies to and from the station. On Feb. 1, 2003, *Columbia* broke up catastrophically over north-central Texas at an altitude of about 60 km (40 miles) as it was returning from an orbital mission. All seven crew members died, including Ilan Ramon, the first Israeli astronaut to go into space. *See also* space exploration.

**space station,** an artificial structure placed in orbit and having the pressurized enclosure, power, supplies, and environmental systems necessary to support human habitation for extended periods. A space station can serve as a base for a variety of activities. They include astronomical observations, study of Earth's resources and environment, military reconnaissance, and investigations of the behaviour of materials and biological systems in a state of weightlessness. Small space stations are launched fully assembled, but larger stations are sent up in modules and assembled in orbit. Since 1971, nine space stations placed in a low orbit around Earth have been occupied for varying lengths of time.

The world's first space station, Salyut 1, was launched April 19, 1971, by the Soviet Union. Equipped for scientific studies, it had the form of a stepped cylinder 14.6 metres (48 feet) long, with its widest section 4.25 metres (13.9 feet) across. Between 1974 and 1982, five additional Salyuts—two outfitted for military reconnaissance—were successfully orbited and occupied. In February 1986, the U.S.S.R. launched the cylindrical core module of the Mir space station. Five modules carrying scientific equipment and expanding the living space were added over the next 10 years, and the complex supported human habitation between March 1986 and June 2000.

The United States orbited its first space station, called Skylab, on May 14, 1973. Occupied by three separate astronaut crews in 1973 and 1974, Skylab served as a solar observatory and a laboratory for studying the response of the human body to space conditions.

In 1998 Russia and the United States launched the first modules of the International Space Station (ISS), a multinational project involving the participation of 16 countries. Other elements were subsequently added, with the overall plan calling for the assembly of a large complex of laboratory and habitat modules. In 2000 the ISS received its first resident crew. *See also* space exploration.

**space-time,** in physical science, single concept that recognizes the union of space and time, posited by Albert Einstein in the theories of relativity (1905, 1915).

Common intuition previously supposed no connection between space and time. Physical space was held to be a flat, three-dimensional continuum—*i.e.,* an arrangement of all possible point locations—to which Euclidean postulates would apply. To such a spatial manifold, Cartesian coordinates seemed most naturally adapted, and straight lines could be conveniently accommodated. Time was viewed independent of space—as a separate, one-dimensional continuum, completely homogeneous along its infinite extent. Any "now" in time could be regarded as an origin from which to take duration past or future to any other time instant. Within a separately conceived space and time, from the possible states of motion one could not find an absolute state of rest. Uniformly moving spatial coordinate systems attached to uniform time continua represented all unaccelerated motions, the special class of so-called inertial reference frames. The universe according to this convention was called Newtonian.

By use of a four-dimensional space-time continuum, another well-defined flat geometry, the Minkowski universe (after Hermann Minkowski), can be constructed. In that universe, the time coordinate of one coordinate system depends on both the time and space coordinates of another relatively moving system, forming the essential alteration required for Einstein's special theory of relativity. The Minkowski universe, like its predecessor, contains a distinct class of inertial reference frames and is likewise not affected by the presence of matter (masses) within it. Every set of coordinates, or particular space-time event, in such a universe is described as a "here-now" or a world point. Apparent space and time intervals between events depend upon the velocity of the observer, which cannot, in any case, exceed the velocity of light. In every inertial reference frame, all physical laws remain unchanged.

A further alteration of this geometry, locally resembling the Minkowski universe, derives from the use of a four-dimensional continuum containing mass points. This continuum is also non-Euclidean, but it allows for the elimination of gravitation as a dynamical force and is used in Einstein's general theory of relativity (1915). In this theory, the continuum still consists of world points that may be identified, though non-uniquely, by coordinates. Corresponding to each world point is a coordinate system such that, within the small, local region containing it, the time of special relativity will be approximated. Any succession of these world points, denoting a particle trajectory or light ray path, is known as a world line, or geodesic. Maximum velocities relative to an observer are still defined as the world lines of light flashes, at the constant velocity *c.*

Whereas the geodesics of a Minkowski continuum (without mass-point accelerations) are straight lines, those of a general relativistic, or Riemannian, universe containing local concentrations of mass are curved; and gravitational fields can be interpreted as manifestations of the space-time curvature. However, one can always find coordinate systems in which, locally, the gravitational field strength is nonexistent. Such a reference frame, affixed to a selected world point, would naturally be in free-fall acceleration near a concentrated mass. Only in this region is the concept well defined—*i.e.,* in the neighbourhood of the world point, in a limited region of space, for a limited duration. Its free-fall toward the mass is due either to an externally produced gravitational field or to the equivalent, an intrinsic property of inertial reference frames. Mathematically, gravitational potentials in the Riemannian space can be evaluated by the procedures of tensor analysis to yield a solution of the Einstein gravitational field equations outside the mass points themselves, for any particular distribution of matter.

The first rigorous solution, for a single spherical mass, was carried out by a German astronomer, Karl Schwarzschild (1916). For so-called small masses, the solution does not differ appreciably from that afforded by Newton's gravitational law; but for "large" masses the radius of space-time curvature may approach or exceed that of the physical object, and the Schwarzschild solution predicts unusual properties. Astronomical observations of dwarf stars eventually led U.S. astrophysicists J.R. Oppenheimer and H. Snyder (1939) to postulate super-dense states of matter. These, and other hypothetical conditions of gravitational collapse, were borne out in later discoveries of pulsars and neutron stars. They also have a bearing on black holes thought to exist in interstellar space. Other implications of space-time are important cosmologically and to unified field theory.

**spacecraft,** vehicle designed to operate, with or without a crew, in a controlled flight pattern above Earth's lower atmosphere.

A brief treatment of spacecraft follows. For full treatment, *see* MACROPAEDIA: Exploration; Industries, Manufacturing.

The first spacecraft, the Soviet Union's Sputnik 1, was launched on Oct. 4, 1957; it weighed 83.6 kg (184 pounds). It was soon followed by other unmanned Soviet and U.S. spacecraft and, within four years (April 12, 1961), by the first manned spacecraft, Vostok 1, which carried the Soviet cosmonaut Yury Gagarin. Since then, numerous other manned and unmanned craft have been launched to increase scientific knowledge or provide important services in areas such as telecommunications and weather forecasting.

Most spacecraft are not self-propelled; they depend on the initial velocity provided by a launch vehicle, which separates from the spacecraft when its task is done. The spacecraft typically either is placed into an orbit around Earth or, if given sufficient velocity to escape Earth's gravity, continues toward another destination in space. The spacecraft itself often carries small rocket engines for maneuvering and orienting in space. The Lunar Module, the manned Moon-landing vehicle used in the Apollo program, had rocket engines that allowed it to soft-land on the Moon and then return its crew to the lunar-orbiting Command Module. The latter craft, in turn, carried sufficient rocket power in its attached Service Module to leave lunar orbit for the return journey to Earth. The space shuttle orbiter uses three on-board liquid-fuel engines supplied by a disposable external tank and a pair of solid-fuel boosters to reach space.

Spacecraft require an on-board source of electrical power to operate the equipment they carry. Those designed to remain in Earth orbit for extended periods generally use panels of solar cells, often in conjunction with storage batteries. The space shuttle, designed for stays in space of one to two weeks, uses hydrogen-oxygen fuel cells. Deep-space probes, such as the Cassini spacecraft launched to Saturn in 1997, are usually powered by small, long-lived radioisotope thermoelectric generators, which convert heat emitted by a radioactive element directly into electricity.

**spadebill,** any of six species of New World flycatchers (family Tyrannidae, order Passeriformes) whose triangular bill is very broad and flat. The white-throated, or stub-tailed, spadebill (*Platyrinchus mystaceus*), scarcely 10 centimetres (4 inches) long, is the most



White-throated spadebill (*Platyrinchus mystaceus*)
Painting by John P. O'Neill

widespread species; it inhabits forest undergrowth from southern Mexico to Argentina in southern South America.

**spadefish** (family Ephippidae), any of about 17 species of marine fishes (order Perciformes), predominantly tropical though also found in temperate regions. In appearance the spadefishes are deep-bodied and laterally compressed, with five or six vertical black bands on a silvery body. The vertical bars may disappear with age, the adults being solid white, black, or, more commonly, silver.

The Atlantic spadefish (*Chaetodipterus faber*) is a western Atlantic species that ranges from New England to Brazil. It feeds primarily on marine invertebrates, particularly crustaceans and ctenophores (comb jellies).

**spadefoot toad,** relatively smooth-skinned amphibian of either the Old World genus *Pelobates* or the North American *Scaphiopus,* both of the family Pelobatidae. Spadefoot



Couch's spadefoot toad (*Scaphiopus couchi*)
Ron Garrison—San Diego Zoo

toads have a broad, horny "spade" projecting from the inside of each hind foot and used by the animals in burrowing.

The European spadefoot (*Pelobates fuscus*) is found in Europe and Central Asia, usually in sandy regions. Some related species have more restricted ranges. It is about 6 to 7.5 cm (2 to 3 inches) long and spends the day underground.

At least seven species of spadefoots are found in regions of Canada, the United States, and Mexico, where soils are sandy. These animals are about 4 to 7.5 cm (1.5 to 3 inches) long and are also nocturnal burrow dwellers. In warm weather after a heavy rain, they emerge to breed in ponds. The young of the western, arid-country forms normally hatch quickly and transform into adults before the ponds dry up; those of the eastern spadefoot develop more slowly.

**Spagnolo, Lo** (Baroque painter): *see* Crespi, Giuseppe Maria.

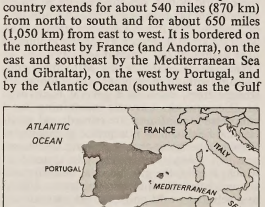
**Spahn, Warren,** in full WARREN EDWARD SPAHN (b. April 23, 1921, Buffalo, N.Y., U.S.—d. Nov. 24, 2003, Broken Arrow, Okla.), American professional baseball player whose total of 363 major league victories established a record for left-handed pitchers. His feat of winning 20 or more games in each of 13 seasons also was a record for left-handers. He set still another mark by striking out at least 100 batters each year for 17 consecutive seasons (1947–63). At the time of his retirement, in 1965, his career total of 2,583 strikeouts was the third highest in baseball history.



Spahn, 1957
UPI

Spahn signed with the Boston Braves (later the Milwaukee Braves) of the National League (NL) in 1940 and pitched his first major league game in 1942. Drafted into the army the following year, he saw extensive combat service during World War II and received a Bronze Star and Purple Heart. In 1946 he returned to baseball, and his fluid, high-kick delivery and pinpoint accuracy established him as one of the game's leading pitchers. In 1957 he helped the Braves win the World Series. A finely conditioned athlete, Spahn pitched two no-hitters at ages 39 and 40. He was also one of the best hitters among pitchers, and his 35 career home runs set a record for pitchers in the NL. In 1965, his last season, he played for the New York Mets and the San Francisco Giants. A 14-time All-Star and recipient of the Cy Young Award (1957), Spahn was inducted into the Baseball Hall of Fame in 1973.

**Spain,** officially KINGDOM OF SPAIN, Spanish ESPAÑA, or REINO DE ESPÃNA, one of Europe's largest countries, located on the Iberian Peninsula at the southwestern corner of Europe. The country extends for about 540 miles (870 km) from north to south and for about 650 miles (1,050 km) from east to west. It is bordered on the northeast by France (and Andorra), on the east and southeast by the Mediterranean Sea (and Gibraltar), on the west by Portugal, and by the Atlantic Ocean (southwest as the Gulf




Spain

of Cádiz, northwest and north as the Bay of Biscay). The Balearic Islands off Spain's eastern coast and the Canary Islands off the coast of North Africa are also part of Spain, and the cities of Ceuta and Melilla in northern Morocco have belonged to Spain for several centuries. The capital of Spain is Madrid. Area 195,379 square miles (506,030 square km). Pop. (2003 est., including Balearic and Canary islands and Moroccan enclaves) 42,600,000.

A brief treatment of Spain follows. For full treatment, *see* MACROPAEDIA: Spain.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*The land.* Spain's topography is dominated by the Meseta, a large central plateau having an average elevation of 2,600 feet (800 m) above sea level. The plateau is almost completely surrounded by mountain ranges: the Cantabrian Mountains (Cordillera Cantábrica) to the north, the Iberian System (Sistema Ibérico) to the northeast, the Sierra Morena to the south, and some lower mountains of the Portuguese frontier to the northwest. Five natural regions surround the central plateau: (1) the valley of the Ebro River in the northeast, (2) the mountainous region of Catalonia in the far northeast, (3) the Mediterranean coastal region of Valencia in the east, (4) the valley of the Guadalquivir River in the south, and (5) the mountainous region of northern Spain extending westward from the Pyrenees Range to the Atlantic. The highest point in mainland Spain is the peak of Mulhacén (11,411 feet [3,478 m]) in the Sierra Nevada in the south. The principal rivers are the Duero, the Tagus, the Ebro, and the Guadalquivir.

Three climatic zones predominate in mainland Spain. The northern and eastern coasts have a maritime climate with average temperatures of 48° F (9° C) in winter and 64° F (18° C) in summer and annual rainfall of 38 inches (965 mm). The central plateau has a continental climate with average temperatures of 40° F (4° C) in winter and 75° F (24° C) in summer and annual rainfall of less than 15 inches (380 mm). Areas having an elevation of more than 9,000 feet (2,750 m) have a mountain climate with average temperatures of less than 32° F (0° C) in winter and 52° F (11° C) in summer and annual rainfall of more than 45 inches (1,150 mm); the northern central plateau is snow-covered for parts of the winter. Deciduous forests and meadows cover most of the humid regions of northern Spain, and scrub forests (evergreen oak and other drought-resistant plants) predominate in the dry southern region; much of the central plateau has steppe vegetation. Wildlife includes deer, the rare Spanish ibex, bear, and wolf.

Some iron ore and zinc deposits are found in the Cantabrian Mountains, copper and lead in the Sierra Morena, and coal in the Asturias region in the northwest.

*The people.* The Spanish population is basically homogeneous in race and culture; the Roma (Gypsies) are perhaps the only true racial minority. Roman Catholicism is the principal religion. Modern standard Spanish, or Castilian, is spoken throughout Spain; the Catalan, Galician, and Basque languages are also spoken by large communities. More than three-fourths of the total population is urban. The birth and death rates are typical of those of a developed country.

*The economy.* Spain has a developed market economy that is largely based on services, light and heavy industries, and agriculture. The government has fostered the development of heavy industries through the National Institute of Industry, which plays a large role in the production of petroleum, steel, automobiles, and various other goods. The gross national product (GNP) is one of the highest in Europe and is growing much more rapidly than the population. The GNP per capita is also relatively high.

Agriculture accounts for 5 percent of the gross domestic product (GDP) and employs less than one-eighth of the work force. The chief crops include barley, rice, lucerne, sugar beets, grapes, wheat, and potatoes. Spain is also one of the world's major producers of wine. Large quantities of agricultural commodities are normally exported to the countries of the European Community (EC). Pastures cover more than one-fifth of the land and support sheep, pigs, cattle, and goats.

Forests cover nearly one-third of the land, and the roundwood removed is processed into pulpwood and sawn wood. Some 17,000 vessels belong to the Spanish fishing fleet, and landings are chiefly sardines, cod, and tuna. The total catch declined in the late 1980s.

Manufacturing industries (including mining and public utilities) account for almost one-third of the GDP and employ more than one-fifth of the work force. The principal minerals mined are iron ore, mercury, pyrite, potash, and coal. Petroleum is produced on a small scale. Major manufactures include chemicals, machine tools, and motors. Other leading industries produce textiles, toys, shoes, and electrical appliances. Production of iron, steel, and ships has slackened. Investments by European and American motor vehicle manufacturers have helped to establish Spain as a leading manufacturer of automobiles. Heavy industries are concentrated around Bilbao, Santander, and Oviedo; the manufacture of textiles and plastics centres around Barcelona. Electricity is largely generated from domestic and imported fuels; nuclear energy supplies about one-third of the country's electric power. Tourism is also a major industry.

The Constitution of 1978 recognized the right of labour unions to exist. The union movement is dominated by the General Union of Workers, affiliated with the Spanish Socialist Workers' Party, and by the Workers' Commissions, affiliated with the Spanish Communist Party (now under the United Left).

Imports ordinarily exceed exports, and the deficit is partially offset by remittances from Spaniards working abroad. Machinery, fuels, transportation equipment, and agricultural products dominate imports; transport equipment, agricultural products, and machinery lead among exports. Spain's chief suppliers include France, Germany, Italy, and Great Britain.

*Government and social conditions.* Spain is a constitutional monarchy. Its constitution, adopted in 1978, establishes the king as head of state and commander in chief of the armed forces. Legislative power is concentrated in the bicameral parliament, the Cortes Generales, with a Congress of Deputies (Lower House) and a Senate (Upper House). Executive power rests in the prime minister (president) of the government, who is named by the king upon the recommendation of the majority party. The prime minister is assisted by a cabinet. In response to the historically sensitive issue of regional autonomy, Spain developed a new system of local government. Autonomous regional communities were initially established in Catalonia (1979), the Basque Country (1979), and Galicia (1981); by 1983 the entire country had been divided into 17 autonomous communities.

Although it was essentially a dictatorship from 1939 to 1975 and was governed by a single party from 1977 to 1982, Spain has nevertheless developed a pluralistic political character, with a large number of registered parties. The independent judiciary is headed by the Supreme Court, which is made up of six branch courts.

Spain's social welfare system provides maternity and sickness benefits; hospital and medical cost assistance; and financial assistance for temporary disability, retirement, death, or unemployment. The steadily increasing number of health facilities, together with improving diets, has contributed to the control of most infectious diseases and to the overall health of the population. Particular emphasis is placed on the provision of perinatal care in a hospital setting. Life expectancy is 77 years. An urban housing shortage remains, despite government-subsidized housing construction.

The literacy rate is 96 percent for men and 90 percent for women. According to reforms introduced in 1970, the educational system includes preschool education; eight years of free and compulsory general basic education; *bachillerato,* a prerequisite for professional and preuniversity institutions; the universities; and professional training.

Press censorship laws of the administration of General Francisco Franco have been replaced by constitutional guarantee of freedom of the press. Until 1983 television was broadcast in Spanish by two government-operated stations. Since then, the Catalan and Basque autonomous governments established television stations that broadcast in the regional languages. In 1989 the socialist government introduced legislation permitting the establishment of privately owned stations.

Throughout history, Spaniards have contributed richly to the arts and humanities. In architecture the tradition begins before the unknown builders of such Gothic cathedrals as those in Burgos and Toledo and continues down to the 20th century with Pedro Muguruza, Felix Candela, Antoni Gaudí, and others. Among 20th-century sculptors are Juan de Avalos, Angel Ferrant, and Eduardo Chillida (noted for his work in metal). In painting the tradition extends from El Greco and Diego Velázquez to the major 20th-century figures of Pablo Picasso, Joan Miró,

**Kings and queens regnant of Spain**

| | |
|---|---|
| **Asturias** | |
| (including Galicia from 739 and Leon from 855) | |
| Pelayo | *c.* 718–*c.* 737 |
| Favila | *c.* 737–739 |
| Alfonso I | 739–757 |
| Fruela I | 757–768 |
| Aurelio | 768–774 |
| Silo | 774–783 |
| Mauregato | 783–788 |
| Bermudo I | 788–791 |
| Alfonso II | 791–842 |
| Ramiro I | 842–850 |
| Ordoño I | 850–866 |
| Alfonso III | 866–910 |
| (Kingdom divided between three sons) | |
| **Asturias** | |
| Fruela II | 910–925 |
| **Leon** | |
| García I | 910–914 |
| Ordoño II | 914–924 |
| **Galicia** | |
| Ordoño II | 910–924 |
| **Leon** | |
| (including Asturias and Galicia) | |
| Fruela II | 924–925 |
| Alfonso IV | *c.* 925–*c.* 931 |
| Ramiro II | *c.* 931–950 |
| Ordoño III | 950–955 |
| Sancho I | 955–958 |
| Ordoño IV | 958–960 |
| Sancho I (*2nd time*) | 960–966 |
| Ramiro III | 967–982 |
| Bermudo II | 982–999 |
| Alfonso V | 999–1028 |
| Bermudo III | 1028–37 |
| **Leon and Castile** | |
| Ferdinand I (Fernando) | 1039–65 |
| (Kingdom divided between three sons) | |
| **Leon** | |
| Alfonso VI | 1065–72 |
| **Castile** | |
| Sancho II | 1065–72 |
| **Galicia** | |
| Garcia II | 1065–71 |
| **Castile and Leon** | |
| (including Galicia) | |
| Sancho II | 1072 |
| Alfonso VI (restored) | 1072–1109 |
| Urraca (ruled with husband, Alfonso I of Aragon) | 1109–26 |
| Alfonso VII | 1126–57 |
| (Kingdom divided between two sons) | |
| **Leon** | |
| Ferdinand II (Fernando) | 1157–88 |
| Alfonso IX | 1188–1230 |
| **Castile** | |
| Sancho III | 1157–58 |
| Alfonso VIII | 1158–1214 |
| Henry I (Enrique) | 1214–17 |
| Ferdinand III | 1217–52 |
| **Castile** | |
| (including Leon) | |
| Alfonso X | 1252–84 |
| Sancho IV | 1284–96 |
| Ferdinand IV (Fernando) | 1296–1312 |
| Alfonso XI | 1312–50 |
| Peter I (Pedro) | 1350–66 |
| Henry II (Enrique) | 1366–67 |
| Peter I (*2nd time*) | 1367–69 |
| Henry II (*2nd time*) | 1369–79 |
| John I (Juan) | 1379–90 |
| Henry III (Enrique) | 1390–1406 |
| John II (Juan) | 1406–54 |
| Henry IV (Enrique) | 1454–74 |
| Isabella I and Ferdinand V (Ferdinand II of Aragon) (Isabel and Fernando) | 1474–1504 |
| Joan and Philip I (Juana and Felipe) | 1504–06 |
| Ferdinand V (*2nd time*) | 1506–16 |
| **Aragon** | |
| Ramiro I | 1035–63 |
| Sancho I | 1063–94 |
| Peter I (Pedro) | 1094–1104 |
| Alfonso I | 1104–34 |
| Ramiro II | 1134–37 |
| Petronilla (ruled with husband, Ramón Berenguer IV of Barcelona) | 1137–63 |
| Alfonso II | 1163–96 |
| Peter II (Pedro) | 1196–1213 |
| James I (Jaime) | 1213–76 |
| Peter III (Pedro) | 1276–85 |
| Alfonso III | 1285–91 |
| James II (Jaime) | 1291–1327 |
| Alfonso IV | 1327–36 |
| Peter IV (Pedro) | 1336–87 |
| John I (Juan) | 1387–95 |
| Martin | 1395–1412 |
| Ferdinand I (Fernando) | 1412–16 |
| Alfonso V | 1416–58 |
| John II (Juan) | 1458–79 |
| Ferdinand II and Isabella I (1479–1504) (Fernando and Isabel) | 1479–1516 |
| **Spain** | |
| *House of Habsburg* | |
| Charles I (Carlos) | 1516–56 |
| Philip II (Felipe) | 1556–98 |
| Philip III (Felipe) | 1598–1621 |
| Philip IV (Felipe) | 1621–65 |
| Charles II (Carlos) | 1665–1700 |
| *House of Bourbon* (Borbón) | |
| Philip V (Felipe) | 1700–24 |
| Louis (Luis) | 1724 |
| Philip V (*2nd time*) | 1724–46 |
| Ferdinand VI (Fernando) | 1746–59 |
| Charles III (Carlos) | 1759–88 |
| Charles IV (Carlos) | 1788–1808 |
| Ferdinand VII (Fernando) | 1808 |
| *House of Bonaparte* | |
| Joseph (José) | 1808–13 |
| *House of Bourbon* (Borbón) | |
| Ferdinand VII (*2nd time*) | 1814–33 |
| Isabella II (Isabel) | 1833–68 |
| *Interregnum* | 1868–70 |
| *House of Savoy* | |
| Amadeus I (Amadeo) | 1870–73 |
| *Republic* | 1873–74 |
| *House of Bourbon* (Borbón) | |
| Alfonso XII | 1874–85 |
| Alfonso XIII | 1886–1931 |
| *Republic* | 1931–39 |
| *Nationalist regime* (Francisco Franco) | 1939–75 |
| *House of Bourbon* (Borbón) | |
| Juan Carlos | 1975– |

and Salvador Dalí. Spanish composers include Antonio de Cabezón and the Italian-born Domenico Scarlatti, who worked in Madrid, and the early 19th-century tenor and famous teacher Manuel García; later composers such as Manuel de Falla had such disciples as Joaquín Turina. Great performers included the cellist Pablo Casals, the guitarist Andrés Segovia, pianist Alicia de la Rocha, and the soprano Victoria de los Angeles.

Spanish literature first flowered with the work of the world-renowned Miguel de Cervantes, author of *Don Quixote.* The Nobel Prize winners José Echegaray y Eizaguirre, Jacinto Benavente y Martínez, Juan Ramón Jiménez, Vicente Aleixandre, and Camilo José Cela also had an international readership. Notable figures of the 20th century include Federico García Lorca, Ramón Pérez de Ayala, José Agustín Goytisolo, and Rafael Alberti.

*History. Homo sapiens sapiens* appeared in Spain after 35,000 BC. The most remarkable remains of their culture are the painted caves in the Cantabrian Mountains in northern Spain. These show polychrome representations of bison, horses, and other animals. Bronze Age settlements such as the El Argar farming culture emerged about 2000 BC, and advanced metallurgical techniques used in working with bronze, silver, and gold are in evidence. Celtic peoples began to migrate through the Pyrenees from central Europe in the 9th and 8th centuries BC. Beginning with the Second Punic War in 218 BC, Rome gradually extended its hegemony over the peninsula. The military conquest was completed during the reign of Augustus. In the 4th century AD Germanic tribes invaded, and the Visigoths emerged dominant, establishing a kingdom over most of the peninsula and accepting Roman Christianity by the early 7th century.

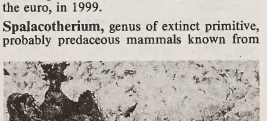
During the early 8th century Muslims invaded the peninsula from North Africa and conquered most of it. By the late 13th century the Christian kingdoms of Castile and Aragon had reconquered most of the Muslim-controlled territory. In 1479 the two kingdoms were joined in a personal union as a result of the marriage (1469) of Ferdinand II of Aragon and Isabella I of Castile, known as the Catholic Monarchs. They reconquered the last Muslim kingdom, Granada, in 1492. At the close of the century Spain became the first European colonial power in the Americas. In 1516 Charles I, Habsburg ruler of the Netherlands, succeeded Ferdinand as king, and he was elected Holy Roman emperor in 1519 as Charles V, then the most powerful ruler in Europe. He was succeeded by his son Philip II (1556–98). A religious fanatic, he resolved to defend the Roman Catholic faith and to stamp out Protestantism and thus involved Spain in many costly wars and military adventures (such as the Spanish Armada of 1588) that drained the country financially. Philip II was succeeded by three weak Habsburg kings who presided over the quick decline of Spain.

Habsburg rule ended in 1700, when Philip V became the first Bourbon king of Spain. Philip's accession to the throne caused the War of the Spanish Succession (1701–14), resulting in heavy territorial losses. In 1808 Napoleon Bonaparte installed his brother Joseph as king of Spain, but British and Spanish forces defeated Napoleon's troops and eventually restored the Bourbon monarchy (1814). Spain's weakness encouraged most of its American colonies to declare independence. In its war with the United States (1898) Spain lost its remaining overseas possessions.

Spain became a republic in 1931 when Alfonso XIII abdicated after election results showed overwhelming support for republicanism. A civil war erupted in 1936 as the Republicans opposed the Nationalists, who, led by General Francisco Franco, received arms from Nazi Germany and Fascist Italy. The Republicans, with domestic and foreign support from socialists, communists, and various liberal sympathizers, received arms only from the Soviet Union. After the Nationalist victory in 1939, Franco became chief of state, remaining in power until his death in 1975. In 1969 Franco designated Juan Carlos de Borbón y Borbón as his successor, and on Franco's death in 1975 Juan Carlos became king, restoring the monarchy and establishing a greater measure of democracy.

Elections were held in 1977, and the new Cortes (parliament) embarked upon a program of democratic reform, including the separation of church and state and the guaranteeing of free enterprise and human and civil rights. The elections of 1982 marked the final break with the Francoist legacy by installing a socialist government under the leadership of Felipe González Márquez, who continued market reforms. Spain, once relatively isolated, became more closely associated with western Europe, joining the European Community (now part of the European Union) in 1986. Spain enjoyed international prominence in 1992 as the host of a fair in Seville and the Olympics in Barcelona. In 1996 the conservative Popular Party ended 13 years of socialist government; their leader, José María Aznar López, became prime minister in 1996. The country experienced a remarkable economic boom during the 1990s and adopted the common European currency, the euro, in 1999.

**Spalacotherium,** genus of extinct primitive, probably predaceous mammals known from



*Spalacotherium* jawbone

By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

fossils found in Late Jurassic deposits of Europe. The genus *Spalacotherium* is representative of the symmetrodonts, a group characterized by molar teeth with three cusps arranged in a triangle. The symmetrodonts are among the oldest known mammals and may in some way have played a role in the development of the higher mammalian forms.

**Spalatin, Georg,** original name GEORG BURKHARDT (b. Jan. 17, 1484, Spalt, Bavaria [Germany]—d. Jan. 16, 1545, Altenburg, Saxony), humanist friend of Martin Luther and prolific writer whose capacity for diplomacy helped advance and secure the Protestant Reformation in its early stages.

As a student Spalatin came in contact with various humanists, and he followed their custom in choosing a last name that reflected his birthplace. In 1505 he joined a circle of humanists led by the German scholar Mutianus Rufus and the same year began to teach in the monastery at Georgenthal. He was ordained priest and made tutor to the heir of Frederick III the Wise, elector of Saxony, in 1508. In 1511 he was made a preceptor to the elector's nephews, who were studying at Wittenberg, where Spalatin first met Luther. The following year Frederick appointed Spalatin his librarian, and in this position he gained increasing trust and respect at the elector's court.

Spalatin passed his admiration for Luther on to Frederick and in 1518 persuaded the elector to protect Luther during the controversy over indulgences. This action was crucial to the progress of the Reformation. Spalatin also helped Luther receive a favourable reception at the Diet of Worms (1521), at which Luther's opponents failed in their efforts to condemn him.

Spalatin similarly championed the Reformation through several successive diets and the tenure of two electors of Saxony, John and John Frederick. From 1526 he participated in the visitations of churches and schools that established the Reformation in Saxony. From 1530 he worked with Luther's associate, Philipp Melanchthon, in preparing the Augsburg Confession (1530), which legally established the Reformation in Germany, and in forming the Schmalkaldic League, a defensive alliance of German princes concluded in 1531. Also a translator of Luther's and Melanchthon's writings for Frederick, Spalatin wrote numerous historical works. Among them are *Annales Reformationis* (1718; "Annals of the Reformation") and "A Life of Frederick III," published in *Georg Spalatins historischer Nachlass und Briefe* (1851, ed. by C.G. Neudecker and L. Preller; "Georg Spalatin's Historical Literary Remains and Letters").

**Spalato** (Croatia): *see* Split.

**Spalding, A.G.,** byname AL SPALDING, in full ALBERT GOODWILL SPALDING (b. Sept. 2, 1850, Byron, Ill., U.S.—d. Sept. 9, 1915, Point Loma, Calif.), American professional baseball player and sporting-goods manufacturer, who contributed to the development of professional baseball and manufactured gear for many sports played in his day.

In his youth Spalding pitched and batted right-handed with such authority that the Forest City (Rockford, Ill.) team became well known. He pitched for the Boston Red Stockings in the National Association (1871–75) and pitched for and managed the Chicago National League Club, the White Stockings (1876–77). In 1876 he and his brother James founded in Chicopee, Mass., the sporting-goods manufacturing company that later became known as A.G. Spalding and Brothers. He remained with the Chicago club after his playing days as president (1882–91) and was a practical organizer in baseball until business took up most of his time in the 1890s. Spalding organized baseball tours abroad (to England and Ireland in 1874, around the world in 1889) and became an official ambassador of goodwill for baseball.

*Spalding's Official Baseball Guide*—begun in 1878 and issued annually after 1880 until the 1940s, when it was amalgamated with official major-league guides—was a sort of unofficial baseball guide. Spalding also wrote a history of baseball, *America's National Game* (1911), and he was elected to the Baseball Hall of Fame in 1939.

**Spalding, Albert** (b. Aug. 15, 1888, Chicago, Ill., U.S.—d. May 26, 1953, New York, N.Y.), American composer and one of the leading violinists of his day.

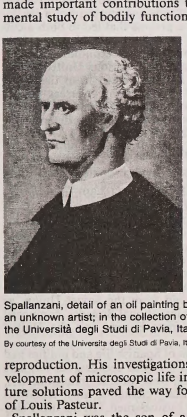
The son of a partner in the sporting-goods firm of A.G. Spalding and Brothers, he began to study the violin at the age of seven, making his debut in Paris in 1905 and in New York City in 1908. He served with the American Expeditionary Force in Europe during World War I. Spalding toured the United States and Europe many times, playing with the leading orchestras. His musical compositions include a suite for orchestra, two violin concerti, and a *String Quartet in E Minor.* He was the author of an autobiography, *Rise to Follow* (1943), and of a novel, *A Fiddle, a Sword, and a Lady* (1953).

**Spalding, Henry Harmon** (b. *c.* 1803—d. *c.* 1843), U.S. Presbyterian missionary who, with his wife, Eliza (*née* Hart), in 1836 established the Lapwai Mission (near present-day

Lewiston, Idaho) with the first white home, church, and school in what is now Idaho.

Spalding was educated at Plattsbury (N.Y.) Academy, Western Reserve College (Ohio), and Lane Theological Seminary (Cincinnati) and was ordained in the Presbyterian ministry in 1835. He was first appointed to the Osage Indian mission (western Missouri) and then went west with the party of Marcus Whitman (*q.v.*) in 1830. The printing press that Spalding and his wife brought in 1839 was the first in the Pacific Northwest. The Lapwai mission was closed in 1847 after the Whitman massacre, but in 1871 the Presbyterian Church resumed the work, which is still being carried on among the Nez Percé Indians.

**Spallanzani, Lazzaro** (b. Jan. 12, 1729, Modena, Duchy of Modena—d. 1799, Pavia, Cisalpine Republic), Italian physiologist who made important contributions to the experimental study of bodily functions and animal



Spallanzani, detail of an oil paintng by an unknown artist; in the collection of the Università degli Studi di Pavia, Italy

By courtesy of the Universita degli Studi di Pavia, Italy

reproduction. His investigations into the development of microscopic life in nutrient culture solutions paved the way for the research of Louis Pasteur.

Spallanzani was the son of a distinguished lawyer. He attended the Jesuit college at Reggio, where he received a sound education in the classics and philosophy. He was invited to join the order, but, although he was eventually ordained (in 1757), he declined this offer and went to Bologna to study law. Under the influence of his kinswoman Laura Bassi, a professor of mathematics, he became interested in science. In 1754 Spallanzani was appointed professor of logic, metaphysics, and Greek at Reggio College and in 1760 professor of physics at the University of Modena.

Although Spallanzani published in 1760 an article critical of a new translation of the *Iliad,* all of his leisure was being devoted to scientific research. In 1766 he published a monograph on the mechanics of stones that bounce when thrown obliquely across water. His first biological work, published in 1767, was an attack on the biological theory suggested by Georges Buffon and John Turberville Needham, who believed that all living things contain, in addition to inanimate matter, special "vital atoms" that are responsible for all physiological activities. They postulated that, after death, the "vital atoms" escape into the soil and are again taken up by plants. The two men claimed that the small moving objects seen in pond water and in infusions of plant and animal matter are not living organisms but merely "vital atoms" escaping from the organic material. Spallanzani studied various forms of microscopic life and confirmed the view of Antonie van Leeuwenhoek that such forms are living organisms. In a series of experiments he showed that gravy, when boiled, did not produce these forms if placed in phials that were immediately sealed by fusing the glass. As a result of this work, he concluded that the objects in pond water and other preparations were living organisms introduced from the air and that Buffon's views were without foundation.

The range of Spallanzani's experimental interest expanded. In 1768 he published the results of his regeneration and transplantation experiments. He studied regeneration in a wide range of animals including planarians, snails, and amphibians and reached a number of general conclusions: the lower animals have greater regenerative power than the higher; young individuals have a greater capacity for regeneration than the adults of the same species; and, except in the simplest animals, it is the superficial parts not the internal organs that can regenerate. His transplantation experiments showed great experimental skill and included the successful transplant of the head of one snail onto the body of another. In 1773 he investigated the circulation of the blood through the lungs and other organs and did an important series of experiments on digestion, in which he obtained evidence that digestive juice contains special chemicals that are suited to particular foods. At the request of his friend Charles Bonnet, Spallanzani investigated the male contribution to generation. Although the spermatozoa had first been seen in the 17th century, their function was not understood until some 30 years after the formulation of the cell theory in 1839. As a result of his earlier investigations into simple animals, Spallanzani supported the prevailing view that the spermatozoa were parasites within the semen. Both Bonnet and Spallanzani accepted the preformation theory. According to their version of this theory, the germs of all living things were created by God in the beginning and were encapsulated within the first female of each species. Thus, the new individual present in each egg was not formed *de novo* but developed as the result of an expansion of parts the delineation of which had been laid down within the germ by God at the creation. It was assumed that the semen provided a stimulus for this expansion, but it was not known if contact was essential nor if all the parts of the semen were required. Using amphibians, Spallanzani showed that actual contact between egg and semen is essential for the development of a new animal and that filtered semen becomes less and less effective as filtration becomes more and more complete. He noted that the residue on the filter paper retained all its original power if it were immediately added to the water containing the eggs. Spallanzani concluded that it was the solid parts of the secretion, proteinaceous and fatty substances that form the bulk of the semen, that were essential, and he continued to regard the spermatozoa as inessential parasites. Despite this error, Spallanzani performed some of the first successful artificial insemination experiments on lower animals and on a dog.

As Spallanzani's fame grew, he became a fellow of most of the scientific societies in Europe. In 1769 he accepted a chair at the University of Pavia, where, despite other offers, he remained for the rest of his life. He was popular with students and colleagues. Once a small group, jealous of his success, accused him of malpractice in association with the museum that he controlled, but he was soon vindicated. Spallanzani took every opportunity to travel, to study new phenomena, and to meet other scientists. The accounts of his journeys to Constantinople and Sicily still provide interesting reading. Toward the end of his life he conducted further research on microscopic animals and plants that he had started early in his career; he also began studies on the electric charge of the torpedo fish and sense organs in bats. In his last set of experiments, published posthumously, he attempted to show that the conversion of oxygen to carbon dioxide must occur in tissues, not in the lungs (as Antoine-Laurent Lavoisier had suggested in 1787). (E.B.G.)

BIBLIOGRAPHY. Most general histories of biology have a short section on Spallanzani. Two books by Elizabeth B. Gasking are *Investigations into Generation, 1651–1828* (1967), which discusses Spallanzani's researches into regeneration, infusions, and his experiments on fertilization, and *The Rise of Experimental Embryology* (1970), a general history, with an account of Spallanzani's experiments and comments on the preformation theory. Spallanzani's own works in translation are *Tracts on the Natural History of Animals and Vegetables,* trans. by J. Dalyell (1803); and *An Essay upon Animal Reproductions,* trans. by M. Maty (1769).

*Where the same name may denote a person, place, or thing, the articles will be found in that order*

**spallation,** high-energy nuclear reaction in which a target nucleus struck by an incident (bombarding) particle of energy greater than about 50 million electron volts (MeV) ejects numerous lighter particles and becomes a product nucleus correspondingly lighter than the original nucleus. The light ejected particles may be neutrons, protons, or various composite particles equivalent to nuclei of hydrogen, helium, or lithium isotopes. The product nucleus is occasionally much lighter than the target nucleus; chlorine-38, for example, has been produced along with an assortment of neutrons, protons, and alpha particles (helium nuclei) by bombarding copper-63 with protons accelerated to 70 MeV.

**Spandau,** district of Berlin, Germany, on the Havel River at the mouth of the Spree. Originally the site of a Sorbian (Wendish) fortress, Spandau became German *c.* 1230 and was granted civic rights in 1232. It was incorporated into Berlin in 1920. The citadel (1560–94, including the 12th-century Julius Tower) is one of the oldest well-preserved Italian-style Renaissance fortifications in northern Germany, and the 14th-century St. Nicholas' Church is the oldest Gothic church in Berlin. After 1946 the Spandau prison, on the Wilhelmstrasse, housed the Nazi war criminals sentenced by the Allies. Spandau is the chief industrial district of Berlin, with the electrotechnical firm of Siemens in the Siemensstadt section and an airport at Gatow. It also has a number of parks and forests, notably the large Spandauerforst, which makes it a favourite weekend resort for Berliners. Pop. (1986 est.) 192,895.

**spandrel,** also spelled SPANDRIL, the roughly triangular area above and on either side of an arch, bounded by a line running horizontally through the apex of the arch, a line rising vertically from the springing of the arch, and the curved extrados, or top of the arch. When arches adjoin, the entire area between their crowns and springing line is a spandrel. If it is filled in, as is ordinarily the case, the resulting structure is termed a spandrel wall. In medieval architecture it was usually ornamented.

In buildings of more than one story the spandrel is the area between the sill of a window and the head of the window below it. In steel or reinforced concrete structures there will sometimes be a spandrel beam extending horizontally from one column to another and supporting a section of wall. The more or less triangular area filling in the space below a stair string is also a form of spandrel.

**Spangenberg, August Gottlieb** (b. July 15, 1704, Klettenberg-Hohenstein, Saxony—

d. Sept. 18, 1792, Berthelsdorf), German bishop of the Unitas Fratrum, successor to its leader, Nikolaus Ludwig, graf von Zinzendorf, and founder of the Moravian Church in North America.

As a law student at Jena, Spangenberg was converted in 1722 to Pietism, a religious movement emphasizing biblical study, morality, and Christian living, and he began to study theology. In 1728, during Zinzendorf's visit to Jena, Spangenberg was drawn into his circle. In 1732 he was named to the theological faculty at Halle, but Pietists there opposed his association with Zinzendorf, and he was expelled the next year. As Zinzendorf's assistant, he went to the United States, first to Georgia and then to Pennsylvania, to supervise Moravian missionary work. Intending to make Philadelphia the centre of Moravian activity, he founded the North American branch of the Unitas Fratrum there (1740), and at Bethlehem, Pa., he established a community in which work was done and goods were held communally. Spangenberg organized another branch in England (1741–42), worked again in Germany, and returned to North America in 1744 after becoming a bishop of his church. After an interval in Europe (1749–51), he extended Moravian missionary work to North Carolina and in 1762 went back to Germany for the last time, assuming leadership of the Unitas Fratrum as a member of its governing body.

In addition to contributing in the mission field, Spangenberg also drafted the *Idea Fidei Fratrum* (1779; *Exposition of Christian Doctrine*, 1784), which became the accepted statement of Moravian beliefs. Through his moderation, internal differences were ameliorated, and the Moravian Church maintained friendly relations with the Lutheran Church. Among his works are a life of Zinzendorf (1772–75; abridged Eng. trans., 1838), some apologetic writings, and several hymns.

**spaniel,** any of several sporting dogs used by hunters to flush game from cover. The earliest spaniels apparently originated in Spain, hence the name, but most of the modern breeds were developed in Britain.



(Top) Cocker spaniel; (bottom) English springer spaniel

Sally Anne Thompson—EB Inc.

The cocker spaniel is a small dog standing 14 to 15 inches (36 to 39 centimetres) and weighing 22 to 29 pounds (10 to 13 kilograms). Compact and sturdily built, it has a rounded head, floppy ears, and a soft, flat or wavy coat. The coat may be either solid coloured or variegated; colours include black, reddish brown, buff, and black and white.

The English cocker spaniel is similar to the cocker spaniel but is larger and has longer legs and a longer muzzle. It has a medium-length silky coat in a variety of colours. The distinction between spaniel breeds originally was one of size, the larger spaniels being called springers and the smaller ones cockers—the latter apparently in reference to their use in flushing woodcocks.

There are two breeds known as springer spaniels. The English springer spaniel is a medium-sized, compact dog standing 19 to 20 inches (48 to 51 centimetres) and weighing 35 to 55 pounds (16 to 25 kilograms). Its glossy coat is flat or wavy and usually black and white or liver-coloured and white. The English springer spaniel is valued both as a companion and for its use in the field as a pheasant hunter. The Welsh springer spaniel is somewhat smaller than the English and is always red-brown and white. It is noted as both a pet and a capable hunting dog and retriever.

There are several other breeds, among them the American water spaniel, a sturdily built, curly-coated, dark brown dog used to hunt birds and small animals; the Brittany spaniel, a setter-like, tailless or short-tailed French dog and the only spaniel that points, rather than flushes, birds; the Clumber spaniel, a low-slung, long-bodied, powerful dog, slow but thorough in the field; and the Irish water spaniel, an old breed valued as both a water retriever and a companion dog. *See also* English toy spaniel; Japanese spaniel.

**Spanish–American War** (1898), conflict between the United States and Spain that ended Spanish colonial rule in the Americas and resulted in U.S. acquisition of territories in the western Pacific and Latin America.

The war originated in the Cuban struggle for independence from Spain, which began in February 1895. Spain's brutally repressive measures to halt the rebellion were graphically portrayed for the U.S. public by several sensational newspapers, and American sympathy for the rebels rose. The growing popular demand for U.S. intervention became an insistent chorus after the unexplained sinking in Havana harbour of the battleship USS *Maine* (Feb. 15, 1898; *see* Maine, destruction of the), which had been sent to protect U.S. citizens and property after anti-Spanish rioting in Havana. Spain announced an armistice on April 9 and speeded up its new program to grant Cuba limited powers of self-government, but the U.S. Congress soon afterward issued resolutions that declared Cuba's right to independence, demanded the withdrawal of Spain's armed forces from the island, and authorized the President's use of force to secure that withdrawal while renouncing any U.S. design for annexing Cuba.

Spain declared war on the United States on April 24, followed by a U.S. declaration of war on the 25th, which was made retroactive to April 21. The ensuing war was pathetically one-sided, since Spain had readied neither its army nor its navy for a distant war with the formidable power of the United States. Commo. George Dewey led a U.S. naval squadron into Manila Bay in the Philippines on May 1, 1898, and destroyed the anchored Spanish fleet in a leisurely morning engagement that cost only seven American seamen wounded. Manila itself was occupied by U.S. troops by August.

The elusive Spanish Caribbean fleet under Adm. Pascual Cervera was located in Santiago harbour in Cuba by U.S. reconnaissance. An army of regular troops and volunteers under Gen. William Shafter (and including Theodore Roosevelt and his 1st Volunteer Cavalry, the "Rough Riders") landed on the coast east of Santiago and slowly advanced on the city in an effort to force Cervera's fleet out of the harbour. Cervera led his squadron out of Santiago on July 3 and tried to escape westward along the coast. In the ensuing battle all of his ships came under heavy fire from U.S. guns and were beached in a burning or sinking condition. Santiago surrendered to Shafter on July 17, thus effectively ending the war.

By the Treaty of Paris (signed Dec. 10, 1898), Spain renounced all claim to Cuba, ceded Guam and Puerto Rico to the United States, and transferred sovereignty over the Philippines to the United States for $20,000,000. The Spanish–American War was an important turning point in the history of both antagonists. Spain's defeat decisively turned the nation's attention away from its overseas colonial adventures and inward upon its domestic needs, a process that led to both a cultural and a literary renaissance and two decades of much-needed economic development in Spain. The victorious United States, on the other hand, emerged from the war a world power with far-flung overseas possessions and a new stake in international politics that would soon lead it to play a determining role in the affairs of Europe.

**Spanish Armada:** *see* Armada.

**Spanish cedar:** *see* cigar-box cedar.

**Spanish Civil War** (1936–39), military revolt against the Republican government of Spain, supported by conservative elements within the country. When an initial military coup failed to win control of the entire country, a bloody civil war ensued. The Nationalists, as the rebels were called, received aid from fascist Italy and Nazi Germany. The Republicans received aid from the Soviet Union, as well as from International Brigades, composed of volunteers from Europe and the United States.

A polarization of Spanish life and politics had developed over previous decades. On one side (the Nationalist) were most Roman Catholics, important military elements, most landowners, and many businessmen. On the other side (the Republican) were urban workers, most agricultural labourers, and many of the educated middle class. Politically their differences often found vehement expression in parties such as the fascist-oriented Falange and the militant anarchists. Between these extremes were other groups covering the political spectrum from monarchism to socialism, including a small communist movement divided among followers of Joseph Stalin and Leon Trotsky. In 1934 there was widespread labour conflict; a bloody uprising by miners in Asturias was suppressed by troops led by General Francisco Franco. Elections on Feb. 16, 1936, brought to power a Popular Front government supported by most of the left and opposed by the right and remnants of the centre.

A well-planned military uprising began on July 17, 1936, in Spanish garrison towns. By July 21 the rebels had achieved control in Spanish Morocco, the Canary Islands, and the Balearic Islands (except Minorca) and in much of Spain north of the Guadarrama mountains and the Ebro River. The Republican forces had put down the uprising in other areas, except for some of the larger Andalusian cities. Republican violence occurred primarily during the early stages of the war before the rule of law was restored, but the Nationalist violence was part of a conscious policy of terror. The proliferation of executions, murders, and assassinations on both sides reflects the great passions that the Civil War unleashed.

The captaincy of the Nationalists was gradually assumed by General Franco, leading forces he had brought from Morocco. On Oct. 1, 1936, he was named head of state and set up

a government in Burgos. The Republican government, beginning in September 1936, was headed by the socialist leader Francisco Largo Caballero. He was followed in May 1937 by Juan Negrín, also a socialist, who remained premier throughout the rest of the war and served as premier in exile until 1945. The president of the Spanish Republic until nearly the war's end was Manuel Azaña, an anticlerical liberal. Internecine conflict compromised the Republican effort from the outset. On one side were the anarchists and militant socialists, who viewed the war as a revolutionary struggle; on the other were the more moderate socialists and republicans, whose objective was the preservation of the Republic. Seeking allies against the threat of Nazi Germany, the Soviet Union had embraced a Popular Front strategy and the Comintern directed Spanish communists to support the Republicans.

Both the Nationalist and Republican sides turned abroad for help. Germany and Italy sent troops, tanks, and planes to aid the Nationalists. The Soviet Union contributed equipment and supplies to the Republicans, who also received help from the Mexican government. Initially the Popular Front government of France also supported the Republicans, but internal opposition forced a change of policy. In August 1936, France joined Britain, the Soviet Union, Germany, and Italy in signing a nonintervention agreement that would be ignored by the Germans, Italians, and Soviets. About 40,000 foreigners fought on the Republican side in the International Brigades largely under the Comintern's command, and 20,000 others served in medical or auxiliary units.

By November 1936 the Nationalists had laid siege to Madrid but were unable to get beyond the University City area. By October 1937, though, they held the whole northern coast. A war of attrition began. The Nationalists drove a salient eastward, reaching the Mediterranean and splitting the republic in two in April 1938. In December 1938, they forced the Republican armies in Catalonia northward toward France. By February 1939, 250,000 Republican soldiers, together with an equal number of civilians, had fled to France. On March 5 the Republican government flew to exile in France. On March 7 a civil war broke out in Madrid between communist and anticommunist factions. By March 28 the Republican armies had begun to disband and surrender, and Nationalist forces entered Madrid on that day.

Nationalist forces put the number of persons killed in the war at 1,000,000, including not only those killed in battle but also the victims of bombardment, execution, and assassination. More recent estimates have been closer to 500,000 or less. This does not include all those who died from malnutrition, starvation, and war-engendered disease.

The political and emotional reverberations far transcended those of a national conflict, for many in other countries saw the Spanish Civil War as part of an international conflict between tyranny and democracy, or fascism and freedom, or communism and civilization. The war also had mobilized many artists and intellectuals to take up arms. Among notable artistic responses to the war were the novels *Man's Hope* (1938) by André Malraux, *Homage to Catalonia* (1938) by George Orwell, *The Adventures of a Young Man* (1939) by John Dos Passos, and *For Whom the Bell Tolls* (1940) by Ernest Hemingway, as well as Pablo Picasso's painting *Guernica* (1937) and Robert Capa's photograph *Loyalist Soldier, Spain* (1936).

**Spanish lace,** lace made in Spain; the name is also erroneously given to much lace that was in fact imported into Spain from the 17th century onward. The Spaniards imported a great deal of Venetian needle lace for church use in the 17th century. When the Spanish monasteries were dissolved in 1830, much ecclesiastical lace came to light that was described as "Spanish point," but little, if any, of this can be said to be indigenous. Similarly, bobbin-made lace was imported from the Spanish-dominated parts of the Netherlands. At Barcelona, lace of a rather undistinguished sort was made in the 18th century, but good-quality lace for mantillas was imported from France, especially Chantilly. At the beginning of the 19th century, blonde and black blonde silk lace (*see* blonde lace) was made in Catalonia and La Mancha, the silk being spun near Barcelona. Various lace-making centres at different times have produced laces specifically in the Spanish style, which generally denotes a somewhat heavier than usual type of lace.



(Top) Spanish lace from Barcelona, mid-19th century, in the Victoria and Albert Museum, London; (bottom) Spanish lace from Nottingham, Eng., made by Brooksbank & Sanby, *c.* 1883, in the Museum and Art Gallery, The Castle, Nottingham, Eng.
By courtesy of (top) the Victoria and Albert Museum, London, (bottom) the Museum & Art Gallery, The Castle, Nottingham, England

**Spanish language,** Spanish ESPAÑOL, Romance language spoken by more than 250,000,000 persons in Spain, the Americas, and Africa. The earliest written materials in Spanish, in the form of glosses on Latin texts, date from the 10th century, and works of literature in Spanish first appeared *c.* 1150.

Spanish is also known (particularly in Latin America) as Castilian, after the dialect from which modern standard Spanish developed. That dialect arose in the 9th century around the town of Burgos, in north central Spain (Old Castile), and, as Spain was reconquered from the Moors, spread southward to central Spain (New Castile) around Madrid and Toledo by the 11th century. In the late 15th century the kingdoms of Castile and Leon merged with that of Aragon, and Castilian became the official language of all Spain. The regional dialects of Aragon, Navarre, Leon, Asturias, and Santander were crowded out gradually and today survive only in secluded rural areas. Galician, a Portuguese dialect spoken in northwestern Spain, was also much reduced.

The dialect of Spanish used in Arab-occupied Spain prior to the 12th century was called Mozarabic (*see* Mozarabic language). A remarkably archaic form of Spanish with many borrowings from Arabic, it is known primarily from Mozarabic refrains (called *kharjahs*) added to Arabic and Hebrew poems.

Outside the Iberian Peninsula, Spanish is spoken in virtually all of Central and South America except Brazil (where the closely related Portuguese language is spoken), as well as in the Canary Islands, parts of Morocco, and the Philippines. Latin-American Spanish has a number of regional dialects; all are derived from Castilian but differ in several points of phonology from European Spanish. Typical of Latin-American Spanish is the use of the *s* sound where Castilian has the lisplike *th* sound (*z* or *c* before *e* or *i* in spelling) and replacement of the Castilian *ly* sound (spelled *ll*) with a *y* sound or even with the *zh* sound of the *z* in English "azure" or the *j* in French *jour.*

In Spanish the case system of Latin has been completely lost except for subject and object forms for pronouns. Nouns are marked for masculine or feminine gender, and plurals are marked by the addition of *-s* or *-es;* adjectives change endings to agree with nouns. The verb system is complex but by and large regular; it uses indicative, imperative, and subjunctive moods, preterite, imperfect, present, future, conditional, and a variety of perfect and progressive tenses, and passive and reflexive constructions.

**Spanish lime** (*Melicoccus bijugus*), tree, of the soapberry family (Sapindaceae), native to the West Indies. It grows to about 15 metres (50 feet). The flowers are small, greenish white, and fragrant. The green fruit is a drupe (a single stony seed covered by soft, fleshy tissue) with yellow or white tasty, juicy flesh.



Spanish lime (*Melicoccus bijugus*)
W.H. Hodge

**Spanish literature,** the body of literary works produced in Spain, consisting principally of those written in Castilian but including those in the Catalan language and the Galician dialect as well. Although the latter two forms have substantial literary traditions, it was Castilian, with its political and linguistic predominance, that established itself as "Spanish."

A brief treatment of Castilian literature follows. For full treatment and a survey of Catalan and Galician letters, *see* MACROPAEDIA: Spanish Literature.

Literature in Castilian began to emerge in the 12th century. Its earliest surviving masterpiece, the epic poem *Poema* (or *Cantar*) *de mío Cid* ("Poem [or Song] of My Cid"), appeared *c.* 1140 and was followed by other heroic narratives centring on subjects from Castilian feudal history. Clerics and scholars also began to produce learned narrative poetry on devotional themes at this time.

Castilian prose was adopted in place of Latin for literary purposes in about the mid-1200s owing to the efforts of King Alfonso X of Castile and Leon. Compilations of Castilian laws, historical chronicles, and translations of Arabic scientific works were all undertaken in the vernacular under his direction. The 14th century saw the rise of such new forms as the moral tale and the chivalric romance. Spanish poetry came into its own with the *Libro de buen amor* (1330; "Book of Good Love") by Juan Ruiz and reached a considerable degree of sophistication in the Italian-influenced lyrics of the Marqués de Santilla and the allegorical epics of Juan de Mena. The first masterpiece of Spanish prose fiction, *La Celestina*

(1499), was a novel in dialogue form that was remarkable for the time in its psychological intensity and realism.

The unification of Spain in 1479 marked the beginning of the Renaissance there as well as the start of the Golden Age (*q.v.*) of Spanish literature. Garcilaso de la Vega revitalized Spanish lyric poetry with his adept transformation of Italian metres into Castilian verse. The mystic poets St. John of the Cross and St. Teresa of Avila treated spiritual and religious themes, while Luis de Góngora y Argote developed an ornate poetic style (*gongorismo*) that featured extravagant imagery, elaborate classical allusions, and complex syntax.

In prose fiction, various genres emerged to replace the chivalric romance that had so long dominated popular taste. The pastoral novel was derived from Italian literature and idealized simple rural life. The picaresque novel was a native Spanish form that originated with the anonymous *Lazarillo de Tormes* in 1554 and reached its height with Mateo Alemán's *Guzmán de Alfarache* (1599). In its description of the comical adventures of low-born rogues, the picaresque novel guided Spanish fiction to the direct and candid observation of society and its mores. The greatest novel of the Golden Age, however, was Miguel de Cervantes' classic *Don Quixote* (part 1, 1605; part 2, 1615), which raised contemporary fiction to a new level of psychological subtlety and social insight.

The Spanish drama, which had slowly evolved from medieval church plays, finally achieved artistic distinction in the work of Lope de Vega. Lope synthesized the disparate sources of the contemporary theatre and produced enormous numbers of plays that featured clever stagecraft and intricate, gripping plots. The most talented of Lope's successors were Tirso de Molina and Pedro Calderón de la Barca. While Tirso achieved considerable mastery of characterization, Calderón was unmatched in dramatic craftsmanship, producing tightly structured works whose formal artistry and thematic depth mark the high point of Spanish Baroque drama.

By 1681, when Calderón died, Spain was politically and economically prostrate. Literary creativity, too, seemed virtually extinct. Recovery came with the 18th-century Bourbon dynasty, whose remaking of Spanish culture on French classical lines promoted many new ideas and institutions but less by way of worthwhile literary production.

Spanish letters was reinvigorated by the Romantic movement, which arrived in Spain in the 1830s and achieved a rapid but brief ascendancy. Among the leading figures of Spanish Romanticism were the poet and playwright Ángel de Saavedra, the playwright José Zorrilla, and the lyric poet José de Espronceda. Saavedra's play *Don Alvaro o la fuerza del sino* (1835; "Don Alvaro; or, The Force of Destiny") embodied all the elements of the Romantic mode and triggered a series of works in a similar vein, culminating in Zorrilla's treatment of the Don Juan theme, *Don Juan Tenorio* (1844). After 1850 there appeared a new generation of poets—Gustavo Adolfo Bécquer, Rosalía de Castro, and Ramón de Campoamor—who succeeded in preserving the sensitivity and emphasis on feeling of the earlier Romantics while avoiding their formal and stylistic excesses.

Spanish prose literature of the first half of the 19th century was dominated by *costumbrismo,* a genre that focused on the customs and manners of the inhabitants of a particular Spanish region or locale. The satirical form of the short *costumbrismo* literary sketch became the principal vehicle for Mariano José de Larra, who mercilessly criticized the foibles of the Madrid bourgeoisie in his *Articulos* (1835–37). A second form of the *costumbrismo* sketch that emphasized local colour and folklore laid the groundwork for the realistic Spanish regional novel that reached predominance during the last half of the 19th century. *Marta y Maria* (1883) by Armando Palacio Valdés and *Penas arriba* (1893) by José María de Pereda are outstanding examples of the regional novel in their emphasis on the traditional values of religion, family, and country life. Juan Valera and Benito Pérez Galdós went beyond the limits of regional Realism, producing novels that dealt with broader and more universal concerns. Galdós in particular thought in national terms in the 46 novels of his *Episodios nacionales* (1873–79, 1898–1912), which recapitulate Spanish history during the 19th century. Emilia Pardo Bazán experimented with Naturalistic writing but quickly returned to regional Realism after recognizing the incompatibility of Spain's deeply Catholic outlook with the determinism of French Naturalism. The only major Spanish novelist who found both the doctrines and techniques of Naturalism congenial was Vicente Blasco Ibáñez, as evidenced by those of his early novels set in Valencia.

The ignominy of Spain's defeat in the Spanish–American War of 1898 caused many Spanish intellectuals to analyze the causes of Spain's long decline and reassess its traditional values, and a group of writers called the Generation of '98 soon attempted to revitalize their nation's cultural life. Foremost among them were the prose-fiction writers Miguel de Unamuno, Azorín (pseudonym of José Martínez Ruiz), Pío Baroja, and Ramón María del Valle-Inclán; the poets Antonio and Manuel Machado; and the philosopher-critic José Ortega y Gasset. The novelists among them broke from the regional Realist tradition, introducing innovative narrative and structural techniques as well as a new seriousness of purpose into the Spanish novel. The critical, psychological, and philosophical essay rose to new importance in Spain at this time, while many poets adapted the Modernist inventions of the Nicaraguan poet Rubén Darío.

Other significant Spanish literary artists during the early 20th century were the novelist Ramón Pérez de Ayala and the lyric poet Juan Ramón Jiménez. A group of brilliant poets known as the Generation of 1927 (Federico García Lorca, Pedro Salinas, Jorge Guillén, Vicente Aleixandre, and Rafael Alberti, among others) followed in the footsteps of the Machado brothers and Jiménez. They took inspiration from Spain's literary past as well as from contemporary trends such as Surrealism to produce an intensely personal poetry characterized by the sophisticated use of symbolic imagery and myth. During the early 20th century, Spanish drama achieved new vigour with the witty bourgeois satires of Jacinto Benavente y Martínez, the historical dramas of Eduardo Marquina, and the intense, lyrical tragedies of García Lorca.

The Spanish Civil War (1936–39) drove many gifted writers into political exile and broke the continuity of Spanish literature. The trauma of the war and its cultural and economic repercussions gave rise to various forms of intense realism in literature, as exemplified by the *tremendismo* (a blend of Naturalistic techniques and Existentialist views) of Camilo José Cela and the stark Social Realism of such politically committed novelists as Carmen Martín Gaite and Elena Quiroga. From the early 1960s, experimentation with structure, narrative technique, and language became a key concern, as seen in the works of Juan Goytisolo, José María Gironella, and others who had earlier embraced Social Realism. Formal and technical innovations similarly are important elements in the drama of Antonio Buero Vallejo and in that of Fernando Arrabal, a proponent of Absurdist theatre, while Alfonso Sastre favoured a more direct, committed approach to social problems in his writings.

Lyric poetry since the Civil War reflects a trend away from the complexities of the Modernists and the Generation of 1927 and toward a simpler approach stressing discipline of form, clarity of expression through direct imagery, and increased social content. This direction in lyric expression is best represented by the works of such poets as Gabriel Celaya, Blas de Otero, and Claudio Rodríguez.

**Spanish Marriages, Affair of the,** the political maneuvering surrounding the dual marriages (Oct. 10, 1846) of Queen Isabella II of Spain to her cousin Francisco de Asís de Bourbon, duke of Cadiz, and of her younger sister and heiress to the throne, Luisa Fernanda, to Antoine, duc de Montpensier, the youngest son of King Louis-Philippe of France. The marriages revived dynastic ties between Spain and France but caused the breakdown of friendly relations between England and France.

In 1843 and 1845 the French foreign minister, François Guizot, had assured the British that Isabella would marry within the Spanish or Neapolitan branches of the House of Bourbon and that her sister Luisa would not marry a French prince before the birth of one or more children to Isabella. This agreement was upset when, in June 1846, Viscount Palmerston returned to the British Foreign Office and revived the idea of a marriage between Isabella and Prince Leopold of Saxe-Coburg, the cousin of the English prince consort. Palmerston also opposed the French support of the Moderados, Spaniards who accepted the conservative royal constitution of 1834. The Spanish and French governments feared the British designs, including possible British support for the Progresistas, who sought restoration of the liberal constitution of 1812, and so they planned and carried out the double marriage. Isabella had to be pressured into accepting her cousin, partly because he was thought to be impotent. Palmerston fruitlessly protested that the marriages were contrary to the terms of the Treaty of Utrecht (1713), which forbade the union of the French and Spanish Bourbons. The effect of the rupture with Britain and the liberal principles it represented was to push Louis-Philippe into closer alliance with the conservatives, led by Guizot, at a time when the liberals were gathering strength. This alliance contributed to Louis-Philippe's downfall in 1848.

**Spanish moss,** also called BLACK MOSS, LONG MOSS, or VEGETABLE HORSEHAIR (*Tillandsia usneoides*), epiphyte (a nonparasitic plant that is supported by another plant and has aerial roots exposed to the humid atmosphere) of the pineapple family (Bromeliaceae). It is found in southern North America, the West Indies, and Central and South America.

The silvery-gray plant often grows in large, beardlike masses. It has threadlike stems up to 6 to 7.5 metres (about 20 to 25 feet) long. The leaves, also threadlike, are about 2.5 to 7.5 centimetres (1 to 3 inches) long. The yellow flowers, which appear rarely, are stalkless, have three yellow petals, and three sepals, and usually grow singly. Hairlike scales that cover the whole plant absorb water from the air. Spanish moss sometimes is used as a filler in packing boxes and as upholstery.

**Spanish Netherlands** (*c.* 1579–1713), Spanish-held provinces located in the southern part of the Low Countries (roughly corresponding to present Belgium and Luxembourg).

Although the provinces of the Low Countries had for some years and for many reasons been chafing under foreign rule, the revolt against Spain received its major impetus from the zeal of members of the nascent Calvinist movement. It was to quell their insurrection that Fernando Álvarez de Toledo y Pimen-

tal, duque (duke) de Alba, was sent in 1567. His harsh, repressive measures (*see* Troubles, Council of) and heavy taxation met with immediate resistance. King Philip II, recognizing his mistake, recalled the hated Alba in 1573. Although the largely Roman Catholic southern provinces had remained loyal to Spain to this time, an active Protestant movement and the growing desire to be autonomous influenced them to join in a united resistance to Spain. In 1576 delegates from the union of northern and southern provinces, known collectively as the States General, met and issued the Pacification of Ghent (*see* Ghent, Pacification of). Yet within three years it was apparent that the religious truce would not hold. The differences between the agrarian, Roman Catholic south and the commercial–industrial, Calvinist-dominated north were too great. In addition, the Spanish king had chosen as his representative Alessandro Farnese (later duke of Parma), well known for his diplomatic and military skills. By emphasizing Roman Catholic unity and showing moderation in his treatment of the Protestants in the south, he regained the confidence of the southern provinces and reestablished Spanish control over them; by 1585 the union of the northern and southern Low Countries was over.

Despite the warfare and confusion, the Spanish Netherlands experienced a resurgence of economic and intellectual growth in the early 17th century. The linen industry quickly recovered from the Spanish reconquest and soon surpassed its former production levels. Flemish painting flourished in the hands of Peter Paul Rubens, Anthony van Dyck, and others. The major cities of Ghent and Bruges grew rapidly. Agriculture advanced through the digging of canals and the introduction of new crops and harvesting methods, and prosperity continued into the mid-17th century.

Although the southern provinces were far from independent, they did experience a considerable degree of freedom in internal affairs. They controlled their own judiciary system and set up councils to aid the governor general. They also enjoyed the privileges established with the Joyeuse Entrée (*q.v.*). Foreign affairs, however, were strictly the domain of the Spanish throne.

Beset on all sides, the Spanish Netherlands was the scene of constant warfare. It was in the unfortunate position of being a buffer between Protestant and Roman Catholic states. Consequently, it was mercilessly carved up. Northern Brabant, Zeeland, and the region east of the Meuse River was ceded to the United Provinces (Dutch Republic) in 1648. The county of Artois was taken by France in 1659, to be followed later by large southern portions of Hainaut, Luxembourg, and Flanders. In 1648 the Peace of Münster closed the flourishing port of Antwerp to foreign trade.

Under these conditions, the territory began to decline. Spanish control was lost when Charles II of Spain died without issue (1700), naming Philip, duc d'Anjou of France as his successor (as Philip V). The Spanish Netherlands was ruled for six years by Bourbon France and occupied for another seven by British and Dutch troops. In 1713 the Treaties of Utrecht divided the Spanish inheritance, and rule of the Spanish Netherlands passed to the Holy Roman emperor Charles VI and the Austrian Habsburgs (*see* Austrian Netherlands).

**Spanish North Africa,** five small areas, in special relationship with the Spanish government, on and off the Mediterranean coast of Morocco. They are Alhucemas, Ceuta, the Chafarinas Islands, Melilla (*qq.v.*), and Peñón de Vélez de la Gomera, with a combined area of about 12 square miles (31 square km). Ceuta is administered as part of Cádiz province, the rest as part of Málaga province.

**Spanish Riding School of Vienna,** also called (until 1918 and 1939–45) SPANISH IMPERIAL RIDING SCHOOL, German SPANISCHE REITSCHULE WIEN, or SPANISCHE HOFREITSCHULE, school of classical horsemanship in Vienna, probably founded in the late 16th century. It is the only remaining institution where haute école ("high school") riding and training methods are exclusively practiced, much as they were in the 18th century. The school is particularly noted for its white Lipizaner (*q.v.*) horses, bred especially for haute école performance. The horses were originally imported from Spain, giving the school its name.

**Spanish Sahara** (West Africa): *see* Western Sahara.

**Spanish Socialist Workers' Party,** Spanish PARTIDO SOCIALISTA OBRERO ESPAÑOL (PSOE), Socialist party that played an important role in 20th-century Spanish politics. The party was founded in 1879 by the Madrid typographer Pablo Iglesias. He was also the founder in 1888 of the party's affiliated trade union confederation, the Unión General de Trabajadores (UGT; General Union of Workers). The party grew slowly at first, partly because the UGT had to compete with the anarchist trade union confederation in organizing the working class. But by the time the Spanish Republic was proclaimed in 1931, the PSOE was the largest political party in the country. It participated in coalition governments during the years 1931–36. The Socialists were among the principal supporters of the Republic during the Spanish Civil War, and the head of the UGT, Francisco Largo Caballero, served as prime minister of Republican Spain during 1936–37. The PSOE was banned following the victory of the Nationalist forces and the fall of the Republic in 1938.

The PSOE was revived during the 1970s as the Nationalist regime of Francisco Franco waned. The internal wing of the party took over the leadership from its aging, exiled leaders in 1972 and elected the young Felipe González as the party's secretary-general. The PSOE, along with other political parties, was legalized in 1977 and took about 30 percent of the vote in national elections that year. González and other pragmatic leaders dropped the party's official Marxist-Socialist orientation in 1979 and thereafter managed to woo large numbers of middle-class and moderate voters.

The Socialists won a sweeping victory in the 1982 national elections. The charismatic and highly popular González became prime minister, and his party was easily retained in power in elections during 1986. By the time of their initial victory, the Socialists were a rather moderate party that spurned large-scale nationalization but favoured government planning and intervention to facilitate the equitable distribution of income. They were strongly democratic and advocated liberalizing divorce and other social laws. They supported Spain's membership in the European Economic Community and, once they came to power, in NATO. The party held office continuously from 1982 until March 1996, when it lost the general election to the conservative Popular Party (*q.v.*) after suffering a series of financial and security scandals.

**Spanish Succession, War of the** (1701–14), conflict that arose out of the disputed succession to the throne of Spain following the death of the childless Charles II, the last of the Spanish Habsburgs. In an effort to regulate the impending succession, to which there were three principal claimants, England, the Dutch Republic, and France had in October 1698 signed the First Treaty of Partition, agreeing that on the death of Charles II, Prince Joseph Ferdinand, son of the Elector of Bavaria, should inherit Spain, the Spanish Netherlands, and the Spanish colonies. Spain's Italian dependencies would be detached and partitioned between Austria (to be awarded the Duchy of Milan) and France (Naples and Sicily). In February 1699, however, Joseph Ferdinand died. A second treaty, signed on June 11, 1699, by England and France and in March 1700 by the Dutch Republic, awarded Spain and the Spanish Netherlands and colonies to Archduke Charles, second son of the Holy Roman emperor Leopold I, and Naples, Sicily, and other Spanish territories in Italy to France. Leopold, however, refused to sign the treaty, demanding that Charles receive all the Spanish territories intact. The Spanish grandees likewise did not recognize it, being unalterably opposed to partition. Charles II allowed himself to be persuaded that only the House of Bourbon had the power to keep the Spanish possessions intact, and in the autumn of 1700 he made a will bequeathing them to Philip, duc d'Anjou, grandson of Louis XIV of France. On November 1 he died, and on November 24 Louis XIV proclaimed his grandson king of Spain, as Philip V (the first Bourbon king of Spain), and then invaded the Spanish Netherlands. An anti-French alliance was formed (Sept. 7, 1701) by England, the Dutch Republic, and the emperor Leopold. They were later joined by Prussia, Hanover, other German states, and Portugal. The electors of Bavaria and Cologne and the dukes of Mantua and Savoy allied themselves with France, although Savoy switched sides in 1703. William III of England, a strong opponent of Louis XIV, died in 1702, but the government of his successor, Queen Anne, upheld the vigorous conduct of the war. John Churchill, duke of Marlborough, played the leading role in Queen Anne's government and on the battlefield until his fall in 1711. He was ably seconded on the battlefield by the imperial general Prince Eugene of Savoy.

The markedly superior generalship of Marlborough and Eugene brought them a series of victories over France from 1704 to 1709. A Franco-Bavarian offensive in Germany was smashed at Blenheim in 1704. The French were then driven out of the Low Countries by the battles of Ramillies in 1706 and Oudenaarde in 1708. The French were also expelled from Italy after their attempted siege of Turin was broken (Sept. 7, 1706) by Eugene's brilliant campaign. The only theatre of the land war in which the alliance had no real success was Spain, where Philip V successfully maintained his position.

Louis XIV sought to end the war from 1708 and was willing to give up the Spanish inheritance to the House of Habsburg. The British, however, insisted on the unrealistic demand that Louis use his army to remove his own grandson from Spain. Louis refused, broke off negotiations, and resumed the war. Two developments in 1711 altered the situation in favour of France. On April 17, 1711, Archduke Charles became heir to all the Austrian Habsburg possessions. Britain and the Dutch had no intention of continuing the war in order to give him the Spanish inheritance as well and thereby resurrect the old empire of Charles V. In Britain the enemies of Marlborough won influence with the Queen and had him removed from command on Dec. 31, 1711. With the collapse of the alliance, peace negotiations began in 1712. Because of the conflicts of interest between the former allies, each dealt separately with France. The first group of treaties was signed at Utrecht in April 1713. These and the later treaties of Rastatt and Baden ignored the will of Charles II and divided his inheritance among the powers. Louis XIV's grandson remained king of Spain, but the treaties of Utrecht marked the rise of the power of Britain and the British colonial empire at the expense of both France and Spain.

**Spanish Town,** city, southeastern central Jamaica. It is situated along the Rio Cobre, 10 miles (16 km) west of Kingston. Probably laid out by Diego Columbus (*c.* 1523), it was originally called Santiago de la Vega (St. James of the Plain) and was Jamaica's capital from 1692 until 1872. It is now a commercial and processing centre for produce of the irrigated Liguanea Plain (bananas, sugarcane, annatto, breadfruit, coffee, cacao, and citrus fruit). The most striking historical buildings of Spanish Town include St. Catherine's Cathedral (1655), the Rodney Memorial, the House of Assembly, the Court House, and the 17th-century Eagle House. The ruined Old King's House (1762) was the official residence of Jamaica's governors until 1870; it was destroyed by fire in 1925. The new National Repository contains documents going back as far as the early years of English settlement. The Jamaica School of Agriculture was founded in Spanish Town in 1910. Pop. (1982) 89,097.

**Spanish treasure fleet,** from the 16th to the 18th century, Spanish convoy of ships transporting European goods to the Spanish colonies in the Americas and transporting colonial products, especially gold and silver, back to the mother country.

Beginning in the 1560s, shipping between Spain and the Americas was organized on a regular basis. Two fleets of between 30 and 90 vessels sailed from Seville to the American colonies each year: the *flota* left in the spring for Vera Cruz, in what is now Mexico, detaching ships in the West Indies and at Honduras on the way; the *galeones,* or Tierra Firme fleet, left in August for Cartagena, in present Colombia, and Porto Bello (now Portobelo), on the Atlantic coast of Panama. After wintering in America, both fleets met at Havana the following spring and returned to Spain together, protected by warships.

The immense wealth in gold and silver carried by these fleets on the return voyage offered a tempting prize to English, Dutch, and French seamen. One fleet was looted and destroyed by the Dutch admiral Piet Hein off Cuba (1628) and another by the English under Robert Blake in the Azores (1657), but usually the Spanish treasure fleet presented a formidable challenge to marauders.

By the 18th century, Spain had greater control over the sea-lanes and had changed its policies to allow freer trade among Spanish and American ports. As unlimited sailings became the norm, the fleet system declined in importance. The *galeones* were discontinued in 1740 and the *flota* in 1789. *See also* Manila galleon.

**spanner** (hand tool): *see* wrench.

**Spark, Muriel (Sarah),** *née* CAMBERG (b. Feb. 1, 1918, Edinburgh), British novelist, critic, poet, and playwright who progressed from fantastic themes to a preoccupation with the weighty and malign. Her best-known novel



Muriel Spark
Camera Press—Pictorial Parade/EB Inc.

is *The Prime of Miss Jean Brodie* (1961), which also became popular in its stage (1966) and film (1969) versions.

Educated in Edinburgh, Muriel Spark spent some years in Central Africa and then returned to Great Britain during World War II. Thereafter she served as general secretary of the Poetry Society and editor of *The Poetry Review* (1947–49) and later published a series of critical biographies of literary figures and editions of 19th-century letters, including *Child of Light: A Reassessment of Mary Shelley* (1951), *John Masefield* (1953), and *The Brontë Letters* (1954). She converted to Roman Catholicism in 1954, and much of her work concerns questions of good and evil.

Many of Muriel Spark's early novels—such as *The Ballad of Peckham Rye* (1960) and *The Girls of Slender Means* (1963)—were characterized by a mildly humorous fantasy. *The Mandelbaum Gate* (1965), however, marked a departure toward weightier themes, and later novels—*The Driver's Seat* (1970, film 1974), *Not to Disturb* (1971), and *Loitering with Intent* (1981)—are of a distinctly sinister nature. Her novel *The Abbess of Crew* (1974) was made into the film *Nasty Habits* (1977). *Territorial Rights* (1979) is lighter and livelier. Other works include *Collected Poems I* and *Collected Stories I* (both 1967).

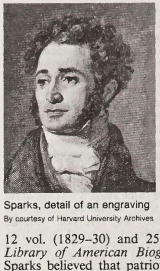
**spark chamber,** radiation detector useful for the investigation of subatomic particles in high-energy particle physics. It consists of a series of thin metal plates, parallel to each other, separated by small gaps, and enclosed in a container filled with neon or another inert gas. A very high potential drop, or voltage, is applied as a brief pulse across the two sets of alternate plates. Sparks are produced between the plates along the paths of charged subatomic particles that enter or are produced within the spark chamber because the particles leave a trail of ionized gas molecules that conduct a current. The paths of ionization remain in the chamber for about a millionth of a second, a sufficient time interval for a logic circuit to identify whether the particles that have emerged are of interest and consequently whether the high voltage pulse be sent to the plates and the resultant spark pattern be photographed for later analysis.

**spark plug,** also called SPARKING PLUG, device that fits into the cylinder head of an internal-combustion engine and carries two electrodes separated by an air gap, across which current from a high-tension ignition system discharges, to form a spark for igniting the fuel. The electrodes must be able to resist high temperatures, and the insulator separating them must withstand high temperatures and also an electric stress up to several thousand volts. Spark-gap length affects the energy of the spark, and the shape of the insulator affects the temperature of operation. When too cool, operation leads to carbonization and short-circuiting of the gap; when too hot, there may be preignition.

**Sparks, Jared** (b. May 10, 1789, Willington, Conn., U.S.—d. March 14, 1866, Cambridge, Mass.), American publisher and editor of the *North American Review,* biographer, and president of Harvard College.

Educated at Phillips Exeter Academy and Harvard College, Sparks served as minister of the First Independent Church (Unitarian) from 1819 to 1823. From then until 1830, under his ownership and editorship, the *North American Review* became the arbiter of literature in New England. He was appointed the first professor of secular history at Harvard and served as president of the college from 1849 to 1853.

He was the author of biographies of Benjamin Franklin, George Washington, and Gouverneur Morris. He edited *The Diplomatic Correspondence of the American Revolution,*

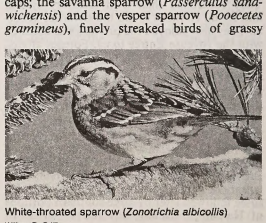


Sparks, detail of an engraving
By courtesy of Harvard University Archives

12 vol. (1829–30) and 25 volumes of *The Library of American Biography* (1834–48). Sparks believed that patriotism obliged him, when editing source materials, to omit passages likely to cause international ill will, and he sometimes embellished what the Founding Fathers had actually written. The exacting scholarly standards of a later age rendered much of his work obsolete.

**sparrow,** any of a number of small, chiefly seed-eating birds having conical bills. The name sparrow is most firmly attached to birds of the Old World family Ploceidae (*q.v.*; order Passeriformes), particularly to the house sparrow (*q.v.; Passer domesticus*) that is so common in temperate North America and Europe, but also to many New World members of the Fringillidae. The house sparrow and its relatives, however, probably do not belong in Ploceidae and may be classified as a separate family, Passeridae.

Most members of the New World family Fringillidae (subfamily Emberizinae) are called sparrows. Examples breeding in North America are the chipping sparrow (*Spizella passerina*) and the tree sparrow (*S. arborea*), trim-looking little birds with reddish-brown caps; the savanna sparrow (*Passerculus sandwichensis*) and the vesper sparrow (*Pooecetes gramineus*), finely streaked birds of grassy



White-throated sparrow (*Zonotrichia albicollis*)
William D. Griffin

fields; the song sparrow (*Melospiza melodia*) and the fox sparrow (*Passerella iliaca*), heavily streaked skulkers in woodlands; and the white-crowned sparrow (*Zonotrichia leucophrys*) and the white-throated sparrow (*Z. albicollis*), larger species with black-and-white crown stripes. The rufous-collared sparrow (*Z. capensis*) has an exceptionally wide breeding distribution: from Mexico and Caribbean islands to Tierra del Fuego. A great many emberizine sparrows are native to Central and South America. *See also* accentor.

**sparrowhawk,** any of various small birds of prey usually of the genus *Accipiter* (family Accipitridae), classified with the goshawks as "accipiters," or true hawks. They eat small birds such as sparrows, small mammals, and insects.

The African little sparrowhawk (*A. minullus*), slate gray above with white tail bars, barred white below, inhabits woods of East and South Africa. The Eurasian sparrowhawk (*A. nisus*), dark gray above and brown barred white below, is a common inhabitant of wooded areas

throughout Europe, in coastal northwestern Africa, and in temperate to sub-Arctic forests of Asia. The Levant sparrowhawk, or shikra (*A. brevipes*), is gray above and brown barred white below. It occurs from southeastern Eu-



Eurasian sparrowhawk (*Accipiter nisus*)
Stephen Dalton—EB Inc.

rope throughout most of continental southern Asia and subequatorial Africa. For the small falcon called sparrow hawk in the United States, *see* kestrel.

**Sparta,** Modern Greek SPARTÍ, historically LACEDAEMON, ancient capital of the Laconia district of the southeastern Peloponnese, Greece, and capital of the present-day *nomós* (department) of Lakonía on the right bank of the Evrótas Potamós (river). The sparsity of ruins from antiquity around the modern city reflects the austerity of the military oligarchy that ruled the Spartan city-state from the 6th to the 2nd century BC.

A brief treatment of ancient Sparta follows. For full treatment, *see* MACROPAEDIA: Greco-Roman Civilization, Classical.

Reputedly founded in the 9th century BC with a rigid oligarchic constitution, the state of Sparta for centuries retained as lifetime corulers two kings who arbitrated in time of war. In time of peace, power was concentrated in a Senate of 30 members. Between the 8th and 5th century BC, Sparta subdued Messenia, reducing the inhabitants to serflike status. From the 5th century the ruling class of Sparta devoted itself to war and diplomacy, deliberately neglecting the arts, philosophy, and literature, and forged the most powerful army standing in Greece.



The Metropolis (cathedral) dedicated to St. Demetrios at Mistra, ruined Byzantine city near Sparta, Gr.
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Sparta's single-minded dedication to rule by a militarized oligarchy precluded any hope of a political unification of classical Greece, but it performed a great service in 480 BC by its heroic stand at Thermopylae and its subsequent leadership in the Greco-Persian wars. The Battle of Salamis (480) revealed the magnitude of Athenian naval power and set in motion the deadly struggle between the two powers that ended in Athenian defeat at the close of the Peloponnesian War in 404 and the emergence of Sparta as the most powerful state in Greece. In the Corinthian War (395–387) Sparta had two land victories over Athenian allied states and a severe naval defeat at Cnidus by a combined Athenian and Persian fleet. Sparta's involvement in Persian civil wars in Asia Minor under Agesilaus II (ruled 399–360) and the subsequent Spartan occupation (382) of the Theban citadel, Cadmea, overextended Spartan power and exposed the state to defeat at Leuctra (371) by the Theban Epaminondas, who went on to liberate Messenia. A century-long decline followed.

Sparta's continued agitation spurred Rome's war on the Achaeans (146) and the Roman conquest of the Peloponnese. In AD 396 the modest city was destroyed by the Visigoths. The Byzantines repopulated the site and gave it the ancient Homeric name Lacedaemon. After 1204 the Franks built a new fortress city, Mistra, on a spur of the Taygetus range southwest of Sparta; after 1259 Mistra was capital of the Despotate of Morea (*i.e.,* the Peloponnese) and flourished for about two centuries. From 1460 until the War of Greek Independence (1821–29), except for a Venetian interlude, the region was under Turkish rule.

The present-day town was built in 1834 on the ancient site; it is called Néa (New) Spartí locally to distinguish it from the ruins that were excavated in 1906–10 and 1924–29. A small commercial and industrial centre of the Eurotean plain, the city trades in citrus fruits and olive oil. As in antiquity, it is served by the small port of Githion, modern Greek Yithion (*q.v.*), 28 miles (45 km) southeast, to which it is linked by a paved road. Pop. (1981) metropolitan area, 14,388.

**Spartacus** (d. 71 BC), leader in the Gladiatorial War (73–71) against Rome.

A Thracian by birth, Spartacus served in the Roman Army, perhaps deserted, led bandit raids, and was caught and sold as a slave. With about 70 fellow gladiators he escaped a gladiatorial training school at Capua in 73 and took refuge on Mount Vesuvius, where other runaway slaves joined the band. After defeating two Roman forces in succession, the rebels overran most of southern Italy. Ultimately their numbers grew to at least 90,000. Spartacus defeated the two consuls for the year 72 and fought his way northward toward the Alps, hoping to be able to disperse his soldiers to their homelands once they were outside Italy. When his men refused to leave Italy, he returned to Lucania and sought to cross his forces over to Sicily but was thwarted by the new Roman commander sent against him, Marcus Licinius Crassus. Hemmed in by Crassus' eight legions, Spartacus' army divided; the Gauls and Germans were defeated first, and Spartacus himself ultimately fell fighting in pitched battle. Pompey's army intercepted and killed many slaves who were escaping northward, and 6,000 prisoners were crucified by Crassus along the Appian Way.

Spartacus was apparently both competent and humane, although the revolt he led inspired terror throughout Italy. Although his uprising was not an attempt at social revolution, his name has frequently been invoked by revolutionaries such as Adam Weishaupt in the late 18th century and Karl Liebknecht, Rosa Luxemburg, and the other members of the German Spartacus League of 1916–19.

**Spartacus League,** German SPARTAKUSBUND, revolutionary socialist group active in Germany from autumn 1914 to the end of 1918. It was officially founded in 1916 by Karl Liebknecht, Rosa Luxemburg, Clara Zetkin, and Franz Mehring. The name derived from their illegally distributed pamphlets *Spartakusbriefen* (Spartacus Letters). The league developed as an offshoot of the Social Democratic Party, among elements who violently opposed Germany's role in World War I and who called for a socialist revolution.

The Spartacus League was transformed into the Communist Party of Germany at a party congress held from Dec. 30, 1918, to Jan. 1, 1919. Meanwhile, the Spartacists had encouraged demonstrations in December that led to the abortive Spartacus Revolt in Berlin in January 1919. On January 15, Luxemburg and Liebknecht were arrested and murdered in Berlin by members of the conservative Free Corps (Freikorps), who had seized control of the city's police presidium.

**Spartan alliance:** *see* Peloponnesian League.

**Spartanburg,** city, seat (1785) of Spartanburg County, in the Piedmont section of northwestern South Carolina, U.S. It lies in the foothills of the Blue Ridge Mountains, 30 miles (48 km) northeast of Greenville. The name is derived from the Spartan Rifles, a regiment of local militia that fought in the American Revolution. Established first as a courthouse village in 1785, the community was in an area noted before 1860 for ironworks, cotton planting, and a few cotton mills. After 1865 growth was accelerated by the intersection of three major rail lines at Spartanburg. Its diversified industry now includes textile mills, metalworking plants, the manufacture of machinery, office furniture, chemicals, clothing, ceramics, and carpets. Agriculture is still an important economic factor, the chief products being peaches, cotton, livestock, and poultry.

Spartanburg is the site of Wofford College (1854; Methodist), Converse College (1889), Spartanburg Methodist College (1911), a branch of the University of South Carolina (1967), and Spartanburg Technical College (1961). The South Carolina School for the Deaf and Blind (1849) is a few miles south. In Morgan Square stands a bronze statue of a Revolutionary rifleman, in memory of General Daniel Morgan, commander of American forces at the Battle of Cowpens (Jan. 17, 1781), fought 12 miles (19 km) northeast of Spartanburg. Inc. 1831. Pop. (1990) city, 43,467; Greenville-Spartanburg MSA, 640,861.

**Spassky, Boris Vasilyevich** (b. Jan. 30, 1937, Leningrad), Soviet chess master, world champion from 1969 to 1972.

When Spassky was evacuated from Leningrad during World War II to a children's home in Kirov Region, he learned to play chess. While still in his teens he gained the rank of international master (1953). In 1955 he won the World Junior Championship, and the same year he won the title of international grand master. In the following years, however, he was overshadowed by the rise of the young Riga chess genius Mikhail Tal and also was occupied with his journalism studies at Leningrad University. In 1966, still having little international reputation, Spassky first challenged Tigran Petrosyan for the world title, but he was not successful at taking the title until three years later. Spassky's style was characterized by an adaptability rarely matched in the history of chess. His victory over Petrosyan was narrow (12½–10½), however, and his subsequent tournament results were unremarkable. In 1972 he lost the world title to Bobby Fischer of the United States.

**spatial disorientation,** the inability of a person to determine his true body position, motion, and altitude relative to the earth or his surroundings. Both airplane pilots and underwater divers encounter the phenomenon.

Most clues with respect to orientation are derived from sensations received from the eyes, ears, muscles, and skin. The human sensory apparatus, however, is often not delicate enough to perceive slow and gradual changes in motion; also, when motion changes are abrupt, the sense organs tend to overestimate the degree of change. Spatial disorientation in aircraft can arise from flight situations or visual misinterpretation. Banks and turns often create false sensations. When turning gradually, a pilot may feel as though he were on a straight course but ascending; when a turn is corrected, the impression is that of descending. If the plane banks or ascends or descends slowly, the pilot may not perceive the change, and the plane will feel level to him. If the plane skids while turning, the sensation is one of being banked in the direction opposite from the skid. A reaction called "leans" is caused by level flight after a rapid roll; the inertia of the roll causes the body to lean in a direction opposite to the direction of turning even after the motion of the roll has been stopped. If the pilot rapidly looks downward while turning, the so-called Coriolis effect occurs, in which the plane feels as though it is descending. The usual reaction of the pilot is to pull back on the stick to raise the plane. In a spin, the illusion of nonmotion is created if the spin is continued long enough; when the pilot corrects the spin, he has the feeling of spinning in the opposite direction, and his natural reaction is to counter his corrective measures and go back into the original spinning pattern. This phenomenon is known as the "graveyard spin." The "graveyard spiral" results when the sensation of turning is lost in a banked turn. Because the pilot's instruments show that he is losing altitude, he may pull back on the stick and add power, thus inducing a spiral motion. The oculogyral illusion is created by acceleration and turning; a turning target watched by a pilot while turning himself appears to move faster than it is actually going; it may appear to continue to turn even after the pilot has stopped his motion and the target has stopped. Another illusion is caused by forward acceleration: when a pilot takes off from land, the increased speed gives the impression of nosing the plane too high; to compensate the pilot may lower the nose and dive back to the ground. During a rapid deceleration the nose of the plane appears to drop; if the pilot corrects this feeling by trying to gain more altitude, the plane stalls and goes into a spin. The gravitational forces on a pilot cause the oculoagravic illusions: a target watched by a pilot appears to rise if weightlessness occurs and appears to fall when gravity is increased.

Visual misinterpretations do not usually depend on acceleration factors or on the sense of equilibrium but, rather simply, on visual illusions. The autokinetic phenomenon is the apparent wandering of an object or spot of light; when following another plane at night, the pilot may have trouble distinguishing between real and apparent movements of the lead plane. If two planes are flying parallel and level but at different speeds, they give the pilots the illusion of turning. Ground lights can be mistaken for the horizon or stars; fixed beacon lights can be mistaken for another plane flying in formation.

The only measures that can prevent spatial disorientation are thorough training and instrumentation.

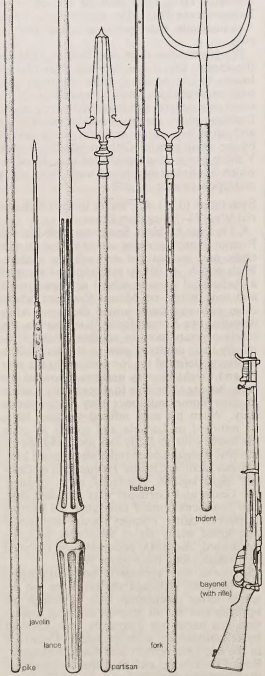
**spatterware,** in the United States, American and English pottery of about 1800–50 with patterns either spattered or sponged on. The technique has a wider incidence in pottery history, however, occurring, for instance, in Staffordshire, England, about 1750. About 1800–20 spatterware was made at the Wedgwood factory in England, sometimes specifically for sale in the United States, where it was also made.

**SPD** (German political party): *see* Social Democratic Party of Germany.

**speaker** (electronics): *see* loudspeaker.

**spear,** a pole weapon with a sharp point, either thrown or thrust at an enemy or prey. It appears in an infinite variety of forms in societies around the world.

One of the earliest weapons devised by man, the spear was originally simply a sharpened stick. Primitive peoples used spears primarily as thrown weapons. When military practice evolved from the independent action of individuals to the group movements of masses of soldiers, the spear became a thrusting weapon. It took the form of the pike, the lance, and later the ax-bladed halberd, among other variations. The spear-carrying phalanx, or massed formation of closely ranked men, was used by Sumerian armies as early as 3,000 BC. Two thousand years later the Greeks refined the concept, using pikes 6 to 9 feet (2 to 3 m) long. Around 350 BC, Philip II of Macedon introduced the sarissa, a pike 13 to 21 feet (4 to 6.5 m) long that gave the Macedonian infantry an extra reach before the pike blades of the opposing Greeks could reach them. These close formations of men marched or ran toward their opponents bristling with spear points, which they then thrust into the enemy's line. Alexander the Great used sarissa-equipped infantry to conquer his huge empire.



Major types of spears

Roman legionaries used the pilum, a heavy seven-foot-long javelin. Foot soldiers were not the only ones to use spearlike weapons. Greek, Macedonian, and Roman cavalry and the mounted knights of the European Middle Ages all carried lances. Pole-arms and tactics evolved along these lines until the 14th, 15th, and 16th centuries, when soldiers used elaborate pikes like the halberd—a combination spear with a point, an ax-blade for cleaving helmets, and a hook for pulling armoured knights off their horses. The masters of pike warfare in this period were the Swiss, who were employed as fighters by various European monarchs. Then the introduction of gunpowder weapons gradually rendered the pike, lance, halberd, and other pole-arms largely obsolete. The modern bayonet attached to a rifle, however, may be considered a thrusting spear. *See also* halberd; lance; pike.

**spear-thrower,** also called THROWING-STICK, or ATLATL, a device for throwing a spear (or dart) usually consisting of a rod or board with a groove on the upper surface and a hook, thong, or projection at the rear end to hold the weapon in place until its release. Its purpose is generally to give greater range to the spear.

Usually constructed of wood, bamboo, bone, or antler, the spear-thrower performs the function of an extra joint in the arm. The spear lies along the spear-thrower, with its butt resting against a projecting peg or in the slight socket made by the septum of the node (in the case of bamboo devices). Typical of Australia, the spear-thrower is also used in parts of New Guinea and in some of the islands of Micronesia, and it was formerly used in Central and South America, as among the Mayan and the Aztecs (who called it the atlatl). Eskimo and Indian tribes of the northwest coast of North America also used it for discharging harpoons and fish spears. In East Africa an unusual form of spear-thrower consisted of a shaft of wood with a hollowed-out, swollen head into which the butt of the spear was placed. The man then manipulated the thrower as though it were a part of the spearshaft, but it did not leave his hand.

Allied to these spear-throwers is the becket, a short length of cord that operates like a sling, causing the hurled spear to spin as it flies. A similar contrivance used by the soldiers of ancient Greece and Rome was also used by some North African peoples; it differs from the becket in that the cord is attached to the spear and is not retained in the hand.

**spearfish,** any of certain marine fishes of the genus *Tetrapterus,* family Istiophoridae (order Perciformes). Spearfishes are characterized by a relatively short snout in comparison with other spear-nosed fishes. Several species may be recognized; two, *T. audax* and *T. albidus,* are commonly called marlin (*q.v.*). The shortbill, or short-nosed, spearfish (*T. angustirostris* or *T. brevirostris*) is a Pacific member of the genus—scarce, little-known, and rather small

for a billfish. Blue above and silvery below, it usually does not exceed 1.8 m (6 feet) and 27 kg (60 pounds). The species *T. belone* is a Mediterranean form resembling *T. angustirostris.*

**spearfishing,** the sport of underwater hunting that became popular in the early 1930s and after World War II spread rapidly throughout the world.

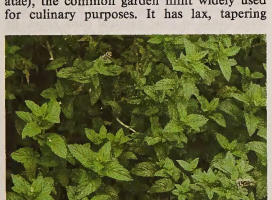
Underwater weapons range from the simple hand spear to guns capable of penetrating the largest fish. The simplest weapon is the Hawaiian sling, a hollow wooden tube with an elastic loop at one end. The shaft, which is tipped by one of a variety of spearheads, is drawn through the tube and pulled back, stretching the loop. When released, the shaft is propelled forward. In the mid-1930s, Alec Kramarenko patented an underwater gun in which the spear was propelled by a compressed spring. Shortly after, there appeared a spring-propulsion-type gun invented by a Frenchman, Maxime Forlot, and the popular spear gun designed by his compatriot Georges Beuchat and propelled by a rubber elastic band. Other guns were designed that used gunpowder, carbon dioxide, or compressed air to propel the spear; one of the latter type, invented in 1956 by Juan Vilarrubis of Spain, became popular because of its accuracy, power, and simplicity of operation.

The foregoing are rifle-type weapons in which the spear either travels through a long barrel or is guided along its upper surface. In all of them the spear shaft is released by a trigger mechanism. Spearfishing guns often have a line attached to the shaft, making retrieval easier. On strike, the line holds the quarry securely. The targets of underwater hunters may include sharks, barracuda, and fish weighing several hundred pounds, as well as the ordinary game prized by fishermen everywhere.

Stalking and shooting his quarry underwater is usually only the beginning of a skin diver's battle. After a fish is hit, it must be held on a harpoon line and landed. With large fish this may mean an underwater ride as the diver is towed through the water.

Underwater spearfishing is so popular among diving clubs that local, national, and international competitions are held each year. The competitions do not permit the use of scuba, and the contestants dive while holding their breath.

**spearmint** (species *Mentha spicata*), aromatic herb of the mint family (Lamiaceae, or Labiatae), the common garden mint widely used for culinary purposes. It has lax, tapering



Spearmint (*Mentha spicata*)
Runk/Schoenberger from Grant Heilman

spikes of flowers similar to peppermint flowers and sharply serrated leaves that are used fresh or dried to flavour many foods, particularly sweets, beverages, jellies, salads, soups, cheeses, meats, fish, sauces, fruits, and vegetables. The aroma and taste of spearmint are similar to those of peppermint but less strong. Native to Europe and Asia, spearmint has been naturalized in North America.

Oil obtained from spearmint leaves is used to flavour candies and jellies. The principal component is carvone.

**special economic zone** (SEZ), Chinese (Wade-Giles) CHING-CHI T'E-CHÜ, or (Pinyin) JINGJI TEQU, in late 20th-century China, any of several localities in which foreign and domestic trade and investment are conducted without the authorization of the Chinese central government in Peking. Special economic zones are intended to function as zones of rapid economic growth by using tax and business incentives to attract foreign investment and technology.

The first four special economic zones were created in 1979 in southeastern coastal China, and consisted of the small cities of Shenchen, Chu-hai, and Swatow in Kwangtung province and Amoy in Fukien province. In these areas, local governments are allowed to offer tax incentives to foreign investors and to develop their own infrastructure without the approval of the central government. Business enterprises make most of their own investment, production, and marketing decisions, and foreign ownership of such ventures was legalized. Though they began as little more than small towns, the new SEZs soon attracted foreign investment and became boomtowns, with rapidly expanding light and consumer-goods industries and growing populations.

Encouraged by the zones' success, the Chinese government in 1984 opened 14 larger and older cities along the coast to foreign trade and investment. These "open" cities offered foreign investors much the same incentives as in the special economic zones, but their corporate income taxes were higher. In 1988 Hainan Island was made a separate province and a special economic zone, and in 1990 the city of Shanghai became a special economic zone with policies even more flexible than those already in force in the original four SEZs. In 1992 the Chinese government decided to adopt some of the same policies in 23 major cities in inland China, including many provincial capitals, in hopes of encouraging foreign investment in them.

**special education,** also called SPECIAL NEEDS EDUCATION, the education of children who differ socially, mentally, or physically from the average to such an extent that they require major modifications of usual school practices. These include children with emotional, behavioral, or cognitive impairments, mental retardation, hearing, vision, or speech disabilities, gifted children, and those with orthopedic and neurological impairments.

*Historical background.* Although there are isolated examples of caring for and treating disabled individuals in ancient Greece and Rome, early societies typically shunned people who differed from the norm. During the Middle Ages the church became the first institution to provide care for physically or mentally impaired people, but the development of techniques associated with special education did not emerge until the Renaissance with its emphasis on human dignity. In the mid-1500s Pedro Ponce de Leõn succeeded in teaching deaf pupils in Spain to speak, read, and write; it is assumed that his methods were followed by Juan Pablo Bonet, who, in 1620, published the first book on the subject. This gave rise to a wider European interest in the education of deaf individuals. In 17th-century England John Bulwer published an account of his experiences teaching deaf persons to speak and lip-read, and, in France, similar work was carried on by Charles-Michel, abbé de l'Epée (1712–89), who changed the nature of communication for deaf and hard-of-hearing individuals by developing the natural sign language they used into a systematic and conventional language for more universal use. His work was developed by the abbé Roch-Ambroise Cucurron Sicard and gave rise to the manual system, or silent method, of teaching people with hearing impairments. In Germany Samuel Heinicke educated deaf children orally, and in the 19th century Friedrich Moritz Hill (1805–74) developed this method in accordance with the concept that education must relate to the "here and now" of the child—known as the "natural method." Thus arose the oral method of instruction that became an accepted practice worldwide.

No serious attempt was made to educate or to train persons with visual impairments, however, until the late 18th century. Valentin Haüy, known as the "father and apostle of the blind," opened the National Institution of Blind Youth (Institution Nationale des Jeunes Aveugles) in Paris in 1784, with 12 blind children as his first pupils. News of Haüy's success in teaching these children to read soon spread to other countries. Subsequently, schools for blind individuals were founded in Liverpool, Eng. (1791), London (1799), Vienna (1804), Berlin (1806), Amsterdam and Stockholm (1808), Zürich (1809), Boston (1829), and New York City (1831).

Scientific attempts to educate children with mental retardation originated in the efforts of Jean-Marc-Gaspard Itard, a French physician and otologist. In his classic book, *The Wild Boy of Aveyron* (1801), he related his five-year effort to train and educate a boy who had been found running wild in the woods of Aveyron. Itard's work with the boy became notable for the possibilities it raised regarding the education of persons with mental or emotional disabilities. Years later his student Edouard Séguin, who emigrated from France to the United States in 1848, devised an educational method that used physical and sensory activities to develop the mental processes. Séguin's published works influenced Maria Montessori, an Italian pediatrician who became an educator and the innovator of a unique method of training young mentally retarded and culturally deprived children in Rome in the 1890s and early 1900s. Her approach emphasized self-education through specially designed "didactic materials" for sensorimotor training.

Special education for people with disabilities became universal in developed countries by the late 20th century. Concurrent with this development was the identification of two concepts of individual differences: (1) "interindividual differences," which compares one child with another, and (2) "intraindividual differences," which compares the child's abilities in one area with the child's abilities in other areas. The grouping of children in special classes rests on the concept of interindividual differences, but the instructional procedures for each child are determined by intraindividual differences—that is, by a child's abilities and disabilities.

*Diagnostic patterns.* Children with a particular kind of disability do not necessarily form a homogeneous group, so diagnosis must go beyond merely classifying the children according to their major differences. A child with cerebral palsy, for example, has a motor handicap but may also be of superior intelligence or have a learning disability. Hence children with certain labels of impairment—cerebral palsy or deafness or blindness, for example—must be carefully assessed before they can be properly placed in a particular group.

For the gifted and the mentally retarded, the primary criterion of identification is an individually administered intelligence (IQ) test. Children who score particularly high (IQ scores higher than 130 indicate giftedness) or low (scores below 75 indicate mental retardation) are considered for special programs. The determination is made by psychologists who in most cases certify a child's eligibility for such programs. In making these assessments,

psychologists also consider criteria such as school achievement, personality, and the adjustment of the child in the regular grades.

Medical specialists evaluate the needs of children who have sensory, neurological, or orthopedic disabilities. Children who have learning disabilities are assessed primarily by psychoeducational diagnosticians who, through educational and psychological diagnostic tests, determine a child's potential for learning and achievement. Ancillary diagnoses by medical, psychological, and other personnel also help determine a child's eligibility for special programs. Children with social and emotional disabilities might be evaluated by any number of specialists, including psychiatrists, clinical psychologists, social workers, and educational personnel.

*Patterns of instructional adaptation.* The goals of special education are similar to the goals for ordinary children; only the techniques for attaining them are different. An effort is made, for example, to teach all children with special needs (except those unable to profit at all from school experience) to read. Children who have learning and mental disabilities require prolonged periods of intensive and more individualized instruction; for them the learning process might include techniques to maintain interest, more active participation, and much more repetition of similar material in varied form. Children with severe sensory handicaps (such as deafness and blindness) must learn to read through other sense modalities. Deaf individuals learn to read



A teacher uses sign language to communicate with hearing-impaired students
© Gabe Palmer/Corbis

through visual methods while blind individuals learn to read Braille through the tactile and kinesthetic sense.

Children who have motor handicaps require few, if any, academic adjustments. Unless the child has additional problems such as learning disabilities, mental retardation, or speech problems (which are often found among the cerebral palsied), children with disabilities learn like other children, and they can follow the same classroom materials. Special techniques are necessary, however, to help such children to adapt to their environment and to adapt the environment to their disability. Wheelchairs, modified desks, and other apparatus aid the child in mobility and the manipulation of classroom materials. One of the most important aspects of the education of the orthopedically disabled is attitudinal—that is, preparing children for adapting to the world outside the classroom and maximizing their potential for leading relatively normal lives.

Children with learning disabilities and those with speech defects require highly specialized techniques, usually on an individual basis.

For children with social and emotional problems, special therapeutic and clinical services may be provided. Psychotherapy and behaviour therapy by clinical psychologists, social workers, and psychiatrists are generally a part of the educational program. Academic teachers in these classes stress personality development, social adjustment, and habits of interpersonal relations. With this group of children, these factors are prerequisite to academic achievement. Academic work is, however, sometimes therapeutic in itself and is promoted as much as possible.

*Grouping patterns.* Special classes for children who are gifted, who have mental retardation, who have visual or hearing impairments, or who have been diagnosed with other disabilities are found in school systems throughout the world. This type of organization allows the child to live at home and attend a neighbourhood school that offers specialized instruction. "Residential schools" enroll handicapped children for 24 hours a day and are usually attended by children who cannot obtain services in their community.

One of the major goals of special education (beyond developing skills and imparting information) is the ultimate adjustment into society. Increasing emphasis on this goal has led to criticism of special-education programs that segregate children with special needs. As a result, efforts are made to integrate the special-needs child with other children. The 1994 World Conference on Special Needs Education: Access and Quality in Salamanca, Spain, endorsed inclusive schooling on a worldwide basis. As a result of this conference, UNESCO was charged with promoting special education concerns among teachers, documenting progress in various regions and among different programs, and encouraging research in special needs education. For the gifted, special programs of enrichment and acceleration are increasingly preferred to special classes. Resource rooms for those with sight or hearing impairments allow children to participate in regular classroom activities for part of the day. Older, educable persons with mental retardation can be assigned to regular workshops, physical education classes, and other nonacademic classes for part of the day. The eventual goal is to prepare these students for life in the larger society before they leave school.

**special-interest group:** *see* interest group.

**special jury:** *see* blue-ribbon jury.

**Special Olympics,** international program to provide mentally retarded persons (age eight or older) with year-round sports training and athletic competition in a variety of Olympic-type summer and winter sports. Inaugurated in 1968, the Special Olympics was officially recognized by the International Olympic Committee on Feb. 15, 1988. International headquarters are in Washington, D.C.

In June 1963, with support from the Joseph P. Kennedy, Jr., Foundation, Eunice Kennedy Shriver (sister of U.S. President John F. Kennedy) started a summer day-camp for children with mental retardation at her home in Rockville, Md. Between 1963 and 1968, the Kennedy Foundation promoted the creation of dozens of similar camps in the United States and Canada. Special awards were developed for physical achievements, and by 1968 Shriver had persuaded the Chicago Park District to join with the Kennedy Foundation in sponsoring a "Special Olympics," held at Soldier Field on July 19–20. About 1,000 athletes from 26 U.S. states and Canada participated. The games were such a success that, in December, Special Olympics, Inc. (now Special Olympics International), was founded, with chapters in the United States, Canada, and France. The first International Winter Special Olympics Games were held on Feb. 5–11, 1977 (in Steamboat Springs, Colo.). The number of participating countries proliferated so that by the early 21st century there were chapters in some 150 countries. More than one million athletes participate annually in some 20,000 meets and tournaments held worldwide, culminating in the International Special Olympics Games every two years, alternating between winter and summer sports and each lasting for nine days.

**speciation,** the formation of new and distinct species in the course of evolution. In individual cases, it involves the splitting of a single evolutionary lineage into two or more genetically independent ones. *See* species.

**Specie Circular** (July 11, 1836), in U.S. history, an executive order issued by President Andrew Jackson requiring that payment for the purchase of public lands be made exclusively in gold or silver. In an effort to curb excessive land speculation and to quash the enormous growth of paper money in circulation, Jackson directed the Treasury Department, "pet" banks, and other receivers of public money to accept only specie as payment for government-owned land after Aug. 15, 1836. But actual settlers and bona fide residents of the state in which they purchased land were permitted to use paper money until December 15 on lots up to 320 acres. The Specie Circular, by seriously curtailing the use of paper money, was highly deflationary and at least in part produced the ensuing credit crunch and the economic crisis called the Panic of 1837. On May 21, 1838, a joint resolution of Congress repealed the Specie Circular.

**specie payment,** the redemption of U.S. paper money by banks or the Treasury in metallic (usually gold) coin.

Except for a few periods of suspension (1814–15, 1836–42, and 1857), Americans were able to redeem paper money for specie from the time of the ratification of the Constitution (1789) to the onset of the Civil War (1861). The suspensions had occurred during periods of war or economic crisis. With the outbreak of hostilities between the North and the South, the federal government again suspended specie payments late in 1861.

In 1862 the government began issuing paper money, called "greenbacks" and "shinplasters," and in 1863 it authorized federally chartered banks to issue national bank notes. By the end of the war in 1865, more than $430,000,000 worth of paper money (declared legal tender by Congress) was in circulation.

"Hard money" advocates wanted to resume paying specie for this paper money, while "soft money" supporters feared the deflationary impact resumption would produce. After the Supreme Court sanctioned the legitimacy of the paper money in the Legal Tender Cases (1870–71), congressional backers of a return to specie payments passed the Resumption Act of 1875.

In accord with the Resumption Act, specie payments were resumed on Jan. 1, 1879. But the knowledge that the government could indeed redeem each greenback or bank note at par in gold made the public favourably inclined to keep using the much more convenient paper money.

**species,** biological classification comprising related organisms that share common characteristics and are capable of interbreeding. The term speciation designates the process by which one species of organism splits into two or more species. Speciation is one of the fundamental processes of evolution.

A brief treatment of species and speciation

follows. For full treatment, *see* MACROPAEDIA: Evolution, Theory of.

The classification of species is helped by the international system of nomenclature, which assigns new species a standard two-part name of "genus" and "species." The genus is the generic name that includes closely related species; the Gila monster, for example, is classified as *Heloderma suspectum* and is a close relative to the lizard found in Mexico called *Heloderma horridum*, their relation being indicated by their sharing the same genus name, *Heloderma*. Similarly, genera that have shared traits are classified in the same "family"; related families are placed in the same "order"; related orders are placed in the same "class"; and related classes are placed in the same "phylum."

Organisms are grouped into species partly according to their morphological, or external, similarities, but more important in classifying sexually reproducing organisms is the organisms' ability to successfully interbreed. Individuals of a single species can mate and produce viable offspring with one another but not with members of other species. Separate species have been known to produce hybrid offspring (for example, the horse and the donkey producing the mule), but, because the offspring are almost always inviable or sterile, the interbreeding is not considered successful.

Interbreeding only within the species is of great importance for evolution in that individuals of one species share a common gene pool that members of other species do not. Within a single pool there is always a certain amount of variation among individuals, and those whose genetic variations leave them at a disadvantage in a particular environment tend to be eliminated in favour of those with advantageous variations. This process of natural selection results in the gene pool's evolving in such a way that the advantageous variations become the norm. Because genetic variations originate in individuals of a species and because those individuals pass on their variations only within the species, then it is at the species level that evolution takes place. The evolution of one species into others is called speciation.

Subspecies are groups at the first stage of speciation; individuals of different subspecies sometimes interbreed, but they produce many sterile male offspring. At the second stage are incipient species, or semispecies; individuals of these groups rarely interbreed, and all their male offspring are sterile. Natural selection separates incipient species into sibling species, which do not mate at all but which in morphology, or appearance, are nearly indistinguishable. Sibling species then evolve into morphologically (and taxonomically) different species.

Speciation may occur in many ways. A population may become geographically separated from the rest of its species and never be rejoined. Through the process of adaptive radiation (*q.v.*) this population might evolve independently into a new species, changing to fit particular ecological niches in the new environment and never requiring natural selection to complete its reproductive isolation from the parent species. Within the new environment, populations of the new species might then radiate into species themselves. A famous example of adaptive radiation is that of the Galápagos finch.

Quantum speciation is a rapid process of reproductive isolation often brought about by chromosomal mutation in one population of a species. When the mutant population interbreeds with the parent population, unfit hybrid offspring are produced; then, as in geographic speciation, natural selection completes the isolation of the two groups.

Polyploidy is a form of quantum speciation that creates the beginnings of a new species in two or three generations. It is most common among flowering plants. As a consequence of abnormal cell division at the gamete stage, a hybrid plant may develop not two sets of chromosomes (one inherited from each parent) but four or more in each cell nucleus. Through self-fertilization at the flowering stage, the hybrid may produce its own viable offspring, which, being polyploid (of multiple chromosomes), would be reproductively isolated from the parent species that is diploid (of double chromosomes).

The evidence for speciation was formerly found in the fossil record by tracing successive changes in the morphology, or structure and form, of organisms. Genetic studies now show that morphological change does not always accompany speciation, as many apparently identical groups are, in fact, reproductively isolated.

**species ecology:** *see* autecology.

**specific gravity,** also called RELATIVE DENSITY, ratio of the density of a substance to that of a standard substance. The usual standard of comparison for solids and liquids is water at 4° C (39.2° F), which has a density of 1.000 kg per litre (62.4 pounds per cubic foot). Gases are commonly compared to dry air, which has a density of 1.29 g per litre under so-called standard conditions (0° C and 1 atmosphere pressure). For example, the liquid mercury has a density of 13.6 kg per litre; therefore, its specific gravity is 13.6. The gas carbon dioxide, which has a density of 1.976 g per litre under standard conditions, has a specific gravity of 1.53. Because it is the ratio of two quantities that have the same dimensions (mass per unit volume), specific gravity has no dimension.

Buoyancy is intimately related to specific gravity. If a substance has specific gravity less than that of a fluid, it will float on that fluid: helium-filled balloons will rise in air, oil will form a slick on water, and lead will float on mercury. The specific gravity of a substance is characteristic; it is the same for different samples of a substance (if pure, the same in composition, and free from cavities or inclusions) and is used to help identify unknown substances. Specific gravity has many other applications: gemologists use it to distinguish similar gems; chemists, to check on the progress of reactions and the concentration of solutions; and auto mechanics, to test battery fluid and antifreeze.

Specific gravity is the basis of methods used throughout history to concentrate ores. Panning, jigging, shaking, spiral separation, and heavy-medium separation are among the ore-dressing methods that depend on differences in specific gravity to obtain concentrated ore. Specific gravity is highest in rocks rich in iron, magnesia, and the heavy metals and lowest in those rich in alkalies, silica, and water.

The ease with which specific gravity can be precisely determined leads to its widespread use in chemical science and technology; for example, determination of the specific gravity is part of the routine characterization of a new liquid compound. The specific gravity of most organic compounds containing only carbon, hydrogen, and oxygen is less than one.

Among the devices used to measure specific gravity are the Jolly balance, the Westphal balance, the pycnometer, and the hydrometer.

**specific heat,** ratio of the quantity of heat required to raise the temperature of a body one degree to that required to raise the temperature of an equal mass of water one degree. The term is also used in a narrower sense to mean the amount of heat, in calories, required to raise the temperature of one gram of a substance by one Celsius degree. The Scottish scientist Joseph Black, in the 18th century, noticed that equal masses of different substances needed different amounts of heat to raise them through the same temperature interval, and, from this observation, he founded the concept of specific heat. In the early 19th century the French physicists Pierre-Louis Dulong and Alexis-Thérèse Petit demonstrated that measurements of specific heats of substances allow calculation of their atomic weights (*see* Dulong-Petit law). *See also* heat capacity.

**specific humidity,** mass of water vapour in a unit mass of moist air, usually expressed as grams of vapour per kilogram of air, or, in air conditioning, as grains per pound. The specific humidity is an extremely useful quantity in meteorology. For example, the rate of evaporation of water from any surface is directly proportional to the specific humidity difference between the surface and the adjoining air.

Furthermore, the specific humidity does not vary as the temperature or pressure of a body of air changes, as long as moisture is not added to or taken away from it. (Certain other indices of humidity are sensitive to the pressure and temperature.) This stability of the specific humidity makes it useful as an identifying property of a moving air mass. The specific humidity of saturated air (*i.e.*, that in equilibrium with a vapour source, either water or ice) increases rapidly with increasing temperature.

**Speck, Frank Gouldsmith** (b. Nov. 8, 1881, Brooklyn, N.Y., U.S.—d. Feb. 6, 1950, Philadelphia, Pa.), American cultural anthropologist known for his work on the Algonquin Indian tribes of the eastern United States.

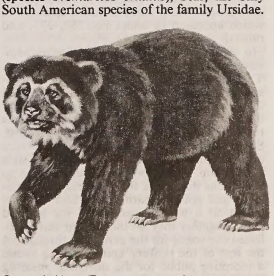
Speck studied under Franz Boas at Columbia University. He founded the anthropology department at the University of Pennsylvania and was its chairman for much of his life.

Speck attempted, as did others of the period, to preserve and analyze fragments of information about the rapidly fading aboriginal cultures of the indigenous peoples. From only scattered remnants of ritual and lore, Speck was able in some cases to reconstruct extensive information on the historic culture of the Delaware and other tribes. He pioneered investigations in ethnoscience and ethnomusicology and gathered a large body of native folklore. He is remembered for the respect he enjoyed in Indian communities.

**specklebelly:** *see* white-fronted goose.

**speckled trout:** *see* brook trout.

**spectacled bear,** also called ANDEAN BEAR (species *Tremarctos ornatus*), bear, the only South American species of the family Ursidae.



Spectacled bear (*Tremarctos ornatus*)
Painting by Donald C. Meighan

It inhabits mountainous regions (particularly of the Andes), dwelling primarily in forested areas, and it feeds mainly on shoots and fruit.

The spectacled bear is an agile climber. The adult stands to 64 cm (about 25 inches) at the

shoulder and varies from 1.2 to 1.8 m (4 to 6 feet) in length, with a 7-centimetre (3-inch) tail. Its shaggy coat varies from dark brown to black. Characteristic whitish to yellowish marks usually encircle the eyes partially or completely to form "spectacles," often extending down the neck and to the chest. Litters of one to three cubs have been born in captivity after a gestation period of 8–8½ months.

**spectacled owl** (species *Pulsatrix perspicillata*), nocturnal bird of prey of the tropical American forests, belonging to the family Strigidae (order Strigiformes). The juvenile is white with a dark mask. The adult, about 50 cm (1.7 feet) long, is brown above and light below except for a brown chest. The face is brown with white brows. The bird has no ear tufts. Little is known of the spectacled owl's feeding habits.

**spectacles:** *see* eyeglasses.

**Spectator, The,** a periodical published in London by the essayists Sir Richard Steele and Joseph Addison from March 1, 1711, to Dec. 6, 1712 (appearing daily), and subsequently revived by Addison in 1714 (for 80 numbers). It succeeded *The Tatler,* which Steele had launched in 1709. In its aim to "enliven morality with wit, and to temper wit with morality," *The Spectator* adopted a fictional method of presentation through a "Spectator Club," whose imaginary members extolled the authors' own ideas about society. These "members" included representatives of commerce, the army, the town (respectively, Sir Andrew Freeport, Captain Sentry, and Will Honeycomb), and of the country gentry (Sir Roger de Coverley). The papers were ostensibly written by Mr. Spectator, an "observer" of the London scene. Though Whiggish in tone and opinion, *The Spectator* generally steered clear of party politics.

Because of its fictional framework, *The Spectator* is sometimes said to have heralded the rise of the English novel in the 18th century. This is perhaps an overstatement, since the fictional framework, once adopted, ceased to be of primary importance and served instead as a social microcosm within which a tone at once grave, good-humoured, and flexible could be sounded. The real authors of the essays were free to consider whatever topics they pleased, with reference to the fictional framework (as in Steele's account of Sir Roger's views on marriage, which appeared in issue no. 113) or without it (as in Addison's critical papers on *Paradise Lost,* John Milton's epic poem, which appeared in issues no. 267, 273, and others).

In addition to Addison and Steele themselves, contributors included Alexander Pope, Thomas Tickell, and Ambrose Philips. Addison's reputation as an essayist has surpassed that of Steele, but their individual contributions to the success of *The Spectator* are less to the point than their collaborative efforts: Steele's friendly tone was a perfect balance and support for the more dispassionate style of Addison. Their joint achievement was to lift serious discussion from the realms of religious and political partisanship and to make it instead a normal pastime of the leisured class. Together they set the pattern and established the vogue for the periodical throughout the rest of the century and helped to create a receptive public for the novelists, ensuring that the new kind of prose writing—however entertaining—should be essentially serious.

**Spectator, The,** weekly magazine of news and opinion, published in London and widely noted for its critical reviews and essays on political, literary, and economic issues. Its editorial stance is moderately conservative and much more conservative than the larger journals with which it shares its eminence, *The Economist* and *New Statesman & Society. The Spectator* has been a serious journal of intellectual discussion since it was founded in 1828. For many years it was noted for its witty essays, but in modern times it has turned to more straightforward treatment of political and cultural affairs. It is noted for outstanding book reviews in particular and for the quality of its writing in general. Its influence is much greater than is suggested by its limited circulation.

**spectral line series,** any of the related sequences of wavelengths characterizing the light and other electromagnetic radiation emitted by energized atoms. The simplest of these series are produced by hydrogen. When resolved by a spectroscope, the individual components of the radiation form images of the source (a slit through which the beam of radiation enters the device). These images, in the form of lines, appear to have a regularity in spacing, coming closer together toward the shortest wavelength, called the series limit. Hydrogen displays five of these series in various parts of the spectrum, the best-known being the Balmer series in the visible region. Johann Balmer, a Swiss mathematician, discovered (1885) that the wavelengths of the visible hydrogen lines can be expressed by a simple formula: the reciprocal wavelength ($1/\lambda$) is equal to a constant ($R$) times the difference between two terms, $1/4$ (written as $1/2^2$) and the reciprocal of the square of a variable integer ($1/n^2$), which takes on successive values 3, 4, 5, etc., *i.e.*, $1/\lambda = R(1/2^2 - 1/n^2)$. The constant $R$ is known as the Rydberg constant, after Johannes Robert Rydberg, a Swedish physicist, and, in the case of hydrogen, has a value of 109,677.58 reciprocal centimetres. When $n = 3$, Balmer's formula gives $\lambda = 656.21$ nanometres (1 nanometre $= 10^{-9}$ metre), the wavelength of the line designated H$\alpha$, the first member of the series (in the red region of the spectrum), and when $n = \infty$, $\lambda = 4/R$, the series limit (in the ultraviolet).

The four other spectral line series, in addition to the Balmer series, are named after their discoverers, Theodore Lyman, A.H. Pfund, and F.S. Brackett of the United States and Friedrich Paschen of Germany. The Lyman series lies in the ultraviolet, whereas the Paschen, Brackett, and Pfund series lie in the infrared. Their formulas are similar to Balmer's except that the constant term is the reciprocal of the square of 1, 3, 4, or 5, instead of 2, and the running number $n$ begins at 2, 4, 5, or 6, respectively, instead of 3.

Atoms of other elements that have lost all their electrons, save one, and therefore are hydrogen-like (*e.g.,* singly-ionized helium and doubly-ionized lithium), also emit radiation that can be analyzed into spectral line series that can be expressed by formulas similar to Balmer's.

**spectrochemical analysis,** methods of chemical analysis that depend upon the measurement of the wavelength and the intensity of electromagnetic radiation. Its major use is in the determination of the arrangement of atoms and electrons in molecules of chemical compounds on the basis of the amounts of energy absorbed during changes in the structure or motion of the molecules. In its restricted and more common usage two methods usually are implied: (1) ultraviolet (nonvisible) and visible emission spectroscopy and (2) ultraviolet, visible, and infrared absorption spectrophotometry.

In emission spectroscopy, atoms are excited to energy levels higher than their lowest normal levels (ground states) by means of electrical discharges (arcs, sparks) or flames. Identification of the elemental composition of an unknown substance is based on the fact that when the excited atoms return to lower energy states, they emit light of characteristic frequencies. These characteristic frequencies are separated into an ordered sequence (spectrum) by diffraction or refraction (deflection of the path of the light by a grating or a prism) for observation in a spectroscope (visual), spectrograph (photographic), or spectrometer (photoelectric). The process consists of four interdependent steps: (1) vaporization of the sample, (2) electronic excitation of its atoms or ions, (3) dispersion of the emitted or absorbed radiation into its component frequencies, and (4) measurement of the intensity of the radiation, usually at wavelengths at which the intensity is greatest.

Ordinarily, emission spectrochemical analysis is applied to the qualitative and quantitative determination of metallic elements, but it is not restricted to them. The method is among the most sensitive of all analytical methods: a few milligrams of a solid sample usually suffice for the detection of metallic elements present to the extent of a few parts per million or less. In addition, the method is capable of detecting several atomic species simultaneously, thus obviating chemical separations.

Quantitative analysis by emission spectroscopy depends upon the fact that the quantity of light (*i.e.,* the intensity) emitted at a given wavelength is proportional to the number of atoms vaporized and excited. The quantity of a given element is usually determined by a comparative method—that is, the intensity of the radiation emitted at a selected wavelength by the sample is compared with the intensity of the radiation emitted by a standard of known composition. Other spectrochemical methods useful in elemental analysis are atomic absorption spectrometry and atomic fluorescence spectrometry. Both methods resemble the flame method of emission spectroscopy (*i.e.,* a method that uses flame as the energy source to excite atoms) in that a solution of the sample is usually vaporized into a flame of hydrogen or acetylene in air or oxygen. In addition, light of the same wavelength as that emitted by the desired element is passed through the flame. A certain fraction of the light is absorbed by atoms that are in their ground electronic state. The quantity of radiation absorbed is proportional to the concentration of atoms in the flame in their ground state and, because thermal equilibrium exists, to the total concentration of that atomic species.

Atomic fluorescence spectrometry makes use of the same basic instrumental components as atomic absorption spectrometry; however, it measures the intensity of the light emitted by atoms that have been excited from their ground state by the absorption of light of shorter wavelength than that emitted. The atomic absorption method is particularly well adapted to the determination of the alkali and alkaline earth metals.

**spectrophotometry,** branch of spectroscopy that deals with measurement of the radiant energy transmitted or reflected by a body as a function of the wavelength. Ordinarily the intensity of the energy transmitted is compared to that transmitted by some other system that serves as a standard. Different types of modern spectrophotometers cover wide ranges of the electromagnetic spectrum: X-ray, ultraviolet, visible, infrared, or microwave.

Two laws express the relationship between the absorption of radiant energy and the absorbing medium. According to Bouguer's (or Lambert's) law, each layer of equal thickness of the medium absorbs an equal fraction of the energy traversing it. According to Beer's law, the absorptive capacity of a dissolved substance is directly proportional to its concentration in a solution.

Ultraviolet spectrophotometry is particularly useful in detecting colourless substances in solution and measuring their concentration. In-

frared spectrophotometry is most commonly used in studying the molecular structures of complex organic compounds.

**spectroscopy,** the investigation of spectra, the phenomena observed when electromagnetic radiations from a particular source are separated into their constituent colours or wavelengths. Such separation results from refraction (as by a prism) or from diffraction (as by a grating). Instruments designed for this purpose are called spectroscopes, if used for direct visual observation, and spectrographs, if photography or other methods of recording the spectra are employed. Through spectroscopy, chemical elements present on distant stars have been identified, and an increased understanding of atomic and molecular structure and such phenomena as luminescence has been achieved.

A brief treatment of spectroscopy follows. For full treatment, *see* MACROPAEDIA: Analysis and Measurement, Physical and Chemical.

The composite nature of white light was first demonstrated by Isaac Newton (1664) when he allowed sunlight entering a round hole in a shutter to pass through a glass prism and fall on a screen. The resulting elongated image of the Sun, showing the same gradation of colours as the rainbow, he called a spectrum. In 1800 William Herschel studied the solar spectrum with the aid of thermometers and found the greatest effect beyond the red end, thus discovering infrared radiation. In 1801 Johann Wilhelm Ritter, studying the effect of solar radiation upon silver salts, found this action extending beyond the violet, thus discovering ultraviolet rays.

The first connection between spectral colour and wavelength appeared in 1802, when Thomas Young applied his wave theory of light to calculate the approximate wavelengths of the seven colours recognized by Newton. In 1814 Joseph von Fraunhofer modified Newton's experiment by substituting a narrow slit for a hole and a telescope for a screen. Under these conditions he observed the continuous spectrum of the Sun interrupted by hundreds of dark lines, still known as Fraunhofer lines. Fraunhofer constructed the first diffraction gratings, and with these he determined the wavelengths corresponding to many of these lines. Although Fraunhofer and others observed that certain bright lines in the spectra of flames seemed to coincide with dark lines in the solar spectrum, it remained for Gustav Robert Kirchhoff in 1859 to enunciate the generality of this phenomenon and to emphasize the fact that each species of atom has a uniquely characteristic spectrum.

Kirchhoff and Robert Wilhelm Bunsen in 1861 systematically compared the lines in the solar spectrum with those in the flame or spark spectra of the purest elements available, thereby making the first chemical analysis of the Sun's atmosphere and founding spectrochemical analysis and astrophysics. In the course of these investigations, they discovered two new elements, cesium and rubidium. In 1868 Anders Jonas Ångström measured the wavelengths of about 1,000 Fraunhofer lines and expressed them in units of $10^{-10}$ metre—a unit now known as the angstrom and used for many spectroscopic measurements.

Because light rays of different colours, or wavelengths, are refracted differently on passing obliquely from one medium to another of different density, a spectrum can be produced by the use of a prism of any transparent material. A composite ray of light is accordingly dispersed as well as refracted in passing through a prism, the amount of refraction being usually greater for shorter wavelengths. A continuous spectrum comprises an uninterrupted gamut of wavelengths over a considerable range. Discontinuous spectra exhibit bright lines or bands of different colours or wavelengths on a dark background. Continuous spectra are emitted by incandescent solids and liquids (gas mantle, lamp filament, hot molten metal) or by certain electrical discharges (underwater sparks). Discontinuous spectra are emitted by atoms, ions, or molecules in a gaseous state in which the individual particles are excited by absorbing energy either from collisions with other particles or from incident radiation. Light sources producing discontinuous spectra are flames, furnaces, and electrical discharges in arcs and sparks at atmospheric pressure or in lamps containing gases or metal vapours at reduced pressure.

As a consequence of Kirchhoff's law, practically everything that has been said about emission spectra applies also to absorption spectra. There are, however, some experimental conditions that permit molecular identification and quantitative chemical analysis by means of absorption spectra that cannot be duplicated in emission spectra.

Any experiment in spectroscopy involves: (1) a source of light; (2) a prism or grating for forming the spectrum; (3) detectors for observing or recording details of the spectrum; (4) measurements of wavelengths and intensities; and (5) the interpretation of such measurements either as chemical identifications or as clues to the structure of atoms and molecules.

There are, in general, four ways of observing spectra: visual, photoelectric, radiometric, and photographic; each has advantages and limitations. The photographic method provides a permanent, detailed record of a spectrum that can be examined as often as desired without repeating the experiment. Furthermore, the cumulative nature of photographic exposures imparts additional advantages in integrating the light from intermittent or extremely faint sources by prolonged exposure.

Until spectroscopy was introduced there was no way—save for chemical analysis of meteorites that fell to Earth—to learn anything concerning the chemical and physical conditions of celestial bodies. The application of spectroscopy to astronomy has provided a wealth of information on the radial motions, chemical compositions, and physical conditions of planets, comets, stars, and nebulae, making possible the new science of astrophysics.

In terrestrial laboratories the application of spectroscopy to chemical analysis had to compete with conventional chemical methods. Progress was slow until precise photographic photometry was introduced in about 1925, whereupon quantitative spectrochemical analysis quickly became common practice.

**spectrum,** in optics, the arrangement according to wavelength of visible, ultraviolet, and infrared light. An instrument designed for visual observation of spectra is called a spectroscope; an instrument that photographs or maps spectra is a spectrograph. Spectra may be classified according to the nature of their origin, *i.e.,* emission or absorption. An emission spectrum consists of all the radiations emitted by atoms or molecules, whereas in an absorption spectrum, portions of a continuous spectrum (light containing all wavelengths) are missing because they have been absorbed by the medium through which the light has passed; the missing wavelengths appear as dark lines or gaps.

The spectrum of incandescent solids is said to be continuous because all wavelengths are present. The spectrum of incandescent gases, on the other hand, is called a line spectrum because only a few wavelengths are emitted. These wavelengths appear to be a series of parallel lines because a slit is used as the light-imaging device. Line spectra are characteristic of the elements that emit the radiation. Line spectra are also called atomic spectra because the lines represent wavelengths radiated from atoms when electrons change from one energy level to another. Band spectra is the name given to groups of lines so closely spaced that each group appears to be a band, *e.g.,* nitrogen spectrum. Band spectra, or molecular spectra, are produced by molecules radiating their rotational or vibrational energies, or both simultaneously.

**spectrum analyzer:** *see* harmonic analyzer.

**speculative grammar,** a linguistic theory of the Middle Ages, especially the second half of the 13th century. It is "speculative" not in the modern sense but as the word is derived from the Latin *speculum* ("mirror"), indicating a belief that language reflects the reality underlying the physical world. In accordance with this belief, speculative grammarians searched for a universal grammar, valid for all languages despite the "accidents" of their differences. The categories of this grammar would correlate with the categories of logic, epistemology, and metaphysics; *e.g.,* nouns and pronouns were thought to express the metaphysical category of "permanence," whereas verbs and participles expressed "becoming." Speculative grammarians took over Priscian grammar but relabeled the parts of speech to show their "modes of signifying." So many of their works were titled *De modis significandi* ("The Modes of Signifying") that they have come to be called the Modistae.

The search by speculative grammarians for a universal grammar has been criticized as the result of their shortsightedness: the privileged, predominant position of Latin in their culture made "universality" seem more likely. Nevertheless, speculative grammar was more coherent and theoretical than any previous grammar, and its proponents investigated ideas still of interest today, such as deep structure, the incorporation of meaning into grammatical systems, and universals.

**Spedding, Frank Harold** (b. Oct. 22, 1902, Hamilton, Ont., Can.—d. Dec. 15, 1984, Ames, Iowa, U.S.), American chemist who, during the 1940s and '50s, developed processes for reducing individual rare-earth elements to the metallic state at low cost, thereby making these substances available to industry at reasonable prices. He also helped to purify the uranium used in 1942 for the first self-sustaining nuclear chain reaction experiment.

After studying at several American institutions of higher education, Spedding held various teaching and research positions until he became professor of physical chemistry at Iowa State University of Science and Technology, Ames, in 1941. The following year he joined other scientists at the University of Chicago who were seeking to determine whether a self-sustaining nuclear chain reaction was possible. Dividing his time between Chicago and Ames, Spedding, together with Harley A. Wilhelm and C.F. Gray, found a way to produce very pure uranium metal; that substance was used in the first self-sustaining nuclear chain reaction experiment at Stagg Field, University of Chicago, on Dec. 2, 1942.

After World War II Spedding returned to Ames, where research by his group resulted in the theoretical and practical advances that made possible the production of rare-earth metals at low cost. Spedding was director of the Institute for Atomic Research and of the Ames Laboratory of the Atomic Energy Commission at Iowa State University until 1968, when he became principal scientist at the Ames Laboratory. From 1968 to 1976 he was a member of the Committee on Radioactive Waste Management for the National Academy of Sciences.

**Spee, Maximilian (Johannes Maria Hubert), Graf von** (count of) (b. June 22, 1861, Copenhagen—d. Dec. 8, 1914, off Falkland Islands), admiral who commanded German forces in the battles of Coronel and the Falk-

land Islands early in World War I. He entered the German Navy in 1878, and in 1887–88 he commanded the port in German Cameroon. In 1908 he was made chief of staff of the German Ocean (North Sea) Command, and at the end of 1912 he was appointed commander of the Far Eastern Squadron.

When World War I began, Spee was in the Caroline Islands. Japan's declaration of war against Germany (Aug. 22, 1914) caused him to abandon plans for operations in Chinese waters and to head for South America. After bombarding Tahiti on September 22, he defeated the British 4th Cruiser Squadron, on Nov. 1, 1914, off Coronel, Chile.

Two battle cruisers under Vice Admiral Sir Frederick Doveton Sturdee were sent from England against Spee. They arrived at Port Stanley, Falkland Islands, on Dec. 7, 1914. Spee, who had left Chile on November 26, appeared off the Falklands on December 8, perhaps not knowing that the British squadron was there. The Germans were defeated; Spee's flagship, the armoured cruiser *Scharnhorst,* went down with all hands.

**speech,** human communication through spoken language. Although many animals possess voices of various types and inflectional capabilities, human beings have learned to modulate their voices by articulating the laryngeal tones into audible oral speech.

A brief treatment of speech follows. For full treatment, *see* MACROPAEDIA: Speech.

Most speech sounds are made with the pulmonary airstream (that is, air exhaled from the lungs) as it passes between the vocal cords at the base of the throat and out through the vocal tract (consisting of the pharynx, oral cavity, and nasal cavity). Speech sounds may be voiced or unvoiced. In making voiced sounds, the vocal cords are tensed so as to narrow the air passageway (glottis) between them; a cyclic series of changes in pressure of the air passing through the glottis is initiated by this original tension, vibrating the vocal cords and the air between them to produce sound. The frequency of these vibrations determines the pitch of the voice: for a bass voice, 75–100 cycles per second is usual; for a soprano, more than 400 cycles per second.

The airstream passing through the vocal tract is shaped into a series of syllabic, or segmented, speech sounds by the articulators: mainly the tongue, palate, and lips. Articulatory phonetics describes individual speech sounds in terms of whether they are voiced or unvoiced and in terms of the position and action of the articulators used in making them. For instance, the S sound in the English word "sing" is an unvoiced labial-alveolar fricative—that is, a friction sound made by air passing between the raised tongue and the alveolar ridge (upper gums) and lips (labia). Other types of consonants include stops, or plosives (where the oral airstream is closed off and then released, as with the sounds for T and D), approximants (where the airstream is almost closed off but friction is not produced, as with the W sound in "weep"), trills (where an articulator is vibrated, as in the Spanish R sound), or laterals (where the airstream moves along the edges of the tongue, rather than through the centre of the vocal tract, as with the sound for the double L in "pullet").

Vowels are produced with the vocal tract unobstructed and are traditionally specified in terms of which part of the tongue is raised highest in articulation and how high it is raised; thus, the sound for the double E in English "keep" is a high front vowel, that for the O in "shoe" a low (or open) back vowel.

Speech is also described in terms of syntax (rules for putting words together to form phrases, clauses, or sentences), lexicon (meanings of words or of morphemes, the smallest meaningful segments of words [*e.g.,* the prefix *un-*]), and phonology (sounds). Phonological rules specify which sounds are used in a language to distinguish one meaning from another; these sounds are called phonemes. For instance, English phonology carries /b/ and /p/ as distinct phonemes, since the substitution of one for the other will change the meaning of some utterances (as in "bin" and "pin"). American English has 13 or more distinct vowel phonemes.

The phonological rules of a language also specify the alternate forms (allophones) of each phoneme and which allophone will be used in a given context. For instance, in English, the aspirated P and unaspirated P are allophones of the phoneme /p/, since it is the context of adjacent sounds, and not of meaning, that determines which is used; *e.g.,* aspirated P occurs at the beginning of a word ("park"), unaspirated P occurs following S ("spark").

Thus, the lexicon of a language will consist of a list of combinations of phonemes, each combination representing the basic form of a word having a certain meaning. The phonological rules will yield the forms that each phoneme takes as it is combined with other phonemes to make the sentences allowed by the grammar.

**speech, figure of,** any intentional deviation from literal statement or common usage that emphasizes, clarifies, or embellishes both written and spoken language. Forming an integral part of language, figures of speech are found in primitive oral literatures, as well as in polished poetry and prose and in everyday speech. Greeting-card rhymes, advertising slogans, newspaper headlines, the captions of cartoons, and the mottoes of families and institutions often use figures of speech, generally for humorous, mnemonic, or eye-catching purposes. The argots of sports, jazz, business, politics, or any specialized groups abound in figurative language.

Most figures in everyday speech are formed by extending the vocabulary of what is already familiar and better known to what is less well known. Thus metaphors (implied resemblances) derived from human physiology are commonly extended to nature or inanimate objects as in the expressions "the mouth of a river," "the snout of a glacier," "the bowels of the earth," or "the eye of a needle." Conversely, resemblances to natural phenomena are frequently applied to other areas, as in the expressions "a wave of enthusiasm," "a ripple of excitement," or "a storm of abuse." Use of simile (a comparison, usually indicated by "like" or "as") is exemplified in "We were packed in the room like sardines." Personification (speaking of an abstract quality or inanimate object as if it were a person) is exemplified in "Money talks"; metonymy (using the name of one thing for another closely related to it), in "How would the Pentagon react?"; synecdoche (use of a part to imply the whole), in expressions such as "brass" for high-ranking military officers or "hard hats" for construction workers.

Other common forms of figurative speech are hyperbole (deliberate exaggeration for the sake of effect), as in "I'm so mad I could chew nails"; the rhetorical question (asked for effect, with no answer expected), as in "How can I express my thanks to you?"; litotes (an emphasis by negation), as in "It's no fun to be sick"; and onomatopoeia (imitation of natural sounds by words), in such words as "crunch," "gurgle," "plunk," and "splash."

Almost all the figures of speech that appear in everyday speech may also be found in literature. In serious poetry and prose, however, their use is more fully conscious, more artistic, and much more subtle; it thus has a stronger intellectual and emotional impact, is more memorable, and sometimes contributes a range and depth of association and suggestion far beyond the scope of the casual colloquial use of imagery.

In European languages figures of speech are generally classified in five major categories: (1) figures of resemblance or relationship (*e.g.,* simile, metaphor, kenning, conceit, parallelism, personification, metonymy, synecdoche, and euphemism); (2) figures of emphasis or understatement (*e.g.,* hyperbole, litotes, rhetorical question, antithesis, climax, bathos, paradox, oxymoron, and irony); (3) figures of sound (*e.g.,* alliteration, repetition, anaphora, and onomatopoeia); (4) verbal games and gymnastics (*e.g.,* pun and anagram); and (5) errors (*e.g.,* malapropism, periphrasis, and spoonerism). Figures involving a change in sense, such as metaphor, simile, and irony, are called tropes.

All languages use figures of speech, but differences of language dictate different stylistic criteria. In a culture not influenced by classical Greece and Rome, some figures may be absent; irony is likely to be confined to fairly sophisticated cultures. Japanese poetry is based on delicate structures of implication and an entire vocabulary of aesthetic values almost untranslatable to the West. Arabic literature is rich in simile and metaphor, but the constructions used are so different from those familiar in the West that translation requires much adaptation. This condition is also true of the oral literatures of Africa and of the written literatures deriving from them.

One of the most powerful single literary influences upon world cultures has been the Bible. Both the Old Testament and the New Testament are rich in simile, metaphor, and personification and in the special figure of Hebrew poetry, parallelism.

**speed,** in photography, any of those standards that indicate (1) the size of the lens opening, or aperture, (2) the duration of exposure, and (3) the sensitivity of the film to light.

The aperture, or lens speed, of a camera is the size of the opening in the lens. Aperture settings provide one means of controlling the amount of light that falls on the film by determining the maximum diameter of the light beam entering the camera body. A standard set of numbers, called f-stops, describe the lens aperture as a ratio of the focal length (*see* relative aperture).

The shutter speed regulates the length of time that the shutter is open during an exposure. Varying the shutter speed controls the film's exposure to light and determines the speed of action that the photograph can "freeze," or reproduce without blurring the image. Shutter speeds generally range from one second to 1/2,000 of a second.

Film speed indicates the sensitivity of a particular emulsion to light. It is usually expressed as an ISO (International Standards Organization) number (formerly called, and identical to, the ASA [American Standards Association; now American National Standards Institute] number), or, in Europe, as a DIN (Deutsche Industrie Norm) number. A film with a speed of 32 ISO/ASA, or 16/10 DIN, for example, would be considered a slow film—*i.e.,* relatively insensitive to light, and most effectively used in bright light—whereas one with a speed of 400 ISO/ASA, or 27/10 DIN, would be considered fast—*i.e.,* relatively sensitive to light and therefore usable in dim light or with a very fast shutter speed.

**speed skating,** the sport of racing on ice skates that originated in The Netherlands, possibly as early as the 13th century. Organized international competition developed in the late 19th century, and the sport was included in the first Winter Olympics in 1924.

The blade of the modern speed skate is longer and thinner than that of the hockey or figure skate. When planted on the ice with weight upon it, the blade describes a nearly straight



Becky Sundstrom (U.S.) competing in the 100-metre event at the 2002 Olympics
Tony Marshall—EMPICS

line. Only the last few feet of the stride curve slightly outward as the skate leaves the ice. Length of stride has tended to diminish since the days of the 11- to 16-metre (12- to 17-yard) stride attributed to the English champion William Smart, who was active during the mid-19th century. The modern racing stride rarely exceeds 9 m (10 yards) and is usually about 5 or 6 m. The clapskate, introduced in 1996, features a hinge at the toe of the shoe, allowing for greater extension and a longer stride.

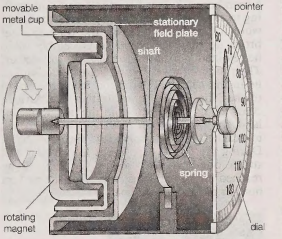
International long-track speed skating involves a course with straight sides and curved ends of such a radius that no slackening of speed is necessary. The competitors race two at a time on a double track, and their times are recorded. Each skater must keep his own course. The advantage of the inner curve is given alternately, and a space is left open between the tracks at one point for the skaters to switch tracks. The 500-metre event requires skaters to race twice per heat—once in each of the lanes. The times are then combined. The official track measures 400 m. World championships are decided annually under the supervision of the International Skating Union (ISU) at distances of 500, 1,000, 1,500, 5,000, and 10,000 metres for men and 500, 1,000, 1,500, 3,000, and 5,000 metres for women.

Unlike long-track speed skating, which takes place on indoor or outdoor rinks, a later development, short-track speed skating, is done indoors on a 111-metre track. Events are held over distances of 500, 1,000, 1,500, and 3,000 metres. There are also four-person relay events for men and women. Four to six skaters race in each elimination heat, and passing strategies and pacing are important components of the sport. World championships were held annually from 1978 to 1980 before being recognized by the ISU in 1981. Short-track speed skating became a medal sport in the 1992 Winter Olympics.

*See* Sporting Record: *Ice skating. See also* Olympic Games.

**speedometer,** instrument that indicates the speed of a vehicle, usually combined with a device known as an odometer that records the distance traveled. Speedometers and odometers measure speed and distance using electronic sensors and counters and then display them digitally on liquid-crystal displays; or they work mechanically through linkages to the vehicle's transmission and display their measurements on circular dials and drums.

The speed-indicating mechanism of a traditional mechanical speedometer is actuated by a circular permanent magnet that is rotated as the vehicle travels by a flexible shaft driven by gears at the rear of the transmission. The magnet turns within a movable metal cup made of a light nonmagnetic metal that is attached to the shaft carrying the indicating pointer; the magnetic circuit is completed by a circular stationary field plate surrounding the movable cup. As the magnet rotates it exerts a magnetic drag on the movable cup that tends to turn it against the restraint of a spiral spring. The faster the magnet rotates, the greater is the pull on the cup and the pointer. The speed-indicating dial is graduated in miles per hour, kilometres per hour, or both. The speedometer is frequently augmented by a cruise-control device that is coupled to the throttle of the engine so as to maintain the vehicle at a selected speed.

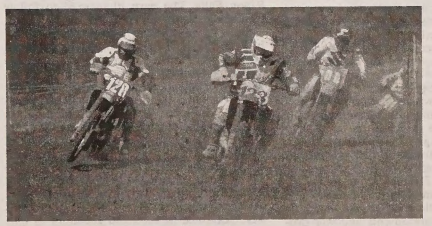



Mechanism of a circular-dial speedometer
EB Inc.

The odometer registers the distance traveled by the vehicle; it consists of a train of gears that turns a series of drums whose numerals are visible through a rectangular window. The numbers appearing in the window represent the vehicle's accumulated mileage.

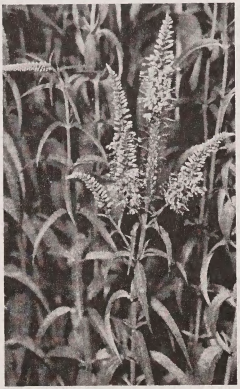
**speedway racing,** automobile or motorcycle racing on a racecourse or track, usually oval and flat. Both speedway racing and Grand Prix racing, which is done on closed highways or other courses partly simulating road conditions, began in 1906. Speedway racing became the dominant kind of automobile racing in the United States. For the position of speedway racing in the history of automobile racing, *see* automobile racing.

Speedway racing for motorcycles began much later, originating in Australia in the 1920s. It also became popular in Europe by the 1930s and remained so. The racing is done on small, flat, oval tracks with lightweight motorcycles that have small fuel tanks and no brakes. Tracks measure about 320 metres (350 yards) and have unpaved surfaces of dirt, cinders, grass, or sand. Competition ranges from local to international in Europe, Australia, and New Zealand. World championships under the supervision of the Fédération Internationale Motocycliste were held from 1937.



Speedway motorcycle racing on a dirt track
Nick Rains—Corbis/By Photo Library Ltd./Corbis

**speedwell,** any plant of the genus *Veronica* (order Scrophulariales; *q.v.*), especially the small, sometimes weedy, herbaceous types. The about 250 to 300 species are found mostly in the Northern Hemisphere. Speedwells are grown as ornamentals. Their small blossoms are usually white, blue, purple, or pink.



Speedwell (*Veronica longifolia*)
Werner W. Schulz

**Speedwriting,** shorthand system using the letters of the alphabet and punctuation marks. The name is a registered trademark for the system devised in the United States by Emma Dearborn about 1924. In Speedwriting, words are written as they sound, and only long vowels are expressed. Thus, "you" is written *u*, and "file" is *fil.* Some letters are modified for speed (*e.g.*, the *i* is not dotted). The system also uses abbreviations and flourishes. One flourish is the underscoring of a final letter to express "ing." Speedwriting is considered easier to learn but not as rapid as the Pitman or Gregg shorthand systems, which use symbols rather than longhand letters.

**Speelman, Cornelis Janszoon** (b. March 3, 1628, Rotterdam, Dutch Republic [now The Netherlands]—d. Jan. 11, 1684, Batavia, Dutch East Indies [now Jakarta, Java, Indonesia]), Dutch military leader and governor-general of the Dutch East Indies (1681–84) who spurred the transformation of the Dutch commercial empire in the Indies into an expanding territorial one.

Speelman went to the Indies in 1645 as a clerk for the Dutch East Indies Company and by 1663 was appointed governor of the Coro-

mandel Coast of southeast India. In 1666 he led an expedition that subjugated Macassar, on the south coast of Celebes. In the resulting Treaty of Bongaais the Dutch gained a monopoly of trade with, and control of, all of Macassar's possessions. Speelman was named to the Council of the Indies (1671), an advisory body to the governor general, and in that capacity urged the use of force in settling native disputes and thus obtained territory for the Dutch. In a dispute between two factions fighting for the throne of Mataram, Java's great empire, Speelman was appointed commander of the Dutch forces and subdued Mataram, which became a vassal to the Dutch. In 1677 he won trade concessions for Semarang and a large territory south of Batavia.

In 1681 Speelman managed to establish Dutch interests in Bantam (a kingdom of extreme western Java), driving out all other foreigners and gaining a monopoly of trade. As governor general, however, he was arbitrary in his rule and often neglectful of his duties.

**Speenhamland system,** practice of economic relief for the poor that was adopted over much of England following a decision by local magistrates at the Pelican Inn, Speenhamland, near Newbury, Berkshire, on May 6, 1795. Instead of fixing minimum wages for poor labourers, the practice was to raise workingmen's income to an agreed level, the money to come out of the parish rates. This allowance was designated as the price of 3 gallon loaves a week for each man (a gallon loaf was 8½ pounds [about 4 kilograms]) plus the cost of 1½ loaves each for a wife and every child. The money was to cover all expenses. This allowance system lasted until the enactment of the Poor Law Amendment (1834).

Contemporary commentators and modern historians alike have condemned the system; the former claim it encouraged the poor in idleness, while the latter stress the opportunity it gave unscrupulous employers and landlords to reduce wages and raise rents respectively, knowing their depredations would be redressed from the public pocket.

**Speer, Albert** (b. March 19, 1905, Mannheim, Baden, Ger.—d. Sept. 1, 1981, London), German architect who was Adolf Hitler's chief architect (1933–45) and minister for armaments and war production (1942–45).

Speer studied at the technical schools in Karlsruhe, Munich, and Berlin, and acquired an architectural license in 1927. After hearing Hitler speak at a Berlin rally in late 1930, he enthusiastically joined the Nazi Party (January 1931) and so impressed the Führer by his efficiency and talent that, soon after Hitler became chancellor, Speer became his personal architect. He was rewarded with many important commissions, including grandiose plans to rebuild the whole of Berlin (never accomplished) and the design of the parade grounds, searchlights, and banners of the spectacular Nürnberg party congress of 1934, filmed by Leni Riefenstahl in *Triumph of the Will.*

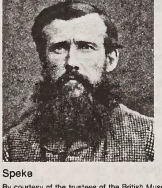
In 1942 Speer became minister of armaments and munitions, a title enlarged the following year to minister of armaments and war production, when he was charged not only with armaments production, transportation, and placement but also with final authority over raw materials and industrial production. With this authority, Speer expanded a system of conscript and slave labour, supplied primarily from concentration camps, that maintained production of war material for Nazi Germany.

Speer confessed his guilt at the Nürnberg trials in 1945–46 and served a 20-year sentence at Spandau prison in West Berlin. Following his release in 1966 he had a career as a writer. His published works include *Erinnerungen* (1969; *Inside the Third Reich,* 1970), *Spandauer Tagebücher* (1975; *Spandau: The Secret Diaries,* 1976), and *Der Sklavenstaat* (1981; *Infiltrator,* 1981).

**Speier** (Germany): *see* Speyer.

**Speke, John Hanning** (b. May 3, 1827, Bideford, Devon, Eng.—d. Sept. 15, 1864, near Corsham, Wiltshire), British explorer who was the first European to reach Lake Victoria in East Africa, which he correctly identified as a source of the Nile.

Commissioned in the British Indian Army in 1844, he served in the Punjab and travelled in the Himalayas and Tibet. In April 1855, as a member of Richard Burton's party attempting to explore Somaliland, Speke was severely wounded in an attack by the Somalis that broke up the expedition. In December 1856 he rejoined Burton on the island of Zanzibar. Their intention was to find a great lake said to lie in the heart of Africa and to be the origin of the Nile. After exploring the East African coast for six months to find the best route inland, the two men became the first Europeans to reach Lake Tanganyika (February 1858). During the return trip, Speke left Burton and struck out northward alone. On July 30 he reached the great lake, which he named in honour of Queen Victoria.



Speke
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd

Speke's conclusion about the lake as a Nile source was rejected by Burton and was disputed by many in England, but the Royal Geographical Society, which had sponsored the expedition, honoured Speke for his exploits. On a second expedition (1860), he and James Grant mapped a portion of Lake Victoria. On July 28, 1862, Speke, not accompanied by Grant for this portion of the journey, found the Nile's exit from the lake and named it Ripon Falls. The party then tried to follow the river's course, but an outbreak of tribal warfare required them to change their route. In February 1863 they reached Gondokoro in the southern Sudan, where they met the Nile explorers Samuel Baker and Florence von Sass (who later became Baker's wife). Speke and Grant told them of another lake said to lie west of Lake Victoria. This information helped the Baker party to locate another Nile source, Lake Albert.

Speke's claim to have found the Nile source was again challenged in England, and, on the day he was to debate the subject publicly with Richard Burton, he was killed by his own gun while hunting. Accounts of his explorations were published in 1863 and 1864.

**speleology,** scientific discipline that is concerned with all aspects of caves and cave systems. Exploration and description of caves and their features are the principal focus of speleology, but much work on the chemical solution of limestone, rates of formation of stalagmites and stalactites, the influence of groundwater and hydrologic conditions generally, and on modes of cave development has been accomplished within this discipline. Speleology requires, essentially, the application of geological and hydrological knowledge to problems associated with underground cavern systems. Amateur exploration of caves, as a hobby, is called spelunking.

**speleothem:** *see* cave deposit.

**spell,** words uttered in a set formula with magical intent. The correct recitation, often with accompanying gestures, is considered to unleash supernatural power. Some societies believe that incorrect recitation can not only nullify the magic but cause the death of the practitioner.

The language of spells is sometimes archaic and is not always understood by the reciter. In some cases meaningless but familiar terms are believed to be efficacious because of their traditional value. Much magical language, however, is clearly and directly correlated with the aim of the recital. In symbolic statement by analogy it represents and foreshadows the technical achievement, and metaphor and simile are freely used. An example is a Maori spell giving speed and grace to a canoe, which speaks of the swiftness of a bird on the wing and the lightness of a sea gull and which uses such onomatopoeic effects as speed noises or the wailing of the sea.

In blessings and curses, which are similar types of verbal expressions, the efficacy of the recitation is also believed to be connected to the magical power of the words themselves or to the sacred power of a supernatural being. Certain gestures as well as words may be bound up with the act of blessing, as in putting one's hands on the head of the person being blessed. The curse, a wish to cause harm or misfortune, is usually directed against others, although an important form of curse, associated with oaths, contracts, and treaties, is conditionally directed against oneself, should one fail to keep one's word or tell the truth.

**spelling bee,** also called SPELLING MATCH, or SPELLDOWN, contest or game in which players attempt to spell correctly and aloud words assigned them by an impartial judge. Competition may be individual, with players eliminated when they misspell a word and the last remaining player being the winner, or between teams, the winner being the team with the most players remaining at the close of the contest. The spelling bee is an old custom that was revived in schools in the United States in the late 19th century and enjoyed a great vogue there and in Great Britain. In the United States, local, regional, and national competitions continue to be held annually.

**spelter,** zinc in the form of slabs cast from the liquid obtained in the process of reducing the ores. Spelter is the most common commercial form of zinc metal. *See* zinc.

**Spelthorne,** district (borough), county of Surrey, England, bounded on the south and west by the River Thames and on the north and east by Greater London. It includes Staines (the principal settlement and district headquarters), Ashford, Shepperton, Sunbury, and the southern edge of London's Heathrow Airport. It is crossed by the M3 motorway and other major roads out of London. A remarkable feature of the district is the large fraction of its area covered by water. There is a series of large reservoirs, including a vast one at Littleton, fed by the Thames and designed to supply the needs of London. The area of the district is 22 sq mi (56 sq km). Pop. (1983 est.) 91,100.

**Spelvin, George,** U.S. theatrical convention used in the credits commonly to conceal dual roles or for a corpse or other anthropomorphic props. Spelvin first "appeared" on Broadway in the cast list of Charles A. Gardiner's *Karl the Peddler* in 1886. Winchell Smith employed the character in many of his plays, beginning with *Brewster's Millions* in 1906. He appeared with Maude Adams in *Joan of Arc* (1908), as a Betting Man in *High Button Shoes* (1947), and as Colonel Dent in *Jane Eyre* (1958).

D.W. Griffith cast Spelvin as a Union soldier in his epochal film *The Birth of a Nation* (1915) and as a dancer in *Way Down East* (1920). He also had a small role in the Academy Award-winning *From Here to Eternity* (1953). Spelvin was first listed in television credits in the dramatic series *The Fugitive,* and from time to time he has filled out the cast of such daytime soap operas as *The Guiding Light* and *Edge of Night.*

When a female character is needed, the player is listed as Georgiana, or Georgette, Spelvin. Spelvin's British counterparts are Walter Plinge, Mr. F. Anney, and Mr. Bart.

**Spemann, Hans** (b. June 27, 1869, Stuttgart, Württemberg [now in Ger.]—d. Sept. 12, 1941, Freiburg im Breisgau, Ger.), German embryologist who was awarded the Nobel Prize for Medicine or Physiology in 1935 for the discovery of the effect now known as embryonic induction, the influence exercised by various parts of the embryo that directs the development of groups of cells into particular tisues and organs.

Spemann, initially a medical student, attended the universities of Heidelberg, Munich, and Würzburg and graduated in zoology, botany, and physics. He worked at the Zoological Institute of Würzburg (1894–1908), held a professorship at Rostock (1908–14), was director of the Kaiser Wilhelm Institute for Biology in Berlin (1914–19), and occupied the chair of zoology at Freiburg (1919–35).

Spemann's concept of induction was based upon a lifetime of research into the early development of the newt. His work showed that, in the earliest stages, the fate of the embryonic parts has not been determined: if a piece of presumptive skin tissue is excised and transplanted into an area of presumptive nervous tissue, it will form nervous tissue, not skin. These results illuminated not only normal processes of development but also the origin of congenital abnormalities. Spemann summarized his researches in *Experimentelle Beiträge zu einer Theorie der Entwicklung* (1936; *Embryonic Development and Induction,* 1938).

*Consult the* INDEX *first*

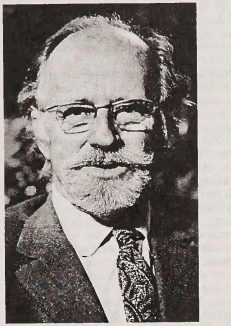
**Spence, A. Michael** (b. 1943, Montclair, N.J., U.S.), American economist who, with George A. Akerlof and Joseph E. Stiglitz, won the Nobel Prize for Economics in 2001 for laying the foundations for the theory of markets with asymmetric information.

Spence attended Yale University (B.A., 1966), the University of Oxford (B.A., M.A., 1968), and Harvard University (Ph.D., 1972). He later taught at Harvard and at Stanford University, serving as dean of the latter's business school from 1990 to 1999.

Through his research on markets with asymmetric information, Spence developed the theory of "signaling" to show how better-informed individuals in the marketplace communicate their information to the less-well-informed to avoid the problems associated with adverse selection. In his 1973 seminal paper, "Job Market Signaling," Spence demonstrated how a college degree signals a job seeker's intelligence and ability to a prospective employer. Other examples of signaling included corporations giving large dividends to demonstrate profitability and manufacturers issuing guarantees to convey the high quality of a product.

**Spence, Sir Basil (Urwin)** (b. Aug. 13, 1907, Bombay, India—d. Nov. 19, 1976, Eye, Suffolk, Eng.), English architect best known for the new Coventry cathedral, built to replace the cathedral that had been gutted during a World War II bombing raid.

He was educated at the schools of architecture of London and Edinburgh universities and worked in Sir Edwin Lutyens' office on drawings for the Viceroy's House in New Delhi. Before the war he built large country



Sir Basil Spence, 1972
J.S. Lewinski

houses, and in 1951 he won the competition for the new Coventry cathedral (completed in 1962). This monumental, richly decorated structure incorporates the ruins of the bombed 14th-century cathedral. He gave his account of the project in *Phoenix at Coventry* (1962).

Spence had a strong sense of the relations of buildings to landscape, as shown especially in his designs for the University of Sussex (first quadrangle 1962–63), in a beautiful Downland setting. He also designed parish churches, housing developments, apartment buildings, theatres, factories, and office buildings. He was knighted in 1960, and from 1961 to 1968 he was professor of architecture at the Royal Academy. He was architect for the British Embassy at Rome (completed in 1971) and for the British pavilion at Expo 67 in Montreal. His *New Buildings in Old Cities* was published in 1973.

**Spencer, Sir (Walter) Baldwin** (b. June 23, 1860, Stretford, Lancashire, Eng.—d. July 14, 1929, Tierra del Fuego), English biologist and anthropologist, the first trained and experienced scientist to enter the field of Australian anthropology.

After briefly studying art, Spencer went to Owens College and in 1881 to Exeter College, Oxford, receiving a B.A. with first-class honours in natural science in 1884. He became a professor of biology at the University of Melbourne in 1887.

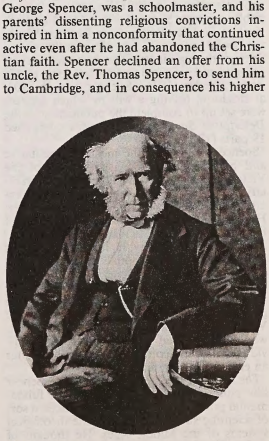
Spencer's interest in anthropology blossomed in 1894, when he joined the Horn Scientific Expedition to explore central Australia and met Francis James Gillen, who had been independently pursuing studies of the Aboriginals. In 1896 Spencer and Gillen began the study that resulted in the publication of *The Native Tribes of Central Australia* (1899). Getting to know the Aboriginals intimately and winning their trust, the two men accumulated an immense amount of information about Aboriginal customs, rituals, and beliefs. In 1904 they published *The Northern Tribes of Central Australia,* which drew on their travels around the Gulf of Carpentaria and conveyed a living picture of seminomadic, food-gathering and hunting people engaged in everyday economic and social activities and rituals. Spencer believed that the Aboriginals' social organization illustrated an early stage in the development of mankind.

In 1900 Spencer became a fellow of the Royal Society and was knighted in 1916. He also wrote *The Arunta: A Study of a Stone Age People* (1927), in which he renewed and confirmed his earlier views, and *Wanderings in Wild Australia* (1928), a popular account of his experiences. He died while on an expedition to Tierra del Fuego to study the last Indians at Ushuaia.

**Spencer, Charles:** *see* Sunderland, Charles Spencer, 3rd earl of.

**Spencer, Herbert** (b. April 27, 1820, Derby, Derbyshire, Eng.—d. Dec. 8, 1903, Brighton, Sussex), English sociologist and philosopher, an early advocate of the theory of evolution, who achieved an influential synthesis of knowledge, advocating the preeminence of the individual over society and of science over religion. His magnum opus was *The Synthetic Philosophy,* a comprehensive work completed in 1896 and containing volumes on the principles of biology, psychology, morality, and sociology.

*Life and works.* Spencer's father, William George Spencer, was a schoolmaster, and his parents' dissenting religious convictions inspired in him a nonconformity that continued active even after he had abandoned the Christian faith. Spencer declined an offer from his uncle, the Rev. Thomas Spencer, to send him to Cambridge, and in consequence his higher



Herbert Spencer
The Gernsheim Collection, the University of Texas at Austin

education was largely the result of his own reading, which was chiefly in the natural sciences. He was, for a few months, a schoolteacher and from 1837 to 1841 a railway civil engineer.

In 1842 he contributed some letters (republished later as a pamphlet, *The Proper Sphere of Government,* 1843) to *The Nonconformist,* in which he argued that it is the business of governments to uphold natural rights and that they do more harm than good when they go beyond this. After some association with progressive journalism through such papers as *The Zoist* (devoted to mesmerism and phrenology) and *The Pilot* (the organ of the Complete Suffrage Union), Spencer became in 1848 a subeditor of *The Economist.* In 1851 he published *Social Statics* (reissued in 1955), which contained in embryo most of his later views, including his argument in favour of an extreme form of economic and social laissez-faire. About 1850 Spencer became acquainted with Marian Evans (the novelist George Eliot), and his philosophical conversations with her led some of their friends to

expect that they would marry; but in his *Autobiography* (1904) Spencer denies any such desire, much as he admired Evans' intellectual powers. Other friends were G.H. Lewes, T.H. Huxley, and J.S. Mill. In 1853 Spencer, having received a legacy from his uncle, resigned his position with *The Economist*.

Having published the first part of *The Principles of Psychology* in 1855, Spencer in 1860 issued a prospectus and accepted subscriptions for a comprehensive work, *The Synthetic Philosophy*, which was to include, besides the already published *Principles of Psychology*, volumes on first principles and on biology, sociology, and morality. *First Principles* was published in 1862, and between then and 1896, when the third volume of *The Principles of Sociology* appeared, the task was completed. In order to prepare the ground for *The Principles of Sociology*, Spencer started in 1873 a series of works called *Descriptive Sociology*, in which information was provided about the social institutions of various societies, both primitive and civilized. The series was interrupted in 1881 because of lack of public support. Spencer was a friend and adviser of Beatrice Potter, later Beatrice Webb, the social reformer, who frequently visited Spencer during his last illness and left a sympathetic and sad record of his last years in *My Apprenticeship* (1926). Spencer died in 1903, at Brighton, leaving a will by which trustees were set up to complete the publication of the *Descriptive Sociology*. The series comprised 19 parts (1873–1934).

Spencer was one of the most argumentative and most discussed English thinkers of the Victorian period. His strongly scientific orientation led him to urge the importance of examining social phenomena in a scientific way. He believed that all aspects of his thought formed a coherent and closely ordered system. Science and philosophy, he held, gave support to and enhanced individualism and progress. Though it is natural to cite him as the great exponent of Victorian optimism, it is notable that he was by no means unaffected by the pessimism that from time to time clouded the Victorian confidence. Evolution, he taught, would be followed by dissolution, and individualism would come into its own only after an era of socialism and war.

*The synthetic philosophy in outline.* Spencer saw philosophy as a synthesis of the fundamental principles of the special sciences, a sort of scientific summa to replace the theological systems of the Middle Ages. He thought of unification in terms of development, and his whole scheme was in fact suggested to him by the evolution of biological species. In *First Principles* he argued that there is a fundamental law of matter, which he called the law of the persistence of force, from which it follows that nothing homogeneous can remain as such if it is acted upon, because any external force must affect some part of it differently from other parts and cause difference and variety to arise. From this, he continued, it would follow that any force that continues to act on what is homogeneous must bring about an increasing variety. This "law of the multiplication of effects," due to an unknown and unknowable absolute force, is in Spencer's view the clue to the understanding of all development, cosmic as well as biological. It should be noted that Spencer published his idea of the evolution of biological species before the views of Charles Darwin and the British naturalist Alfred Russel Wallace were known, but Spencer at that time thought that evolution was caused by the inheritance of acquired characteristics, whereas Darwin and Wallace attributed it to natural selection. Spencer later accepted the theory that natural selection was one of the causes of biological evolution, and he himself coined the phrase "survival of the fittest" (*Principles of Biology* [1864], vol. 1, p. 444).

*Sociology and social philosophy.* That Spencer first derived his general evolutionary scheme from reflection on human society is seen in *Social Statics*, in which social evolution is held to be a process of increasing "individuation." He saw human societies as evolving by means of increasing division of labour from undifferentiated hordes into complex civilizations. Spencer believed that the fundamental sociological classification was between military societies, in which cooperation was secured by force, and industrial societies, in which cooperation was voluntary and spontaneous.

Evolution is not the only biological conception that Spencer applied in his sociological theories. He made a detailed comparison between animal organisms and human societies. In both he found a regulative system (the central nervous system in the one, government in the other), a sustaining system (alimentation in the one case, industry in the other), and a distribution system (veins and arteries in the first; roads, telegraphs, etc., in the second). The great difference between an animal and a social organism, he said, is that, whereas in the former there is one consciousness relating to the whole, in the latter consciousness exists in each member only; society exists for the benefit of its members and not they for its benefit.

This individualism is the key to all of Spencer's work. His contrast between military and industrial societies is drawn between despotism, which is primitive and bad, and individualism, which is civilized and good. He believed that in industrial society the order achieved, though planned by no one, is delicately adjusted to the needs of all parties. In *The Man Versus the State* (1884) he wrote that England's Tories generally favour a military and Liberals an industrial social order but that the Liberals of the latter half of the 19th century, with their legislation on hours of work, liquor licensing, sanitation, education, etc., were developing a "New Toryism" and preparing the way for a "coming slavery." "The function of liberalism in the past was that of putting a limit to the powers of kings. The function of true liberalism in the future will be that of putting a limit to the powers of parliaments."

*Metaphysics.* In his emphasis on variety and differentiation, Spencer was unwittingly repeating, in a 19th-century idiom, the metaphysics of liberalism that Spinoza and Leibniz had adumbrated in the 17th century. Spinoza had maintained that "God or Nature" has an infinity of attributes in which every possibility is actualized, and Leibniz had argued that the perfection of God is exhibited in the infinite variety of the universe. Though neither of them believed that time is an ultimate feature of reality, Spencer combined a belief in the reality of time with a belief in the eventual actualization of every possible variety of being. He thus gave metaphysical support to the liberal principle of variety, according to which a differentiated and developing society is preferable to a monotonous and static one.

*Evaluation.* Spencer's attempt to synthesize the sciences showed a sublime audacity that has not been repeated because the intellectual specialization he welcomed and predicted increased even beyond his expectations. His sociology, although it gave an impetus to the study of society, was superseded as a result of the development of social anthropology since his day and was much more concerned with providing a rationale for his social ideals than he himself appreciated. Primitive men, for example, are not the childlike emotional creatures that he thought them to be, nor is religion to be explained only in terms of the souls of ancestors. When T.H. Huxley said that Spencer's idea of a tragedy was "a deduction killed by a fact," he called attention to the system-building feature of Spencer's work that led him to look for what confirmed his theories and to ignore or to reinterpret what conflicted with them. (H.B.A.)

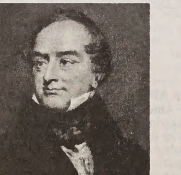
MAJOR WORKS. *Philosophy and religion. The Nature and Reality of Religion*, 1885 (withdrawn from publication). Spencer's series on *Synthetic Philosophy* comprises: *First Principles*, 1862; *The Principles of Biology*, 2 vol., 1864–67; *The Principles of Psychology*, 1855; *The Principles of Sociology*, 3 vol., 1876–96; *The Principles of Ethics*, 2 vol., 1892–93.

*Political and social. The Proper Sphere of Government*, 1843; *Social Statics*, 1851; *Education: Intellectual, Moral, Physical*, 1861; *The Study of Sociology*, 1872; *The Man Versus the State*, 1884; *Facts and Comments*, 1902.

*Other works.* Essays: *Scientific, Political, and Speculative*, 3 vol., 1891; *Autobiography*, 1904, an intellectual rather than a personal autobiography.

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**Spencer, John Charles Spencer, 3rd Earl,** also called (until 1834) VISCOUNT ALTHORP (b. May 30, 1782, London—d. Oct. 1, 1845, near Clayworth, Nottinghamshire, Eng.), statesman, leader of the British House of Commons



The 3rd Earl Spencer, detail of a chalk drawing by Charles Turner; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

and chancellor of the Exchequer from 1830 to 1834; he greatly aided Lord John Russell (afterward 1st Earl Russell), chief author of the Reform Bill of 1832, in securing its passage in the Commons. Courageous, honest, and sensible though not brilliant, he successfully led an ill-assorted majority of Whigs, Radicals, and Irish against an opposition powerfully directed by Sir Robert Peel.

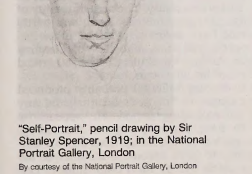
As Viscount Althorp, he sat in the House of Commons for 30 years, from 1804. In 1827 he declined the leadership of the Whig opposition, but in November 1830 he accepted office in the new ministry of the 2nd Earl Grey. In addition to his work on the Reform Bill, he sponsored the Factory Act of 1833 (Althorp's Act), restricting the employment of children in textile mills. His opposition to a "coercion" bill against Irish nationalists led to Grey's resignation (1834). Althorp remained

in office four more months, but when he inherited the Spencer earldom and left the House of Commons, King William IV took the opportunity to dismiss (November 15) the government of Grey's successor, the 2nd Viscount Melbourne. Spencer then retired from politics.

**Spencer, Robert:** *see* Sunderland, Robert Spencer, 2nd Earl of.

**Spencer, Sir Stanley** (b. June 30, 1891, Cookham, Berkshire, Eng.—d. Dec. 14, 1959, Taplow, Buckinghamshire), one of the leading painters in England between the world wars, whose work primarily draws upon Christian religious subjects. Spencer's work has Surrealistic overtones, a curiously distorted style of drawing, and a strong element of satiric social comment.

Spencer studied at the Slade School and first exhibited at the New English Art Club. He frequently used his hometown as a setting and employed modern dress in his paintings based on biblical themes. In the huge "Resurrection" (1928–29; Sandham Memorial Chapel, Burghclere, Hampshire) dead soldiers in Cookham churchyard struggle from their tombs into a cross-strewn landscape. In "The Resurrection: Port Glasgow" (1950; Tate Gallery, London)



"Self-Portrait," pencil drawing by Sir Stanley Spencer, 1919; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

the swollen figures swarm and writhe over the picture space in attitudes that suggest the apocalyptic visions of early medieval sculpture.

Spencer also painted highly finished landscapes and humorous comments on the absurdity of human behaviour. "The Nursery" (1936; Museum of Modern Art, New York City) is a biting satiric comment on the parent-child relationship. Spencer was elected to the Royal Academy (1950) and knighted in 1959.

**Spencer carbine,** any of a family of rim-fire repeating arms—both carbines and rifles—that were widely used in the American Civil War. The carbine was invented by Christopher M. Spencer of Connecticut and was patented in 1860. Its buttstock contained a magazine carrying seven cartridges that could be fired in about 18 seconds. The cartridges were fed to the breech by pressure from a spring in the magazine. With the addition of the Blakeslee cartridge box as an auxiliary, the Spencer carbine had greatly improved capacity for sustained fire. The box contained from 6 to 13 tin tubes, each of which held seven cartridges. The carbine was almost exclusively a cavalry weapon, and it was normally chambered in .52 calibre. The weapon had a 22-inch (56-centimetre) barrel and was 39 inches long overall. The Spencer rifle was of similar design but had a barrel 47 inches long.

**Spencer Gulf,** triangular inlet of the Indian Ocean, indenting the southeastern coast of South Australia, between the Eyre and Yorke peninsulas. Its maximum width is 80 miles (130 km) and overall length 200 miles (320 km). The Sir Joseph Banks, Thistle, Gambier, and Neptune islands are located in its 50-mile- (80-kilometre-) wide mouth. Mangrove swamps line the eastern shore and marine fibre beds the western. Major ports are Whyalla, Port Pirie, and Port Augusta (near the head of the inlet) and Port Lincoln (at the entrance on the west). Explored by Matthew Flinders in 1802, the gulf was named in honour of Earl Spencer, first lord of the Admiralty (1794–1801).

**Spencer Jones, Sir Harold** (British astronomer): *see* Jones, Sir Harold Spencer.

**Spencerian penmanship,** style of cursive script developed by Platt Rogers Spencer (d. 1864) of Geneva, Ohio. Energetically pro-



Spencerian handwriting from "Pioneer Anthem," by Platt Rogers Spencer, 1850; in the collection of Dartmouth College, Hanover, N.H.

By courtesy of Ray Nash

moted by five sons and a nephew, the Spencerian method became the most widely known system of handwriting instruction in the third quarter of the 19th century. In partnership with Victor M. Rice, who became New York state superintendent of public instruction, Spencer in 1848 began issuing engraved copy slips in series and by the thousands. These were followed in the 1850s by copybooks with engraved and lithographed models that were used in American schoolrooms for several decades.

**Spender, Sir Stephen,** in full SIR STEPHEN HAROLD SPENDER (b. Feb. 28, 1909, London, Eng.—d. July 16, 1995, London), English poet and critic, who made his reputation in the 1930s with poems expressing the politically conscience-stricken, leftist "new writing" of that period.

A nephew of the Liberal journalist and biographer J.A. Spender, he was educated at University College School, London, and at University College, Oxford. While an undergraduate he met the poets W.H. Auden and C. Day-Lewis, and during 1930–33 he spent many months in Germany with the writer Christopher Isherwood. Among important influences shown in his early volumes—*Poems* (1933); *Vienna* (1934); *Trial of a Judge,* a verse play (1938); and *The Still Centre* (1939)—were the poetry of the German Rainer Maria Rilke and of the Spaniard Federico García Lorca. Above all, his poems expressed a self-critical, compassionate personality. In the following decades Spender, in some ways a more personal poet than his early associates, became increasingly more autobiographical, turning his gaze from the external topical situation to the subjective experience. His reputation for humanism and honesty is fully vindicated in subsequent volumes—*Ruins and Visions* (1942), *Poems of Dedication* (1947), *The Edge of Being* (1949), *Collected Poems* (1955), *Selected Poems* (1965), *The Generous Days* (1971), and *Dolphins* (1994).

From the 1940s he was better known for his perceptive criticism and his editorial association with the influential reviews *Horizon* (1940–41) and *Encounter* (1953–67) than he was as a poet. Spender's prose works include short stories (*The Burning Cactus,* 1936), a novel (*The Backward Son,* 1940), literary criticism (*The Destructive Element,* 1935; *The Creative Element,* 1953; *The Making of a Poem,* 1955; *The Struggle of the Modern,* 1963), an autobiography (*World Within World,* 1951, reissued 1994), and uncollected essays with new commentary (*The Thirties and After,* 1978).

During World War II Spender was a member of the National Fire Service (1941–44). After the war he made several visits to the United States, teaching and lecturing at universities. In 1970 he was appointed professor of English at University College, London; he became professor emeritus in 1977. He was knighted in 1983.

**Spener, Philipp Jakob** (b. Jan. 23, 1635, Rappoltsweiler, Upper Alsace [now Ribeauvillé, France]—d. Feb. 5, 1705, Berlin, Prussia [Germany]), theologian, author, and a leading figure in German Pietism, a movement among 17th- and 18th-century Lutherans that stressed personal improvement and upright conduct as the most important manifestations of Christian faith.

During his studies at Strassburg (1651–59) Spener developed an interest in reforming Lutheran orthodox theology and practice. In particular, he objected to the rigidity of ecclesiastical structures and the lack of moral discipline among the clergy. At the age of 31, Spener became president of the Lutheran Church at Frankfurt am Main, where he began his *collegia pietatis* ("schools of piety"), devotional gatherings intended to encourage personal spiritual growth, prayer, and Bible study. His extensive correspondence with the German clergy contributed to the growth of Pietism, as did his major work, *Pia Desideria* (1675; *Pious Desires*). That work outlined Pietism's basic program and earned Spener a reputation throughout Germany as the spokesman for the movement. His emphasis upon practice was often considered extreme, to the detriment of doctrine. But the doctrinal conflicts of his time deeply concerned Spener, who considered many of them harmful and irrelevant. In 1686 he was made first court chaplain at Dresden, then the most valued position in the German Lutheran Church, but his views soon aroused opposition. Attacks upon Pietism came from the orthodox Lutherans at the University of Leipzig and from the Saxon court, whose elector, John George III, had been rebuked by Spener for drunkenness.

Spener consequently moved to Berlin in 1691 to become provost of St. Nicholas' Church. There he gained from the Brandenburg-Prussian court the support that enabled him to carry out numerous reforms. At the new University of Halle, founded on a Pietist basis by the Elector of Brandenburg in 1694, Spener obtained positions for his disciples Christian Thomasius and August H. Francke. By the time of Spener's death, Pietism was well established in Germany, and its influence reached to England and eventually to the British colonies in America. Other important works among Spener's more than 300 writings are *Das geistliche Priestertum* (1677; "The Spiritual Priesthood") and *Die allgemeine Gottesgelehrtheit* (1680; "General Theology").

**Spengler, Oswald** (b. May 29, 1880, Blankenburg, Ger.—d. May 8, 1936, Munich), German philosopher whose reputation rests entirely on his influential work *Der Untergang des Abendlandes,* 2 vol. (1918–22; *The Decline of the West*), a major contribution to social theory.

After taking his doctorate at the University of Halle (1904), Spengler worked as a schoolmaster until 1911, when he went to live in Munich on a small inheritance and began work on *Der Untergang.* The first volume, published in 1918, won him immediate acclaim from the general public. The second volume followed in 1922, and a revised edition of the first a year later. From 1919 onward, Spengler tried to turn his reputation to account as a political commentator, but he met with little success.

*Der Untergang* is a study in the philosophy of history. Spengler contended that because most

civilizations must pass through a life cycle, not only can the historian reconstruct the past but he can predict "the spiritual forms, duration, rhythm, meaning and product of the still unaccomplished stages of our Western history."



Spengler, pencil drawing by K. Grossmann, 1920; in a private collection
Deutsche Fotothek, Dresden

Unlike Arnold Toynbee, who later held that cultures are usually "apparented" to older cultures, Spengler contended that the spirit of a culture can never be transferred to another culture. He believed that the West had already passed through the creative stage of "culture" into that of reflection and material comfort ("civilization" proper, in his terminology) and that the future could only be a period of irreversible decline. Nor was there any prospect of reversing the process, for civilizations blossomed and decayed like natural organisms, and true rejuvenation was as impossible in the one case as the other.

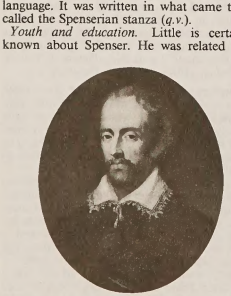
Spengler's work won scant approval from professional scholars, who were scandalized by his unorthodox methods and contemptuous of his errors of fact. He was also criticized by the National Socialist Party, despite some affinity between his political ideas and Nazi dogma, and, after Adolf Hitler's rise to power in 1933, Spengler lived in isolation until his death.

Among his other works, *Der Mensch und die Technik* (1931; *Man and Technics*) stands out.

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**Spenser, Edmund** (b. 1552/53, London, Eng.—d. Jan. 13, 1599, London), English poet whose long allegorical poem, *The Faerie Queene,* is one of the greatest in the English language. It was written in what came to be called the Spenserian stanza (*q.v.*).

*Youth and education.* Little is certainly known about Spenser. He was related to a noble Midlands family of Spencer, whose fortunes had been made through sheep raising. His own immediate family was not wealthy. He was entered as a "poor boy" in the Merchant Taylors' grammar school, where he would have studied mainly Latin, with some Hebrew, Greek, and music.



Spenser, oil painting by an unknown artist; in the collection of Pembroke College, Cambridge, Eng.
By courtesy of the Master and Fellows, Pembroke College, Cambridge, Eng.

In 1569, when Spenser was about 16, his English versions of poems by the 16th-century French poet Joachim du Bellay and his translation of a French version of a poem by the Italian poet Petrarch appeared at the beginning of an anti-Catholic prose tract, "The Theatre for Worldlings"; they were no doubt commissioned by its chief author, the wealthy Flemish expatriate Jan van der Noodt. (Some of these poems Spenser later revised for his *Complaints* volume.)

From May 1569 Spenser was a student in Pembroke Hall (now Pembroke College) of the University of Cambridge, where, along with perhaps a quarter of the students, he was classed as a sizar—a student who, out of financial necessity, performed various menial or semimenial duties. He received his bachelor of arts degree in 1573. Because of an epidemic Spenser left Cambridge in 1574, but he received his master of arts degree in 1576.

His best-known friend at Cambridge was the slightly older Gabriel Harvey, a fellow of Pembroke, who was learned, witty, and enthusiastic for ancient and modern literature but also pedantic, devious, and ambitious. There is no reason to believe that Spenser shared the most distasteful of these qualities, but, in the atmosphere of social mobility and among the new aristocracy of Tudor England, it is not surprising that he hoped for preferment to higher position.

Spenser's period at the University of Cambridge was undoubtedly important for the acquisition of his wide knowledge not only of the Latin and some of the Greek classics but also of Italian, French, and English literature of his own and earlier times. His knowledge of the traditional forms and themes of lyrical and narrative poetry provided foundations for him to build his own highly original compositions. Without the Roman epic poet Virgil's *Aeneid,* the 15th-century Italian Ludovico Ariosto's *Orlando Furioso,* and, later, Torquato Tasso's *Gerusalemme liberata* (1581), Spenser could not have written his heroic, or epic, poem *The Faerie Queene.* Without Virgil's *Bucolics* and the later tradition of pastoral poetry in Italy and France, Spenser could not have written *The Shepheardes Calender.* And without the Latin, Italian, and French examples of the highly traditional marriage ode and the sonnet and canzone forms of Petrarch and succeeding sonneteers, Spenser could not have written his greatest lyric, *Epithalamion,* and its accompanying sonnets, *Amoretti.* The patterns of meaning in Spenser's poetry are frequently woven out of the traditional interpretations—developed through classical times and his own—of pagan myth, divinities, and philosophies and out of an equally strong experience of the faith and doctrines of Christianity; these patterns he further enriched by the use of medieval and contemporary story, legend, and folklore.

Spenser's religious training was a most important part of his education. He could not have avoided some involvement in the bitter struggles that took place in his university over the path the new Church of England was to tread between Roman Catholicism and extreme Puritanism. Contrary to a former view, there is little reason to believe that he inclined toward the Puritanical side. His first known appointment (after a blank of several years, when he may have been in the north of England) was in 1578 as secretary to Bishop John Young of Rochester, formerly master of Spenser's college at Cambridge. His first important publication, *The Shepheardes Calender* (1579 or 1580), is more concerned with the bishops and affairs of the English church than is any of his later work.

*Early works. The Shepheardes Calender* can be called the first work of the English literary Renaissance. Following the example of Virgil and of many later poets, Spenser was beginning his career with a series of eclogues (literally "selections," usually short poems in the form of pastoral dialogues), in which various characters, in the guise of innocent and simple shepherds, converse about life and love in a variety of elegantly managed verse forms, formulating weighty—often satirical—opinions on questions of the day. The paradoxical combination in pastoral poetry of the simple, isolated life of shepherds with the sophisticated social ambitions of the figures symbolized or discussed by these shepherds (and of their probable readership) has been of much interest in modern literary criticism.

The *Calender* consists of 12 eclogues, one named after each month of the year. One of the shepherds, Colin Clout, who excels in poetry but is ruined by his hopeless love for one Rosalind, is Spenser himself. The eclogue "April" is in praise of the shepherdess Elisa, really the queen (Elizabeth I) herself. "October" examines the various kinds of verse composition and suggests how discouraging it is for a modern poet to try for success in any of them. Most of the eclogues, however, concern good or bad shepherds—that is to say, pastors—of Christian congregations. The *Calender* was well received in its day, and it is still a revelation of what could be done poetically in English after a long period of much mediocrity and provinciality. The archaic quality of its language, sometimes deplored, was partly motivated by a desire to continue older English poetic traditions, like that of Geoffrey Chaucer. Archaic vocabulary is not so marked a feature of his later work.

The two years 1578–80 probably produced more changes in Spenser's life than did any other corresponding period. He appears by 1580 to have been serving the fascinating, highly placed, and unscrupulous Earl of Leicester and to have become a member of the literary circle led by Sir Philip Sidney, Leicester's nephew, to whom the *Calender* was dedicated and who praised it in his important critical work *The Defence of Poesie* (1595). Spenser remained permanently devoted to this brilliant writer and good nobleman, embodied him variously in his own poetry, and mourned his early death in an elegy. By 1580 Spenser had also started work on *The Faerie Queene* and in the previous year had apparently married one Machabyas Chylde. Interesting sidelights on his personal character, of which next to nothing is known, are given in a small collection of letter's between Spenser and Gabriel Harvey that was printed in 1580. The ironies in Harvey's and Spenser's exchange of letters are so intricate, however, as to make it difficult to draw many conclusions from them about Spenser, except that he was young, ambitious, accomplished, and sincerely interested in the theory and practice of poetry. In 1580 Spenser was made secretary to the new lord deputy of Ireland, Arthur Lord Grey, who was a friend of the Sidney family.

*Career in Ireland.* Sixteenth-century Ireland and the Irish were looked on by the English as a colony, although the supposed threat of an invasion by Spain and the conflict between an imposed English church and the Roman Catholicism of the Irish were further complicating factors. Irish chieftains and the Anglo-Irish nobility encouraged native resistance to newly arrived English officials and landowners. As Grey's secretary, Spenser accompanied the lord deputy on risky military campaigns as well as on more routine journeys. But Ireland was certainly no exile for Spenser. He became deeply attached to the country, its people and its landscapes. He several times gives poetic form to romantic or

idyllic reactions to the Irish scene, along with an equally strong dislike for its unproductive wildness and lawlessness. The conflict between Grey's direct, drastic governmental measures and the queen's characteristic procrastinating and temporizing style soon led to his frustration and recall. But Spenser, like many others, admired Grey's methods; his later tract, *A View of the Present State of Ireland* (written 1595–96, published 1633), argues lucidly for a typically 16th-century theory of rule: firm measures, consistently applied, with gentleness only for completely submissive subject populations.

For four or five years from about 1584, Spenser carried out the duties of a second important official position in Ireland, deputizing for his friend Lodowick Bryskett as clerk of the lords president (governors) of Munster, the southernmost Irish province. The fruits of his service in Ireland are plain. He was given a sinecure post and other favours, including the right to dispose of certain forfeited parcels of land (he no doubt indulged in profitable land speculation). For a time he leased the small property of New Abbey, County Kildare, and on this basis was first designated "gentleman." Finally, he obtained a much larger estate in Munster. One of the chief preoccupations of the presidents of this province, scarred as it was by war and starvation, was to repopulate it. To this end, large "plantations" were awarded to English "undertakers," who undertook to make them self-sustaining by occupying them with Englishmen of various trades. In 1588 or 1589 Spenser took over the 3,000-acre plantation of Kilcolman, about 25 miles to the north and a little to the west of Cork. No doubt he took there his son and daughter and his wife, if she was still alive (she is known to have died by 1594). By acquiring this estate, Spenser made his choice for the future: to rise into the privileged class of what was, to all intents, a colonial land of opportunity rather than to seek power and position on the more crowded ground of the homeland where he had made his poetic reputation. In his new situation he, like other undertakers, had much conflict with the local Anglo-Irish aristocracy and had limited success in filling the plantations with English families. Nevertheless, it was under these conditions that Spenser brought his greatest poetry to completion.

*"The Faerie Queene" and last years.* In its present form, *The Faerie Queene* consists of six books and a fragment (known as the "Mutabilitie Cantos"). According to Spenser's introductory letter in the first edition (1590) of his great poem, it was to contain 12 books, each telling the adventure of one of Gloriana's knights. Like other poets, Spenser must have modified his general plan many times, yet this letter, inconsistent though it is with various plot details in the books that are extant, is probably a faithful mirror of his thinking at one stage. The stories actually published were those of Holiness (the Red Cross Knight), Temperance (Sir Guyon), Chastity (Britomart, a female knight), Friendship (ostensibly concerning Triamond and Cambello, although these play a small part), Justice (Artegall), and Courtesy (Calidore). As a setting, Spenser invented the land of Faerie and its queen, Gloriana. To express himself he invented a nine-line stanza, the first eight of five stresses and the last of six, whose rhyme pattern is ababbcbcc.

What is most characteristic of Spenser in *The Faerie Queene* is his serious view of the capacity of the romance form to act as a paradigm of human experience: the moral life as quest, pilgrimage, aspiration; as eternal war with an enemy, still to be known; as encounter, crisis, the moment of illumination—in short, as ethics, with the added dimensions of mystery, terror, love, and victory and with all the generous virtues exalted. Modern readers' impatience with the obscure allusions in the poem, with its political and ecclesiastical topicalities, is a failure to share the great conflict of Spenser's time between Protestant England and Roman Catholic Spain—to Spenser, the war between good and evil was here and now. In *The Faerie Queene* Spenser proves himself a master: picture, music, metre, story—all elements are at one with the deeper significance of his poem, providing a moral heraldry of colours, emblems, legends, folklore, and mythical allusion, all prompting deep, instinctive responses.

The poem was published with the help of Sir Walter Raleigh, who owned large lands to the east of Spenser's estate. He and the poet came together at Kilcolman in 1589 and became well acquainted with one another's poetry. Spenser implies that Raleigh persuaded Spenser to accompany him back to England to present the completed portion of *The Faerie Queene* to Queen Elizabeth herself. The history of this episode is charmingly evoked in *Colin Clouts Come home againe* (completed 1595), which is also one of Spenser's most effective pastoral embodiments of a provincial innocent up against the sophistications of a centre of power, with subsequent reflections on false, superficial love and the true love that finally animates a concordant universe.

Arriving thus in London with the support of the queen's favourite, Spenser was well received—not least by Elizabeth herself. The first three books of *The Faerie Queene* were duly published in 1590, together with a dedication to her and commendatory sonnets to notables of the court. Spenser saw the book through the press, made a hurried visit to Ireland, and returned speedily to London—presumably in the hope of preferment. At this time he supervised the printing of certain other of his poems in a collection called *Complaints* (1591), many of which had probably been written earlier in his career and were now being published so as to profit from the great success of his new heroic poem. It is difficult to believe that the many titles of poems that have not survived but were mentioned earlier in his career were not published in revised form and under other titles in his known work; for *Complaints* suggests by its miscellaneous and uneven character that Spenser was hastily bringing to the light of day nearly every last shred that he had to offer: early translations, an elegy, and the delightful mock-heroic poem "Muiopotmos" are contained in it; another item, the beast fable "Prosopopoia, or Mother Hubberd's Tale," apparently caused the authorities to withdraw unsold copies of the volume (perhaps in 1592) because it contained a covert attack on Lord Burghley, who was one of the most powerful figures of the court. Nevertheless, in 1591 Queen Elizabeth gave Spenser a small pension for life.

Back in Ireland, Spenser pressed on with his writing, in spite of the burdens of his estate. In early 1595 he published *Amoretti* and *Epithalamion,* a sonnet sequence and a marriage ode celebrating Spenser's marriage to his second wife (Elizabeth Boyle) after what appears to have been an impassioned courtship in 1594. This group of poems is unique among Renaissance sonnet sequences in that it celebrated a successful love affair culminating in marriage. As in passages in *The Faerie Queene,* Spenser develops in *Epithalamion* an aspect of Platonism according to which the changes wrought by time in our imperfect universe imitate the unchanging excellence of eternity through their cyclical character, continually restoring what they continually remove. Such are day and night, the circling year, the rebirth of plant and animal life, and human reproduction under the stimulus of sexual pleasure in marriage. Spenser conveys the unity of these cycles in his marriage ode, where he symbolizes the daily and annual cycles of the sun by giving the poem 24 stanzas (representing the hours) and a total of 365 pentameter and hexameter lines (representing the days). In that year Spenser may have again been busy in London supervising the publication of a number of works, including Books IV, V, and VI of *The Faerie Queene,* which appeared in 1596.

This burst of publication was the last of his lifetime. His early death may have been precipitated by the penetration into Munster of the Irish uprising of 1598. The undertakers and other loyalists failed to make head against this. Kilcolman was burned, and Spenser, probably in despair despite the Privy Council's having just recommended his appointment to the important post of sheriff of Cork, carried official letters about the desperate state of affairs from the president to London, where he died. He was buried with ceremony in Westminster Abbey close by the grave of Geoffrey Chaucer.

*Assessment.* Spenser was considered in his day to be the greatest of English poets, who had glorified England and its language by his long allegorical poem *The Faerie Queene,* just as Virgil had glorified Rome and the Latin tongue by his epic poem the *Aeneid.* Spenser had a strong influence upon his immediate successors, and the sensuous features of his poetic style, as well as his nine-line stanza-form, were later admired and imitated by such poets as Lord Byron and Percy Bysshe Shelley in the Romantic period of the late 18th and early 19th centuries. He is widely studied today as one of the chief begetters of the English literary Renaissance and as a master who embodied in poetic myth a view of the virtuous life in a Christian universe. (A.K.H./Ed.)

MAJOR WORKS. *Poems. The Shepheardes Calender* (1579); *The Faerie Queene,* Books I–III (1590); *Complaints* (1591); *Daphnaïda* (1591); *Amoretti* and *Epithalamion* (1595); *The Faerie Queene,* Books I–VI, 2 vol. (1596); *Fowre Hymnes* (1596); *Prothalamion* (1596); *The Faerie Queene,* Books I–VI with the fragment of Book VII known as "Mutabilitie Cantos" (1609).

*Prose. Three Proper, and Wittie, Familiar Letters,* by Gabriel Harvey and Spenser (1580); *A View of the Present State of Ireland* (1633).

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**Spenserian stanza,** verse form that consists of eight iambic pentameter lines followed by a ninth line of six iambic feet (an alexandrine); the rhyme scheme is *ababbcbcc.* The first eight lines produce an effect of formal unity, while the hexameter completes the thought of the stanza. Invented by Edmund Spenser for his poem *The Faerie Queene* (1590–1609), the Spenserian stanza has origins in the Old French ballade (eight-line stanzas, rhyming *ababbcbc*), the Italian ottava rima (eight iambic pentameter lines with a rhyme scheme of *abababcc*), and the stanza form used by Chaucer in his "Monk's Tale" (eight

lines rhyming *ababbcbc*). A revolutionary innovation in its day, the Spenserian stanza fell into general disuse during the 17th and 18th centuries. It was revived in the 19th century by the Romantic poets—*e.g.*, Byron in *Childe Harold's Pilgrimage,* Keats in "The Eve of St. Agnes," and Shelley in "Adonais."

**Spenta Mainyu,** in Zoroastrianism, the Holy Spirit, created by the Wise Lord, Ahura Mazdā, to oppose the Destructive Spirit, Angra Mainyu.

Spenta Mainyu is an aspect of the Wise Lord himself. Through the Holy Spirit, Ahura Mazdā creates life and goodness. According to Zoroastrian belief, Spenta Mainyu protects and maintains many realms and creatures—the sky, water, earth, plants, and children yet to be born.

**Speransky, Mikhail Mikhaylovich, Graf** (Count) (b. Jan. 12 [Jan. 1, old style], 1772, Cherkutino, Russia—d. Feb. 23 [Feb. 11, O.S.], 1839, St. Petersburg), Russian statesman prominent during the Napoleonic period, administrative secretary and assistant to Em-



Speransky, detail of a portrait by an unknown artist
Novosti Press Agency

peror Alexander I. He later compiled the first complete collection of Russian law, *Complete Collection of the Laws of the Russian Empire,* 45 vol. (1830), leading to his supervision of the *Digest of the Laws,* 15 vol. (1832–39).

*Early life.* Mikhail, or Misha, Mikhaylovich was the son of the village priest of Cherkutino in central Russia. He was sent at the age of 12 to the ecclesiastical seminary in Vladimir, the provincial capital. His lack of a surname (Mikhaylovich indicating simply "son of Mikhail") was overcome by an imaginative uncle, who dubbed him Speransky, a Russified form of the Latin word for hope. The boy soon distinguished himself by his ability to analyze problems and to express his thoughts with grace and clarity, but he already displayed an aloofness that emphasized his consciousness of his intellectual superiority yet cloaked his very real desire to feel the affection of those whom he respected, a quality that was to be a handicap in his later official career.

As a priest's son, he was sent at government expense to the Main Seminary newly founded in St. Petersburg. On completion of the course, he should have returned to his native diocese as a teacher. But a practice sermon so pleased the Metropolitan of St. Petersburg that the Synod granted permission to retain Speransky as a teacher of mathematics in the Main Seminary. Speransky resisted the urging of the Metropolitan that he take monastic vows, a step that would have opened to him the possibility of rising to the highest offices in the church. Despite his refusal, he was, in 1795, appointed instructor of philosophy and prefect of the seminary.

*Secretary to Prince Kurakin.* At this point, Speransky's future prospects were radically changed. Prince A.B. Kurakin took him into his household as secretary. Here he deepened his knowledge of the thought of the French Enlightenment and was introduced to the Idealist philosophy of Immanuel Kant. On the accession of Emperor Paul I (1796), Kurakin was appointed procurator general of the Senate, a post as close as possible in the Russian system of that time to that of prime minister. He was, thus, powerful enough to secure Speransky's release from his priestly status, which enabled him to enter government service. Speransky was pushed rapidly upward through the lower bureaucratic grades; by the end of 1798, still not 27 years old, he had already risen high enough in the Table of Ranks to be entitled to enjoy, on a hereditary basis, all the privileges of "the most ancient nobility."

In the same year, Speransky met an English girl whose widowed mother had come to Russia as a governess. He became so enamored of her that, although she knew no Russian and he understood no English, a courtship in fractured French led to their marriage. In the following year a daughter was born, but the mother, suffering from tuberculosis, died a few months later. Speransky, completely shattered, disappeared for a time. He never remarried but immersed himself wholly in his work. When Kurakin suddenly fell from favour, Speransky's tact, his evident ability, and his industry enabled him to continue his career.

*Secretary to the Emperor.* Under Paul's successor, Alexander I, he was assigned to ever more responsible positions, at first in the new Ministry of the Interior, where he gained invaluable experience in drafting legislation and was the prime mover in founding *Severnaya pochta* or *Novaya Sankt-Petersburgskaya gazeta,* Russia's first official newspaper. In 1807 he became intimately associated with the Emperor himself, as his administrative secretary and assistant. In 1808 he accompanied Alexander to his meeting with Napoleon, who described him as "the only clear head in Russia." Though he proved not yet able to cope successfully with the task of codifying the country's laws, he reorganized the seminaries and secured the establishment of the first Russian lycée (state secondary school).

In 1809 he laid the basis for his own downfall by two measures that outraged the bureaucratic nobility: one required that holders of court titles perform actual service to the state; the other required that all officials must pass examinations in order to be promoted at various stages of their careers. The angry nobles began to refer contemptuously to him as the *popovich* ("priest's son"). It was in this year, also, that Speransky proposed his new "constitution" (the Plan of 1809). Well aware that Alexander wanted no tampering with the essence of the autocracy or with its basis in serfdom, Speransky prepared complicated plans for dividing the population into three classes with varying degrees of political and civil rights and for creation of elective assemblies, the dumas, and an appointive State Council. The latter was set up on Jan. 1, 1810, but the dumas, innocuous though they would have been, remained on paper.

In these years (1807–12) when he had the Emperor's confidence, Speransky was responsible for a number of financial and administrative reforms designed not to change the essence of the state structure but to improve its functioning. His obvious pro-French leanings, however, added to the hostility of the nobles, whose pocketbooks had suffered by Russian participation in the Continental System, the systematic economic warfare employed by Napoleon against England.

Speransky's aloof personality and his continued association with persons inferior to him in social standing had prevented him from making friends among men with political prestige. He was thus left defenseless against his high-placed enemies at court, including the Emperor's sister, Catharine of Oldenburg. In 1811 the renowned historian N.M. Karamzin attacked him in his well-known memoir, *Of Old and New Russia.*

*Exile.* In March 1812, Speransky was summarily dismissed. Returning to his home at midnight, he found a police carriage waiting at his door. Without even taking leave of his daughter, the fallen minister started on the long journey to exile in Nizhny-Novgorod, whence he was soon transferred to the even more distant Perm, in the Urals.

Two years later he was permitted to return to his estate near Novgorod, but it was not until 1816 and only after he had stooped to appeal to his successor in Alexander's favour, Count A.A. Arakcheyev (whom the poet Pushkin contrasted with Speransky as Alexander's "evil genius"), that he was permitted to reenter state service—though only as provincial governor in remote Penza. In 1819, however, he was promoted to be governor general of Siberia, where he effected significant administrative reforms. In 1821 he was summoned to St. Petersburg and appointed a member of the State Council, in which he was to prudent to advocate further reforms, lest he again irritate his master.

*Work for Nicholas I.* Under Alexander's successor, Nicholas I, Speransky's great talents were again utilized, first as a member of the special tribunal that tried and sentenced the Decembrists, a group of officers who staged a liberal revolt on Nicholas' accession in December 1825. Here he again demonstrated his ability to read an emperor's mind; it was he who drafted the letter to the court that secured a significant reduction of the sentences the tribunal had imposed. In the same year he became, in effect, the head of the Second Division of the Emperor's personal chancellery. Still an efficient workhorse, he took part in the labours of Nicholas' secret committees for study of the peasant problem. His major achievement, however, was the publication, in 1830, of the first *Complete Collection of the Laws of the Russian Empire* (*Polnoye sobraniye zakonov Rossiyskoy imperii*). On the basis of this compilation, which began with the *Code* (*Sobornoye ulozheniye*) of 1649, he supervised preparation of a *Digest of the Laws* (*Svod zakonov Rossiyskoy imperii*). In 1837 he was awarded the highest grade of the Order of Andrew the First-Called and, in January 1839, was accorded the title of count. He died a few weeks later in St. Petersburg.

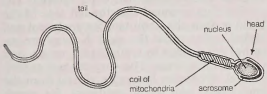
(J.D.C.)

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**sperm,** also called SPERMATOZOON, plural SPERMATOZOA, male reproductive cell, produced by most animals. With the exception of nematode worms, decapods (*e.g.,* crayfish), diplopods (*e.g.,* millipedes), and mites, sperm are flagellated; that is, they have a whiplike tail. In higher vertebrates, especially mammals, sperm are produced in the testes. The sperm unites with (fertilizes) an ovum (egg) of the female to produce a new offspring. Mature sperm have two distinguishable parts, a head and a tail.

The head of the sperm varies in shape for each animal species. In man it is flattened and almond shaped, four to five microns long and two to three microns wide (there are about 25,000 microns in an inch). The head portion is mainly a cell nucleus; it consists of genetic substances, called chromosomes, which are responsible for transmitting specific characteristics of an individual, such as the colour of eyes, hair, and skin. In each body cell of

normal human beings, there are 46 chromosomes, which are responsible for the individual's general physical makeup. The sperm cells have only 23 chromosomes, or half of the usual number. When a sperm cell unites with the ovum, which also has 23 chromosomes, the resulting 46 chromosomes determine the offspring's characteristics. The sperm cells also carry the X or Y chromosome that determines the sex of the future child.



Human sperm

Covering the head of the sperm is a cap known as the acrosome, which contains chemical substances that help sperm to enter an egg. Only one sperm fertilizes each egg, even though 300,000,000 to 400,000,000 sperm are contained in an average ejaculation. Each egg and sperm produced has slightly different genetic information carried in the chromosomes; this accounts for the differences and similarities between children of the same parents.

A small middle portion of the sperm contains the mitochondria. The tail of the sperm, sometimes called the flagellum, is a slender, hairlike bundle of filaments that connects to the head and middle portion. The tail is about 50 microns long; its thickness of one micron near the mitochondria gradually diminishes to less than one-half micron at the end of the tail. The tail gives the sperm cell movement. It whips and undulates so that the cell can travel to the egg. Sperm deposited in the reproductive tract of the female travel through the tract until they fertilize an egg or die.

Sperm cells may live in the human body for two or three days after mating. Sperm may also be stored in a frozen state for months or years and still retain their capacity to fertilize eggs when thawed. *See also* spermatogenesis.

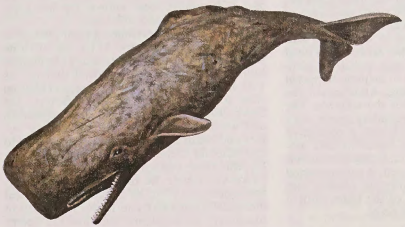
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**sperm oil,** pale yellow liquid wax obtained with spermaceti (*q.v.*) from the head cavities and blubber of the sperm whale, used formerly as a fuel for lamps but now chiefly as a lubricant. The fluid-filled spermaceti organ, occupying a volume as large as 500 gallons (1,900 l), in the head of the whale is believed to act either as a cushion to protect the whale's vital organs from the water pressures of the ocean depths, or as part of the animal's "sonar." The organ is cooked with the blubber to produce crude sperm oil, from which spermaceti, a wax, is removed.

Upon being treated with sulfur, crude sperm oil provides lubricants that are resistant to extreme pressures. The oil can also be hardened to make textile sizes and wax compositions. Saponification yields fatty acids for soap manufacture and fatty alcohols for cosmetics and detergents. Refined sperm oil, after removal of spermaceti, is used for lubricating high-speed machinery and precision instruments and for textile lubrication.

**sperm whale,** also called CACHALOT (*Physeter catodon*), blunt-snouted whale of the family Physeteridae. The white, presumably albino, whale of Herman Melville's novel *Moby Dick* is of this species. The sperm whale is a thick-set animal with small, paddlelike flippers and a series of rounded humps on its back. It is distinguished by an enormous head, squarish in profile, and a narrow, underslung lower jaw equipped with large, conical teeth. When the mouth is closed, the teeth fit into sockets in the usually toothless upper jaw. The sperm whale is dark blue-gray or brownish, with a paler belly. The male attains a maximum length of about 19 m (62 feet); the female is much smaller.

The sperm whale is found in temperate and tropical waters throughout the world, usually in herds of about 15 to 20. Solitary males, however, may wander into colder regions. A deep diver, the sperm whale commonly reaches a depth of about 350 m (1,150 feet) and has been found tangled in cables 1,134 m (3,720 feet) below the surface. It feeds primarily on


Sperm whale (*Physeter catodon*)
Painting by Richard Ellis

cephalopods, including the giant squid (*Architeuthis*). It is a commercially valuable whale and has been hunted for several centuries. Among other things, it produces spermaceti (a waxy substance contained in the snout) and ambergris (a material sometimes found floating in the sea and thought to be formed by feces impacted around a core of solid matter, such as squid beaks). Spermaceti is used in ointments, cosmetics, and other products, and ambergris as a fixative to hold the scent of fine perfumes.

The pygmy sperm whale (*Kogia*) of the Northern Hemisphere is the only other member of the family Physeteridae. It is a little-known, dolphinlike whale, black above and paler below, and about 4 m (13 feet) long. It is of no commercial value.

**spermaceti,** solid wax, easily liquefied at moderate temperatures, obtained from the head cavities and from the oils of whales, porpoises, and dolphins. It is used chiefly in pomades, ointments, cosmetic creams, fine wax candles, and in textile finishing. Spermaceti was so named from the Latin *sperma,* "sperm," and *cetus,* "whale," in the belief that it was the coagulated semen of the whale.

The great spermaceti organ in the whale's head is usually cooked together with the blubber to obtain crude sperm oil (*q.v.*) containing spermaceti. The spermaceti is removed by chilling, called wintering; it separates as a white, crystalline, waxy solid. Chemically, spermaceti consists principally of cetyl palmitate and other esters of fatty acids with fatty alcohols.

**spermatic cord,** either of a pair of tubular structures in the male reproductive system that support the testes in the scrotum. Each cord is sheathed in connective tissue and contains a network of arteries, veins, nerves, and the first section of the ductus deferens, through which sperm pass in the process of ejaculation. The cords extend from the testes to the inguinal rings (openings at the level of the bladder) in the fascia transversalis, the connective-tissue sheath of abdominal wall muscles.

In surgery of the spermatic cord, the aims are to preserve the blood supply to the testicle and the continuity of the ductus deferens. Varicocelectomy is the operation performed when dilated veins of the spermatic cord cause pain. The dilated portions are excised, leaving the arteries to the testicle intact and sufficient veins to drain the testicle. An operation for correction of torsion is performed when the spermatic cord becomes twisted through overactivity of the cremaster muscle, which surrounds the cord. Prompt correction of this condition is necessary to prevent gangrene of the testicle. In the operation the cord is untwisted and the testicle is fixed to the base of the scrotum, the fixation being called orchiopexy. Because torsion is likely to occur on both sides, bilateral orchiopexy is performed even though torsion affects only one side. In bilateral vasectomy, small sections of the two ductus deferentes are excised through small scrotal incisions to prevent passage of the spermatozoa to the epididymis (and eventually on to the prostate and urethra), thus rendering the male sterile.

**spermatogenesis,** the origin and development of the sperm cells within the male reproductive organs, the testes. The testes are composed of numerous thin, tightly coiled tubules known as the seminiferous tubules; the sperm cells are produced within the walls of the tubules. Within the walls of the tubules, also, are many randomly scattered cells, called Sertoli cells, that function to support and nourish the immature sperm cells by giving them nutrients and blood products. As the young germ cells grow, the Sertoli cells help to transport them from the outer surface of the seminiferous tubule to the central channel of the tubule.

Sperm cells are continually being produced by the testes, but not all areas of the seminiferous tubules produce sperm cells at the same time. One immature germ cell takes as long as 74 days to reach final maturation, and during this growth process there are intermittent resting phases.

The immature cells (called spermatogonia) are all derived from cells called stem cells in the outer wall of the seminiferous tubules. The stem cells are composed almost entirely of nuclear material. (The nucleus of the cell is the portion containing the chromosomes.) The stem cells begin their process by multiplying in the process of cell duplication known as mitosis. Half of the new cells from this initial crop go on to become the future sperm cells, and the other half remain as stem cells so that there is a constant source of additional germ cells. Spermatogonia destined to develop into mature sperm cells are known as primary sperm cells. These move from the outer portion of the seminiferous tubule to a more central location and attach themselves around the Sertoli cells. The primary sperm cells then develop somewhat by increasing the amount of cytoplasm (substances outside of the nucleus) and structures called organelles within the cytoplasm. After a resting phase

the primary cells divide into a form called a secondary sperm cell. During this cell division there is a splitting of the nuclear material. In the nucleus of the primary sperm cells there are 46 chromosomes; in each of the secondary sperm cells there are only 23 chromosomes, as there are in the egg. When the egg and sperm combine and their chromosomes unite, the characteristics of both individuals blend and the new organism starts to grow.

The secondary sperm cell still must mature before it can fertilize an egg; maturation entails certain changes in the shape and form of the sperm cell. The nuclear material becomes more condensed and oval in shape; this area develops as the head of the sperm. The head is covered partially by a cap, called the acrosome, which is important in helping the sperm to gain entry into the egg. Attached to the opposite end of the head is the tailpiece. The tail is derived from the secondary sperm cell's cytoplasm. In the mature sperm, it consists of a long, slender bundle of filaments that propel the sperm by their undulating movement. Once the sperm has matured, it is transported through the long seminiferous tubules and stored in the epididymis of the testes until it is ready to leave the male body.

**spermatophyte,** also called SEED PLANT, any of the flowering plants (angiosperms) and conifers and allies (gymnosperms). An earlier classification considered these plants subgroups of the Spermatophyta, a taxonomic unit no longer generally considered valid.

**spermatozoon** (biology): *see* sperm.

**Sperrgebiet** (German: "restricted area"), also called DIAMOND AREA 1, diamond-rich area in the southern Namib (desert), southwestern Namibia, to which access by unauthorized persons is rigidly prohibited. It lies along the Atlantic coast from Oranjemund and the Orange River north to about 45 miles (72 km) north of Lüderitz (26° S latitude), encompassing an area approximately 60 miles (97 km) wide and 200 miles (322 km) long. The visual aspect of the Sperrgebiet is drab, characterized mainly by north-south sand dunes.

Rich deposits of guano on offshore islands were exploited in the mid-19th century, and a few diamonds were found on some of these islands in 1905–06. Major discoveries of diamonds in 1908 on the mainland in the vicinity of the port of Lüderitz led to the German colonial government's closing of the area to unauthorized persons later in the same year. In 1920 the assorted German-owned mining companies of northern Sperrgebiet (the Lüderitz area) sold their interests to Consolidated Diamond Mines of South West Africa, Ltd. (CDM; a subsidiary of the De Beers Consolidated Mines, Ltd. of South Africa), which has held the monopoly of the mining rights in Sperrgebiet ever since.

Today the mining operations in Sperrgebiet extend north from the CDM company town of Oranjemund (directly north of the Orange River mouth) for about 60 miles (97 km) along the coast. Giant earthmoving equipment is used to remove overlying sand to uncover diamond-bearing, alluvially deposited gravels, which often lie as far as 50 feet (15 m) below the surface. The Owambo (Ovambo) people of northern Namibia are the chief contract workers for the CDM. A remarkably high 95 percent of all diamonds recovered are of gem quality. Political instability in Namibia was a major factor in Sperrgebiet's overall production decline from more than 20 percent of the world's gem diamond production in 1977 to less than 5 percent in the mid-1980s. Gem diamonds continue to be mined in the coastal Namaqualand region of South Africa immediately south of the mouth of the Orange River.

**Sperrin Mountains,** Irish SLIABH SPEIRÍN, mountain range disposed along an arc about 20 miles (32 km) southeast of Londonderry city, Northern Ireland. The highest peaks—Sawel, Mullaclogher, and Mullaghaneany—all exceed 2,000 feet (608 m) and are capped with crystalline limestone. The Sperrins were extensively glaciated and bear evidence of both erosion and deposition. They are partly penetrated by glaciated glens and are mainly covered in blanket bog and heather.

**Sperry, Elmer Ambrose** (b. Oct. 12, 1860, Cortland, N.Y., U.S.—d. June 16, 1930, Brooklyn, N.Y.), versatile American inventor and industrialist, best known for his gyroscopic compasses and stabilizers.

As a boy, Sperry developed a keen interest in machinery and electricity. At the age of 19 he persuaded a Cortland manufacturer to finance him in developing an improved dynamo as well as an arc lamp. The next year (1880) he went to Chicago and opened a factory, the Sperry Electric Company, to make dynamos and arc lamps. He invented the electric rotary and chain undercutting machines, and, to manufacture them, he established the Sperry Electric Mining Machine Company (1888).

Two years later, he turned his attention to transportation. First, he designed an electrical industrial locomotive and motor transmission machinery for streetcars, founding the Sperry Electric Railway Company in Cleveland (later sold to General Electric Company). From 1894 he made electric automobiles powered by his patented storage battery.

After 1900 he established an electrochemical research laboratory with C.P. Townsend at Washington, D.C. There they invented the chlorine detinning process—for salvaging tin from old cans and scrap—and processes for producing white lead from impure lead and caustic soda from salt. Around this time he also founded the Chicago Fuse Wire Company to manufacture electric fuse wire by machines he had invented. In the meantime, he had not forsaken his old interest in lighting; by 1918 he was producing a high-intensity arc searchlight six times brighter than any earlier light.

Sperry's greatest inventions sprang from what for decades had been a toy—the gyroscope, which, once properly aligned, always points to true north. The German inventor H. Anschütz-Kaempfe developed the first workable gyrocompass in 1908; Sperry's version was first installed on the U.S. battleship *Delaware* in 1911. Sperry set up his Sperry Gyroscope Company in Brooklyn in 1910. He extended the gyro principle to guidance of torpedoes, to gyropilots for the steering of ships and for stabilizing airplanes, and finally to a ship stabilizer.

The Sperry Corporation (now part of Unisys Corporation) manufactured computers, precision instruments and controls, farm machinery, and electric and hydraulic equipment and was a direct descendant of his gyroscope firm. In his lifetime, Sperry founded eight manufacturing companies and took out more than 400 patents.

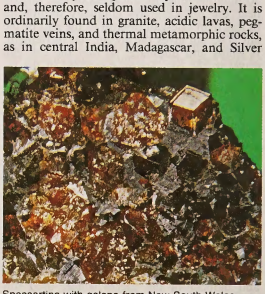
**Sperry, Roger Wolcott** (b. Aug. 20, 1913, Hartford, Conn., U.S.—d. April 17, 1994, Pasadena, Calif.), American neurobiologist, corecipient with David Hunter Hubel and Torsten Nils Wiesel (*qq.v.*) of the Nobel Prize for Physiology or Medicine in 1981 for their investigations of brain function. Sperry in particular for his study of functional specialization in the cerebral hemispheres.

Sperry earned a bachelor's degree in English literature and a master's degree in psychology from Oberlin (Ohio) College and a doctorate in zoology from the University of Chicago in 1941. He then became an associate of Karl Lashley, first at Harvard University and then at the Yerkes Laboratories of Primate Biology in Orange Park, Fla. In 1946 he joined the faculty of the University of Chicago and in 1954 moved to the California Institute of Technology as Hixon professor of psychobiology.

Sperry's early research was on the regeneration of nerve fibres. He eventually became interested in brain function and undertook research on animals and then on human epileptics whose brains had been "split"; *i.e.,* in whom the thick cable of nerves (the corpus callosum) connecting the right and left cerebral hemispheres had been severed. His studies demonstrated that the left side of the brain is normally dominant for analytical and verbal tasks, while the right hemisphere assumes dominance in spatial tasks, music, and certain other areas. The surgical and experimental techniques Sperry developed from the late 1940s laid the groundwork for much more specialized explorations of the mental functions carried out in different areas of the brain.

**Sperry Corporation,** formerly (1955–79) SPERRY RAND CORPORATION, American corporation that merged with the Burroughs Corporation in 1986 to form Unisys Corporation (*q.v.*), a large computer manufacturer.

**spessartine,** manganese aluminum garnet that is a semiprecious gem when clear. Found combined with almandine, it ranges in colour from pale orange yellow, when nearly pure, to orange or deep red, when appreciable proportions of almandine are present. It is similar in colour to grossular, but, unlike that species, it is commonly transparent. Spessartine is rare and, therefore, seldom used in jewelry. It is ordinarily found in granite, acidic lavas, pegmatite veins, and thermal metamorphic rocks, as in central India, Madagascar, and Silver



Spessartine with galena from New South Wales, Australia

By courtesy of the Field Museum of Natural History, Chicago; photograph, John H. Gerard

Cliff, Colo., U.S. For details of chemistry and occurrence, *see* garnet.

**Speusippus** (d. 339/338 BC), Greek philosopher who became head, or scholarch, of the Greek Academy after the death in 347 BC of Plato, who had founded it in 387. A nephew and disciple of Plato, Speusippus accompanied him on his journey to Sicily in 361. He was also a partisan in his uncle's relations with political rulers, including Dionysius II of Syracuse.

Little survives of Speusippus' philosophical writings except a long excerpt from his work *On Pythagorean Numbers,* a few other fragments, and reports by other writers. Like his contemporaries and early successors in the beginning years of the Academy, he stressed the importance of numbers and numerical combinations and deemphasized ideas. The excerpt from *Numbers,* for example, explains the "perfections," or special importance, of the number 10.

According to Aristotle's report, which is frequently criticized for representing Plato inaccurately, Speusippus adopted the Platonic doctrine asserting the timeless derivation of

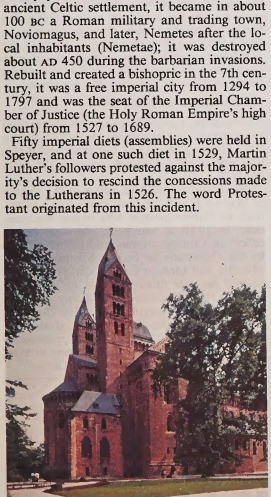
all reality from two opposite principles, often called "the One" and "the indeterminate dyad," terms meant to explain the presence of both unity and multiplicity in the universe. His colleagues, however, viewed "the One" and "the dyad" as principles of good and evil, respectively, but Speusippus denied the attachment of moral qualities. Using numerical labels, he also organized reality into successively more spiritual spheres. Between the spheres of pure numbers, or "mathematicals," and of the body, or "the sensible," he inserted the sphere of the soul, considered immortal in all of its parts. Though Speusippus is strongly criticized by Aristotle, his *Homoia* ("Similitudes"), a comparative study of plant and animal physiology, has been favourably compared with Aristotle's own *History of Animals* and conceivably reflects Speusippus' view that no single thing can be defined unless all are, because classification and definition are closely related.

**Spey River,** river in Scotland, flowing for 107 miles (172 km) northeast across the Highlands into the North Sea. Rising at about 1,150 feet (350 m) in the Corrieyairack Forest, it derives tributaries also from the Monadhliath Mountains, the Grampians, and the Cairngorms. In its wider, lower valley of Strathspey, it swings between great swells of terraces and finally enters the sea by a shifting mouth across a shingle spit between Buckie and Lossiemouth.

It is esteemed for salmon, and its valley is known for its high-quality whisky distilleries.

**Speyer,** also spelled SPEIER, English SPIRES, city, Rhineland-Palatinate *Land* (state), southwestern Germany. Speyer is a port on the left bank of the Rhine River at the mouth of the Speyer River, south of Ludwigshafen. An ancient Celtic settlement, it became in about 100 BC a Roman military and trading town, Noviomagus, and later, Nemetes after the local inhabitants (Nemetae); it was destroyed about AD 450 during the barbarian invasions. Rebuilt and created a bishopric in the 7th century, it was a free imperial city from 1294 to 1797 and was the seat of the Imperial Chamber of Justice (the Holy Roman Empire's high court) from 1527 to 1689.

Fifty imperial diets (assemblies) were held in Speyer, and at one such diet in 1529, Martin Luther's followers protested against the majority's decision to rescind the concessions made to the Lutherans in 1526. The word Protestant originated from this incident.



East towers of the cathedral at Speyer, Ger.
Hans Huber

Destroyed by French troops (1689) during the War of the Grand Alliance, Speyer was incorporated into the French Republic in 1797, passed to Bavaria in 1815, and was the capital of the Bavarian (Rhenish) Palatinate from 1816 to 1945.

Historic remains in the city include the Altpörtal ("old gate"), with a 13th-century gate tower, the subterranean Jews' Bath (1104), and the Baroque Trinity Church (1701–17). The city's Romanesque cathedral, founded in 1030 by the Holy Roman emperor Conrad II, contains a unique crypt and the tombs of eight German emperors and kings and three empresses. Gutted in 1689 and rebuilt several times, it was consecrated in 1961 after its most recent restoration.

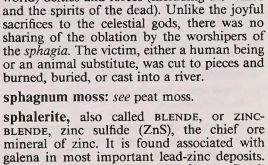
The medieval city is surrounded by modern industrial and residential areas. The city's bridge across the Rhine, destroyed in 1945, has been rebuilt (1956). Speyer has electrotechnical industries, an oil refinery, metal and wood processing, and textile, chemical, and shoe plants. There are also stoneworks, glassworks, and brickworks, breweries, sparkling-wine (*sekt*) cellars, and aircraft factories. Pop. (1989 est.) 45,089.

**Spezia** (Italy): *see* La Spezia.

**sphagia,** in ancient Greek religion, a propitiatory sacrifice made to the chthonic (underworld) deities and forces (including the winds and the spirits of the dead). Unlike the joyful sacrifices to the celestial gods, there was no sharing of the oblation by the worshipers of the *sphagia.* The victim, either a human being or an animal substitute, was cut to pieces and burned, buried, or cast into a river.

**sphagnum moss:** *see* peat moss.

**sphalerite,** also called BLENDE, or ZINC-BLENDE, zinc sulfide (ZnS), the chief ore mineral of zinc. It is found associated with galena in most important lead-zinc deposits. The name sphalerite is derived from a Greek word meaning treacherous, in allusion to the



Sphalerite from Baxter Springs, Kan.
By courtesy of the Ted and Elsie Boente Collection; photograph, John H. Gerard—EB Inc.

ease with which the dark-coloured, opaque varieties are mistaken for galena (a valuable lead ore). The alternative names blende and zincblende, from the German word meaning "blind," similarly allude to the fact that sphalerite does not yield lead. For detailed physical properties, *see* sulfide mineral (table).

In the United States the most important sphalerite deposits are those in the Mississippi River valley region. There it is found associated with chalcopyrite, galena, marcasite, and dolomite in solution cavities and brecciated (fractured) zones in limestone and chert. Similar deposits occur in Poland, Belgium, and North Africa.

Sphalerite also is distributed worldwide as an ore mineral in hydrothermal vein deposits, in contact metamorphic zones, and in high-temperature replacement deposits.

**sphene,** also called TITANITE, titanium and calcium silicate mineral, $CaTiSiO_4(O,OH,F)$, that, in a crystallized or compact form, makes up a minor component of many igneous rocks and gneiss, schist, crystalline limestone, and pegmatite. Occurrences include the Tirol, Austria; Trentino, Italy; Norway; Switzerland; Madagascar; and the United States (New York). Sphene's relatively high dispersion causes it to be a brilliant gem of various colours; it is usually faceted. For detailed physical properties, *see* silicate mineral (table).



Sphene (titanite) from Brazil: a natural crystal (right) and a faceted stone
Joseph and Helen Guetterman collection; photograph, John H. Gerard—EB Inc.

**sphenisciform** (bird order): *see* penguin.

**Sphenoclea,** the only genus in the plant family Sphenocleaceae (order Campanulales). It contains one species (*S. zeylanica*), an herb 1.5 m (4 feet) tall with spikes of whitish flowers.

*Sphenoclea* is widespread in moist areas of warm temperate and tropical zones, including southern North America, but is native to the Old World tropics. It is sometimes united with the family Campanulaceae, from which it differs by having overlapping corolla (petal) lobes in bud and a capsule that opens by a lid. The five-lobed flowers are in tight masses, and the narrow leaves are oval in shape.

**Sphenophyllum,** a genus of plants representative of the extinct order Sphenophyllales, class (or subdivision) Sphenopsida. It appeared first in the Late Devonian Epoch (374 to 360 million years ago). The wood of its stems is unique in showing a central triangle of tracheids (water-conducting elements). There is great variation in leaf form and in apparent growth habit.

**Sphenophyta,** also called ARTICULATAE, a division of spore-bearing, vascular plants with three extinct orders and only one living genus, *Equisetum,* order Equisetales. The 15 living species of *Equisetum* are commonly known as horsetails or scouring rushes.

A brief treatment of sphenophytes follows. For full treatment, *see* MACROPAEDIA: Ferns and Other Lower Vascular Plants.

Sphenophytes, both fossil and living, are characterized by conelike structures called strobili located at the tips of the branches. The living members are all perennial herbaceous plants, with creeping underground rhizomes and hollow upright stems, both having a segmented structure. The leaves and branches grow in whorls from the nodes and continue to grow upward along the stem. The highly branched stems of some species give the appearance of a horse's tail.

Members go through distinct gametophytic (sexual) and sporophytic (asexual) stages in their life cycle. Horsetails reproduce by releasing spores that give rise to lobed, bisexual gametophytes. After fertilization, a sporophyte develops from each gametophyte. Two or more sporophytes may grow from one gametophyte before the latter decays, leaving only the rhizome and horsetail.

Some extinct sphenophytes developed as vines (order Sphenophyllales) or shrubs (Hyeniales) in the Devonian Period (408 to 360 million years ago). The Calamitaceae, a family of treelike forms up to 30 m (100 feet) in height and about one metre (three feet) in diameter, were abundant in the later, coal-producing Carboniferous Period. *See also* horsetail.

**sphere of influence:** *see* influence, sphere of.

**spherical helix** (navigation): *see* loxodrome.

**spheroidal joint** (anatomy): *see* ball-and-socket joint.

**sphincter muscle,** any of the ringlike muscles surrounding and able to contract or close a bodily passage or opening. One of the most important human sphincter muscles is the sphincter pylori, a thickening of the middle layer of stomach muscle around the pylorus (opening into the small intestine) that holds food in the stomach until it is thoroughly mixed with gastric juices. Other sphincters are involved in excretion of waste: the sphincter ani externus keeps the anal opening closed by its normal contraction, and the sphincter urethrae is the most important voluntary control of urination. There is also a sphincter in the eye, the sphincter pupillae, a ring of fibres in the iris that contracts the pupil in the presence of bright light. *Compare* dilator muscle.

**sphingolipid,** any member of a class of lipids (fat-soluble constituents of living cells) containing the organic aliphatic amino alcohol sphingosine or a substance structurally similar to it. Among the most simple sphingolipids are the ceramides (sphingosine plus a fatty acid), widely distributed in small amounts in plant and animal tissues. The other sphingolipids are derivatives of ceramides.

Glycolipids, a large group of sphingolipids, are so called because they contain one or more molecules of sugar (glucose or galactose). Glycolipids, a general property of which is immunological activity, include the cerebrosides, gangliosides, and ceramide oligosaccharides. Of limited distribution in nature, cerebrosides are most abundant in the myelin sheath surrounding nerves. Sulfate-containing cerebrosides, known as sulfatides, occur in the white matter of brain. Gangliosides, most abundant in nerve tissue (especially the gray matter of brain) and certain other tissues (*e.g.,* spleen) are similar to cerebrosides except that, in addition to the sugar component, they contain several other molecules of carbohydrate (*N*-acetylglucosamine or *N*-acetylgalactosamine and *N*-acetylneuramine). Ceramide oligosaccharides also contain several molecules of carbohydrate; an example is globoside from red blood cells.

Sphingomyelins, which are the only phosphorus-containing sphingolipids, are most abundant in nervous tissue, but they also occur in the blood.

Abnormal sphingolipid metabolism is a characteristic of a variety of diseases known collectively as sphingolipidosis, or sphingolipodystrophy. One of the more common forms of cerebral sphingolipidosis (or cerebral lipidosis), formerly called amaurotic familial idiocy, is Tay-Sachs disease (*q.v.*), a rare, inheritable disorder caused by the accumulation of sphingolipids in the brain. Another inheritable lipidosis is Niemann-Pick disease (*q.v.*), in which lecithin and sphingomyelin accumulate in various body tissues, such as the spleen and the liver.

**sphinx,** mythological creature with a lion's body and human head, an important image in Egyptian and Greek art and legend. The word *sphinx* was derived by Greek grammarians from the verb *sphingein* ("to bind," or "to squeeze"), but the etymology is not related to the legend and is dubious.

The winged sphinx of Boeotian Thebes, the most famous in legend, was said to have terrorized the people by demanding the answer to a riddle taught her by the Muses—what is it that has one voice and yet becomes four-footed and two-footed and three-footed?—and devouring a man each time the riddle was answered incorrectly. Eventually Oedipus gave the proper answer: man, who crawls on all fours in infancy, walks on two feet when grown, and leans on a staff in old age; the sphinx thereupon killed herself. From this tale apparently grew the legend that the sphinx was omniscient, and even today the wisdom of the sphinx is proverbial.



The Great Sphinx at Giza, 4th dynasty
E. Streichan—Shostal Assoc.

The earliest and most famous example in art is the colossal recumbent Sphinx at Giza, Egypt, dating from the reign of King Khafre (4th king of 4th dynasty, *c.* 2575–*c.* 2465 BC). This is known to be a portrait statue of the king, and the sphinx continued as a royal portrait type through most of Egyptian history. (Arabs, however, know the Sphinx of Giza by the name of Abū al-Hawl, or "Father of Terror.") Through Egyptian influence the sphinx became known in Asia, but its meaning there is uncertain. The sphinx did not occur in Mesopotamia until about 1500 BC, when it was clearly imported from the Levant. In appearance the Asian sphinx differed from its Egyptian model most noticeably in the addition of wings to the leonine body, a feature that continued through its subsequent history in Asia and the Greek world. Another innovation was the female sphinx, which first began to appear in the 15th century BC. On seals, ivories, and metalwork they were portrayed sitting on their haunches, often with one paw raised, and were frequently paired with a lion, a griffin (part eagle and part lion), or another sphinx.

In about 1600 BC the sphinx first appeared in the Greek world. Objects from Crete at the end of the middle Minoan period and from the shaft graves at Mycenae throughout the late Helladic age showed the sphinx characteristically winged. Although derived from the Asian sphinx, the Greek examples were not identical in appearance; they customarily wore a flat cap with a flamelike projection on top. Nothing in their context connected them with later legend, and their meaning remains unknown.

After 1200 BC the depiction of sphinxes disappeared from Greek art for about 400 years, though they continued in Asia in forms and poses similar to those of the Bronze Age. By the end of the 8th century, the sphinx reappeared in Greek art and was common down to the end of the 6th century. Often associated with Oriental motifs, it was clearly derived from an Eastern source, and from its appearance it could not have been a direct descendant of the Bronze Age Greek sphinx. The later Greek sphinx was almost always female and usually wore the long-tiered wig known on contemporary sculptures of the Daedalic style; the body became graceful, and the wings developed a beautiful curving form unknown in Asia. Sphinxes decorated vases, ivories, and metal works and in the late Archaic period occurred as ornaments on temples. Although their context is usually insufficient to enable their meaning to be judged, their appearance on temples suggests a protective function. By the 5th century clear illustrations of the encounter between Oedipus and the sphinx appeared on vase paintings, usually with the sphinx perched on a column (*e.g.,* the red-figured Nolan amphora in Boston). Other monuments of classical age showed Oedipus in armed combat with the sphinx and suggested an earlier stage of the legend in which the contest was physical instead of mental. Of such a stage the literature gave no hint, but battles of men and monsters were common in Asian art from prehistoric times down to the Achaemenidian Persians, and Greek art may have adopted from the Middle East a pictorial theme that Greek literature did not share.

**sphinx moth:** *see* hawk moth.

**Sphrantzes, George,** Sphrantzes also spelled SPHRANTES, or PHRANTZES (b. 1401—d. late 15th century), Byzantine historian and diplomat who wrote a chronicle covering the years 1413–77.

Sphrantzes rose to high office in the service of Manuel II and the later Palaeologan rulers, both in Constantinople and in the Peloponnese. In 1451 he was great logothete (chancellor) in Constantinople, and on its capture by the Ottomans he fled to Mistra (modern Mistrás) and then to Corfu (Kérkyra), where he and his wife finally entered monastic life (1468). His chronicle is probably what is known as the *Chronicon Minus.* The chronicle was written for the Corfiotes and deals with the last years of the Palaeologi in Constantinople and the Peloponnese, and it shows marked aversion to the Ottomans and the Latins.

*Consult the* INDEX *first*

**sphygmomanometer,** instrument for measuring blood pressure. It consists of an inflatable rubber cuff, which is wrapped around the upper arm and which is connected to an apparatus that records pressure, usually in terms of the height of a column of mercury or on a dial. A blood pressure reading consists of two numbers, which typically may be recorded as $x/y$. The $x$ is the systolic pressure, and $y$ is the diastolic. Systole refers to the contraction period of the heart, when it forces blood from the heart into the circulating system, and diastole refers to the resting period, when the heart expands and receives another supply of blood. At each heartbeat, blood pressure is raised to the systolic level, and, between beats,

it drops to the diastolic level. As the cuff is inflated with air, a stethoscope is placed against the skin at the crook of the arm. As the air is released, the first sound heard marks the systolic pressure; as the release continues, a dribbling noise is heard. This marks the diastolic pressure.

**Spica** (Latin: Head of Grain), also called ALPHA VIRGINIS, brightest star in the zodiacal constellation Virgo and one of the 15 brightest in the entire sky, having an apparent visual magnitude of 0.96. It is a bluish star; spectroscopic examination reveals Spica to be a binary, with two components of the first and third magnitudes, respectively. Spica lies about 270 light-years from the Earth.

**spice and herb,** dried parts of various plants cultivated for their aromatic, pungent, or otherwise desirable substances. Spices and herbs consist of rhizomes, bulbs, barks, flower buds, stigmas, fruits, seeds, and leaves. They are commonly spoken of loosely as spices, spice seeds, and herbs. Spices are the highly esteemed, fragrant or pungent plant products of tropical and subtropical regions, the dominant species of the trade including cardamom, cinnamon, cloves, ginger, and pepper. Spice seeds are the tiny aromatic fruits and oily seeds of herbaceous plants including anise, caraway, cumin, fennel, poppy, and sesame. Herbs are the fragrant leaves of such plants as marjoram, mint, rosemary, and thyme. Spices, spice seeds, and herbs are employed as adjuncts to impart flavour and aroma or piquancy to foods. In the small quantities used to prepare culinary dishes they have little or no nutritive value, but they stimulate the appetite, add zest to food, enhance the taste, and delight the gourmet.

The most notable uses of spices and herbs in very early times were in medicine, in the making of holy oils and unguents, and as aphrodisiacs. Priests employed them in worship, incantations, magical rites, and rituals.

Ancient herbals, including those of Cathay, Sumer, Assyria, Egypt, Greece, and Rome, testify to the use of spices and herbs in the treatment of disease. Hippocrates, Galen, and Pedanius Dioscorides, among others, employed them. In the 1st century of the Christian Era Pliny the Elder, in his *Natural History,* extols at length the efficacy and healing powers of spices and herbs in the treatment of just about every ailment known in his day. Such virtues, tempered and moderated, filtered down into the Middle Ages and early modern times.

It is not known when man first used spices and herbs in food. Sesame seems to have been known and employed as food, for making wine, and for its oil from time immemorial. Garlic and onions were employed as part of the diet in very early times. Certainly by the time of the ancient Greeks and Romans many spices and herbs had come into use to flavour food and beverages.

Herodotus (*c.* 484–*c.* 425 BC) describes the food of peoples he had met or heard about and relates that some ate fish and meats raw, sun-dried, salted, or pickled. Dried, salted, and pickled meats were staple items of food in many lands centuries after his time, and it requires no effort to imagine the welcome change the gratifying flavour of spices and herbs brought to foods, not only to opulent Greeks and Romans but to the affluent of society everywhere long after them.

Only the wealthy could indulge in the use of imported aromatic spices, and this was apparently true all over the world. Marco Polo observed, in 13th-century Cathay, that the higher class people ate meat that had been preserved in several of their spices, but the poor had to be content with meat steeped in garlic juice.

In Europe, in the course of time, knowledge slowly spread of the use of spices and herbs to aid in the preservation of food by retarding or preventing rancidity or other deterioration caused by oxidation and to flavour dishes. By medieval times large quantities of culinary herbs were in use. Eastern spices were beyond the purse of the greater number of people, but with the ascendency of the western European nations in the Oriental spice trade these conditions gradually changed, and the aromatic and pungent spices finally came into general use by rich and poor alike.

Modern uses of spices, spice seeds, and herbs are legion. There are few culinary recipes that do not include them, and their judicious use brings a delectable, distinctive aroma and taste to a host of dishes (see Table).

In the food industry they are employed in the preparation of numerous products including processed meats, fancy sausages, sauces and vinegars, prepared mustard, pickles, chut-

**Uses of spices and herbs with foods**

| | beverages | breads, rolls | cakes, cookies, biscuits | cheese dishes | chutneys | desserts | dressings | egg dishes | fish and seafood | fruit dishes | gravies | meat dishes | pickles | poultry | salads | sauces and relishes | soups | vegetable dishes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| allspice | | | + | | + | + | + | | | | | | + | | | + | | |
| aniseed | + | + | + | | | | | | | | | | + | | | | | |
| basil, sweet | | | | | | | | + | + | | | + | | | + | | + | + |
| caraway seed | | + | + | + | | | | | | | | + | | + | + | | | + |
| cardamom | | + | + | | | + | | | | + | | | + | | | | | |
| cayenne pepper | | | | | + | | | + | + | | | + | | | | + | | |
| celery salt | | | | | | | | + | + | | | + | | | | | + | |
| celery seed | | | | | | | + | | + | | | | + | | + | | | + |
| chervil | | | | | | | + | + | + | | | + | | + | + | + | + | |
| chili peppers | | | | | + | | | | | | | | + | | | + | | |
| chili powder | | | | | | | | + | + | | + | + | | | | + | + | |
| cinnamon | + | + | + | | | + | | | | + | | | + | | | | | |
| cloves | | | + | | + | + | + | | | + | | + | + | | | | | |
| coriander seed | | + | + | | | | + | | | | | + | + | + | + | | | |
| cuminseed | | | | + | | | + | + | | | | + | | + | | | + | |
| curry powder | | | | | | | | + | + | | | + | | + | | + | | + |
| dillseed | | | | | | | + | | | | + | + | + | | + | + | + | + |
| fennel seed | + | | + | | | + | | | + | | | | + | | | | | |
| fenugreek seed | | | | | + | | | | | | | | | | | | | |
| garlic powder | | | | | | | + | | | | | + | | | | | | |
| garlic salt | | | | | | | | + | | | | + | | | | | | |
| ginger | | + | + | | + | + | | | | + | | + | + | + | | | | |
| laurel (bay) leaves | | | | | | | | | + | | | + | + | | | + | + | |
| mace | | | + | | | + | | | | + | | | | | | + | | |
| marjoram, sweet | | | | | | | | + | + | | | + | | + | + | + | + | |
| mint | + | | | | | | | | + | | | + | | | | + | + | + |
| mixed pickling spice | | | | | | | | | | | | | + | | | | | |
| mustard | | | | | + | | + | | + | | + | + | + | | | + | | |
| nutmeg | | | + | | | + | | | | + | | | | | | + | | + |
| onion powder | | | | | | | + | | | | | + | | | + | + | + | |
| onion salt | | | | | | | | | | | | + | | | + | + | + | |
| origanum (oregano) | | | | + | | | + | + | + | | + | + | | | + | + | + | + |
| paprika | | | | | | | + | + | + | | + | + | | | | | | + |
| parsley | | | | | | | | | + | | | + | | + | + | + | + | + |
| pepper | | | | | | | + | + | + | | + | + | + | + | + | + | + | + |
| poppy seed | | + | + | | | | + | | | | | | | | + | | | + |
| red pepper | | | | | | | + | + | + | | | + | | | | + | | |
| rosemary | | | | | | | | | + | | | + | | + | | | + | + |
| saffron | | | + | | | | | | | | | | | | | | | |
| sage | | | | | | | | | + | | | + | | + | | | | |
| savory | | | | | | | + | + | + | | | + | | + | + | + | | |
| sesame seed | | + | + | | | | | | | | | | | | | | | |
| tarragon | | | | | | | | + | | | | + | | + | + | + | | + |
| thyme | | | | | | | + | | | | | + | | + | | + | + | + |
| turmeric | | | | + | | | + | | + | | | | + | | | + | + | |

neys, preserves, mayonnaise, salad dressings, biscuits, cookies, cakes, confections, and beverages.

Their essential oils and oleoresins are the basis of a number of spice flavourings and seasonings employed in food manufacturing, where oil spices are preferred to the whole or ground spices for the preparation of certain products.

Spices and herbs—or their oils where processing temperature permits—go into the preparation of a number of liqueurs, including absinthe, anisette, benedictine, crème de menthe, curaçao, and kümmel.

Their essential oils are the flavouring components of a number of extracts, and they are employed in perfumery, cosmetics, toilet preparations, hair oils, toothpastes, toilet soaps, and tobacco.

In medicine the spices and herbs have not entirely lost their reputation. In India and other Asiatic countries their curative virtues enjoy respect. They still have a place, though limited, in Western medicine. Present-day herbalists extol the efficacies of some spices, spice seeds, and herbs in the treatment of certain ailments.

**spice trade,** the merchandising of spices and herbs, an enterprise of ancient origins and great cultural and economic significance.

Cinnamon, cassia, cardamom, ginger, and turmeric were known to Eastern peoples thousands of years ago, and they became important items of commerce early in the evolution of trade. Cinnamon and cassia found their way to the Middle East at least 2,000 years before the Christian era. From time immemorial, southern Arabia (Arabia Felix of antiquity) had been a trading centre for frankincense, myrrh, and other fragrant resins and gums. Arab traders artfully withheld the true source of these spices. To satisfy the curious, to protect their market, and to discourage competitors, they spread fantastic tales to the effect that cassia grew in shallow lakes guarded by winged animals and that cinnamon grew in deep glens infested with poisonous snakes. Pliny the Elder (AD 23–79) ridiculed these stories and boldly declared that "all these tales, however, have been evidently invented for the purpose of enhancing the price of these commodities."

Whatever part the overland trade routes across Asia played, it was mainly by sea that the spice trade grew. Arabians were making direct sailings before the Christian era. In the Far East, the Chinese were moving through the waters of the Malay Archipelago and trading in the Spice Islands (the Moluccas or the East Indies generally). Ceylon was a central trading point.

In Egypt, Alexandria's revenues from port dues were already enormous when Ptolemy XI bequeathed the city to the Romans in 80 BC. Under the Romans, Alexandria became the greatest commercial centre of the world and the emporium for the aromatic and pungent spices of India that found their way to the markets of Greece and the Roman Empire.

Roman trade with India was extensive for more than three centuries and then began to decline. It had, no doubt, weakened but not broken the Arabian hold on the spice trade. The Roman trade revived in the 5th century but dwindled in the 6th, whereas the Arabian trade endured through the Middle Ages.

By the 10th century Venice was beginning to prosper in the trade of the Levant; by the early part of the 13th century it enjoyed a monopoly of the trade of the Middle East; and by the 15th century it was a formidable power in Europe. Part of Venice's great wealth came from trading in the spices of the East, which it obtained in Alexandria and sold to northern and western European buyer-distributors at exorbitant prices.

The Europeans knew the origin of the spices reaching Alexandria and, unable to break the hold of Venice, determined in the last third of the 15th century to build ships and venture abroad in search of a route to the spice-producing countries. So began the famed voyages of discovery. The Portuguese were first in the race and the first to bring spices from India to Europe by way of the Cape of Good Hope in 1501. In 1492 Christopher Columbus sailed under the flag of Spain, and in 1497 John Cabot sailed for England; but both failed to find the fabulous spice lands.

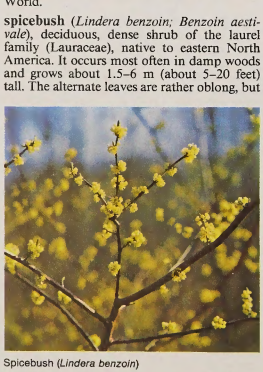
Ferdinand Magellan took up the quest for Spain in 1519. Of the five vessels under his command, only one, the *Victoria,* returned to Spain, but triumphantly, laden with cloves.

In 1577 Sir Francis Drake began his adventurous voyage around the world by way of the Strait of Magellan and the Spice Islands and brought the *Golden Hind,* heavily laden with the cloves of Ternate and other treasures, into Plymouth harbour in 1580.

For Holland, a fleet under the command of Cornelis de Houtman sailed for the Spice Islands in 1595; another, commanded by Jacob van Neck, put to sea in 1598; and their ships returned home with rich cargoes of cloves, mace, nutmegs, and pepper. In 1602 the Dutch East India Company came into existence by authority of the Estates-General of the Netherlands. In 1664 the French East India Company was organized by state authorization under Louis XIV. Other European nations granted charters to East India companies with varying success. There followed struggles and conquests to gain advantage and monopolistic control of the trade. For more than 100 years Portugal was the dominant power, eventually yielding to English and Dutch enterprise and conquest; by the 19th century British interests were firmly rooted in India and Ceylon, and the Dutch were in control over the greater part of the East Indies.

For mariners it was an age of adventure, risk, hardship, disease, and death; for nations it was an age of struggle, defeat, or conquest and an age for acquiring new, near-primitive lands and colonizing and gaining dominion over civilized foreign territories. For European commercial interests it was an age of rewarding success, which broke the monopoly of Venice, overcame the Muslim domination of the spice trade, created a voluminous trade in a great variety of merchandise between Europe and the Far East, and opened up a New World.

**spicebush** (*Lindera benzoin; Benzoin aestivale*), deciduous, dense shrub of the laurel family (Lauraceae), native to eastern North America. It occurs most often in damp woods and grows about 1.5–6 m (about 5–20 feet) tall. The alternate leaves are rather oblong, but wedge-shaped near the base, and 8–13 cm (3–5 inches) long. The small, yellow, unisexual flowers are crowded in small, nearly stalkless clusters. The seed of the fleshy red fruit has a stony covering. Young twigs, leaves, and fruit are sometimes used to make tea.



Spicebush (*Lindera benzoin*)
Walter Chandoha

**spicule,** in astronomy, rising jet of comparatively cool, dense gas extending through the chromosphere, or lower atmosphere, of the Sun. The corona, or outer atmosphere, is above the spicules and seems to be formed from them.

About 100,000 spicules are active in the Sun at any given time. Each rises from the lower chromosphere at about 20 km (12 miles) per second to a height of several thousand kilometres and then within a few minutes disperses or collapses. Spicules appear to be independent of sunspots and other local events in the underlying photosphere. *See* chromosphere.

**spider,** order name ARANEIDA, or ARANEAE, a member of a group of arachnids characterized by having six pairs of appendages, including four pairs of legs and two main body parts (the prosoma, or cephalothorax, and the opisthosoma, or abdomen) attached by a narrow stalk.

A brief treatment of spiders follows. For full treatment, *see* MACROPAEDIA: Arachnids.

Spiders are abundant worldwide except in Antarctica and usually occur at elevations



Wolf spider showing eye arrangement, chelicerae, and fang at end of each chelicera
Anthony Bannister—The Natural History Photographic Agency

from sea level to 5,000 m (16,000 feet). Some 34,000 species of spiders have been described. Most are terrestrial animals. They range in body length from less than 1 mm (0.04 inch) to about 90 mm (3.5 inches). Spiders are predatory and prey mostly on insects.

All spiders have venom glands, but the venoms of only a few (*e.g.,* black widow, brown spider; *qq.v.*) are harmful to humans. There are eight or fewer eyes, always simple rather than compound (*i.e.,* multifaceted). The number and arrangement of these eyes are major considerations in the classification of species. A pair of chelicerae—two-segmented, pincer-like appendages—occur at the front of the prosoma and usually point downward. The end segment of each chelicera is fanglike and is connected to a venom gland. The legs have seven segments. At the tip of the opisthosoma are several fingerlike structures, known as spinnerets, which produce viscous droplets of silk from the silk glands, forming threads.

Spiders change little during growth, except in size. They usually molt, or shed their cuticles (skins), seven or eight times before maturing. If a leg is broken off during development, it is usually replaced.

Spiders exhibit characteristic behaviours during and after courtship and mating, primarily

because, unless the male clearly identifies himself, the female of certain species, commonly larger than the male, often kills and eats the male after mating. The eggs are usually laid in a silken sac that, in some cases, is carried by the female until the eggs hatch; in other cases the female deposits the egg sac either in or near the web, in a crevice, among leaves, or on twigs or bark. The eggs usually hatch soon after being laid.

Insects, the main diet of most spiders, usually are captured in silken webs. In the webs of some species the strands are covered with droplets of a sticky substance that prevents or delays escape. The jumping spider and the wolf spider (*qq.v.*) chase and pounce upon their prey. The crab spider (*q.v.*) awaits its prey in flowers.

The house spider (*see* comb-footed spider) extends its silken strands in almost any direction. The sheet-web weaver (*q.v.*) usually makes a sheetlike, horizontal web. The funnel-web spider (*q.v.*) builds its web in the shape of a funnel. The trap-door spider (*q.v.*) and the wolf spider make tunnels. Others make nests of leaves.

**spider beetle,** any member of about 500 species of insects sometimes considered a part of the family Anobiidae (order Coleoptera) and sometimes placed in their own family, Ptinidae. These spider-shaped beetles have a globular body, long thin legs, and no wings. They range in colour from reddish brown to black and in size from 1 to 5 mm (0.04 to 0.2 inch).

Spider beetles, which occur throughout the world, live in plant or animal remains, stored food products, dry wood, and museum specimens. The white-marked spider beetle (*Ptinus fur*) and the shiny American spider beetle (*Mezium americanum*) are household pests in North America.

**spider crab,** any species of the decapod family Majidae (or Maiidae; class Crustacea). Spider crabs, which have thick, rather rounded bodies and long, spindly legs, are generally slow-moving and sluggish. Most are scavengers, especially of dead flesh.



Spider crab (*Libinia*)
Walter Dawn

Majids, a widely distributed marine group, are fished commercially in temperate waters, such as in the North Pacific. Some are quite small; for example, the long-beaked spider crab (*Macropodia rostrata*) of European coastal waters has a body about 1 cm (less than 0.5 inch) in diameter. The largest spider crab, and perhaps the largest known arthropod, is the giant crab (*q.v.*) of the Pacific waters near Japan. The outstretched claws of this crab (*Macrocheira kaempferi*) measure more than 4 m (13 feet) from tip to tip.

The head of the spider crab is rather beak-shaped; the body surface is generally covered with hairs, spines, and tubercles (knobby projections) that are frequently matted with algae, sponges, and other organisms. The crabs fasten a good deal of this material to themselves by means of a mucuslike secretion from the mouth.

The kelp crab (*Pugettia producta*), a spider crab found among seaweed on the Pacific coast from Canada to Mexico, is about 1.25 cm (0.5 inch) wide and 2.5 cm (1 inch) long. It is green and red on top and green underneath.

*Parthenope investigatoris,* a spider crab of the Indian Ocean, is camouflaged to resemble the coral on which it lives.

Spider crabs of the genera *Libinia, Hyas, Sternorhynchus, Pitho,* and *Lambrus* are common on the Atlantic coast of North America. Pacific coast spider crabs include the genera *Loxorhynchus, Pugettia,* and *Epialtus.*

*Pisa,* 1.3 to 6 cm (0.5 to 2.4 inches) long, is found in the Mediterranean Sea and in the eastern Atlantic Ocean. *Maja squinado,* which attains lengths of 18 cm (7 inches), is found in the Mediterranean Sea and along the southwest coast of Europe.

**spider hunter,** any of several sunbird species. *See* sunbird.

**spider-hunting spider:** *see* pirate spider.

**spider mite:** *see* red spider.

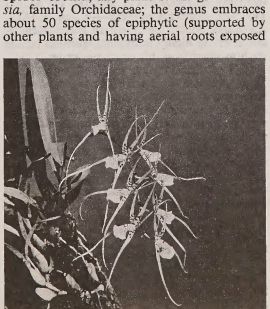
**spider monkey** (*Ateles*), any of several large, extremely agile monkeys, belonging to the family Cebidae, found in forests from Mexico to Brazil. Spider monkeys, of which there are four species, are lanky, somewhat potbellied animals 35–66 cm (14–26 inches) long; they have long limbs, thumbless hands, and a long (60–92 cm [24–36 inches]), heavily furred, prehensile tail that acts as an extra limb. Their hair, of variable length and fineness, ranges in the several species from gray to reddish, dark brown, or black.

Spider monkeys live in bands, roaming the highest branches during the day. They do not normally descend to the ground. Sometimes they move rapidly through the trees, swinging by their hands and tails; at times they leap or drop spread-eagled from one tree to another. They feed on fruit, nuts, and some flowers and buds. A single young, born in seclusion after a gestation period of about 139 days, is dependent on its mother for almost a year.

Spider monkeys shot for food sometimes remove the arrow and attempt to stem the bleeding. They are susceptible to malaria and are used in laboratory studies of the disease. Although they may be gentle pets, adult spider monkeys are likely to throw tantrums and may prove dangerous.

The woolly spider monkey (*q.v.*) is of the genus *Brachyteles.*

**spider orchid,** any plant of the genus *Brassia,* family Orchidaceae; the genus embraces about 50 species of epiphytic (supported by other plants and having aerial roots exposed



Spider orchid (*Brassia verrucosa*)
G.C.K. Dunsterville

to the humid atmosphere) orchids native to southeastern North America, the West Indies, and parts of Central and South America. Each stem of a spider orchid has one to three leaves. The flower spike extends laterally from the plant in most species.

Spider orchid flowers are yellow, greenish yellow, or orange-yellow, often with spots or markings. The long, thin sepals and petals give each flower a spidery appearance.

**spider plant,** African plant of the genus *Chlorophytum* (*q.v.*) of the lily family.

**spider wasp,** any insect of the family Pompilidae, also known as Psammocharidae (order Hymenoptera). They are distributed throughout most of the world. About 40 species occur in Great Britain, and more than 100 species are found in North America. Although they feed on spiders helpful to humans, the wasps are not regarded as economically destructive.

The spider wasps include the largest members of the order; some exceed 5 cm (2 inches) in length. Most are 1.0 to 2.5 cm (0.4 to 1 inch) long. The slender body is usually dark; in many cases the wings are smoky or yellow-



Spider wasp (*Cryptocheilus*)
Jacques Six

ish. Most can run rapidly on legs that are long and spiny. They inflict a very painful sting.

There is apparently much variation in the method of stinging prey. The method of *Cryptocheilus* is a refined process during which the wasp first stings the spider between its poison fangs and then stings it again near the junction of the cephalothorax and abdomen. This produces complete immobility. *Pompilus,* on the other hand, has a less refined sting. It sometimes kills the spider; in other cases, the spider may survive for a few weeks.

Spiders captured and paralyzed by the sting of the spider wasp are fed to the young. (Certain wasps other than pompilids also capture spiders for this purpose.) Adult spider wasps are commonly found on flowers and either on the ground or hovering above it in search of prey. The nest, or cell, is made in soil, on rotten wood, or among rocks. Species of the North American genus *Pseudagenia* construct cells of mud under bark or among stones. Some species construct the nest before capturing the spider; others capture the spider first, then set it aside until the nest is completed. A single spider and a single egg are placed in the nest. The spider, alive but paralyzed, is eaten by the wasp larva.

*Anoplius fuscus,* a European species, captures spiders of five different families. Larvae of the European genus *Homonotus* live on the body of a spider that remains active in its normal habitat until it is gradually killed by the feeding larva.

Methods of carrying the paralyzed spider to the nest vary. *Pompilus plumbeus,* found in North America and Europe, carries its prey before it. Others carry the prey sideways or drag it behind. *Anoplius depressipes,* which captures swamp spiders (*Dolomedes*), drags its prey across the water. Some spider wasps fly with their prey.

Among the best-known spider wasps are the tarantula hawks (*Pepsis*), steel-blue-bodied insects with orange wings; some of the largest members of the family belong to this genus. Especially common in the southwestern United States, they provision their nests with trapdoor spiders and tarantulas and often attack spiders many times their own size.

**spiderflower,** any of about 200 species of plants constituting the genus *Cleome* of the caper family (Capparaceae), mostly tropical annual herbs with a pungent odour.

The popular cultivated spiderflower (*C. hasslerana*), with dark pink flowers fading almost to white by noon, is native to sandy thickets



Spiderflower (*Cleome hasslerana*)
G.R. Roberts

and hillsides of the tropical Western Hemisphere. It has five to seven leaflets and a finely spined stem. It is frequently confused with *C. spinosa,* which has dirty-white flowers. Rocky Mountain bee plant, or stinking clover (*C. serrulata*), is a summer-flowering annual of North American damp prairies and mountains. About 50 to 150 cm (20 to 60 inches) tall, it has three-parted leaves and clusters of spidery pink flowers with long stamens.

**spiderwort,** any member of the genus *Tradescantia* (family Commelinaceae), which includes 20 or more erect to trailing, weak-stemmed herbs native to North and South America. Several species are grown as indoor plants in baskets, especially the wandering Jews (*T. albiflora* and *T. fluminensis*); among other slight differences, the former is green-leaved and the latter has purplish undersides. White velvet, or white-gossamer (*T. sillamontana*), has leaves and stems covered with a whitish fuzz. Flowering inch plant (*T. blossfeldiana*), with leaves green and smooth above, purplish and fuzzy beneath, has purplish hairy blossoms. The chain plant (*T. navicularis*) has fleshy, narrow, lengthwise-folded leaves about 2.5 cm (1 inch) long. *T.* × *andersoniana* comprises a complex series of garden hybrids. Also grown in the garden is the common spiderwort, or widow's tears (*T. virginiana*), an upright juicy-stemmed plant with white to purple flowers. The spiderworts are of extremely easy culture, taking root readily from cuttings, and thus are very popular indoor plants. Certain species resemble but should not be confused with *Zebrina* species.

**Spiegel, Der** (German: "The Mirror"), weekly newsmagazine, preeminent in Germany and one of the most widely circulated in Europe, published in Hamburg since 1947. Founded in 1946 as *Diese Woche* ("This Week"), the magazine is renowned for its aggressive, vigorous, and well-written exposés of government malpractice and scandals and for its photography. Its format resembles that of its American counterparts *Time* and *Newsweek,* although it is usually more than twice as thick. *Der Spiegel* is noted for its aggressive pursuit of news without regard to the peace of mind of the German government. A continuing exposé in 1962 revealed the financial problems of the then West German armed forces. The articles involved Defense Minister Franz Josef Strauss and implied that the armed forces would be unable to withstand a Communist attack, although huge sums of money were being spent on defense. The editor, Rudolf Augstein, was arrested, along with four others on the magazine's staff, and charged with the publication of secret information. He was detained for 104 days. The magazine's hard-hitting news approach won it one of Europe's biggest circulations and an abundance of advertisers. It is widely respected both for its coverage of news events and news analysis and for its concise writing, and it is generally regarded as one of the best news weeklies in Europe.

**Spiegel, Sam,** in full SAMUEL SPIEGEL (b. Nov. 11, 1903, Jaroslau, Austria [now Jaroslaw, Pol.]—d. Dec. 31, 1985, Saint-Martin, Lesser Antilles), Austrian-born American motion-picture producer.

Spiegel studied at the University of Vienna and worked as a Young Pioneer in Palestine in the early 1920s. In 1927 he went to Hollywood to work as a story translator, and in 1930 he was sent by Universal Pictures to head that studio's European headquarters in Berlin. He fled Germany after the Nazis came to power in 1933 and lived in Vienna before settling in Hollywood in 1939. He soon became a producer, and among his earlier projects were *Tales of Manhattan* (1942) and Orson Welles's *The Stranger* (1946).

Spiegel's most important productions were done in the 1950s and included *The African Queen* (1951), *On the Waterfront* (1954), *The Bridge on the River Kwai* (1957), and *Suddenly Last Summer* (1959). He continued producing in the 1960s and '70s with *Lawrence of Arabia* (1962), *Nicholas and Alexandra* (1971), and *The Last Tycoon* (1976). The last film he produced was a motion-picture version of Harold Pinter's play *Betrayal* (1983). Most of Spiegel's films were expensive, large-scale productions that utilized some of the leading actors, screenwriters, and directors of the day. The classic films *The African Queen, The Bridge on the River Kwai,* and *Lawrence of Arabia* were largely shot on location in jungles and deserts, often under difficult conditions.

**Spieghel, Henric Laurenszoon,** also spelled HENDRIK LAURENSZOON SPIEGEL (b. March 11, 1549, Amsterdam, Neth.—d. Jan. 4, 1612, Alkmaar), poet of the northern Dutch Renaissance whose highly individual spiritual beliefs set him apart from his contemporaries.

In Spieghel's greatest work, *Hertspiegel* (1614; "Heart-Mirror"), a long, often allegorical poem written in hexametres, he set out his philosophical vision in simple, direct style. His strong religious faith is based on an amalgamation of Christian and Platonic ideas, together with an underlying pantheism that sees God manifested in all things. Spieghel was also active in the movement toward the purification and wider use of the Dutch language, principles that he advocated in his *Twe-spraack van de Nederduitsche Letterkunst* (1584; "Dialogue on Dutch Literature").

**Spielberg, Steven** (b. Dec. 18, 1947, Cincinnati, Ohio, U.S.), American motion-picture director and producer whose highly entertaining and escapist films enjoyed unprecedented popularity.

An amateur filmmaker even before he entered high school, Spielberg attended California State College, Long Beach, and attracted the attention of Universal Pictures with his short films. For Universal he directed episodes of television series and television movies, including the thriller *Duel* (1971), whose success enabled him to begin making theatrically released motion pictures, beginning with *The Sugarland Express* (1974).

His next picture, the thriller *Jaws* (1975), became one of the highest-grossing films and established many of the touchstones of Spielberg's work. In the typical Spielberg film, an ordinary but sympathetic main character is enlightened through a confrontation with some extraordinary being or force that gradually reveals itself as the narrative unfolds. Among these antagonists are a great white shark in *Jaws*, extraterrestrials in *Close Encounters of the Third Kind* (1977), a whimsical alien in *E.T.—the Extraterrestrial* (1982), and dinosaurs in *Jurassic Park* (1993). Spielberg's films, such as *Raiders of the Lost Ark* (1981) and its sequels, used rich colour cinematography, brisk editing, memorable musical soundtracks, and inventive special effects to create a cinematic experience that was typically light yet highly suspenseful. The aggressive commercialism and optimism of Spielberg's films became the prevailing style in Hollywood in the late 20th century. His pervasive influence was recognized in 1987 by the Academy of Motion Picture Arts and Sciences, when it honoured him with the Irving G. Thalberg Award.

Though Spielberg enjoyed tremendous popular success with these films, his proclivity for broad storytelling hampered his attempts at more complex filmmaking. While generally well received, *The Color Purple* (1985) and *Empire of the Sun* (1987), in the view of many critics, lacked emotional depth or insight. *Schindler's List* (1993), the true story of a group of Polish Jews who avoided Nazi extermination camps with the aid of a German industrialist, quieted many of Spielberg's critics. Shot in black and white and with unflinching detail, it won Academy Awards for best picture and best director. Five years later Spielberg again received the best director honour, for another World War II film, *Saving Private Ryan* (1998). *AI: Artificial Intelligence* (2001), a science-fiction film project that Spielberg inherited from director Stanley Kubrick, is perhaps his most emotionally complex film, though it left critics and audiences divided. In 2002 he returned to his signature themes and style with *Minority Report* and *Catch Me if You Can.*

Spielberg was also the executive producer of many television series, documentaries, and films by other directors. In 1994 he joined with Jeffrey Katzenberg and David Geffen to form DreamWorks SKG, an entertainment company created to produce movies, animation, recordings, and television programs.

**Spielhagen, Friedrich von** (b. Feb. 24, 1829, Magdeburg, Prussian Saxony [Germany]—d. Feb. 25, 1911, Berlin, Ger.), popular writer whose works are considered representative of the social novel in Germany.

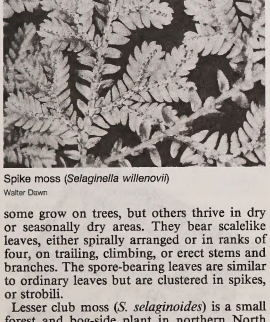
After studying at the universities of Berlin, Bonn, and Greifswald, Spielhagen was a teacher in a gymnasium (high school) at Leipzig, but after 1854 he became entirely involved with literature. From 1878 to 1884 he was editor of *Westermanns Monatshefte;* he was also an actor and an active partisan in democratic movements. After two earlier novels, his *Problematische Naturen,* 4 vol. (1861; *Problematic Characters*), was a remarkable success and considered one of the best works of its time. The hero is pulled in opposite directions by the democratic ideals of society and state and by the distractions of social life. This was followed by *Durch Nacht zum Licht,* 4 vol. (1862; *Through Night to Light*), *Hammer und Amboss,* 5 vol. (1869; *Hammer and Anvil*), and *Sturmflut,* 3 vol. (1877; *The*

*Breaking of the Storm*). The last is a powerful romance, using a tempest that flooded the Baltic coast in 1872 as a symbol for the economic storm that burst on Berlin that same year.

Although the years between 1860 and 1876 are considered his most productive, Spielhagen later produced many other novels. His dramas include *Liebe für Liebe* (1875) and *Hans und Grete* (1868).

**Spielmann** (German: "player," or "entertainer"), plural SPIELLEUTE, wandering entertainer of the European Middle Ages who performed at fairs, markets, and castles. The *Spielleute* included singers, mimics, and sword-swallowers. Also among them were the storytellers credited with keeping alive the native Germanic vernacular legends at a time when nearly all written literature was religious and when the court poets, under foreign influence, were concerned chiefly with love lyrics and Arthurian legends. A number of carefree adventure tales, such as the 12th-century *König Rother,* are evidence of a highly developed underground literature characterized by its humour, amoral tone, and powers of social observation and presumably propagated by the *Spielleute.*

**spike moss,** any member of the plant genus *Selaginella* of the order Selaginellales with more than 700 species of mossy, in some cases fernlike, perennials. They are widely distributed in all parts of the world, particularly in the tropics. Many are forest plants;



Spike moss (*Selaginella willenovii*)
Walter Dawn

some grow on trees, but others thrive in dry or seasonally dry areas. They bear scalelike leaves, either spirally arranged or in ranks of four, on trailing, climbing, or erect stems and branches. The spore-bearing leaves are similar to ordinary leaves but are clustered in spikes, or strobili.

Lesser club moss (*S. selaginoides*) is a small forest and bog-side plant in northern North America and Eurasia. Its branches trail along the ground, but the upright yellow-green strobili rise up to 8 cm (about 3 inches). The similar rock selaginella (*S. rupestris*) of North America has smaller leaves, and its branching stems grow on rocks or in sand. Resurrection plant, or resurrection fern (*S. lepidophylla*), is so named because as an apparently lifeless ball it unrolls when the wet season begins. Spreading club moss (*S. krausiana*), from southern Africa, roots readily along its trailing stems of bright green branches. It sometimes is grown as a houseplant, as are *S. emmeliana* from tropical America, *S. martensii* from Mexico, *S. uncinata* from southern China, and *S. caulescens* from East Asia.

**spikenard,** also called AMERICAN SPIKENARD, PETTY MORREL, or LIFE-OF-MAN (*Aralia racemosa*), North American member of the ginseng family (Araliaceae) of the order Cornales, characterized by large spicy-smelling roots. It grows 3.5 m (11 feet) tall and has leaves divided into three heart-shaped parts. The flowers are grouped into numerous clusters at the end of the central stem.

The roots of *A. nudicaulis,* a close relative of spikenard, are used as a substitute for sarsaparilla flavouring. *Smilacina racemosa,* one of the false Solomon's seals in the family Liliaceae (order Liliales), is sometimes called wild spikenard.

**spilite,** fine-grained or dense, extrusive igneous (volcanic) rock that is usually free of visible crystals and is commonly greenish or grayish green in colour. Spilites are of basaltic character but contain the feldspar albite in place of the normal labradorite. The dark mineral is a pale-brown augite; spilites are, however, usually decomposed, and augite is represented by chlorite and calcite.

Spilites are often blistered or pocked and show a wonderfully preserved pillow structure, a feature in most cases indicative of lavas of submarine origin. The individual pillows are filled with concentric zones of vesicles containing chlorite and calcite. Some spilites showing pillow structure are not strictly lavas but are shallow intrusions into unconsolidated submarine ooze. Excellent examples of such intrusive spilites are those found at Nundle, N.S.W., Australia.

The term spilite was first used for altered basic lavas free from phenocrysts and possessing well-marked vesicular textures, but now it denotes a large suite of igneous rocks genetically associated with the spilites, with a status comparable to that of the alkaline and calc-alkaline series. The composition of the rocks in this suite varies widely, but all possess a high percentage of soda and are usually extensively altered. The rocks included are albite-dolerites, minverites, picrites, keratophyres, soda-felsites, and soda-granites.

The spilitic series is peculiar to districts that have undergone a long, continued, and gentle subsidence with few or slight upward movements and no important faulting. These lavas are poured out on the margins of geosynclines, within which black shales, limestones, and radiolarian cherts accumulate. Because geosynclines are the centres of subsequent fold movements, many ancient spilites have become extensively folded and metamorphosed, with production of new minerals, including albite of metamorphic origin. Spilitic eruptions have occurred repeatedly over a wide area and on a large scale.

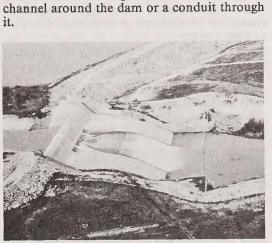
**Spillane, Mickey,** pseudonym of FRANK MORRISON SPILLANE (b. March 9, 1918, Brooklyn, N.Y., U.S.), American writer of detective fiction whose popular work is characterized by violence and sexual licentiousness.

Spillane began his career by writing for pulp magazines and comic books in order to pay for his schooling. His first novel—*I, The Jury* (1947)—introduced detective Mike Hammer, who appeared in other works, such as *My Gun Is Quick* (1950) and *The Big Kill* (1951). In the early 1950s Spillane retired from writing. Ten years later he resumed his career with *The Deep* (1961). Spillane wrote the script and played the role of Hammer for the 1963 film version of *The Girl Hunters* (1962). *Day of the Guns* (1964) initiated another series, with the international agent Tiger Mann. Among Spillane's later books were *The Last Cop Out* (1973) and *The Day the Sea Rolled Back* (1981).

Spillane, who claimed to write solely for monetary gain, flouted literary taste with recurring elements of sadism that disturbed some readers, but the captivating vigour of his narrative and of his central characters brought him popular success.

**spillikins** (game): *see* jackstraws.

**spillway,** passage for surplus water over or around a dam when the reservoir itself is full. Spillways are particularly important safety features for earth dams, protecting the dam and its foundation from erosion. They may lead over the dam or a portion of it or along a channel around the dam or a conduit through it.



Spillway of the Kirwin Dam of the Missouri River Basin Project, Kansas
Ewing Galloway

The erosive energy of the water at the foot of the spillway is dissipated by a stilling basin or by a sloping apron tempering the fall and ending in a curved bucket that directs the flow away from the foundation.

**spin,** in physics, the amount of angular momentum associated with a subatomic particle or nucleus and measured in multiples of a unit called the Dirac $h$, or $h$-bar ($\hbar$), equal to the Planck constant divided by $2\pi$. For electrons, neutrons, and protons, the multiple is .5; pions have zero spin. The spin (more correctly, the total angular momentum) of nuclei more complex than the proton is the vector sum of the orbital angular momenta and intrinsic spins of the constituent nucleons. For nuclei of even mass number, the multiple is an integer; for those of odd mass number, the multiple is a half-integer. All nuclei with even numbers of neutrons and protons have spin zero in their ground states.

**spin-statistics theorem,** in quantum mechanics, fundamental mathematical proof that subatomic particles having integral values of spin (such as photons and helium-4 atoms) must be described by Bose-Einstein statistics (*q.v.*) and that subatomic particles having half-integral values of spin (such as electrons and protons) must be described by Fermi-Dirac statistics (*q.v.*).

**Spina,** ancient Etruscan port on the Adriatic coast of Italy, now about 6 miles (10 km) inland. Spina was founded at the mouth of the Po River toward the end of the 6th century BC and was one of two main ports of entry for the rich Greek commerce with northern Etruria. Soon after 400 BC Spina was sacked



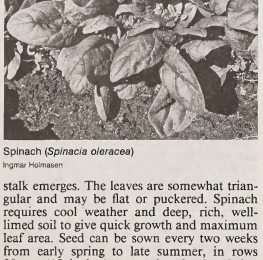
Greek krater from Spina, 5th century BC; in the National Archaeological Museum, Ferrara, Italy
Hirmer Fotoarchiv, München

by the Gauls, and with the collapse of its market and the silting of its port, it rapidly lapsed into obscurity.

Excavations since 1922 in the cemeteries of Valle Trebba and of Valle Pega have yielded many fine bronzes and an unrivaled collection of Greek pottery.

**spina bifida,** congenital cleft of the vertebral column, a form of neural tube defect (*q.v.*).

**spinach** (species *Spinacia oleracea*), hardy, leafy annual of the goosefoot family (Chenopodiaceae), used as a vegetable. The edible leaves are arranged in a rosette, from which a seed-



Spinach (*Spinacia oleracea*)
Ingmar Holmasen

stalk emerges. The leaves are somewhat triangular and may be flat or puckered. Spinach requires cool weather and deep, rich, well-limed soil to give quick growth and maximum leaf area. Seed can be sown every two weeks from early spring to late summer, in rows 30 cm (12 inches) apart, the plantlets being thinned in the row. The last sowings produce young plants that yield a crop in the autumn and stand over the winter, providing leaves in early spring or even through the winter if the weather is not too severe.

Widely grown in northern Europe and the United States, spinach is marketed fresh, canned, and frozen. It received considerable impetus as a crop in the 1920s when attention was first called to its high content of iron and vitamins A and C. Spinach is served as a salad green and as a cooked vegetable. Spinach can be made into various soups, soufflés, and mousses and is used as an ingredient in various prepared dishes.

**spinal column** (anatomy): *see* vertebral column.

**spinal cord,** major nerve tract of vertebrates, extending from the base of the brain through the canal of the spinal column. It is composed of nerve fibres that mediate reflex actions and that transmit impulses to and from the brain.

A brief treatment of the spinal cord follows. For full treatment, *see* MACROPAEDIA: Nerves and Nervous Systems.

Like the brain, the spinal cord is covered by three connective-tissue envelopes called the meninges. The space between the outer and middle envelopes is filled with cerebrospinal fluid, a clear, colourless, noncellular fluid that cushions the spinal cord against jarring shock.

In cross-section the spinal cord appears as a white oval with a gray, butterfly-shaped area in the centre. The white matter consists of myelinated (sheathed) fibres, or axons (*see* axon); the gray matter contains cell bodies, unsheathed motor-neuron fibres, and interneurons connecting either the two sides of the cord or the dorsal and ventral ganglia (*see* ganglion). In humans, 31 paired spinal nerves originate in the spinal cord: 8 cervical, 12 thoracic, 5 lumbar, 5 sacral, and 1 coccygeal. Information about internal and external conditions travels up the ascending tracts of neurons. This information is sorted by the brain, and the proper responses are induced by nerve impulses traveling down the descending tracts to stimulate motor neurons or to initiate glandular secretion.

**spinal curvature,** any of a group of spinal deviations, including scoliosis, lordosis, and kyphosis.

Scoliosis is a lateral, or sideways, deviation of the spine usually including two curves—the original abnormal curve and a later developing compensatory curve. Possible causes of scoliosis include asymmetrical development of back, chest, or abdominal musculature, as may occur in poliomyelitis or cerebral palsy; significant difference in the lengths of the legs; or malformation or disease of the spinal column and associated structures, as in spondylitis, spina bifida, fracture, dislocation, hemivertebrae, or rickets. Treatment, which depends on the cause, usually includes orthopedic surgery, the use of traction, plaster casts, and exercises. Lordosis is an increased curvature in the lumbar (middle-to-lower) region of the vertebral column, and it may be associated with diseases of the hip joint, cirrhosis of the liver, or obesity. Kyphosis is an increased curvature of the thoracic (upper) vertebral column, and it may be caused by rickets or tuberculous spondylitis (Pott's disease).

**spinal nerve,** in vertebrates, any one of many paired nerves that leave the spinal cord at regular intervals. Each pair connects the spinal cord with a specific region of the body. Near the spinal cord each spinal nerve branches into two roots. One, with fibres of sensory nerve cells (neurons), enters the spinal cord via the dorsal root; its cell bodies lie in a spinal ganglion that is outside the spinal cord. The other, with fibres of motor neurons, leaves the spinal cord via the ventral root; its cell bodies lie in specific areas of the spinal cord itself.

**spinal tap** (medicine): *see* lumbar puncture.

**spinalis muscle,** any of the deep muscles of the back near the vertebral column that, as part of the erector spinae (sacrospinalis) muscle group, assist in extension (*e.g.*, bending backward), lateral flexion (bending to the side), and rotation of the spine. The spinalis thoracis is the major spinalis muscle, arising from the bones of the lower thoracic and upper lumbar vertebral spine and inserted into the bones of the upper thoracic vertebral spine. It may be prolonged into the neck (spinalis cervicis) and head (spinalis capitis).

**spine** (anatomy): *see* vertebral column.

**spinel,** mineral composed of magnesium aluminum oxide ($MgAl_2O_4$) or any member of a group of rock-forming minerals, all of which are metal oxides with the general composition $AB_2O_4$, in which $A$ may be magnesium, iron, zinc, manganese, or nickel; $B$ may be aluminum, chromium, or iron; and O is oxygen. The spinel group is divided into three immiscible series; the spinel (aluminum-spinel) series, in which $B$ is aluminum; the chromite (chromium-spinel) series, in which $B$ is chromium; and the magnetite (iron-spinel) series, in which $B$ is iron.

The aluminum spinels are harder, more transparent, and less dense than the others. The spinel series contains the mineral spinel, also called ruby spinel (*q.v.*) or magnesia spinel; other members include hercynite (iron aluminum oxide, $FeAl_2O_4$), gahnite (zinc aluminum oxide, $ZnAl_2O_4$), and galaxite (manganese aluminum oxide, $MnAl_2O_4$). The colour of magnesia spinel ranges from bloodred to blue, green, brown, and colourless; gahnite is dark blue-green; hercynite and galaxite are black. These minerals are found as glassy, hard octahedrons, grains or masses in basic igneous rocks, granite pegmatites, and contact metamorphic limestone deposits. The members of the spinel series often substitute for one another in the crystal structure, so that most specimens are mixtures.

For general information on the use and occurrence of the chromium- and iron-spinel series, *see* chromite; magnetite. For detailed physical properties of any of the spinel minerals, *see* oxide mineral (table). More than 200 synthetic varieties of spinels have been prepared, several as gemstones and many as ferrimagnetic materials (*see also* ferrite).

**Spinello** ARETINO, byname of SPINELLO DI LUCA SPINELLI (b. *c.* 1346, Commune of Arezzo [Italy]—d. March 14, 1410, Arezzo), late Gothic Italian painter noteworthy for his vigorous narrative sense. His style anticipates the realistic painting of the early Renaissance of the 15th century. Early in his career he came under the influence of Orcagna and Nardo di Cione, whose style shows in his first major work, a fresco cycle in San Francesco at Arezzo.

A facile artist, Spinello soon gained a reputation beyond his native town. About 1387 he executed a fresco cycle in the small church at Antella, near Florence, and a cycle of scenes from the life of St. Benedict in the sacristy of San Miniato al Monte, Florence. A triptych (1391) commissioned for Sant' Andrea at Lucca, now in the Accademia, Florence, was painted in conjunction with Lorenzo di Niccolò. In the same year he began work on some frescoes in the Campo Santo (cemetery) at Pisa.

Further commissions at Arezzo followed, and between 1404 and his death he seems to have divided his time between Arezzo and Siena, where he undertook work (lost) for the cathedral and painted (1407–10) a cycle of fresco scenes from the life of Pope Alexander III in the Palazzo Pubblico. These and the Pisa frescoes constitute his most important works.

**spinet,** small form of the harpsichord, generally wing-shaped, with a single set of strings placed at an oblique angle to the keyboard. The wing-shaped spinet may have originated in Italy during the 16th century; later it became known in France and England.



Italian spinet, *c.* 1600; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

Spinets were popular substitutes for the larger, more expensive harpsichords and were made in large numbers during the late 17th and 18th centuries, especially in England. Their cases were often highly ornamented and decorated. The name spinet may derive from the Latin *spinae* ("thorns"), perhaps reflecting the shape of the tiny quills or leather wedges that pluck the strings. In modern usage, "spinet" commonly refers to a short form of upright piano.

**spinneret,** also spelled SPINNERETTE, in the spinning of man-made fibre, small, thimble-shaped, metal nozzle having fine holes through

which a spinning solution is forced to form a filament. The viscous or syrupy solution, prepared by melting or chemically dissolving raw material, emerges from the spinneret as long fibres that are then solidified by coagulation, evaporation, or cooling.

Most spinnerets are made of stainless steel, but rayon production requires platinum. The size and shape of the spinneret holes determine the filament's cross-sectional shape. Each hole forms a single filament, and the combined filaments form filament yarn. The structure in spiders and silkworms through which silk is extruded is also called the spinneret.

**spinning,** in textiles, process of drawing out fibres from a mass and twisting them together to form a continuous thread or yarn. In man-made fibre production the name is applied to the extrusion of a solution to form a fibre, a process similar to the method by which silkworms and similar insect larvae produce filament to make their cocoons from a viscous fluid that they secrete.

Common industrial spinning techniques include ring spinning, open-end (rotor) spinning, and air-jet spinning.

**spinning wheel,** early machine for turning fibre into thread or yarn, which was then woven into cloth on a loom. The spinning wheel



Early American foot-pedal spinning wheel
By courtesy of the New York State Historical Association, Cooperstown

was probably invented in India, though its origins are obscure. It reached Europe via the Middle East in the European Middle Ages. It replaced the earlier method of hand spinning, in which the individual fibres were drawn out of a mass of wool held on a stick, or distaff, twisted together to form a continuous strand, and wound on a second stick, or spindle. The first stage in mechanizing the process was to mount the spindle horizontally in bearings so that it could be rotated by a cord encircling a large, hand-driven wheel. The distaff, carrying the mass of fibre, was held in the left hand, and the wheel slowly turned with the right. Holding the fibre at an angle to the spindle produced the necessary twist.

The Saxon, or Saxony, wheel, introduced in Europe at the beginning of the 16th century, incorporated a bobbin on which the yarn was wound continuously; the distaff on which the raw fibre was held became a stationary vertical rod, and the wheel was actuated by a foot treadle, thus freeing both of the operator's hands.

The improvement of the loom in 18th-century Great Britain created a yarn shortage and a demand for mechanical spinning. The result was a series of inventions that converted the spinning wheel into a powered, mechanized component of the Industrial Revolution.

**Spinola** FAMILY, one of the noble families that dominated the history of Genoa, Italy, during the city-state's great period, from the 12th to the 14th century.

They were descended from a younger son of Ido, the viscount who ruled Genoa in the 10th century as the representative of its feudal lord, the Marchese Obertinghi. The Spinola furnished many consuls to the aristocratic "consular" commune of the 12th century. Guido Spinola served as consul several times between 1102 and 1121. In 1190 his descendant, also named Guido, commanded a Genoese fleet in the Third Crusade, afterward being repeatedly elected consul and serving on a number of embassies.

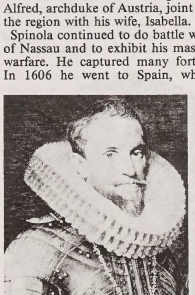
During the first half of the 13th century, in predominantly Guelf (pro-papal) Genoa, the Spinola headed the Ghibellines, the party supporting the Holy Roman emperor Frederick II in the factional struggles of the period. Niccolò Spinola (d. 1240) became grand admiral of Frederick's fleet. In 1237 Guglielmo Spinola led an unsuccessful coup against the Guelf podesta (chief magistrate), who sentenced the rebels to exile and destruction of their houses and property but revoked the sentence on intervention of the archbishop of Genoa. In 1270 Oberto Spinola and Oberto Doria instituted the first of a series of governments headed by members of their two families when they seized power as captains of the people. The two men ruled Genoa for the 15 years that have been termed the golden age of the Genoese medieval commune. Other Spinola who served jointly with Doria as captains of the people were Oberto Spinola's son Corrado; Opizzino (Opicino) Spinola during Emperor Henry VII's invasion of Italy; and, after a long interruption, Galeotto Spinola in 1335. At that time the resumption of the rule of the two powerful families ended in a popular revolt and the installation of the first doge of Genoa (1339). The Spinola made several unsuccessful attempts to regain power.

In later periods, first under the domination of Genoa by the Visconti of Milan and then by Spain, Austria, and France, the Spinola distinguished themselves as soldiers, prelates, ambassadors, and literary men. When the constitutional reforms of Andrea Doria reinstated the dogeship, Battista Spinola occupied that office from 1531 to 1533. Notable among the family's military men was the Spanish general Ambrogio di Spinola (1569–1630). The family contributed three archbishops to Genoa and 13 cardinals. Among its literary figures were several historians, including Massimiliano Spinola (1812–79), the author of works on Ligurian history. Among the famous women of the family was Laura di Negro Spinola (d. 1838), who aided the cause of Giuseppe Mazzini, the Italian revolutionary patriot, and his followers.

**Spinola, Ambrogio di Filippo,** MARQUÉS DE LOS BALBASES (b. 1569, Genoa [Italy]—d. Sept. 25, 1630, Castelnuovo Scrivia), an outstanding military commander in the service of Spain and one of the ablest soldiers of his time. Though he won fame in the wars against the Dutch Republic in the early 17th century, he was ultimately unable to break Dutch military power.

Spinola was born into an old and powerful family of Genoa, an Italian city-state that during his time was a close ally of Spain. To advance the fortunes of his family, Spinola contracted for service in the Spanish Netherlands and marched there in 1602 with a force of 9,000 men he had raised at his own expense. With his disciplined troops, Spinola showed himself a match for his major opponent, the skillful Dutch commander Maurice of Nassau, in his successful one-year siege of Ostend, which fell on Sept. 22, 1604. After that victory, Spinola was appointed commander in chief of the Spanish armies in the Netherlands and the next in line to head its government after Alfred, archduke of Austria, joint sovereign of the region with his wife, Isabella.

Spinola continued to do battle with Maurice of Nassau and to exhibit his mastery of siege warfare. He captured many fortified places. In 1606 he went to Spain, where he was



Spinola, detail of a portrait by an unknown artist
By courtesy of the Biblioteca Nacional, Madrid

forced to pledge his entire fortune as security for the expenses of the Dutch war before bankers would advance funds to the Spanish government. Spinola was never repaid and ultimately suffered financial ruin. The next year he signed a suspension of arms with Maurice and two years later played a major role in the negotiation of a truce that lasted 12 years. During this entire period, Spinola kept his Netherlands forces in readiness and directed repair and maintenance efforts.

Shortly after the opening of the Thirty Years' War (1618–48), Spinola seized nearly all of the Palatinate, a fertile and strategic German region along the Rhine River (1620). He thereby removed a Protestant-held barrier on the route by which money and men reached the Spanish armies in the Netherlands; he was rewarded with the rank of captain general. He returned to the Netherlands to assume command of the Spanish armies in 1621, after Spain had decided to break the truce with the Dutch. There Spinola gained his most famous victory, the capture of the strategic Dutch fortress of Breda, after a long siege (Aug. 28, 1624–June 5, 1625). This victory drew attention throughout Europe and served as the subject for the great painting by Velázquez, "The Surrender of Breda." After Breda, the lack of funds and the enmity of the conde-duque de Olivares, the administrator for the Spanish boy-king Philip IV, hindered Spinola's military efforts. Also, the new Dutch commander, Frederick Henry, prince of Orange, proved himself a formidable opponent.

In 1628 Spinola left for Spain, where he reluctantly accepted an appointment as general and plenipotentiary in the war with the French over the disputed succession to the duchy of Mantua, Italy (1628–31). Spinola arrived in Italy in 1629 and died there in the midst of the siege of Casale. The title of marquês de Los Balbases, which had been bestowed on Spinola, was all the compensation his family received for the great fortune Spinola had spent in the service of Philip III and Philip IV of Spain.

BIBLIOGRAPHY. Studies of his campaigns are found in Pieter Geyl, *The Revolt of the Netherlands, 1555–1609*, 2nd ed. (1958), and *The Netherlands in the Seventeenth Century*, rev. and enlarged ed. (1961).

**Spinoza, Benedict de** (English), Hebrew forename BARUCH, Latin forename BENDIC-

TUS, Portuguese BENTO DE ESPINOSA (b. Nov. 24, 1632, Amsterdam—d. Feb. 21, 1677, The Hague), Dutch-Jewish philosopher, the foremost exponent of 17th-century Rationalism.

*Early life and career.* Spinoza's grandfather and father were Portuguese and had been crypto-Jews after the Spanish Inquisi-



Spinoza, oil painting, c. 1665, in the Herzog-August Bibliothek, Wolfenbüttel, Ger.

By courtesy of the Herzog-August Bibliothek, Wolfenbuttel, Ger.

tion had compelled them to embrace Christianity. Later, after Holland's successful revolt against Spain and the granting of religious freedom, they found refuge in Amsterdam. His mother, who also came from Portugal, died when Benedict was barely six years old. The Spinozas were prosperous merchants and respected members of the Jewish community, and it may be assumed that Spinoza attended the school for Jewish boys founded in Amsterdam in about 1638. Outside school hours the boys had private lessons in secular subjects. Spinoza was taught Latin by a German scholar, who may also have taught him German; and he knew to some extent all of the other significant continental languages. In March 1654 Benedict's father died. There was some litigation over the estate, with Benedict's only surviving stepsister claiming it all. Benedict won the lawsuit but allowed her to retain nearly everything.

His studies so far had been mainly Jewish, but he was an independent thinker and had found more than enough in his Jewish studies to wean him from orthodox doctrines and interpretations of Scripture; moreover, the tendency to revolt against tradition and authority was much in the air in the 17th century. But the Jewish religious leaders in Amsterdam were fearful that heresies (which were no less anti-Christian than anti-Jewish) might give offense in a country that did not yet regard the Jews as citizens. Spinoza soon incurred the disapproval of the synagogue authorities. In conversations with other students, he had held that there is nothing in the Bible to support the views that God had no body, that angels really exist, or that the soul is immortal; and he had also expressed his belief that the author of the Pentateuch (the first five books of the Bible) was no wiser in physics or even in theology than were they, the students. The Jewish authorities, after trying vainly to silence Spinoza with bribes and threats, excommunicated him in July 1656, and he was banished from Amsterdam for a short period by the civil authorities. There is no evidence that he had really wanted to break away from the Jewish community, and indeed the scanty knowledge available would suggest the opposite. On Dec. 5, 1655, for example, he had attended the synagogue and made an offering that, in view of his poverty, must have been a rare event for him, and, about the time of his excommunication, he had addressed a defense of his views to the synagogue.

Among Spinoza's Christian acquaintances was Franciscus van den Enden, who was a former Jesuit, an ardent classical scholar, and something of a poet and dramatist and who had opened a school in Amsterdam. For a time, Spinoza stayed with him, helping with the teaching of the schoolchildren and receiving aid in his own further education. In this way he improved his knowledge of Latin, learned some Greek, and was introduced to Neoscholastic philosophy. It may have also been through van den Enden's school that Spinoza became acquainted with the "new philosophy" of René Descartes, later acknowledged to be the father of modern philosophy. Spinoza's other Christian acquaintances were mostly of the Collegiants, a brotherhood that later merged with the Mennonites; they were especially interested in Cartesianism, the dualistic philosophy of Descartes and his followers.

At the same time, he was becoming expert at making lenses, supporting himself partly by grinding and polishing lenses for spectacles, telescopes, and microscopes; he also did tutoring. A kind of reading and discussion circle for the study of religious and philosophical problems came into being under the guidance of Spinoza. In order to collect his thoughts, however, and reduce them to a system, he withdrew in 1660 to Rijnsburg, a quiet village on the Rhine, near Leiden. Rijnsburg was the headquarters of the Collegiants, and Spinoza's lodgings there were with a surgeon named Herman Homan. In Homan's cottage Spinoza wrote *Korte Verhandeling van God, de Mensch en deszelfs Welstand* (written *c.* 1662; *Spinoza's Short Treatise on God, Man, and His Well-Being,* 1910) and *Tractatus de Intellectus Emendatione* ("Treatise on the Correction of the Understanding"), both of which were ready by April 1662. He also completed the greater part of his geometrical version of Descartes's *Principia Philosophiae* and the first book of his *Ethica.* Spinoza's attitude in these works already showed a departure from Cartesianism. It was also during this stay that he met Heinrich Oldenburg, soon to become one of the two first secretaries of the Royal Society in London, a friendship

*Influence of Descartes and the geometrical method.* His version of Descartes's *Principia* was prepared while Spinoza was giving instruction in the philosophy of Descartes to a private pupil. It was published by his Cartesian friends under the title *Renati des Cartes Principiorum Philosophiae Pars I et II, More Geometrico Demonstratae, per Benedictum de Spinoza* (1663), with an introduction explaining that Spinoza did not share the views expressed in the book. This was the only book published in Spinoza's lifetime with his name on the title page.

The philosophy of Spinoza may thus be regarded as a development from and a reaction to that of his contemporary Descartes (1596–1650). Though it has been argued that Spinoza was also much influenced by medieval philosophy (especially Jewish), he seems to have been much more conscious of the Cartesian influence, and his most striking doctrines are most easily understood as solutions of Cartesian difficulties. Clearly, he had studied Descartes in detail. He accepted Descartes's physics in general, though he did express some dissatisfaction with it toward the end of his life. As for the Cartesian metaphysics, he found three unsatisfactory features: the transcendence of God, the substantial dualism of mind and body, and the ascription of free will both to God and to human beings. In Spinoza's eyes, those doctrines made the world unintelligible. It was impossible to explain the relation between God and the world or between mind and body or to account for events occasioned by free will.

The publication of Spinoza's version of Descartes's *Principia* had been intended to prepare the way for that of his own philosophy, for he had both to secure the patronage of influential men and to show the more philosophically minded that his rejection of Cartesianism was not out of ignorance.

Spinoza became dissatisfied with the informal method of exposition that he had adopted in the *Korte Verhandeling* and the *De Intellectus Emendatione* and turned instead to the geometrical method in the manner of Euclid's *Elements.* He assumed without question that it is possible to construct a system of metaphysics that will render it completely intelligible. It is therefore possible, in his view, to present metaphysics deductively—that is, as a series of theorems derived by necessary steps from self-evident premises expressed in terms that are either self-explanatory or defined with unquestionable correctness. His masterpiece, the *Ethica,* was set out in this manner—*Ordine Geometrico Demonstrata,* according to the reading of its subtitle. Its first part, "De Deo" ("Concerning God"), was finished and in the hands of his friends early in 1663. Initially the work was intended to have three parts only, but it eventually appeared (in 1677) in five parts. Spinoza's desire for an impersonal presentation was probably his chief motive for adopting the geometrical method, appreciating that the method guarantees true conclusions only if the axioms are true and the definitions correct. Spinoza, like his contemporaries, held that definitions are not arbitrary but that there is a sense in which they may be correct or incorrect.

The question was discussed at length in his unfinished *Tractatus de Intellectus Emendatione.* A sound definition, he held, should make clear the possibility or the necessity of the existence of the object defined. Because the *Ethica* begins with the definition of "substance," the necessary existent, the entire system is vulnerable to anyone disputing that definition, however cogent the subsequent reasoning may be. In fact, as Gottfried Wilhelm Leibniz, a Rationalist philosopher and mathematician, pointed out, though the system is closely knit, its demonstrations do not proceed with mathematical rigour.

*Period of the "Ethica."* In June 1663 Spinoza moved to Voorburg, near The Hague, and it appears that by June 1665 he was nearing the completion of the three-part version of the *Ethica.* During the next few years, however, he was at work on his *Tractatus Theologico-Politicus,* which was published anonymously at Amsterdam in 1670. This work aroused great interest and was to go through five editions in as many years. It was intended "to show that not only is liberty to philosophize compatible with devout piety and with the peace of the state, but that to take away such liberty is to destroy the public peace and even piety itself." As this work shows, Spinoza was far ahead of his time in advocating the application of the historical method to the interpretation of the biblical sources. He argued that the inspiration of the prophets of the Old Testament extended only to their moral and practical doctrines and that their factual beliefs were merely those appropriate to their time and are not philosophically significant. Complete freedom of scientific and metaphysical speculation is therefore consistent with all that is important in the Bible. Miracles are explained as natural events misinterpreted and stressed for their moral effect.

In May 1670 Spinoza moved to The Hague, where he remained until his death. He began to compose a Hebrew grammar, *Compendium Grammatices Linguae Hebraeae,* but did not finish it; instead, he returned to the *Ethica,* al-

though the prospect of its publication became increasingly remote. There were many denunciations of his *Tractatus Theologico-Politicus* as an instrument "forged in hell by a renegade Jew and the devil." When the *Ethica* was completed in 1675, Spinoza had to abandon the idea of publishing it, though manuscript copies were circulated among his close friends.

*Last years and posthumous influence.* Spinoza concentrated his attention on political problems and began his *Tractatus Politicus,* which he did not live to finish. During the post-*Ethica* period, he was visited by several important people, among them Ehrenfried Walter von Tschirnhaus (in 1675), a scientist and philosopher, and Gottfried Wilhelm Leibniz (in 1676), like Spinoza, one of the foremost Rationalists of the time. Leibniz, having heard of Spinoza as an authority on optics, had sent him an optical tract and had then received from Spinoza a copy of the *Tractatus Theologico-Politicus,* which deeply interested him. According to Leibniz' own account, he "conversed with him often and at great length." Spinoza, however, was now in an advanced stage of consumption, aggravated by the inhaling of glass dust from the polishing of lenses in his shop. He died in 1677, leaving no heir, and his few possessions were sold by auction. These included about 160 books, the catalog of which has been preserved.

In accordance with Spinoza's previous instructions, several of his friends prepared his manuscripts secretly for the press, and they were sent to a publisher in Amsterdam. The *Opera Posthuma* (Dutch version: *Nagelate Schriften*), published before the end of 1677, was composed of the *Ethica, Tractatus Politicus,* and *Tractatus de Intellectus Emendatione,* as well as letters and the Hebrew grammar. His *Stelkonstige reeckening van den regenboog* ("On the Rainbow") and his *Reeckening van kanssen* ("On the Calculation of Chances") were printed together in 1687. The *Korte Verhandeling* was lost to the world until E. Boehmer's publication of it in 1852.

Spinoza has an assured place in the intellectual history of the Western world, though his direct influence on technical philosophy has not been great. Throughout the 18th century he was almost universally decried as an atheist—or sometimes used as a cover for the detailing of atheist ideas. The tone had been set by Pierre Bayle, a Skeptical philosopher and encyclopaedist, in whose *Dictionnaire historique et critique* Spinozism was described as "the most monstrous hypothesis imaginable, the most absurd"; and even David Hume, a Scottish Skeptic and historian, felt obliged to speak of the "hideous hypothesis" of Spinoza.

Spinoza was rendered intellectually respectable by the efforts of literary critics, especially of the Germans G.E. Lessing and J.W. von Goethe and the English poet S.T. Coleridge, who admired the man and found austere excitement in his works, in which they saw an intensely religious attitude entirely divorced from dogma. Spinoza has also been much studied by professional philosophers since the beginning of the 19th century. Both absolute Idealists and Marxists have read their own doctrines into his work, and Empiricists, while rejecting his metaphysical approach, have developed certain detailed suggestions from his theory of knowledge and psychology.

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**Spinther, Publius Cornelius Lentulus:** *see* Lentulus Spinther, Publius Cornelius.

**spiny anteater** (mammal): *see* echidna.

**spiny eel,** any of two groups of fishes, those of the freshwater family Mastacembelidae (order Perciformes) and of the deep-sea family Notacanthidae (order Notacanthiformes).



Spiny eel (*Mastacembelus ellipsifer*)
Painting by Gilbert Emerson

Members of both groups are elongated and eellike but are not related to true eels.

The freshwater spiny eels comprise about 50 species found in the tropics from Africa to China. Carnivorous, they are usually nocturnal, burrowing into the bottom by day. They have a long, movable snout and a row of spines preceding the soft portion of the dorsal fin. There are no pelvic fins, and the soft dorsal, anal, and tail fins are usually joined. The largest is about 90 cm (3 feet) long, but most are much smaller. Depending on the authority, these fishes may be placed in the suborder Mastacembeloidei or in a distinct order, Mastacembeliformes.

The deep-sea spiny eels comprise a small and little-known group of fishes found at depths to more than 1,980 m (6,500 feet). Usually small and with long, pointed tails and a row of dorsal spines, they are placed in the order Notacanthiformes, with the deep-sea families, Halosauridae and Lipogenyidae.

**spiny-finned fish,** also called SPINY-RAYED FISH, any member of the superorder Acanthopterygii, including four orders of marine and freshwater fishes having fins with some spiny (as opposed to soft) rays—Atheriniformes, Beryciformes, Zeiformes, and Lampridiformes.

The atheriniform (*q.v.*) is the best known of the spiny-finned group, including flying fishes, guppies, mollies, swordtails, and California grunion. Beryciforms and zeiforms are mostly deep-bodied fishes a foot or less in length. Most lampridiforms are elongated, ribbonlike fishes; the giant oarfish can reach 8 m (25 feet) in length. Beryciforms, zeiforms, and lampridiforms are the most primitive groups of spiny-finned fishes. Most live in the open ocean, and relatively little is known of their natural history.

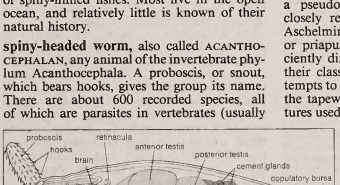
**spiny-headed worm,** also called ACANTHOCEPHALAN, any animal of the invertebrate phylum Acanthocephala. A proboscis, or snout, which bears hooks, gives the group its name. There are about 600 recorded species, all of which are parasites in vertebrates (usually fish) as adults and in arthropods as juveniles. The adults are usually less than 1 cm (0.4 inch) in length, but some reach 50 cm (about 20 inches) or more. Spiny-headed worms are found throughout the world.

*Natural history.* Spiny-headed worms are bisexual, and mating occurs in the intestines of vertebrate hosts. The eggs, which actually are shelled larvae, are excreted with the feces of the host. No further development occurs until the eggs are eaten by an arthropod, which is the intermediate host. After its release in the gut of the arthropod, the larva, called an acanthor, bores through the gut wall into the host's blood cavity (hemocoel), is encapsulated there, and develops into a new stage called an acanthella. The acanthella, a miniature version of the adult, withdraws its armed proboscis before entering a resting stage during which it is known as a cystacanth. Once again, no further development occurs until the cystacanth has been ingested by its definitive host, a vertebrate. The young spiny-headed worm emerges inside the vertebrate's intestine, uses its proboscis to bore into the gut wall, and matures there.

If a cystacanth is swallowed by the wrong host, it may bore through the gut wall into the body cavity, where it encysts and remains infective until the accidental host is eaten; then the cystacanth emerges again in its new host. This behaviour, incorporated into the life cycles of some spiny-headed worms, may provide the only means for completing the life cycle if the definitive host does not feed directly on the intermediate host. Although usually fish parasites, spiny-headed worms also occur in amphibians, reptiles, birds, and mammals. Humans are only rarely infected and then accidentally. Because they do little damage to their hosts, spiny-headed worms are of no economic importance.

*Form and function.* The body of a spiny-headed worm is divided into a proboscis and an elongated cylindrical trunk. The proboscis, which usually bears backward-pointing hooks, can be withdrawn into the trunk, which may also bear hooks or spines. Usually white, spiny-headed worms may occasionally be yellow, orange, or red in colour. The internal anatomy is simple; there is no gut, and the bulk of the trunk is occupied by a proboscis receptacle and the muscles used to retract it. Passing backward from the base of this receptacle are structures known as ligament sacs. One of these sacs in the male encloses two testes and a number of cement glands. The female has two sacs that do not necessarily persist after she matures. Externally the male possesses an eversible copulatory bursa, the female a simple vagina.

*Classification.* The affinities of the spiny-headed worms are uncertain. They possess a pseudocoelom; thus, although they are closely related to members of the phylum Aschelminthes and possibly to the rotifers or priapulids, spiny-headed worms are sufficiently different from these groups to justify their classification as a distinct phylum. Attempts to derive the spiny-headed worms from the tapeworms have not been accepted. Features used in the classification of spiny-headed

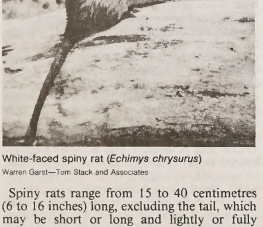



Internal structure of the male *Acanthocephalus ranae*

worms include the nature and distribution of hooks and spines, which are not of any proved phylogenetic significance. For this reason a number of taxonomic systems exist.

**spiny mouse** (*Acomys*), any of 18 species of large-eared rodents, family Muridae (order Rodentia), characterized by the hard, spiny hairs of their backs. Spiny mice are sand-coloured, reddish brown, or grayish and are about 10 centimetres (4 inches) long, excluding the long, scaly tail. Spiny mice are found in rocky or sandy areas of Africa and southwestern Asia. They are herbivorous, feeding primarily on grain and plants, and in some areas they live near or with humans.

**spiny rat,** any of the numerous species of ratlike Central and South American rodents of the family Echimyidae (order Rodentia). There are about 14 living genera; the number of recognized species varies, depending on the authority, from about 40 to more than 70.

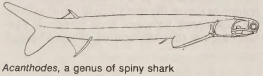


White-faced spiny rat (*Echimys chrysurus*)
Warren Garst—Tom Stack and Associates

Spiny rats range from 15 to 40 centimetres (6 to 16 inches) long, excluding the tail, which may be short or long and lightly or fully haired. They usually have pointed noses, and most have bristly, or spiny, fur. Colour varies but may be reddish brown, brown, blackish, or black and white.

Spiny rats are herbivorous and eat sugarcane, grass, nuts, and fruit. They are eaten by humans and are considered to have a good flavour. Some species are terrestrial, others are arboreal. Spiny rats live in forests or clearings, frequently near water. They are active in the evening and at night and shelter in burrows, among rocks or tree roots, in tree hollows, and occasionally in human dwellings.

**spiny shark,** also called ACANTHODIAN, any of a class (Acanthodii) of small extinct fishes, the earliest known jawed vertebrates, possessing features found in both sharks and bony fishes. Acanthodians appeared first in the Late Silurian Period and lasted into the Early Permian (from about 400,000,000 to about 280,000,000 years ago).



*Acanthodes*, a genus of spiny shark
Reprinted from *Vertebrate Paleontology* by A.S. Romer, by permission of the University of Chicago, copyright 1933, 1945, 1966; all rights reserved

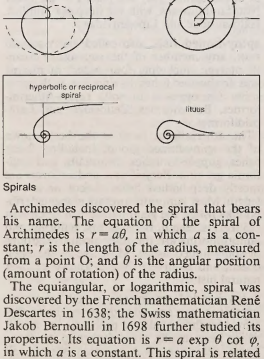
Among the genera of spiny sharks most useful for fossil dating is *Acanthodes*, of the order Acanthodiformes, which attained worldwide distribution. Species of *Acanthodes* grew to be about 30 centimetres (about 12 inches) long and in many respects represent a specialized form, losing many of the traits characteristic of the acanthodians. The spiny shark's head was small compared with its elongated body, and its eyes were very large. The snout region was very short, and it is evident that these fishes relied to a large extent upon sight rather than smell.

**spiny-tailed lizard** (*Uromastix*), any of several species belonging to the lizard family Agamidae. The genus is restricted to arid habitats in northern Africa and western Asia, where they live in burrows.

The lizard's tail is armed with numerous protective spines that discourage most predators. Some spiny-tailed lizards defend themselves by partly entering their burrows and then violently lashing their exposed tails from side to side at their enemies. All species lay eggs and are predominately herbivorous as adults.

**spiracle,** in arthropods, the small external opening of a trachea (respiratory tube) or a book lung (breathing organ with thin folds of membrane resembling book leaves). Spiracles are usually found on certain thoracic and abdominal segments. In elasmobranch and ganoid fishes a pair of spiracles, derived from the gills, is used as a water passageway during respiration. The nasal opening of whales and other cetaceans is called a spiracle, as is the respiratory opening behind the eyes of rays and skates. In tadpoles the spiracle is the excurrent opening from the gill chamber.

**spiral,** plane curve that, in general, unwinds around a point while moving ever farther from the point. Many kinds of spiral are known, the first dating from the days of ancient Greece. The curves are observed in nature, and human beings have used them in machines and in ornament, notably architectural—for example, the whorl in an Ionic capital.




Spirals

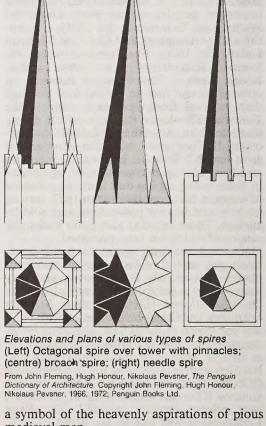
Archimedes discovered the spiral that bears his name. The equation of the spiral of Archimedes is $r = a\theta$, in which $a$ is a constant; $r$ is the length of the radius, measured from a point O; and $\theta$ is the angular position (amount of rotation) of the radius.

The equiangular, or logarithmic, spiral was discovered by the French mathematician René Descartes in 1638; the Swiss mathematician Jakob Bernoulli in 1698 further studied its properties. Its equation is $r = a \exp \theta \cot \varphi$, in which $a$ is a constant. This spiral is related to the circle in that the circle intersects its own radii everywhere at 90°; the equiangular spiral intersects its own radii everywhere at the same angle but other than 90°, that angle being represented in the equation above by $\varphi$. This approximate curve is observed in spider webs and, to a greater degree of accuracy in the chambered mollusk, *Nautilus,* and in certain flowers.

Other plane spirals are Euler's, or Cornu's, or Clothoid; Cotes', Fermat's, or parabolic; lituus; Poinsot's; reciprocal, or hyperbolic; and sinusoidal.

**spirant,** in phonetics, a term defined by some scholars as coextensive with fricative (*q.v.*) and by other scholars as a subclass of fricatives in which the friction is less audible.

**spire,** in architecture, steeply pointed pyramidal or conical termination to a tower. In its mature Gothic development, the spire was an elongated, slender form that was a spectacular visual culmination of the building as well as a symbol of the heavenly aspirations of pious medieval men.



*Elevations and plans of various types of spires*
(Left) Octagonal spire over tower with pinnacles; (centre) broach spire; (right) needle spire
From John Fleming, Hugh Honour, Nikolaus Pevsner, *The Penguin Dictionary of Architecture* Copyright John Fleming, Hugh Honour, Nikolaus Pevsner, 1966, 1972; Penguin Books Ltd.

The spire originated in the 12th century as a simple, four-sided pyramidal roof, generally abrupt and stunted, capping a church tower. Its history is a development toward slimmer, higher forms and a more organic relationship with the tower below. In the attempt to coordinate harmoniously an octagonal spire with a square base, the broach spire was developed: sloping, triangular sections of masonry, or broaches, were added to the bottom of the four spire faces that did not coincide with the tower sides, as in the 12th-century Church of St. Columba at Cologne. In the later 12th and 13th centuries, spires were also integrated with their towers by adding high, gabled dormers (*q.v.*) to the faces of the spire, over the centres of the tower faces—a scheme that can be seen on the southwest tower of Chartres cathedral. On many French cathedrals, steep pinnacles (*q.v.*; vertical ornaments of pyramidal or conical shape) were added to the four corners of the tower to effect the transition between quadrilateral base and octagonal spire. A fine example is a group of spires at Coutances cathedral (13th century), in which the rich treatment of the spire dormers and corner pinnacles emphasizes the sense of height and slimness in every possible way.

In Germany the timber spires of the Romanesque era evolved into Gothic stone spires of great refinement. At the Fribourg (Switz.) cathedral (spire, 1270–88), a low, square tower with corner pinnacles carries a gabled, octagonal lantern that supports the spire of 385 feet (117 metres), a mere skeleton of openwork tracery with ornamented edges giving an amazingly light and delicate effect. This type of openwork spire became the model for later churches in Germany.

In the 14th century, during the Decorated period in England, a slender, needle spire was set in from the edge of the tower, broaches

disappeared, corner pinnacles became customary, and a low parapet was added around the tower's edge, as seen in the two western spires of Lichfield cathedral.

The spire was never thoroughly accepted by the Renaissance, and it failed to become a native form in Spain or Italy. In England, France, and Germany, however, its development continued, influenced to some degree by Italian Baroque forms. During the 17th century in Germany, fantastic, spirelike forms were designed with profiles of broken concave and convex lines, crowned at the top with a sort of onionlike dome; they rose to a considerable height and, in imaginative quality, far surpassed any of the Italian examples. At the same time in England, the spire received a simpler, more straightforward treatment in the designs of Sir Christopher Wren, particularly in churches built after the Great Fire in London (1666), such as St. Martin, Ludgate, and St. Bride's on Fleet Street (only spire and steeple [1701–03] remain).

Noteworthy also are many simplified colonial American spires that were originally based upon the work of Wren and his followers. Characteristic is the type in which a small, octagonal, arcaded lantern crowns a square tower and carries, usually above an attic, a simple, slim, white spire, as in the Old South Meeting House, Boston (1729). This trend toward slender and attenuated proportions reached its climax in the exquisitely light spire of Park Street Church, Boston (1819), by Peter Banner.

Nineteenth-century architects made extravagant use of spires, particularly during the Gothic Revival period of the 1840s, '50s, and '60s. Perhaps because spires were so closely associated with picturesque eclecticism, 20th-century architects have tended to limit them to rather elementary geometric shapes, such as the truncated, octagonal spire of St. Mary's Cathedral (*c.* 1970) in San Francisco.

*Consult the* INDEX *first*

**spirea** (*Spiraea*), any of a large genus (nearly 100 species) of flowering shrubs, in the rose family (Rosaceae), native to the North Tem-



*Spiraea*
E.R. Degginger—EB Inc.

perate Zone and commonly cultivated for their pleasing growth habit and attractive flower clusters.

The most commonly grown—and possibly the most popular of all cultivated shrubs—is the Vanhouttei spirea, also called bridal wreath (*Spiraea ×Vanhouttei*, produced by a cross between *S. cantoniensis* and *S. trilobata*), which grows up to 2 metres (6 feet) high; the graceful arching branches bear numerous white flowers in spring. Other spring-flowering spireas include *S. crenata, S. prunifolia,* and *S. trilobata*; summer-flowering species include *S. albiflora, S. ×Bumalda* (derived from *S. albiflora* and *S. japonica*), *S. ×Billiardii* (derived from *S. douglasii* and *S. salicifolia*), *S. japonica, S. salicifolia,* and *S. tomentosa.*

Among the attractive low-growing spireas are the white-flowering snowmound spirea (*S. nipponica* 'Snowmound') and the Japanese white spirea (*S. albiflora*). The alpine Japanese spirea (*S. japonica* 'Alpina') bears rose-pink flowers. The popular hybrid Bumalda varieties provide colour variations of both flower and foliage.

Plants resembling spirea are the shrubby false spireas (*Sorbaria* species) and the perennial herbaceous spireas (*Astilbe* species).

**Spires** (Germany): *see* Speyer.

**spirillary rat-bite fever:** *see* rat-bite fever.

**Spirillum,** genus of spiral-shaped bacteria of the family Spirillaceae, aquatic except for one species (*S. minor*) that causes a type of rat-bite fever in man. The term spirillum is used generally for any of the corkscrew-like species.

*Spirillum* is microbiologically characterized as a gram-negative, motile helical cell with tufts of whiplike flagella at each end. The helix of the largest spirillum, *S. volutans,* is 5 to 8 $\mu$m (micrometres; 1 $\mu m = 10^{-6}$ metre) across by 60 $\mu$m long.

*S. minor,* found in the blood of apparently healthy mice and rats, can be transmitted to other rodents and to monkeys and man.

The genera *Aquaspirillum* and *Oceanospirillum* have been proposed for the free-living aquatic forms.

**spirit,** any of numerous alcoholic beverages produced by distillation. *See* distilled liquor.

**Spirit Lake Massacre** (March 8–12, 1857), incident in northwestern Iowa, U.S., in which a band of Sioux Indians led by Inkpaduta killed more than 30 white people. In 1856 five cabins had been built and occupied by whites near Okoboji lakes and Spirit Lake. After a severe winter, the Sioux attacked, killed 32 men, women, and children on the spot and abducted four women, of whom two were subsequently killed, one released voluntarily, and one ransomed. A relief expedition sent from Ft. Dodge arrived only in time to bury the dead. Another, sent from Ft. Ridgely in Minnesota, pursued Inkpaduta, who fled westward, but failed to overtake him. The massacre was commemorated by a monument erected in 1895 at nearby Arnolds Park.

**Spirit of Saint Louis,** airplane in which Charles A. Lindbergh made the first nonstop solo flight from New York to Paris, May 20–21, 1927. His flight was sponsored by a group of businessmen in St. Louis, Mo.

The plane was a Ryan NVP developed from the Ryan M2, a single-engine, high-wing monoplane, modified to Lindbergh's specifications. In standard conformation the airplane would have seated five people; extra fuel tanks in the "Spirit of St. Louis" occupied much of what had been cabin space. The windshield was replaced by an extension of the nose cowling. Lindbergh had direct vision only from the side windows, relying on a periscope to see straight ahead. There was no radio. The Wright Whirlwind air-cooled radial engine developed a maximum of 237 horsepower. Wing-span of the craft was 46 feet (14 metres) and length 27 feet 8 inches (8.4 metres). Fuel capacity with the extra tanks was 450 gallons; top speed at sea level, when loaded, was 120 miles (200 kilometres) per hour, and range was 4,100 miles (6,600 kilometres).

The "Spirit of St. Louis" was returned from Europe to the United States aboard ship, and Lindbergh flew it extensively throughout North, Central, and South America to promote interest in aeronautics before donating it to the Smithsonian Institution.

**spirits of turpentine:** *see* turpentine.

**Spiritual,** also called SPIRITUAL FRANCISCAN, member of an extreme group within the Franciscans, a mendicant religious order founded by St. Francis of Assisi in 1209; the Spirituals firmly espoused the austerity and poverty prescribed in the original Rule of St. Francis. Called the Fraticelli, they were opposed, to some extent, by St. Bonaventure, a leading Franciscan theologian, and some were condemned and executed as heretics. Among the Spiritual Franciscans, the works of the late 12th-century mystic Joachim of Fiore were influential, and because of their ideals the Spirituals became sources of inspiration to Protestant mystics of the 16th-century Reformation.

**spiritual,** in North American white and black folk music, an English-language folk hymn.

White spirituals include both revival and camp-meeting songs and a smaller number of other hymns. They derived variously, notably from the "lining out" of psalms, dating from at least the mid-17th century. Where congregations could not read, a leader intoned (lined out) the psalm text, one line at a time, alternating with the congregation's singing of each just-given line to a familiar melody. The tune, sung slowly, was ornamented with passing notes, turns, and other graces, each singer producing his own improvised embellishment at whatever pitch level he found comfortable. (This style persists in isolated areas in the 20th century, both in black and white churches.)

A second source was the singing of hymns (as opposed to psalms only), reintroduced by such 18th-century religious dissenters as John and Charles Wesley, the founders of Methodism. Hymn verses were composed and set to borrowed melodies, often secular folk tunes. Many of these evangelical hymns passed into oral tradition.

In the late 18th century and up to the mid-19th, there were several waves of religious revivalism. The resulting camp meetings and revivals were marked by spontaneous mass singing. It is not completely known how the camp-meeting songs and revival spirituals were sung; but it is thought that they were sung unharmonized, the tune typically begun by the high male voices, the women and basses joining in an octave (or other comfortable interval) above or below. A call-and-response pattern (as in lining out) may have at times been used. Melodies were apparently ornamented.

The texts had verses and refrains that wandered from song to song; these and a common stock of folk-melody fragments allowed new songs to be improvised upon inspiration. The themes included going home to the promised land, the defeat of Satan, and gaining ground against sin; typical refrains were "Roll, Jordan" and "Glory Hallelujah." Hymns from the earlier folk tradition were also sung. The songs were passed on orally, though many were eventually written down in folk hymnbooks using special shape-note notation.

The revival spirituals and other folk hymns passed from favour in 19th-century city churches as standardized European hymn styles came in. They survive in oral tradition in isolated areas and also among users of the shape-note hymnals (*q.v.*).

A 19th-century offshoot of the spiritual was the gospel song. Influenced by "correct" European music, it had composed melodies and texts, was sung with instrumental accompaniment, and (unlike the folk hymns) was written to be harmonized.

The black spirituals developed mostly from white rural folk hymnody. (Blacks and whites attended the same camp meetings, for instance, and black performance style possibly

counterinfluenced the revival songs.) Many black spirituals thus exist in the white folk music tradition also, and many others have melody analogues in secular white American and British folk music. The borrowing of melodies with pentatonic (five-note) and major scales is especially prominent. In voice quality, vocal effects, and type of rhythmic accompaniment, black spirituals differ markedly from white ones. Black spirituals were sung not only in worship but also as work songs, and the text imagery often reflects concrete tasks.

Musically, it is believed that a complex intermingling of African and white folk-music elements occurred and that complementary traits of African music and white U.S. folk-song reinforced each other. For example, the call-and-response pattern occurs in both, as do certain scales and the variable intonation of certain notes. Most authorities see clear African influence in vocal style and in the complex polyrhythmic clapped accompaniments. African tradition also included polyphonic and choral singing. The ring shout (a religious dance usually accompanied by the singing of spirituals and clapped rhythms) is of African ancestry.

After the Civil War the black spirituals were "discovered" by Northerners and either developed toward harmonized versions, often sung by trained choirs, or, conversely, preserved the older traditional style, especially in rural areas and certain sects.

Like the white gospel song, the modern black gospel song is a descendant of the spiritual and is instrumentally accompanied. Black gospel music is closely related to secular black music (as is the spiritual to the work song and blues) and often includes jazz rhythms and instruments alongside traditional clapped accompaniment and often dance. Though gospel songs are usually composed, the melodies are taken for improvisational bases in church services, as popular tunes are improvised upon in jazz.

**spiritual assembly,** in the Bahā'ī faith, any of numerous administrative units that conduct an extensive work of missions, publication, education, and general philanthrophy. Spiritual assemblies consist of nine members elected or designated annually on the local, national, and world levels during the holy days (April 21, April 29, May 2) commemorating the declaration of the founder's mission. Since they are said to be invested with their authority by God himself, the members of the spiritual assemblies have absolute jurisdiction over their electorates and are not answerable to them for their decisions and actions. Financial support comes from voluntary contributions from the community.

A local spiritual assembly exists in any community of nine or more Bahā'ī members. In the early 1980s there were some 26,000 local assemblies. National spiritual assemblies—numbering 130 by the early 1980s—appear when there are enough local assemblies in a country to elect a 19-member convention, which in turn will elect the nine members of the national group from among all Bahā'īs in the country. World leadership of the faith was held by Shogi Effendi Rabbani as Guardian of the Cause of God until his death in 1957; since 1963, it has been assumed by the highest spiritual assembly, the Universal House of Justice, a body elected by the national spiritual assemblies and possessing the sole right to institute new laws or abrogate the old laws laid down in Bahā'ī sacred scriptures.

**spiritualism,** in philosophy, a characteristic of any system of thought that affirms the existence of immaterial reality imperceptible to the senses. So defined, spiritualism embraces a vast array of highly diversified philosophical views. Most patently, it applies to any philosophy accepting the notion of an infinite, personal God, the immortality of the soul, or the immateriality of the intellect and will. Less obviously, it includes belief in such ideas as finite cosmic forces or a universal mind, provided that they transcend the limits of gross Materialistic interpretation. Spiritualism as such says nothing about matter, the nature of a supreme being or a universal force, or the precise nature of spiritual reality itself.

In ancient Greece Pindar (flourished 5th century BC) expounded in his odes the substance of a spiritualistic Orphic mysticism by attributing a divine origin to the soul, which resides temporarily as a guest in the home of the body and then returns to its source for reward or punishment after death. Plato's view of the soul also marks him as a spiritualist, and Aristotle was a spiritualist for distinguishing the active from the passive intellect and for conceiving of God as pure actuality (knowledge knowing itself). René Descartes, often acclaimed as the father of modern philosophy, viewed the soul as the unique source of activity, distinct from, but operating within, a body. Gottfried Wilhelm Leibniz, a versatile German Rationalist, postulated a spiritualistic world of psychic monads. The Idealists F.H. Bradley, Josiah Royce, and William Ernest Hocking saw individuals as mere aspects of a universal mind. For Giovanni Gentile, propounder of a philosophy of actualism in Italy, the pure activity of self-consciousness is the sole reality. The steadfast belief in a personal God maintained by Henri Bergson, a French intuitionist, was joined to his belief in a spiritual cosmic force (*élan vital*). Modern Personalism gives priority to persons and personality in explaining the universe. The French philosophers Louis Lavelle and René Le Senne, specifically known as spiritualists, launched the publication *Philosophie de l'esprit* ("Philosophy of the Spirit") in 1934 to ensure that spirit was given proper attention in modern philosophy. Though this journal professed no philosophical preference, it has given special attention to personality and to forms of intuitionism.

Dualism and monism, theism and atheism, pantheism, Idealism, and many other philosophical positions are thus said to be compatible with spiritualism as long as they allow for a reality independent from and superior to matter.

**spiritualism,** in religion, the belief, or practices based upon the belief, that departed souls hold intercourse with mortals, usually through a medium by means of physical phenomena or during abnormal mental states, such as trances.

The important terms in spiritualism are defined in the following ways. "Spirit" is the essential part of man. After the death of the body the spirit lives on. The "spirit world" is the world of disembodied spirits. A "medium" is a person on earth who is sensitive to vibrations from the spirit world and is able to convey messages between that world and this one and to produce other spiritualist phenomena. A "control" is a disembodied spirit who gives messages to a medium who in turn gives them to men and women on Earth. A "séance" is a meeting (usually small) around a medium to seek messages from the spirits. "Telepathy" is the communication of ideas through other than physical means. "Clairvoyance" is the power of seeing through means other than the physical eye. "Clairaudience" is the power of hearing through means other than the physical ear. "Levitation" is the lifting of an object by other than the physical means. "Materialization" is the appearance of a spirit in matter. "Apport" is the production of objects without physical means or the passing of objects through objects (*e.g.,* walls) which have no openings.

An important later development of spiritualism has been in the direction of "spirit healing." Unorthodox healings have in the past been associated with sacred places and religious rites, and medical science is inclined to attribute all such healings to the normal process of suggestion working under favourable conditions. But it is also claimed that there is a genuine power of paranormal healing found in certain persons, and from the spiritualist point of view these healers are regarded as mediums who acts as agents of spirit doctors. Healings are claimed for a variety of conditions, some of which are regarded as incurable by orthodox medicine.

The attempt to communicate with discarnate spirits seems to be one of the forms that religion may take in human societies and to be widely distributed in space and time. Practices very like those of a modern spiritualistic séance have been reported in various parts of the world, as, for example, Haiti and among the North American Indians, and there is no reason for supposing that these are of recent origin. The record of a materialization séance of long ago is preserved in the account in the Old Testament of Saul's visit to the witch, or medium, of Endor, in the course of which a materialization appeared that was regarded by the king as the prophet Samuel (I Sam. 28:7–19). Certain mediumistic phenomena were reported in the witch trials of the Middle Ages, particularly the appearance of spirits in quasi-material form and the obtaining of knowledge through spirits. It may be supposed that many of those persecuted for the practice of witchcraft were what would now be called mediums—although their mediumship was coloured by the fact that it was organized in a forbidden cult, and the spirits with which communication was established where regarded as devils. Some mediumistic phenomena were also found among those regarded in the Middle Ages as possessed by devils; *e.g.,* speaking in languages unknown to the speaker and levitation or partial levitation.

Although spiritualistic practices seem to be widespread, they were virtually unknown in modern civilized society until March 1848, when odd happenings were reported at the house of a farmer named Fox in a small town in New York state. Previous occupants of the house had been disturbed by unexplained raps at night. After a severe disturbance by raps during Mr. Fox's tenancy, his youngest daughter, Kate, was said to have successfully challenged the supposed spirit to repeat the number of times she flipped her fingers. Once communication had apparently been established a code was agreed upon by which the raps given could answer questions, and the spirit was said to have identified himself as a man who had been murdered in the house.

The practice of having sittings for communication with spirits spread rapidly from that time. Kate Fox (afterward Mrs. Fox-Jencken) and one of her sisters gave much of their later lives to acting as mediums in the United States and in England. Many other mediums gave similar sittings, and the movement became widespread. The attempt to communicate with spirits by table turning became a popular pastime in Victorian drawing rooms.

Much of this activty was motivated by mere curiosity and the fascination of the supernatural, but it also had a more serious intention. Many inquirers wished to convince themselves as to human survival of bodily death; others suffered from the loss of loved relatives and friends and found consolation in the belief that they were able to communicate with them; others wanted information about the future life. To promote these serious ends, spiritualist associations or churches were formed.

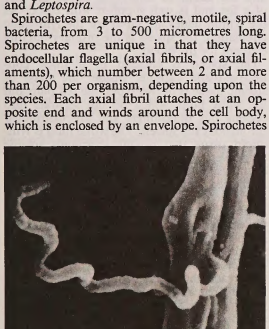
The rise of this new cult was not allowed to take place without opposition. There was not only verbal condemnation with accusations of fraud but also mob violence. This was, no

doubt, partly a popular reaction to a novel system of ideas and practices that were suspected of being based on either fraud or evil. The suspicion of evil was perhaps strengthened by a conjectured relationship to the discarded system of witchcraft. Although individual spiritualists were often members (or even ministers) of Christian churches, the general tendency of the established religious bodies was to suspect the movement and its claim to a new revelation that would either supplement or replace the Christian revelation. The spiritualist practices seemed also to some religious bodies to be a part of the forbidden activity of necromancy. A decree of the Holy Office of the Roman Catholic church in 1898 condemned spiritistic practices, although permitting legitimate scientific investigation of mediumistic phenomena.

For those who had lost their faith in traditional Christianity, there was offered a new religion based not on an ancient tradition but on fact that could be observed by anyone. For those to whom materialistic ways of thinking had closed the possibility of a life after death, there was offered a new hope of immortality. To those suffering from grief after the death of their loved ones, there was offered the possibility of communicating with them. There were strong emotional involvements in both the rejection and the acceptance of spiritualism that have made difficult an impartial appraisal of the evidence.

**spirochete,** also spelled SPIROCHAETE (order Spirochaetales), any of a group of spiral-shaped bacteria, some of which are serious pathogens for humans, causing such diseases as syphilis, yaws, and relapsing fever. Spirochetes include the genera *Spirochaeta, Treponema, Borrelia,* and *Leptospira.*

Spirochetes are gram-negative, motile, spiral bacteria, from 3 to 500 micrometres long. Spirochetes are unique in that they have endocellular flagella (axial fibrils, or axial filaments), which number between 2 and more than 200 per organism, depending upon the species. Each axial fibril attaches at an opposite end and winds around the cell body, which is enclosed by an envelope. Spirochetes

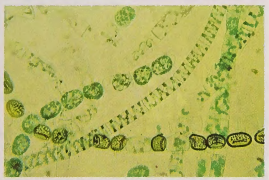


Scanning electron micrograph of the spirochete *Treponema pallidum* attached to testicular cell membranes
ASM/Science Source

are characteristically found in a liquid environment (*e.g.,* mud and water, blood and lymph).

*Treponema* includes the agents of syphilis (*T. pallidum*) and yaws (*T. pertenue*). *Borrelia* includes several species transmitted by lice and ticks and causing relapsing fever (*B. recurrentis* and others) in humans. *Spirochaeta* are free-living, nonpathogenic inhabitants of mud and water, usually in oxygen-free regions. Leptospirosis, caused by *Leptospira,* is principally a disease of domestic and wild mammals and is a secondary infection of humans.

**spirogyra,** also called WATER-SILK, MERMAID'S TRESSES, or POND SCUM (genus *Spirogyra*), any of a group of unbranched filamentous green algae, found in freshwater and usually free-floating. The slippery unbranched



*Spirogyra,* conjugative and vegetative forms
Russ Kinne—Photo Researchers/EB Inc.

filament is composed of cylindrical cells containing one or more beautiful spiral green chloroplasts, from which the genus gets its name. The nucleus is suspended in the central vacuole by fine cytoplasmic filaments. Vegetative reproduction is by fragmentation of the filament. The sexual phenomenon of conjugation also occurs; cells of two strands lying side by side are joined by the outgrowth of conjugation tubes. Rarely, cells of the same strand join end to end, and the contents of one cell passes into and fuses with the contents of the other. The resulting fused cell (zygote) is surrounded by a thick wall and overwinters while the vegetative filaments die.

On bright spring or fall days, masses of spirogyras float near the surface of streams and ponds, buoyed by oxygen bubbles released during photosynthesis. During the night, when photosynthesis decreases, the masses sink.

**spirotrich** (class Spirotrichea), any of a group of ciliated protozoans characterized by nonuniform, sparse ciliation and prominent membranelles of fused cilia around the mouth opening. The subclass contains a number of orders. *See* heterotrich; hypotrich; odontostome; oligotrich; tintinnid.

**spit,** in geology, narrow coastal land formation that is tied to the coast at one end. Spits frequently form where the coast abruptly changes direction and often occur across the mouths of estuaries; they may develop from each headland at harbour mouths. Spits, which may be composed of sand or shingle, are formed by the longshore movement of sediment. They often are complexly curved, with a characteristic recurved head (hook); this probably results from the refraction of waves around the spit's end.

**Spitfire,** also called SUPERMARINE SPITFIRE, British aircraft that was one of the fastest and most effective single-seat fighters of World War II. It was highly effective as a defensive interceptor during the Battle of Britain.

The Spitfire was a low-wing monoplane that was first flown in 1936 and was first put into service with the Royal Air Force in 1938. It was modified continuously throughout the war to serve in a variety of roles: fighter (with notable success at high altitudes), fighter-bomber, and photoreconnaissance plane. The version that entered active service in 1938 had a top speed of about 360 miles (580 km) per hour and an armament of eight .303-inch machine guns. The Spitfire XIV, one of the last models of the war, had a ceiling of 40,000 feet (12,200 m) and a top speed of 440 miles (710 km) per hour; that version shot down more than 300 German V-1 missiles in 1944. During the war the Spitfire's armament was increased to two 20-millimetre cannons along with two .50-inch machine guns or four .303-inch machine guns. Some Spitfire versions could also carry a 250- or 500-pound (115- or 230-kilogram) bomb under the fuselage and a 250-pound bomb under each wing. The last Spitfires in active service (as photoreconnaissance planes) with the Royal Air Force were retired in 1954.

**Spithead,** strait of the English Channel, forming an extensive, deep, and sheltered channel between the northeastern shore of the Isle of Wight and the mainland of England. The Spit Sand forms the western side of the channel leading into Portsmouth harbour. Besides its special association with the Royal Navy—major naval reviews have been held off Cowes (on the Isle of Wight)—Spithead provides the safest approach for large craft entering and leaving Southampton Water, one of England's most important commercial harbours. A lesser channel, The Solent (*q.v.*), forms a westward continuation of the Spithead strait.

**Spitsbergen,** main island within the archipelago of Svalbard (*q.v.*).

**Spitta, (Julius August) Philipp** (b. Dec. 7, 1841, Wechold, Hanover [Germany]—d. April 13, 1894, Berlin, Ger.), German scholar, one of the principal figures in 19th-century musicology and author of the first comprehensive work on Johann Sebastian Bach.

Spitta studied at Göttingen and in 1874 helped found the Bachverein (Bach Society) in Leipzig. In 1875 he became professor of musical history at the University of Berlin. His *Johann Sebastian Bach,* 2 vol. (1873–80), dealt with Bach's life and with religious and technical aspects of his work. His editions of the works of Heinrich Schütz and Dietrich Buxtehude established a high standard of scholarship. With Johannes Brahms, K.F.F. Chrysander, and others, he was a chief founder, in 1892, of the great edition of the works of German composers, *Denkmäler deutscher Tonkunst* ("Monuments of German Music"). He also founded, with Chrysander and Guido Adler, the first true journal of musicology, "Vierteljahrsschrift für Musikwissenschaft" (1885–94; "Quarterly Journal of Musicology").

**Spittal,** also called SPITTAL AN DER DRAU, town, *Bundesland* ("federal state") Kärnten, southern Austria. It lies along the Drava (Drau) River at the mouth of the Lieser valley, just west of Millstätter Lake and northwest of Villach. Named for a hospital founded there by the counts of Ortenburg in 1191, it received market rights in 1242 but achieved municipal status only in 1930. Many old houses, the parish church, the town hall, and the former Renaissance palace of the Porcia princes date from the 16th century. A tourist centre and rail junction, Spittal manufactures wood products, paper, building materials, shoes, and chemicals. Pop. (1981) 14,736.

**Spitteler, Carl** (b. April 24, 1845, Liestal, Switz.—d. Dec. 29, 1924, Luzern), Swiss poet of visionary imagination and author of pessimistic yet heroic verse.

A private tutor for eight years in Russia and Finland, Spitteler wrote his first great poetic work, the mythical epic *Prometheus und Epimetheus* (1881), following his return. Dur-



Spitteler, photograph by R. Dührkoop
By courtesy of the Bibliotheque Nationale Suisse, Bern

ing the next few years, when he had to make his living by teaching and journalism, he began to express himself in a wide range of literary forms. In 1892 a legacy enabled him to settle in Luzern and devote himself to creative work.

Spitteler's second great work (which won him the Nobel Prize in 1919) was the poetic epic *Der olympische Frühling* (1900–05; revised 1910; "The Olympic Spring"), in which he found full scope for bold invention and vividly expressive power. The last years of his life were given up to rewriting his first work. Tighter in composition than the early version and, like *Der olympische Frühling,* in rhyming couplets, it appeared in 1924 under the title *Prometheus der Dulder* ("Prometheus the Long-suffering").

The widely varied peripheral works belong to Spitteler's middle period. He produced, in verse, *Extramundana* (1883), seven cosmic myths of his own invention; *Balladen* (1896); *Literarische Gleichnisse* (1892; "Literary Parables"); and two cycles of lyrics, *Schmetterlinge* (1889; "Butterflies") and *Gras- und Glockenlieder* (1906; "Grass and Bell Songs"). He also wrote two masterly stories—*Die Mädchenfeinde* (1907; *Two Little Misogynists,* 1922), a childhood idyll derived from his own experience; and *Conrad der Leutnant* (1898), a dramatically finished *Novelle* in which he approached the Naturalism he otherwise hated. His novel *Imago* (1906) so sharply reflected his inner conflict between a visionary creative gift and middle-class values that it influenced the development of psychoanalysis. He published a volume of stimulating essays, *Lachende Wahrheiten* (1898; *Laughing Truths,* 1927), and some biographical works of charm, including *Meine frühesten Erlebnisse* (1914; "My Earliest Experiences"). In 1914 he published a politically influential tract, "Unser Schweizer Standpunkt," directed against a one-sided pro-German view of the war. An English translation of *Selected Poems* appeared in 1928.

**spitting spider,** any member of the family Scytodidae (order Araneida). Most species have six pearly-white eyes rather than the usual eight. Spitting spiders ensnare their prey by spitting a mucilaginous saliva. They are



Spitting spider (*Scytodes thoracica*)
Ann Moreton

most common in shady spots in the tropics. *Scytodes thoracica,* common in the eastern United States, is yellow with black spots. The body is 3½–5½ millimetres (⅛–¼ inch) long.



"Poor Poet," painting by Carl Spitzweg, 1839; in the Neue Pinakothek, Munich
By courtesy of the Bayerische Staatsgemäldesammlungen, Munich

**spittlebug:** *see* froghopper.

**spitz,** any of a group of northern dogs, such as the chow chow, Pomeranian, and Samoyed, characterized by dense, long coats, erect pointed ears, and tails that curve over their backs. In the United States, the name spitz is often given to any small, white, long-haired dog. It is also used for the American Eskimo dog, an all-white breed that weighs about 20 pounds (9 kilograms) and resembles a small Samoyed (*q.v.*). The American Eskimo dog is recognized by the United Kennel Club, a U.S. organization, but not by the more widely known American Kennel Club.

There are a number of dogs known as spitz in Europe. Among these is the Finnish spitz, a breed recognized by the Kennel Club of England. The Finnish spitz stands about 16 to 19 inches (40 to 48 centimetres), has a bright reddish brown coat, and is characterized by a lively and alert disposition. Other spitz breeds include the Eskimo dog (*q.v.*), or Greenlandic dog, and the Lapland spitz, a breed with a white, brown, black, or blackish brown coat.

**Spitz, Mark (Andrew)** (b. Feb. 10, 1950, Modesto, Calif., U.S.), U.S. swimmer, first athlete to win seven gold (first-place) medals in a single Olympic Games (1972, Munich).

Like many other outstanding U.S. swimmers, Spitz trained for several years at the Santa Clara Swim Club (California). A graduate (1972) of Indiana University, Bloomington, he served as captain of the school's intercollegiate swimming team. In the Olympic Games of 1968 (Mexico City) he aroused controversy by publicly predicting that he would capture six gold medals. In fact he won only two, both in team relay races (400-metre and 800-metre freestyle). In the 1972 Games, however, he placed first and set world records in all four individual men's events he entered: the 100-metre and 200-metre freestyle (51.2 sec and 1 min 52.8 sec), and the butterfly over the same distance (54.3 sec and 2 min 0.7 sec). He added three more gold medals as a member of victorious U.S. men's teams (in the 400-metre and 800-metre freestyle relays and the 400-metre medley relay), which also set world records (all records subsequently broken).

**Spitzweg, Carl** (b. Feb. 5, 1808, Munich—d. Sept. 23, 1885, Munich), German painter who is recognized as the most representative of the Biedermeier (early Victorian) artists in Germany.

Trained in pharmacy at the University of Vienna, Spitzweg was a pharmacist and newspaper illustrator before becoming a painter in 1833. Though widely travelled in Europe, he was provincial in his choice of subjects; tenderly, humorously, but with firm control of light, shadow, compositon, and detail, he portrayed small town misfits, street musicians, postmen, night watchmen, and lovers bidding farewell.

**spleen,** lymphoid organ located in the left side of the abdominal cavity under the diaphragm, the muscular partition between the abdomen and the chest. In man it is about the size of a fist and is well supplied with blood. As the lymph nodes are filters for the lymphatic circulation, the spleen is the primary filtering element for the blood.

The spleen is encased in a thick connective-tissue capsule. Inside, the mass of splenic tissue is of two types, the red pulp and the white pulp, which do not separate into regions but intermingle and are distributed throughout the spleen. The white pulp is lymphoid tissue that usually surrounds splenic blood vessels. The red pulp is a network of channels (sinuses) filled with blood, and it is in the red pulp that most of the filtration occurs.

The white pulp of the spleen contains such typical lymphoid elements as plasma cells, lymphocytes, and lymphatic nodules, called follicles in the spleen. Like the lymph nodes, it reacts to microorganisms and other antigens that reach the bloodstream. Phagocytic cells in both red and white pulp serve to remove foreign material from the blood and initiate an immune reaction that results in the production of antibodies. Germinal centres in the white pulp are sites of lymphocyte production.

The red pulp has a specialized role in addition to filtration. It is the body's major site of the destruction of red blood cells, which normally have a life span of only 120 days. Degenerate red cells are removed from the circulation in the spleen, and the hemoglobin that they contain is degraded to a readily excretable pigment and an iron molecule that is recycled; *i.e.,* used to produce new hemoglobin elsewhere.

In some species the spleen also acts as a reservoir for blood during periods of inactivity. When such an animal is aroused for defense or flight, the capsule of the spleen contracts, forcing additional blood reserves into the circulation. The human spleen probably does not have this capability.

For depiction of the spleen in human anatomy, shown in relation to other parts of the body, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

**splenitis,** enlargement and inflammation of the spleen as a result of infection, parasite infestation, or cysts.

Infections spread readily to the spleen from other parts of the body. In pneumonia the spleen is moderately enlarged and soft; the cut surface is reddish to gray, while the tissue may be mushy in consistency. In typhoid the enlargement is greater because of the large amount of blood congestion. In infectious mononucleosis, so called because of the presence of abnormal numbers of white blood cells of the type called mononuclear leukocytes, swelling three to four times the normal size occurs. There are large clumps of white blood cells in the sinuses and pulp.

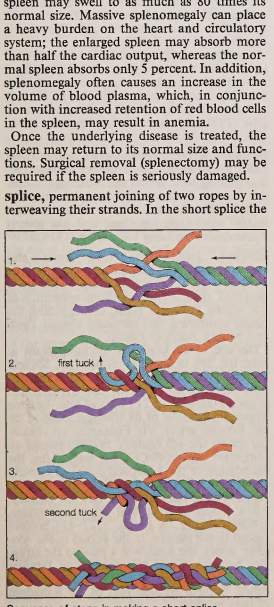
Abscesses of the spleen are fairly uncommon. When they occur, they are usually the result of a nearby bacterial infection in the upper abdomen. Stomach ulcers, blood clots in the arteries or veins, and splenic blood tumours (hematomas) can complicate these infections. Treatment may include surgical drainage and administration of antibiotic drugs.

**splenomegaly,** enlargement of the spleen, the abdominal organ that serves as a temporary storage site for blood and filters out degenerated and old blood cells. Splenomegaly may arise as a symptom of a number of diseases, including certain systemic infections, inflammatory diseases, hematologic diseases, inherited spleen disorders, cysts, and neoplastic diseases. In one form of the disorder, called congestive splenomegaly, the spleen becomes engorged with blood because of impaired flow through the splenic vein, which empties into the portal vein. Such impairment may be caused by liver disease, portal vein or splenic vein pathology, constrictive pericarditis, or congestive cardiac failure.

Depending on the underlying cause, the spleen may swell to as much as 80 times its normal size. Massive splenomegaly can place a heavy burden on the heart and circulatory system; the enlarged spleen may absorb more than half the cardiac output, whereas the normal spleen absorbs only 5 percent. In addition, splenomegaly often causes an increase in the volume of blood plasma, which, in conjunction with increased retention of red blood cells in the spleen, may result in anemia.

Once the underlying disease is treated, the spleen may return to its normal size and functions. Surgical removal (splenectomy) may be required if the spleen is seriously damaged.

**splice,** permanent joining of two ropes by interweaving their strands. In the short splice the strands of each rope are unlayed (untwisted), interwoven, and tucked into the lay (twist) of the other rope. For neatness the strands are usually trimmed down before the final tuck is made.



Sequence of steps in making a short splice

For making a permanent eye (closed circle) in a single rope, the eye splice, in which the free end is unlayed and interwoven at some point in the standing part of the rope, is employed, especially on sailing vessels.

**Split,** Italian SPALATO, seaport, resort, and chief city of Dalmatia, in Croatia. It is situated on a peninsula with a deep, sheltered harbour on the south side, which, combined with its central position on the Adriatic coast and its good rail and road connections to the northern parts of the country, has made it of great commercial importance. The port of Split has a large shipyard. It produces plastics, chemicals, aluminum, and cement. Several island ferries depart from Split, and an international airport has been expanded since 1962. Split has a university (1974) and an oceanographic institute. The growth of the port facilities dates from the temporary loss of Fiume (Rijeka) to Italy in 1924 (recovered 1945).

The nucleus of the old town is built within the Palace of Diocletian, who abdicated the imperial crown in AD 305 and lived there until his death in 313. The immense palace (built 295–305) has walls 7 feet (2 m) thick and 72 feet (22 m) high on its seaward side and 60 feet (18 m) high on the northern side. Originally it had 16 towers, of which 3 remain, and 4 gates. A tree-lined promenade keeps the Adriatic from lapping against the south walls as it once did. The palace was damaged by the Avars, who in 614 had sacked nearby Solin (Salonae); its inhabitants first fled to the islands but then returned to seek refuge in the palace (*c.* 620), calling the settlement Spalatum. They built their homes within the 7-acre (3-hectare) palace compound, incorporating its walls and pillars.

The palace is the largest and best-preserved example of Roman palatial architecture, representing a transitional style half-Greek and half-Byzantine. Its ground plan is like a Roman camp—*i.e.,* rectangular, with four streets meeting at the middle. The streets are lined with massive arcades. At the north end were the quarters for a large population of slaves, servants, and garrisons; at the south end were the imperial apartments and offices, impressive vaulted structures. The mausoleum of Diocletian was converted to a cathedral in 653 by the first bishop of Split; it is noteworthy for its fine frescoes, marble pulpit, and Romanesque carvings. The Temple of Jupiter long has been transformed into a baptistery, to which a beautiful Romanesque campanile was added in the 14th and 15th centuries. The area within the walls of the palace has been continuously inhabited since it was built. It contains buildings and embellishments of medieval, Renaissance, and Baroque periods as well as Roman. Efforts have been made not only to further excavate the Roman remains and identify and elucidate remains of the early medieval period but also to preserve the eclectic architecture of the palace and its modern character. The palace is still thought of by the inhabitants of Split as the city centre and not a museum: the cathedral and baptistery are in use, the peristyle court is a café, shops occupy the Roman arcades, and the main market is just outside the east gate of the palace. Tourists can see architectural remains of all periods from Roman times onward while walking under the laundry lines of the modern citizens.

Museums include one devoted to the works of the Croatian sculptor Ivan Meštrović and one of armaments. The Venetian Gothic town hall is a museum of ethnography. West and south of the main square is a maze of narrow streets, the medieval expansion of the old town. The belfry (*c.* 100) of Our Lady of the Belfry Church is the oldest in Dalmatia.

From 812 Split developed as a major Byzantine city. In 1105, after brief incursions by Venice (998) and Croatia (1069), the city acknowledged the nominal suzerainty of Hungary-Croatia and fought sporadically with its rival Trogir; from 1420 to 1797 it was held by Venice. The Austrians ruled from 1797 to 1918 with a brief French interregnum in 1808–13. Split became part of Yugoslavia in 1918 and of independent Croatia in 1992. During World War II the port facilities were wrecked by the Germans and by Allied bombing, but the old city was little damaged. A new sports complex was built for the 1980 Mediterranean Games. Pop. (1991) 200,459.


Entrance to the imperial apartments of the Palace of Diocletian, Split, Croatia, seen through the Corinthian columns of the peristyle court
D. Waugh – Peter Arnold, Inc.

**Spock, Benjamin (McLane)** (b. May 2, 1903, New Haven, Conn., U.S.—d. March 15, 1998, La Jolla, Calif.), American pediatrician whose books on child rearing, especially his *Common Sense Book of Baby and Child Care* (1946; 6th ed., 1992), influenced generations of parents; translated into some 39 languages, it sold nearly 50 million copies. The book, urging parental understanding and flexibility, made his name a household word.

Spock received his medical degree in 1929 from Columbia University's College of Physicians and Surgeons and trained for six years at the New York Psychoanalytic Institute. He practiced pediatrics in New York City and taught psychiatry and child development at various universities, including Western Reserve, Cleveland (1955–67), from which he resigned in order to devote himself more fully to the antiwar movement. Spock's bitter opposition to U.S. involvement in the Vietnam War during the 1960s led to his trial and conviction (1968) for counseling draft evasion—a conviction overturned on appeal. In 1972 he was the presidential candidate of the pacifist People's Party.

Spock's many other books on child care include *Dr. Spock Talks with Mothers* (1961), *Raising Children in a Difficult Time* (1974), and *Dr. Spock on Parenting* (1988). Spock also wrote *Decent and Indecent: Our Personal and Political Behavior* (1970). In 1989 *Spock*

*on Spock: A Memoir of Growing Up with the Century*, edited by Spock's second wife, Mary Morgan, was published.

**Spode porcelain,** porcelain introduced about 1800 in the factory of Josiah Spode and Josiah Spode II at Stoke-on-Trent, Staffordshire, Eng. This hybrid porcelain—combining the ingredients of hard-paste porcelain (china clay and china stone) and bone ash—became the standard English bone china. Early Spode porcelain consists of elaborate services and outsize vases, lavishly decorated and gilded in the Empire style. So-called Japan patterns (deriving vaguely from Japanese Imari ware)



Spode bone china potpourri with a Japan pattern, Staffordshire, England, *c.* 1835; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London

were also executed at the Spode factory in the early 19th century. About 1813 William Copeland, who had run the company's London warehouse and had been a partner since about 1797, was succeeded by his son, William Taylor Copeland. When Josiah Spode III died in 1829, the firm continued under various combinations of the name Copeland. In 1846 Copeland introduced Parian ware, a white matte unglazed porcelain, resembling marble, in which statuettes were modeled.

**spodosol,** ashy gray acidic soil type showing strong horizon development of cool, humid forested areas. Formed mostly of underlying sandy parent materials, spodosols tend to be strongly leached, with low fertility and limited water storage capacity. Many areas where these soils occur have not been cleared of trees for farming. Large tracts of spodosol border the tundras of North America and Eurasia. Characteristic of these soils are subsurface horizons in which amorphous materials composed of organic matter, aluminum, and iron have accumulated. The heavy application of fertilizers and lime has enabled cultivation of grains, potatoes, berries, and silage corn (maize) on spodosol soils in the cool climate of the north-central United States.

**spodumene,** also called TRIPHANE, a lithium aluminum silicate mineral ($LiAlSi_2O_6$) in the pyroxene family, an important ore of lithium and a source of ceramic materials. It is ordinarily found in lithium-bearing granite pegmatites. When brilliant and glassy, clear spodumene is valued as a semiprecious gem (more by collectors and museums than by the public, because its colour fades when it is exposed to sunlight). Its main varieties are hiddenite (emerald green) and kunzite (pink or lilac).

**Spohr, Louis,** original name LUDWIG SPOHR (b. April 5, 1784, Brunswick, Brunswick [Germany]—d. Oct. 22, 1859, Kassel, Hesse [Germany]), German violinist, composer, and conductor whose compositions illustrate an early aspect of the Romantic period in German music.

Spohr taught himself composition by studying the scores of Wolfgang Amadeus Mozart. He studied violin with the leader of the Brunswick orchestra and in 1802 with Franz Eck, who took him on a tour of Russia. He toured Italy with the great violin virtuoso Niccolò Paganini and in 1817 became conductor of the opera in Frankfurt am Main. In 1820 Spohr made the first of his six tours of England. He became court conductor at Kassel in 1821. In his later years his political radicalism incurred the displeasure of his patron, the elector of Hesse-Kassel, who pensioned him in 1857. Shortly afterward, he broke his left arm and was no longer able to play the violin.

Though opposed to the forward-looking composers of his time—he disliked the works of Carl Maria von Weber and the late works of Ludwig van Beethoven—Spohr regarded Richard Wagner's music highly and conducted *The Flying Dutchman* and *Tannhäuser*. Spohr's 11 operas include *Faust* (1816), one of the earliest German Romantic operas, and *Jessonda*. Of his nine symphonies, the fourth, *Die Weihe der Töne* (*The Consecration of Sound*), was the most successful. He also wrote 15 violin concerti (of which No. 8 continues to be performed), 34 string quartets, 4 double string quartets, and a nonet. A selection of his works was published from 1949 onward at Kassel, where in 1954 a society to propagate his music, the Spohr-Gesellschaft, was founded.

**spoils system,** also called PATRONAGE SYSTEM, practice in which the political party winning an election rewards its campaign workers and other active supporters by appointment to government posts and by other favours. The spoils system involves political activity by public employees in support of their party and the employees' removal from office if their party loses the election. A change in party control of government necessarily brings new officials to high positions carrying political responsibility, but the spoils system extends personnel turnover down to routine or subordinate governmental positions.

The term was in use in American politics as early as 1812, but it was made famous in a speech made in 1832 by Senator William Marcy of New York. In defending one of President Andrew Jackson's appointments, Marcy said, "To the victor belong the spoils of the enemy." In Marcy's time, the term *spoils* referred to the political appointments, such as cabinet offices or ambassadorships, controlled by an elected official.

Arguments in favour of the spoils system defend it as a means of maintaining an active party organization by offering loyal workers occupational rewards. It also guarantees the ruling party loyal and cooperative employees. Supporters of the practice claim this results in more effective government because the appointed officeholders have a stake in helping the elected official to carry out his policies and fulfill his campaign promises.

On the other hand, the spoils system too often resulted in appointments that were based strictly on the needs of the party, without regard for the appointee's qualifications or ability to do the job. Extensive changes in positions that did not affect government policy, such as President Benjamin Harrison's changing 31,000 postmasters in one year, also led to inefficiency.

The spoils system flourished unchallenged in the United States from the 1820s until after the Civil War, at which time the system's abuses prompted civil-service reforms designed to cut down the number of government posts filled by appointment and to award jobs on the basis of merit. The Pendleton Federal Civil Service Act of 1883 provided the initial basis for the adoption of the merit system in the recruitment of federal officials, and by the late 20th century merit systems had almost completely replaced the spoils system at the federal, state, and city levels of government.

In addition to designating the awarding of public offices to party supporters, the term has come to refer to other abuses of political power designed to benefit and enrich the ruling party. These practices may involve, for example, siphoning public funds to the party by contracting with party contributors to handle public projects at inflated rates or by granting public franchises to party contributors at very low prices. The term also includes favouring supporters in areas like the prosecution of law cases, the placement of insurance policies, or the levying of taxes.

Although spoils system is an American political term, the practice of distributing public offices to reward supporters and strengthen a government is and has been common in many other countries as well.

**Spokane,** city, seat (1879) of Spokane county, eastern Washington, U.S., at the falls of the Spokane River.

Frequented by trappers when the North West Company built a trading post there in 1810, the site was settled in 1871 and laid out in 1878. Known as Spokane Falls (for the Spokan Indians), it was incorporated in 1881 after the arrival of the Northern Pacific Railway. Abundant waterpower and a rich hinterland (minerals, forests, and agriculture) encouraged growth as a trade and shipping point for an area (comprising eastern Washington, northern Idaho, northeastern Oregon, western Montana, and southern British Columbia) known as the "Inland Empire." A disastrous fire destroyed much of the city in 1889. Rebuilt, it was reincorporated under its present name in 1900 and established lumber, metal, and food-processing industries. Development of the nearby Coeur d'Alene mineral field (gold, silver, uranium, and copper, among others) and completion of the Grand Coulee Dam Project (1941) assured financial and industrial growth. Spokane Air Force Base and the establishment of aluminum reduction and rolling mills (during World War II) have contributed to the economy. The city's Riverfront Park was the site of EXPO '74.

Gonzaga University (1887), Whitworth College (1890), and several community colleges serve the city. Spokane is a gateway to the resorts of Mount Spokane (5,881 feet [1,793 m]) and the Colville and Kaniksu national forests. Pop. (1991 est.) city, 182,705; Spokane MSA, 372,597.

**Spokane River,** river rising in Coeur d'Alene Lake, Kootenai county, northern Idaho, U.S., and flowing west across the Washington border through Spokane for about 50 miles (80 km) to the Columbia River. The Spokane is 100 miles (160 km) long and has several dams, including Long Lake Dam (1915).

**Spoleto,** Latin SPOLETIUM, town and archiepiscopal see, Perugia *provincia*, in the Umbria *regione* of central Italy; it lies on a detached spur at the southern extremity of the central Umbrian plain, commanding the passes southward and eastward toward Terni and Norcia, north of Rome.

The site of an Umbrian township from at least the 7th to the 6th century BC, Spoleto became a Roman colony in 241 BC. It successfully repulsed an attack by the Carthaginian general Hannibal in 217 BC and later became important because of its strategic location on the Roman artery Via Flaminia. An episcopal see by the 4th century, Spoleto played an important role in the Gothic wars. After the foundation of the Lombard duchy of Spoleto about 570, it became one of the most important towns of Italy until the late 8th century, when it lost a great deal of its autonomy. Under Gregory IX (pope, 1227–41) Spoleto passed to the papacy. In the period of the Avignon popes, the town was a prey to the struggles between Guelf and Ghibelline families until 1354, when papal authority was reestablished. Spoleto became part of the Kingdom of Italy in 1860.

Spoleto has ruins of pre-Roman and Roman walls, as well as a Roman theatre, an amphitheatre, a bridge, and an arch of Drusus (AD 23) with a ruined temple beside it. The medieval town clusters picturesquely on the hillside and is dominated both by the massive Rocca (fortress), built in 1355–64 on the site of the ancient citadel, and by the cathedral, consecrated in 1198 and extensively remodeled in 1634–44. The cathedral, with eight rose windows and a central mosaic by Solsternus (1207), contains a magnificent fresco of the Coronation of the Virgin by Fra Filippo Lippi and pupils, as well as Lippi's tomb. Other notable churches include Santa Eufemia (10th century), San Pietro (13th century), San Gregorio Maggiore (12th century), and San Salvatore, an elaborately decorated monument, usually assigned to the 5th century but possibly dating from the late 8th. The town is supplied with water by an aqueduct that crosses a ravine on an arched bridge built in 1364.

Spoleto is the centre of a large agricultural district (olives), and it also has light industries (cotton goods, phosphorous products, printing). Since 1958 it has held the annual Festival of Two Worlds (drama and music). Pop. (1984 est.) mun., 37,972.

**spondee,** metrical foot consisting of two long (as in classical verse) or stressed (as in English verse) syllables occurring together. The term was derived from a Greek word describing the two long musical notes that accompanied the pouring of a libation. Spondaic metre occurred occasionally in classical verse. It does not, however, form the basis for any English verse, as there are virtually no English words in which syllables receive equal stress. An approximation of a spondaic foot is sometimes achieved with such compounds as "heyday" or "childhood," but even these words can be seen as examples of primary and secondary stress rather than equal stress. In English verse, the spondaic foot is usually composed of two monosyllables. It is frequently used as an introductory variation in a line of iambic metre, such as:

ˊ ˊ ◡ ˊ ◡ ˊ
Green grow | the rush | es, O

(Robert Burns)

**spondylitis,** inflammation of one or more of the vertebrae. Spondylitis takes several forms; the most widely occurring forms are ankylosing spondylitis, hypertrophic spondylitis, and tuberculous spondylitis.

Ankylosing spondylitis (also called Bekhterev spondylitis, deforming spondylitis, or Marie-Strümpell arthritis) is a degenerative disease of the spine that is characteristically seen chiefly in adolescent boys and young men. Its earliest symptom is chronic lower back pain. The progression of the disease can be noted in stiffness and limitation of movement, swollen joints (often indistinguishable from rheumatoid arthritis), fusion (ankylosis) and deformity of the spine, and anemia. Treatment is similar to that for rheumatoid arthritis and may include the use of nonsteroid anti-inflammatory drugs.

Hypertrophic spondylitis, also known as osteoarthritis of the spine, is a degenerative disease seen mostly in individuals over the age of 50. It is characterized by the destruction of intervertebral disks and the growth of spurs on the vertebrae themselves. Treatment includes rest, the application of heat, and exercises to maintain a normal range of movement.

Tuberculous spondylitis (also called Pott's disease, or tuberculosis of the spine) is usually a disease of childhood. It is caused by infection of the spinal column by *Mycobacterium tuberculosis* and is characterized by softening and collapse of the vertebrae, often resulting in a hunchback deformity. Sometimes the spinal nerves are affected, and rigid paralysis may result. Treatment includes chemotherapy against the tuberculosis bacilli and orthopedic care of the spine.

**spondylolisthesis,** forward slipping of the body of one of the lumbar (lower back) vertebrae on the subjacent vertebra or on the sacrum, the triangular bone at the base of the spinal column. The condition is often associated with incompleteness of the vertebral arch, which surrounds the spinal cord. Pressure transmitted to the arch from above encourages slippage. Deformity (lordosis) develops insidiously during childhood and is later followed by mild to severe backache. Rest and back support control the symptoms in most cases, but orthopedic surgery may be necessary, especially if pressure on spinal nerves causes disability.

**spondylosis,** noninflammatory degenerative disease of the spine reducing mobility of the intervertebral joints and resulting in abnormal bone development around the vertebrae. It is primarily a condition of age and occurs much more commonly in men than in women; onset of symptoms is gradual, but untreated spondylosis will progress to disabling tingling pain, limited motion, and partial paralysis in affected areas of the body. The lumbar and cervical spine are more frequently affected than the thoracic spine, because curvature of the latter prevents spondylosis from impinging on the spinal cord; lumbar and cervical spondylosis frequently occur simultaneously in the same individual.

Spondylosis involves both hypertrophic degenerative changes (excessive growth of bone) and reactive osteoarthritis. The narrowing of the intervertebral spaces by the former process produces symptoms by compressing nerves that emerge from the spinal cord; these symptoms are worsened when arthritic bone growth further narrows the spinal canal. Eventual fusion of the intervertebral joints results when connecting ligaments are replaced with bone or when osteoarthritic bony spurs unite.

Lumbar spondylosis is treated by surgical decompression of the affected nerves to relieve leg pain and paralysis, although low back pain may recur after surgery. Mild, uncomplicated cervical spondylosis may respond to rest and traction, but more severe cervical symptoms also require surgical decompression.

**sponge,** any member of some 5,000 species of primitive multicellular aquatic animals that constitute the phylum Porifera. Sponges are characterized by the presence of a porous skeleton of interlocking spicules (bony, needle-like structures), glasslike rods, or horny fibres; they live in colonies or as solitary animals attached to the sea bottom or to other solid objects. Commercial natural sponges are the skeletons that support the sponge animal.

A brief treatment of sponges follows. For full treatment, *see* MACROPAEDIA: Sponges.

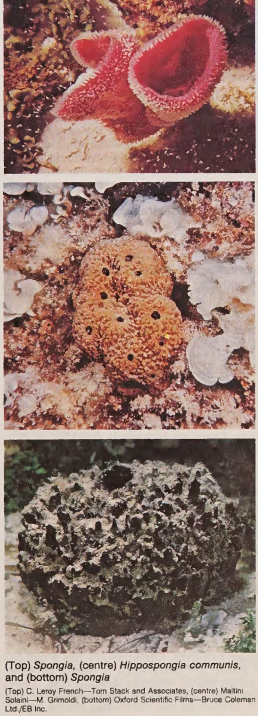
All of the 5,000 species of sponge are marine except for about 20 freshwater species (*Spongilla*). They occur in all seas, from the intertidal zone to depths of 8,500 m (more than 28,000 feet), and are most common in warm waters. They range in length from a few centimetres to several metres (an inch to several yards). Some rounded forms may be several metres in diameter. The body shape is variable; it may be fingerlike, treelike, or bushy. Some sponges are tubular; others are flat or shapeless masses.

Sponges are divided into three classes: Calcispongiae (Calcarea), Hyalospongiae (Hexactinellida), and Demospongiae. Calcispongiae, or calcareous sponges, are marine sponges containing needlelike or branching spicules of lime. The Hyalospongiae, or glass sponges, have a skeleton often composed of six-rayed spicules of silica; the spicules may be united into a continuous network. The skeletons of some such as that of the Venus's flower basket are often beautiful and prized as curios.

The Demospongiae, or siliceous sponges, a class that includes about 80 percent of all sponges, have a skeleton composed of spongin, a plasticlike material. Most are shallow-water species; among them are the commercial bath sponges and the freshwater sponges.

The body of the living sponge is covered by a thin, slimy, usually dark epidermal layer consisting of flat cells called pinacocytes. Numerous perforations lead through the skin into a central cavity, the spongocoel, which is lined with choanocytes—flagellum-bearing cells. These whiplike structures create currents that draw water into the spongocoel through the perforations; the water passes out through one or several large openings, the oscula (singular osculum). Between the outer and inner cell layers is the mesoglea, a jellylike substance containing free-moving cells known as amoebocytes.

The choanocytes ingest food particles—bacteria, other microorganisms, and organic debris—and absorb oxygen from the water current. The amoebocytes produce spherical eggs. After fertilization the larvae swim by means of hairs, or cilia, until they find a suitable site for permanent attachment; they then quickly develop into mature animals. Some species also reproduce by budding, an asexual process



(Top) *Spongia*, (centre) *Hippospongia communis*, and (bottom) *Spongia*

(Top) C. Leroy French—Tom Stack and Associates, (centre) Mattini Solaini—M. Grimoldi, (bottom) Oxford Scientific Films—Bruce Coleman Ltd./EB Inc.

in which a section of the adult animal separates and becomes established as a distinct individual.

Some sponges live in close association with other animals. The back of the crab *Dromia,* for example, is always covered with a growth of sponge, which serves as camouflage. Certain spider crabs transplant sponges into their own bodies. Large sponges often harbour smaller organisms that burrow into them but do not feed on the sponge tissue. The boring sponge (clionid) lives on dead and living seashells, disintegrating and absorbing the shell substance. Among the few natural enemies of sponges is a fungus that is sometimes a serious pest of commercial sponges.

The so-called bath sponge, or commercial sponge, is obtained mainly from the eastern Mediterranean and from the Gulf of Mexico and the Caribbean Sea (off the western coast of Florida and the West Indies and elsewhere) usually at depths of less than 60 m (200 feet). Sponges are harvested by means of hooks or harpoons used by men in boats, or they are cut from the bottom by skindivers. One of the most commonly used species of commercial sponge is *Spongia officinalis,* sometimes called the glove sponge, which grows in a variety of shapes and reaches a height of 12 to 15 cm (5 to 6 inches). *Hippospongia canaliculata,* variety *gossypina,* the sheep's-wool sponge, is valued for its wooly texture; it has an irregular, shaggy surface. Once in considerable demand, commercial sponges have largely been replaced by synthetic sponges.

**sponge gourd:** *see* dishcloth gourd.

**sponge rubber:** *see* foam rubber.

**Spongilla,** sponge genus that includes the freshwater sponge (*q.v.*) species.

**spongillafly,** any insect of the parasitic neuropteran family Sisyridae. The adult, a smoky brown insect, deposits clusters of eggs under a silky web near or on the water. The larva lives as a parasite on a freshwater sponge. It leaves the water when fully grown and spins a double-walled, lacelike cocoon in which it passes the pupal stage. Spongillaflies are found throughout the world wherever there are freshwater sponges.

**spontaneous abortion:** *see* miscarriage.

**spontaneous combustion,** the outbreak of fire without application of heat from an external source. Spontaneous combustion may occur when combustible matter, such as hay or coal, is stored in bulk. It begins with a slow oxidation process (as bacterial fermentation or atmospheric oxidation) under conditions not permitting ready dissipation of heat—*e.g.,* in the centre of a haystack or a pile of oily rags. Oxidation gradually raises the temperature inside the mass to the point at which a fire starts. Crops are commonly dried before storage or, during storage, by forced circulation of air, to prevent spontaneous combustion by inhibiting fermentation. For the same reason, soft coal in small size is wetted to suppress aerial oxidation.

**spontaneous fission,** type of radioactive decay in which certain unstable nuclei of heavier elements split into two nearly equal fragments (nuclei of lighter elements) and liberate a large amount of energy. Spontaneous fission, discovered (1941) by the Russian physicists G.N. Flerov and K.A. Petrzhak in uranium-238, is observable in many nuclear species of mass number 230 or more. Among these nuclides, those with lower mass numbers generally have longer half-lives. Uranium-238 has a half-life of about $10^{16}$ years when it decays by spontaneous fission, whereas fermium-256 decays with a half-life of about three hours.

Nuclides that undergo spontaneous fission also are subject to alpha decay (emission from the nucleus of a helium nucleus). In uranium-238, alpha decay is about 2 million times more probable than is spontaneous fission, whereas in fermium-256, 3 percent of the nuclei undergo alpha decay and 97 percent undergo spontaneous fission.

The fission that occurs in nuclear reactors and explosive devices is induced by the neutron bombardment of certain types of nuclei.

**spontaneous generation,** also called ABIOGENESIS, the hypothetical process by which living organisms develop from nonliving matter; also, the archaic theory that utilizes this process to explain the origin of life. Pieces of cheese and bread wrapped in rags and left in a dark corner, for example, were thus thought to produce mice, according to this theory, because after several weeks, there were mice in the rags. Many believed in spontaneous generation because it explained such occurrences as the appearance of maggots on decaying meat.

By the 18th century it had become obvious that higher organisms could not be produced by nonliving material. The origin of microorganisms such as bacteria, however, was not fully determined until Pasteur proved in the 19th century that microorganisms reproduce. *See also* biopoiesis.

**Spontini, Gaspare (Luigi Pacifico)** (b. Nov. 14, 1774, Maiolati, Papal States [Italy]—d. Jan. 24, 1851, Maiolati), Italian composer and conductor whose early operas, notably his masterpiece, *La vestale* (1807), represent the spirit of the Napoleonic era and form an operatic bridge between the works of Christoph Gluck and Richard Wagner.

Entering the Conservatorio della Pietà dei Turchini in Naples in 1793, he studied music with Nicola Sala and Giacomo Tritto before his first opera, *Li puntigli delle donne* ("The Obstinacy of Women"), was performed in Rome (1796). Its success led him to continue writing comic operas in Rome—the most famous was *L'eroismo ridicolo* (1798; "Ridiculous Heroism")—before he moved to Paris, where he established himself with *Milton* (1804). Influenced by French composers, Spontini developed the dramatic composition *La vestale* ("The Vestal Virgin") that established his European reputation. He became conductor of the Italian Opera in 1810 but left two years later for political reasons and became the court composer to Louis XVIII in 1814. He left Paris in 1819 after the failure of his opera *Olimpie.* In 1820 he received an appointment from Frederick William III of Prussia as director of music at Berlin. This appointment lasted until shortly after the king's death in June of 1840, when political intrigue forced Spontini to relinquish his duties and leave Berlin.

Additional significant operas by Spontini include *La finta filosofa* (1799; "The Fake Philosopheress"), *La fuga in Maschera* (1800; "The Masked Flight"), *Olimpie* (1819), *Nurmahal* (1822), *Alcidor* (1825), and *Agnes von Hohenstaufen* (1829).

**spookfish,** any of about 11 species of small marine fishes constituting the family Opisthoproctidae (order Salmoniformes), with representatives in each of the major oceans. The name spookfish, or barreleye, as they are sometimes called, originates from their unusual eyes, which are pointed upward and are borne at the end of short tubular stalks. Specimens have been collected at depths of almost 900 m (3,000 feet) and are nearly always found at least 100 m (330 feet) below the surface.

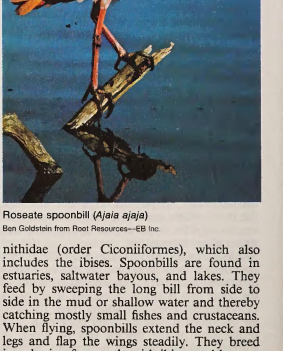
The barreleye (*Macropinna microstoma*), a spookfish of the Pacific, occurs along the North American coast. It is less than 10 cm (4 inches) in length and brownish in colour.

**spool furniture:** *see* bobbin furniture.

**spoon,** an implement consisting of a small, shallow, bowl-shaped receptacle supported by a handle, used for eating, serving, and cooking foods. Spoons, together with forks, are known as flatware (*q.v.*).

**Spoon River,** river in west-central Illinois, U.S. It rises in southwestern Bureau county and flows south and southwest to a point near Lewistown, where it turns southeast, joining the Illinois River opposite Havana after a course of 160 miles (257 km). The Dickson Mounds, a rich archaeological area, are near the confluence of the two rivers. Spoon River was made famous by Edgar Lee Masters, the poet who wrote *Spoon River Anthology* (1915), dealing with the frustrated ambitions of people who lived in the fictitious town of Spoon River, actually a compound of two towns, Petersburg and Lewistown. The river's name is probably a translation of *maquon,* Algonquian Indian for "mussel shell," which the Indians used as a spoon.

**spoonbill,** any member of six species of long-legged wading birds that constitute the subfamily Plataleinae of the family Threskior-



Roseate spoonbill (*Ajaia ajaja*)
Ben Goldstein from Root Resources—EB Inc.

nithidae (order Ciconiiformes), which also includes the ibises. Spoonbills are found in estuaries, saltwater bayous, and lakes. They feed by sweeping the long bill from side to side in the mud or shallow water and thereby catching mostly small fishes and crustaceans. When flying, spoonbills extend the neck and legs and flap the wings steadily. They breed in colonies, frequently with ibises and herons, building a large nest of sticks in a low bush or tree and laying three to five white eggs, blotched with reddish brown.

Spoonbills range in length from about 60 to 80 cm (24 to 32 inches). The head is partly or entirely bare. In most species the plumage is white, sometimes with a rosy tinge, but the roseate spoonbill (*Ajaia ajaja*), of North and South America, about 80 cm long, is deep pink with a white neck and upper back. It ranges from the Gulf Coast of Texas and the West Indies to Argentina and Chile. In some places it has been exterminated by plume hunters.

The European spoonbill (*Platalea leucorodia*) is a crested white bird about 60 cm long with cinnamon buff on the foreneck. It breeds in marshes of central and southern Europe and Asia, south to Egypt, India, and Taiwan. Others are the African spoonbill (*P. alba*); the lesser spoonbill (*P. minor*) of eastern Asia; and two Australian species, the royal,

or black-billed, spoonbill (*P. regia*), and the yellow-billed, or yellow-legged, spoonbill (*P. flavipes*).

**spoonbill,** also called SPOONBILL CAT, primitive North American fish, a species of paddlefish (*q.v.*).

**Spooner, John (Coit)** (b. Jan. 6, 1843, Lawrenceburg, Ind., U.S.—d. June 11, 1919, New York City), U.S. senator from Wisconsin (1885–91; 1897–1907), a powerful conservative force in his state and in Congress.

Spooner moved to Wisconsin as a youth. After service in the Union Army during the Civil War, he was admitted to the bar (1867). He began a law practice at Hudson, Wis., and eventually became best known in legal circles as counsel for railroad interests. A member of the Wisconsin legislature (1872), he was elected by that body to represent the state of Wisconsin in the U.S. Senate, where he served from 1885 to 1891 and from 1897 to 1907.

Spooner emerged as a leading conservative voice in the Senate, consistently opposing labour reform and other progressive measures. With senators Nelson W. Aldrich of Rhode Island, William B. Allison of Iowa, and Orville H. Platt of Connecticut, he formed a core of conservative leadership that exerted strong influence on national affairs at the turn of the century. He was author of the Spooner Act (1902), which authorized Pres. Theodore Roosevelt to purchase rights to build the Panama Canal. At the 1904 Republican national convention in Chicago, Spooner, as the head of the regular Wisconsin delegation, became embroiled in a bitter credentials fight with state Progressives led by Robert M. La Follette. Spooner survived the challenge, but the ascendency of Progressivism, especially in Wisconsin, was inevitable. The change in the political climate contributed to Spooner's decision to retire from public life in 1907. He thereafter practiced law in New York City.

**Spooner Amendment,** congressional amendment to the Army Appropriations Act of 1901 that called for the end of the U.S. military government in the Philippines. By the terms of the Treaty of Paris (December 1898), sovereignty over the Philippine Islands had passed from Spain to the United States.

Filipinos fought the imposition of American rule, and it was believed in the United States that their resistance was due to the harshness of military government. The Spooner Amendment authorized Pres. William McKinley to supplant military rule with civilian government, which was inaugurated in July 1901. Filipino guerrillas, however, continued hostilities for a number of years.

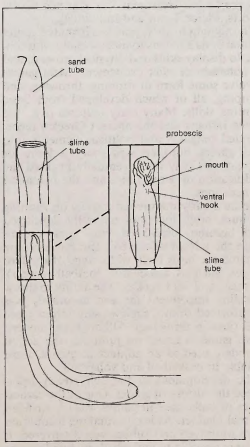
**spoonerism,** reversal of the initial letters or syllables of two or more words, such as "I have a half-warmed fish in my mind" (for "half-formed wish") and "a blushing crow" (for "a crushing blow"). The word was derived from the name of William Archibald Spooner (1844–1930), a distinguished Anglican clergyman and warden of New College, Oxford, a nervous man who committed many "spoonerisms." Such transpositions are sometimes made intentionally to produce comic effect.

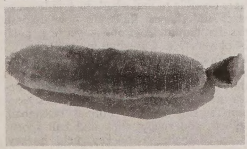
**spoonworm,** also called ECHIURID, any member of the primarily marine invertebrate phylum Echiura, also known as Echiuroidea, or Echiurida. Spoonworms are sausage-shaped organisms with a flattened extension of the "head" that is curved along its lateral edges and sometimes shaped like a scoop or spoon to form a nonretractable anterior proboscis. Adult spoonworms vary from a few to 600 millimetres (2 feet) in length. In *Urechis* the proboscis is only a fraction of the length of the trunk; however, in *Ikeda* the proboscis may exceed 10 times the trunk length.

Apart from a few brackish-water species, spoonworms are marine and occur in seabeds throughout the world. Although some species inhabit rock crevices, most live in burrows in the mud. A flow of water is maintained through the burrow by peristaltic contractions of the body. Some respiration probably takes place across the body wall, but the hind gut is often utilized as a respiratory organ by drawing water through the anus.

*Life cycle.* The sexes are separate and, apart from members of the family Bonelliidae, superficially alike. Ova or spermatozoa produced by an unpaired gonad and shed into the coelomic fluid contained in the body cavity are nourished there until maturation is complete. The mature gametes are taken up by ciliated funnels of the anterior nephridia, which lose their excretory function. Then the gametes pass into thin-walled nephridial sacs and are stored there until their expulsion into the sea, where fertilization takes place. Spiral cleavage occurs in the zygote; a free-swimming trochophore larva develops and metamorphoses into a burrowing worm.

Species of the family Bonelliidae are unusual in that the male (only 1 to 6 mm [0.04 to 0.24 in.] long) is parasitic within a modified nephridium (or uterus) of a female. A male develops when a larva comes in contact with a female's proboscis, which secretes a hormone that affects larval development. The larva passes to the esophagus and undergoes reduced metamorphosis to a sexually mature male; however, the proboscis and circulatory system fail to develop and only a reduced digestive system forms. Cilia cover the entire body (as with the larva), yet a system of gonoducts develops fully. The male remains within the egg-storage organ of the female, presumably to fertilize the eggs as they are shed into the water.



*Spoonworms*
(Top) *Urechis caupo* and (bottom) *Echiurus echiurus*
(Top) From Paul A. Meglitsch, *Invertebrate Zoology*, copyright © 1967 by Oxford University Press, Inc., reprinted by permission; (bottom) R.N. Mariscal—Bruce Coleman Inc.

*Form and function.* The trunk of spoonworms is saclike, with a body wall composed of three muscle layers. Anteriorly is a muscular but noncontractile, tactile proboscis, which is highly mobile and capable of great extension in some species. The mouth is situated at the base of the proboscis. Typically, there is a pair of setae on the ventral surface behind the mouth and one or two circles of setae around the posteriorly located anus. The body cavity is filled with coelomic fluid containing two types of cells; in some species, one type of cell contains a respiratory pigment similar to hemoglobin. The alimentary canal is coiled and associated along much of its length with a siphon, or collateral intestine, whose function is obscure. A pair of anal vesicles with an excretory function arises from the end of the intestine. Single to numerous nephridia are attached to the ventral body wall. Most species have a closed vascular system comprising dorsal, ventral, and neurointestinal blood vessels. The nerve cord is ventral. The gonads arise from a mesentary above the nerve cord or from others near the cloaca. They are diffuse, and eggs or spermatozoa are shed into the coelomic fluid.

Feeding methods vary according to the size of the proboscis. Species with a long proboscis reach out and pick up detritus around the burrow entrance; the material collected becomes attached to strings of mucus and is transferred to the mouth. In species with a short proboscis, a mucous tube is secreted and forms a lining to the burrow. Food particles drawn into the burrow with the flow of water for respiration become fixed to the mucous tube. When this is filled, the tube and its contents are swallowed.

*Classification.* Spoonworms were earlier linked with the peanutworms, or sipunculids; then Adam Sedgewick assigned them to the phylum Annelida. They were not widely accepted as Annelida; and, after W.W. Newby (1940) studied the embryology and development of *Urechis caupo,* they became established as a separate phylum.

**Sporades,** group of Greek islands in the Aegean Sea, lying northeast of Euboea (Évvoia) island, including Skiathos, Skópelos, Skyros, and Alónnisos, as well as neighbouring islets. In antiquity these were known as the Thessalian, or Northern, Sporades, while the Thracian, or Eastern, Sporades included the now-Turkish island of Imroz (Greek Imvros), Samothrace, Thasos, Lemnos, and Áyios Evstrátios in the northeast Aegean. The Western Sporades were the scattered small islands of the southwestern Aegean, with the exception of the Cyclades and the islands of the Saronic Gulf; the Western Sporades included Hydra and Spétsai.

**spore,** a reproductive cell capable of developing into a new individual without fusion with another reproductive cell. Spores thus differ from gametes, which are reproductive cells that must fuse in pairs in order to give rise to a new individual. Spores are agents of asexual reproduction, whereas gametes are agents of sexual reproduction.

Spores are produced by bacteria, fungi, and green plants. Bacterial spores serve largely as a resting, or dormant, stage in the bacterial life cycle, serving to preserve the bacterium through periods of unfavourable conditions. Many bacterial spores are highly durable and can germinate even after years of dormancy.

Among the fungi, spores serve a function analogous to that of seeds. Produced and released by specialized fruiting bodies, such as the edible portion of the familiar mushrooms, fungal spores germinate and grow into new

individuals under suitable conditions of moisture, temperature, and food availability.

Among green plants—all of which have a life cycle characterized by alternating generations of asexually and sexually reproducing individuals—spores are the reproductive agents of the asexual generation. Produced by the sporophyte (*i.e.*, spore-bearing) generation, plant spores give rise to the gametophyte (*i.e.*, gamete-bearing) generation. Spores are most conspicuous in the non-seed-bearing plants, including algae, liverworts, mosses, and ferns. In these lower green plants, as in fungi, the spores function much like seeds. In general, the parent plant sheds the spores locally; the spore-generating organs are frequently located on the undersides of leaves. The spores of plants that inhabit the edges of bogs or lakes are frequently shed into the water or are carried there by rain and are preserved in the sediments. Wind dispersal is a factor in plants that shed their spores explosively.

Among the seed-bearing plants—the gymnosperms and the angiosperms—the spores are far less conspicuous. They are not released from the parent plant, but rather they germinate into microscopic gametophyte individuals that are entirely dependent upon the sporophyte plant. Gymnosperms and angiosperms form two kinds of spores: microspores, which give rise to male gametophytes, and megaspores, which produce female gametophytes.

**sporophyte,** in certain plants and algae, nonsexual phase (or an individual representing the phase) in the alternation of generations—a phenomenon in which two distinct phases (a haploid and a diploid phase) occur in the life history of a plant, each phase producing the other. (The alternate, sexual phase is the gametophyte.) In the sporophyte phase, a diploid plant body grows and eventually produces spores through meiosis. These spores divide mitotically to produce haploid, gamete-producing bodies called gametophytes. The union of two gametes during fertilization produces a diploid zygote, which divides mitotically to form a new sporophyte.

The character and relative extent of the two phases vary greatly among different groups of plants and algae. During the course of evolution, the gametophyte stage is progressively reduced; thus, in the higher (*i.e.,* vascular) plants, the sporophyte is the dominant phase in the life cycle, whereas in the more primitive nonvascular plants the gametophyte remains dominant. *See also* gametophyte.

**sporotrichosis,** subacute or chronic infection by the fungus *Sporotrichum,* or *Sporothrix, schenckii,* usually characterized by a chancre at the site of inoculation and, extending from the site, a chain of hard, red, pus-generating lumps along the lymphatics of the skin and subcutaneous tissue. The fungus, which is most commonly found in the soil or on vegetation or decaying wood, most often enters the body through a scratch or abrasion. Inhalation of the fungus may cause pulmonary sporotrichosis. Cutaneous lymphatic sporotrichosis is painless and feverless; it usually responds quickly to treatment with potassium iodide. In its rare, blood-borne, disseminated form, sporotrichosis may affect the muscles, bones, joints, or central nervous system, causing fever, weight loss, fatigue, and pain; this form of the disease may respond to treatment with the antibiotic amphotericin B.

**sporozoan:** *see* apicomplexan.

**Sports, Book of,** formally DECLARATION OF SPORTS, order issued by King James I of England for use in Lancashire to resolve a conflict, on the subject of Sunday amusements, between the Puritans and the gentry, many of whom were Roman Catholics. Permission was given for dancing, archery, leaping and vaulting, and for "having of May games, Whitsun ales and morris dances, and the setting up of May-poles and other sports therewith used, so as the same may be had in due and convenient time without impediment or neglect of divine service, and that women shall have leave to carry rushes to church for the decorating of it." On the other hand, "bear and bull-baiting, interludes, and (at all times in the meane sort of people by law prohibited) bowling" were not to be permitted on Sunday. In 1618 James ordered all English clergy to read the declaration from the pulpit, but so strong was the Puritan opposition to Sunday amusements that he prudently withdrew his command. In 1633 Charles I not only directed the republication of his father's declaration but insisted upon the reading of it by the clergy. Many of the clergy were punished for refusing to obey the injunction. When Charles was overthrown during the English Civil War, Puritan prohibitions against sports and games on the Sabbath again prevailed until Charles II was restored in 1660.

**sports and games,** recreational or competitive activities that involve some amount of physical strength or skill. At one time, sports were commonly considered to include only the outdoor recreational pastimes, such as fishing, shooting, and hunting, as opposed to games, which were regarded as organized athletic contests played by teams or individuals according to prescribed rules. The distinction between sports and games has grown less clear, and the two terms are now often used interchangeably.

A brief treatment of sports and games follows. For full treatment, *see* MACROPAEDIA: Sports, Major Team and Individual.

Throughout history, man has invented games primarily as a means to meet socially with others, to display skills and physical prowess, and to entertain or offer excitement. Most games involve some form of running, throwing, and jumping, all of which developed from basic hunting skills. Many early cultures (*e.g.,* the Aztec Indians and the ancient Greeks) incorporated religious and political elements into their games, but there was always a desire for recreational play that eventually inspired the codification of early games and the invention of new ones.

Because early man relied heavily on running to hunt prey, footraces naturally developed and became formalized into track events. With the advent of the ball and bat, running became the basis for a wide range of modern games, such as association football (soccer), lacrosse, and field hockey. The ability to throw a killing implement far and accurately was transformed from a survival skill into a game skill (javelin throwing). Although no modern team game is based on jumping, the action is widely used as an adjunct in games, most notably in basketball and volleyball.

The development of the ball greatly influenced the history of games. One of the earliest types of balls used in games was an air-filled animal bladder. As leather-making techniques were improved and rubber was discovered, it became possible to make balls in a wide range of sizes and shapes. Balls are now used in games that require from one player (*e.g.,* golf) to 24 players (*e.g.,* Canadian football).

The world's existing sports can be grouped into various categories, though certain sports fit more than one category. The major categories are team sports, which includes association football (soccer), football, basketball, volleyball, and rugby; stick and ball sports, such as baseball, ice hockey, field hockey, cricket, and lacrosse; court sports, such as tennis, table tennis, handball, and squash; winter sports, which includes various skating and skiing events; water sports, which includes various swimming and boating events; athletics, which includes various running, jumping, and throwing events; target sports, such as archery and firearm shooting; target ball sports, such as bowling, golf, and billiards; combat sports, such as boxing, wrestling, judo, and karate; sports on wheels, such as roller skating and motorcycle and automobile racing; animal sports, chief among which are horse racing, dog racing, and polo; and aerial sports, such as gliding, air racing, and ballooning.

An important factor in the development of modern sports was the increasing urbanization of society. The emergence of towns with relatively stable populations permitted the organization of regular teams and schedules. As more teams entered into competition, however, conflicts arose as each team insisted on playing according to its own local standards. Thus, a uniform set of rules was made to regulate equipment and principles of play. Local and national organizations were also set up to govern the games, and a distinction was made between professional and amateur competitors.

Games serve a number of important functions. As physical outlets, they allow participants to work out aggressive energies and emotions through involvement in competitive recreational activity. As entertainment, they provide diversion from the demands of day-to-day living and allow the spectator to enjoy much of the experience of play without actual involvement. In addition, the economic impact of games is unquestionable. Several of the most popular games have become major industries worldwide. Television has been at least partly responsible for this, with networks paying huge sums to broadcast major sports events to national and international audiences.

**sports-car racing,** form of motor racing involving cars built to combine aspects of racing and touring cars. Although there are many conflicting definitions of sports cars, it is usually conceded that in normal production form they do not resemble Grand Prix (Formula One) racing machines. Whereas the latter is a single-seat design carrying spartan cockpit furnishings and utterly functional equipment throughout, the sports car is usually a two-seater, sometimes a four-seater, characterized by its nimble abilities (if not speed and power) together with general suitability for high-speed touring on ordinary roads. Unlike a Grand Prix car, it is usually series-produced, seldom handmade. Some manufacturers of Grand Prix machines, such as Ferrari and Lotus, also make sports cars. Other makes include MG, Jaguar, Aston Martin, Austin-Healey, Triumph, Porsche, Lancia, Morgan, and Chevrolet Corvette. Although not usually designed exclusively for racing, sports cars are, nevertheless, able racing machines and are often entered in competitions with others of their class. Most of the world's sports-car racing is conducted for amateur drivers by local and regional organizations. Some of the world's most famous professional races are sports-car events, however, and may even be designated as Grand Prix. (When the term Grand Prix is used in this context, it does not refer to the type of car used but rather to the race's being a major automotive event of the nation in which it is held.) The development of sports cars for racing, especially in such commercially important events as the 24-hour endurance race at Le Mans, where the reputations of participating manufacturers are very much at stake, brought about some prototype sports cars that are, in reality, little different in their power and speed potentials from Formula One machines. A world sports-car championship was awarded from 1953 to 1961. It was replaced in 1962 by a manufacturer's championship, for which grand touring and prototype cars also compete, awarded annually to the make of car that achieves the best record in a specified series of races.

**Sporting Record.** The tables that follow contain the significant information about the world championships of all the major sports that are international in character. It also includes some professional and amateur sports that attract a huge national following—such as baseball in the United States and cricket in the United Kingdom, Australia, India, and the other Test Match countries—and some sports, such as rowing, in which national competition overshadows international events.

Major team and individual sports are discussed in greater detail in MACROPAEDIA: Sports. Individual articles on particular sports or sporting events can also be found in the MICROPAEDIA.

In many sports the Olympic Games held every four years constitute the world championships; they are included in the listings below. For the complete table of Olympic competition since 1896, *see* MICROPAEDIA: Olympic Games. For standing world records and for an event's most recent winners, *see* BRITANNICA BOOK OF THE YEAR.

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## ARCHERY

The international governing body for archery, the Fédération Internationale de Tir à l'Arc (FITA), instituted world championships in 1931. Between 1931 and 1957 a variety of scoring rounds were used. In 1957, however, FITA established its own competition standard—two FITA rounds shot over four days. A single FITA round consists of 36 arrows shot from each of four distances; different distances are used for men's and women's competition. From 1987 to 1991 the grand FITA round was used. The Olympic round was used for the 1993 world championships; under this system the highest possible individual score was 120. Since 1959 championships have been held biennially.



Kim Soo Nyung (S.Kor.) just after completing a shot at the 1991 FITA Outdoor World Target Archery Championships in Krakow, Pol., where she successfully defended her 1989 title
Robert Rhoda

**FITA Outdoor World Target Archery Championships**

| year | men's individual | | men's team | | women's individual | | women's team | |
|---|---|---|---|---|---|---|---|---|
| | winner | points | winner | points | winner | points | winner | points |
| 1931 | M. Sawicki (Pol.) | * | France | * | J. Spychajowa-Kurkowska (Pol.) | * | | |
| 1932 | L. Reith (Belg.) | | Poland | | J. Spychajowa-Kurkowska (Pol.) | | | |
| 1933 | D. Mackenzie (U.S.) | | Belgium | | J. Spychajowa-Kurkowska (Pol.) | | Poland | * |
| 1934 | H. Kjellson (Swed.) | | Sweden | | J. Spychajowa-Kurkowska (Pol.) | | Poland | |
| 1935 | A. van Kohlen (Belg.) | | Belgium | | I. Catani (Swed.) | | United Kingdom | |
| 1936 | E. Heilborn (Swed.) | | Czechoslovakia | | J. Spychajowa-Kurkowska (Pol.) | | Poland | |
| 1937 | G. de Rons (Belg.) | | Poland | | E. Simon (U.K.) | | United Kingdom | |
| 1938 | F. Hadas (Czech.) | | Czechoslovakia | | N. Weston-Martyr (U.K.) | | Poland | |
| 1939 | R. Beday (Fr.) | | France | | J. Spychajowa-Kurkowska (Pol.) | | Poland | |
| 1946† | E. Tang Holbek (Den.) | | Denmark | | P. de Wharton Burr (U.K.) | | United Kingdom | |
| 1947 | H. Deutgen (Swed.) | | Czechoslovakia | | J. Spychajowa-Kurkowska (Pol.) | | Denmark | |
| 1948 | H. Deutgen (Swed.) | | Sweden | | P. de Wharton Burr (U.K.) | | Czechoslovakia | |
| 1949 | H. Deutgen (Swed.) | | Czechoslovakia | | B. Waterhouse (U.K.) | | United Kingdom | |
| 1950 | H. Deutgen (Swed.) | | Sweden | | J. Lee (U.S.) | | Finland | |
| 1952 | S. Andersson (Swed.) | | Sweden | | J. Lee (U.S.) | | United States | |
| 1953 | B. Lundgren (Swed.) | | Sweden | | J. Richards (U.S.) | | Finland | |
| 1955 | N. Andersson (Swed.) | | Sweden | | K. Wisniowska (Pol.) | | United Kingdom | |
| 1957 | O.K. Smathers (U.S.) | 2,231 | United States | 6,591 | C. Meinhart (U.S.) | 2,120 | United States | 6,187 |
| 1958 | S. Thysell (Swed.) | 2,101 | Finland | 5,936 | S. Johansson (Swed.) | 2,053 | United States | . . . |
| 1959 | J. Caspers (U.S.) | 2,247 | United States | 6,634 | A. Weber Corby (U.S.) | 2,023 | United States | 5,847 |
| 1961 | J. Thornton (U.S.) | 2,310 | United States | 6,601 | N. Vonderheide (U.S.) | 2,173 | United States | 6,376 |
| 1963 | C.T. Sandlin (U.S.) | 2,332 | United States | 6,867 | V. Cook (U.S.) | 2,253 | United States | 6,508 |
| 1965 | M. Halkonen (Fin.) | 2,313 | United States | 6,792 | M. Lindholm (Fin.) | 2,214 | United States | 6,358 |
| 1967 | R. Rogers (U.S.) | 2,298 | United States | 6,816 | M. Maczynska (Pol.) | 2,240 | Poland | 6,686 |
| 1969 | H. Ward (U.S.) | 2,423 | United States | 7,194 | D. Lidstone (Can.) | 2,361 | U.S.S.R. | 6,897 |
| 1971 | J.C. Williams (U.S.) | 2,445 | United States | 7,050 | E. Gapchenko (U.S.S.R.) | 2,380 | Poland | 6,907 |
| 1973 | V. Sidoruk (U.S.S.R.) | 2,185 | United States | 6,400 | L. Myers (U.S.) | 2,204 | U.S.S.R. | 6,389 |
| 1975 | D. Pace (U.S.) | 2,548 | United States | 7,444 | Z. Rustamova (U.S.S.R.) | 2,465 | U.S.S.R. | 7,252 |
| 1977 | R. McKinney (U.S.) | 2,501 | United States | 7,444 | L. Ryon (U.S.) | 2,515 | United States | 7,379 |
| 1979 | D. Pace (U.S.) | 2,474 | United States | 7,409 | Kim Jin Ho (S.Kor.) | 2,507 | South Korea | 7,341 |
| 1981 | K. Laasanen (Fin.) | 2,541 | United States | 7,547 | N. Butuzova (U.S.S.R.) | 2,514 | U.S.S.R. | 7,455 |
| 1983 | R. McKinney (U.S.) | 2,617 | United States | 7,812 | Kim Jin Ho (S.Kor.) | 2,616 | South Korea | 7,704 |
| 1985 | R. McKinney (U.S.) | 2,601 | South Korea | 7,660 | I. Soldatova (U.S.S.R.) | 2,595 | U.S.S.R. | 7,721 |
| 1987‡ | V. Esheyev (U.S.S.R.) | 329 | West Germany | 891 | Ma Xiangjun (China) | 330 | U.S.S.R. | 884 |
| 1989 | S. Zabrodsky (U.S.S.R.) | 332 | U.S.S.R. | 985 | Kim Soo Nyung (S.Kor.) | 338 | South Korea | 995 |
| 1991 | S. Fairweather (Austl.) | 334 | South Korea | 998 | Kim Soo Nyung (S.Kor.) | 333 | South Korea | 1,030 |
| 1993 | Park Kyung Mo (S.Kor.) | 113 | France | 249 | Kim Hyo Jung (S.Kor.) | 104 | South Korea | 236 |
| 1995 | Lee Kyung Chul (S.Kor.) | 109 | South Korea | 255 | N. Valeyeva (Moldova) | 113 | South Korea | 247 |
| 1997 | Kim Kyung Ho (S.Kor.) | 108 | South Korea | 254 | Kim Du Ri (S.Kor.) | 105 | South Korea | 242 |
| 1999 | Hong Sung Chil (S.Kor.) | 115 | Italy | 252 | Lee Eun Kyung (S.Kor.) | 115 | Italy | 240 |
| 2001 | Yeon Jung Ki (S.Kor.) | 115 | South Korea | 247 | Park Sung Hyun (S.Kor.) | 111 | China | 232 |

*Rounds shot varied from 1931 to 1957. †No competition held during unlisted years: 1940–45, 1951, 1954, 1956. Competition biennial since 1959. ‡Grand FITA round instituted.

## ATHLETICS

The world governing body for athletics, or track-and-field, is the International Amateur Athletic Federation (IAAF), founded in 1912. The sport includes relay running, a number of individual running, jumping, and throwing events, and one event (the decathlon for men and the heptathlon for women) that includes all three activities. The World Cup (inaugurated 1977) is a finals-only competition for national, hemispheric, and continental teams. In 1983 the first officially recognized non-Olympic world athletics championships were held. A long-distance event that has special status is the marathon race. The standard distance for marathons is 42,195 m (26 miles 385 yards).

**IAAF World Cup—men**

| | *100 m* | *200 m* | *400 m* | *800 m* | *1,500 m* | *3,000 m* |
|---|---|---|---|---|---|---|
| 1977 | S. Williams (U.S.) | C. Edwards (U.S.) | A. Juantorena (Amer.) | A. Juantorena (Amer.) | S. Ovett (Eur.) | — |
| 1979 | J. Sanford (U.S.) | S. Leonard (Amer.) | K. Hassan (Africa) | J. Maina (Africa) | T. Wessinghage (Eur.) | — |
| 1981 | A. Wells (Eur.) | M. Lattany (U.S.) | C. Wiley (U.S.) | S. Coe (Eur.) | S. Ovett (Eur.) | — |
| 1985 | B. Johnson (Amer.) | R. Caetano da Silva (Amer.) | M. Franks (U.S.) | S. Koskei (Africa) | O. Khalifa (Africa) | — |
| 1989 | L. Christie (U.K.) | R. Caetano da Silva (Amer.) | R. Hernandez (Amer.) | T. McKean (U.K.) | A. Bile (Africa) | — |
| 1992 | L. Christie (U.K.) | R. Caetano da Silva (Amer.) | S. Bada (Africa) | D. Sharpe (U.K.) | M. Suleiman (Asia) | — |
| 1994 | L. Christie (Gr.Brit.) | J. Regis (Gr.Brit.) | A. Pettigrew (U.S.) | M. Everett (U.S.) | N. Morceli (Africa) | — |
| 1998 | O. Thompson (Amer.) | F. Fredericks (Africa) | I. Thomas (Gr.Brit.) | N. Schumann (Ger.) | L. Rotich (Africa) | D. Baumann (Ger.) |
| 2002 | U. Emedolu (Africa) | F. Obikwelu (Eur.) | M. Blackwood (Amer.) | A.M. Reina (Spain) | B. Lagat (Africa) | C. Mottram (Oceania) |
| | *5,000 m* | *10,000 m* | *Steeplechase* | *110-m hurdles* | *400-m hurdles* | *4 × 100-m relays* |
| 1977 | M. Yifter (Africa) | M. Yifter (Africa) | M. Karst (W.Ger.) | T. Munkelt (E.Ger.) | E. Moses (U.S.) | United States |
| 1979 | M. Yifter (Africa) | M. Yifter (Africa) | K. Rono (Africa) | R. Nehemiah (U.S.) | E. Moses (U.S.) | Americas |
| 1981 | E. Coghlan (Eur.) | W. Schildhauer (E.Ger.) | B. Maminski (Eur.) | G. Foster (U.S.) | E. Moses (U.S.) | Europe |
| 1985 | D. Padilla (U.S.) | W. Buch (Africa) | J. Kariuki (Africa) | T. Campbell (U.S.) | A. Phillips (U.S.) | United States |
| 1989 | S. Aouita (Africa) | S. Antibo (Eur.) | J. Kariuki (Africa) | R. Kingdom (U.S.) | D. Patrick (U.S.) | United States |
| 1992 | F. Bayesa (Africa) | A. Abebe (Africa) | P. Barkutwo (Africa) | C. Jackson (U.K.) | S. Matete (Africa) | United States |
| 1994 | B. Lahlafi (Africa) | K. Skah (Africa) | M. Kiptanui (Africa) | T. Jarrett (Gr.Brit.) | S. Matete (Africa) | Great Britain |
| 1998 | D. Komen (Africa) | — | D. Kallabis (Ger.) | F. Balzer (Ger.) | S. Matete (Africa) | Great Britain |
| 2002 | A. Garcia (Spain) | — | W. Boit Kipketer (Africa) | A. Garcia (Amer.) | J. Carter (U.S.) | United States |
| | *4 × 400-m relays* | *Triple jump* | *High jump* | *Pole vault* | *Long jump* | *Shot put* |
| 1977 | West Germany | J. de Oliveira (Amer.) | R. Beilschmidt (E.Ger.) | M. Tully (U.S.) | A. Robinson (U.S.) | U. Beyer (E.Ger.) |
| 1979 | United States | J. de Oliveira (Amer.) | F. Jacobs (U.S.) | M. Tully (U.S.) | L. Myricks (U.S.) | U. Beyer (E.Ger.) |
| 1981 | United States | J. de Oliveira (Amer.) | T. Peacock (U.S.) | K. Volkov (U.S.S.R.) | C. Lewis (U.S.) | U. Beyer (E.Ger.) |
| 1985 | United States | W. Banks (U.S.) | P. Sjöberg (Eur.) | S. Bubka (U.S.S.R.) | M. Conley (U.S.) | U. Timmerman (E.Ger.) |
| 1989 | Americas | M. Conley (U.S.) | P. Sjöberg (Eur.) | P. Collet (Eur.) | L. Myricks (U.S.) | U. Timmermann (E.Ger.) |
| 1992 | Africa | J. Edwards (U.K.) | Y. Sergeyenko (U.T.*) | I. Potapovich (U.T.*) | I. Pedroso (Amer.) | M. Stulce (U.S.) |
| 1994 | Great Britain | Y. Quesada (Amer.) | J. Sotomayor (Amer.) | O. Brits (Africa) | F. Salle (Gr.Brit.) | C.J. Hunter (U.S.) |
| 1998 | United States | C. Friedek (Ger.) | C. Austin (U.S.) | M. Tarasov (Eur.) | I. Pedroso (Amer.) | J. Godina (U.S.) |
| 2002 | Americas | J. Edwards (Gr.Brit.) | Y. Rybakov (Eur.) | O. Brits (Africa) | S. Stringfellow (U.S.) | A. Nelson (U.S.) |
| | *Discus throw* | *Hammer throw* | *Javelin throw* | *Team* | | |
| 1977 | W. Schmidt (E.Ger.) | K.-H. Riehm (W.Ger.) | M. Wessing (W.Ger.) | East Germany | | |
| 1979 | W. Schmidt (E.Ger.) | S. Litvinov (U.S.S.R.) | W. Hanisch (W.Ger.) | United States | | |
| 1981 | A. Lemme (E.Ger.) | Yu. Sedykh (U.S.S.R.) | D. Kula (U.S.S.R.) | Europe | | |
| 1985 | G. Kolnootchenko (U.S.S.R.) | Yu. Tamm (U.S.S.R.) | U. Hohn (E.Ger.) | United States | | |
| 1989 | J. Schult (E.Ger.) | H. Weis (Eur.) | S. Backley (U.K.) | United States | | |
| 1992 | T. Washington (U.S.) | T. Gécsek (Eur.) | J. Zeleznv (Eur.) | Africa | | |
| 1994 | V. Dubrovshchik (Eur.) | A. Abduvaliyev (Asia) | S. Backley (Gr.Brit.) | Africa | | |
| 1998 | V. Alekna (Eur.) | T. Gécsek (Eur.) | S. Backley (Gr.Brit.) | Africa | | |
| 2002 | R. Fazekas (Eur.) | A. Annus (Eur.) | S. Makarov (Eur.) | Africa | | |

*Unified Team, consisting of athletes from the Commonwealth of Independent States plus Georgia.

**IAAF World Cup—women**

| | *100 m* | *200 m* | *400 m* | *800 m* | *1,500 m* | *3,000 m* |
|---|---|---|---|---|---|---|
| 1977 | M. Gelsner (E.Ger.) | I. Szewinska (Eur.) | I. Szewinska (Eur.) | T. Petrova (Eur.) | T. Kazankina (U.S.S.R.) | G. Waitz (Eur.) |
| 1979 | E. Ashford (U.S.) | E. Ashford (U.S.) | M. Koch (E.Ger.) | N. Shtereva (Eur.) | C. Wartenburg (E.Ger.) | S. Ulmasova (U.S.S.R.) |
| 1981 | E. Ashford (U.S.) | E. Ashford (U.S.) | J. Kratochvilová (Eur.) | L. Veselkova (U.S.S.R.) | T. Sorokina (U.S.S.R.) | A. Zauber (E.Ger.) |
| 1985 | M. Göhr (E.Ger.) | M. Koch (E.Ger.) | M. Koch (E.Ger.) | C. Wachtel (E.Ger.) | H. Körner (E.Ger.) | U. Bruns (E.Ger.) |
| 1989 | S. Echols (U.S.) | S. Möller (E.Ger.) | A. Quirot (Amer.) | A. Quirot (Amer.) | P. Ivan (Eur.) | Y. Murray (Eur.) |
| 1992 | N. Voronova (U.T.*) | M.-J. Pérec (Eur.) | J. Miles (U.S.) | M. Mutola (Africa) | Y. Podkopayeva (U.T.*) | D. Tulu (Africa) |
| 1994 | I. Privalova (Eur.) | M. Ottey (Amer.) | I. Privalova (Eur.) | M. Mutola (Africa) | H. Boulmerka (Africa) | Y. Murray (Gr.Brit.) |
| 1998 | M. Jones (U.S.) | M. Jones (U.S.) | F. Ogunkoya (Africa) | M. Mutola (Africa) | S. Masterkova (Russia) | G. Szabo (Eur.) |
| 2002 | M. Jones (U.S.) | D. Ferguson (Amer.) | A. Guevara (Amer.) | M. Mutola (Africa) | S. Ayhan (Eur.) | B. Adere (Africa) |
| | *5,000 m* | *10,000 m* | *100-m hurdles* | *400-m hurdles* | *4 × 100-m relays* | *4 × 400-m relays* |
| 1977 | — | — | G. Rabsztyn (Eur.) | — | Europe Select | East Germany |
| 1979 | — | — | G. Rabsztyn (Eur.) | B. Klepp (E.Ger.) | Europe Select | East Germany |
| 1981 | — | — | T. Anisimova (U.S.S.R.) | E. Neumann (E.Ger.) | East Germany | East Germany |
| 1985 | — | A. Cunha (Eur.) | C. Oschkenat (E.Ger.) | S. Busch (E.Ger.) | East Germany | East Germany |
| 1989 | — | K. Ullrich (E.Ger.) | C. Oschkenat (E.Ger.) | S. Farmer-Patrick (U.S.) | East Germany | Americas |
| 1992 | — | D. Tulu (Africa) | A. López (Amer.) | S. Farmer-Patrick (U.S.) | Asia | Americas |
| 1994 | — | E. Meyer (Africa) | A. López (Amer.) | S. Gunnell (Gr.Brit.) | Africa | Great Britain |
| 1998 | S. O'Sullivan (Eur.) | — | G. Alozie (Africa) | N. Bidouane (Africa) | United States | Germany |
| 2002 | O. Yegorova (Russia) | — | G. Devers (U.S.) | Y. Pechonkina (Russia) | Americas | Americas |
| | *Triple jump* | *High jump* | *Pole vault* | *Long jump* | *Shot put* | *Discus throw* |
| 1977 | — | R. Ackermann (E.Ger.) | — | L. Jacenko (Oceania) | H. Fibingerová (Eur.) | F. Melnik (U.S.S.R.) |
| 1979 | — | D. Brill (Amer.) | — | A. Stukane (U.S.S.R.) | I. Slupianek (E.Ger.) | E. Jahl (E.Ger.) |
| 1981 | — | U. Meyfarth (Eur.) | — | S. Ulbricht (E.Ger.) | I. Slupianek (E.Ger.) | E. Jahl (E.Ger.) |
| 1985 | — | S. Kostadinova (U.S.S.R.) | — | H. Daute Drechsler (E.Ger.) | N. Lisovskaya (U.S.S.R.) | M. Optiz (E.Ger.) |
| 1989 | — | S. Costa (Amer.) | — | G. Chistyakova (U.S.S.R.) | Zhihong Huang (Asia) | I. Wyludda (E.Ger.) |
| 1992 | — | I. Quintero (Amer.) | — | H. Drechsler (Ger.) | B. Laza (Amer.) | M. Marten (Amer.) |
| 1994 | A. Biryukova (Eur.) | B. Bilac (Eur.) | — | I. Kravets (Eur.) | Zhihong Huang (Asia) | I. Wyludda (Eur.) |
| 1998 | O. Vasdeki (Eur.) | M. Iagar-Dinescu (Eur.) | — | H. Drechsler (Ger.) | V. Pavlysh (Eur.) | F. Dietzsch (Ger.) |
| 2002 | F. Mbango Etone (Africa) | H. Cloete (Africa) | A. Becker (Ger.) | T. Kotova (Russia) | I. Korzhanenko (Russia) | B. Faumuina (Oceania) |
| | *Javelin throw* | *Team* | | | | |
| 1977 | R. Fuchs (E.Ger.) | Europe Select | | | | |
| 1979 | R. Fuchs (E.Ger.) | East Germany | | | | |
| 1981 | A. Todorova (Eur.) | East Germany | | | | |
| 1985 | O. Gavrilova (U.S.S.R.) | East Germany | | | | |
| 1989 | P. Felke (E.Ger.) | East Germany | | | | |
| 1992 | T. Sanderson (U.K.) | Unified Team* | | | | |
| 1994 | T. Hattestad (Eur.) | Europe | | | | |
| 1998 | J. Stone (Oceania) | United States | | | | |
| 2002 | O. Menéndez (Amer.) | Russia | | | | |

*Unified Team, consisting of athletes from the Commonwealth of Independent States plus Georgia.

## World Track-and-Field Championships—men

| | *100 m* | *200 m* | *400 m* | *800 m* | *1,500 m* | *5,000 m* |
|---|---|---|---|---|---|---|
| 1983 | C. Lewis (U.S.) | C. Smith (U.S.) | B. Cameron (Jam.) | W. Wülbeck (W.Ger.) | S. Cram (U.K.) | E. Coghlan (Ire.) |
| 1987 | B. Johnson (Can.) | C. Smith (U.S.) | T. Schoenlebe (E.Ger.) | B. Konchellah (Kenya) | A. Bile (Som.) | S. Aouita (Mor.) |
| 1991 | C. Lewis (U.S.) | M. Johnson (U.S.) | A. Pettigrew (U.S.) | B. Konchellah (Kenya) | N. Morceli (Alg.) | Y. Ondieki (Kenya) |
| 1993 | L. Christie (U.K.) | F. Fredericks (Namib.) | M. Johnson (U.S.) | P. Ruto (Kenya) | N. Morceli (Alg.) | I. Kirui (Kenya) |
| 1995 | D. Bailey (Can.) | M. Johnson (U.S.) | M. Johnson (U.S.) | W. Kipketer (Den.) | N. Morceli (Alg.) | I. Kirui (Kenya) |
| 1997 | M. Greene (U.S.) | A. Boldon (Trin.) | M. Johnson (U.S.) | W. Kipketer (Den.) | H. El Guerrouj (Mor.) | D. Komen (Kenya) |
| 1999 | M. Greene (U.S.) | M. Greene (U.S.) | M. Johnson (U.S.) | W. Kipketer (Den.) | H. El Guerrouj (Mor.) | S. Hissou (Mor.) |
| 2001 | M. Greene (U.S.) | K. Kederis (Greece) | A. Moncur (Bah.) | A. Bucher (Switz.) | H. El Guerrouj (Mor.) | R. Limo (Kenya) |
| 2003 | K. Collins (S.Kitts) | J. Capel (U.S.) | J. Young (U.S.) | D. Saïd-Guerni (Alg.) | H. El Guerrouj (Mor.) | E. Kipchoge (Kenya) |
| | *10,000 m* | *Steeplechase* | *110-m hurdles* | *400-m hurdles* | *Marathon* | *20-km walk* |
| 1983 | A. Cova (Italy) | P. Ilg (W.Ger.) | G. Foster (U.S.) | E. Moses (U.S.) | R. de Castella (Austl.) | E. Canto (Mex.) |
| 1987 | P. Kipkoech (Kenya) | F. Panetta (Italy) | G. Foster (U.S.) | E. Moses (U.S.) | O. Wakiihuru (Kenya) | M. Damilano (Italy) |
| 1991 | M. Tanui (Kenya) | M. Kiptanui (Kenya) | G. Foster (U.S.) | S. Matete (Zamb.) | Taniguchi H. (Japan) | M. Damilano (Italy) |
| 1993 | H. Gebrselassie (Eth.) | M. Kiptanui (Kenya) | C. Jackson (U.K.) | K. Young (U.S.) | M. Plaatjes (U.S.) | V. Massana (Spain) |
| 1995 | H. Gebrselassie (Eth.) | M. Kiptanui (Kenya) | A. Johnson (U.S.) | D. Adkins (U.S.) | M. Fiz (Spain) | M. Didoni (Italy) |
| 1997 | H. Gebrselassie (Eth.) | W.B. Kipketer (Kenya) | A. Johnson (U.S.) | S. Diagana (Fr.) | A. Antón (Spain) | D. Garcia (Mex.) |
| 1999 | H. Gebrselassie (Eth.) | C. Koskei (Kenya) | C. Jackson (U.K.) | F. Mori (Italy) | A. Antón (Spain) | I. Markov (Russia) |
| 2001 | C. Kamathi (Kenya) | R. Kosgei (Kenya) | A. Johnson (U.S.) | F. Sánchez (Dom.Rep.) | G. Abera (Eth.) | R. Rasskazov (Russia) |
| 2003 | K. Bekele (Eth.) | S.S. Shaheen (Qatar) | A. Johnson (U.S.) | F. Sánchez (Dom.Rep.) | J. Gharib (Mor.) | J. Pérez (Ecua.) |
| | *50-km walk* | *4 × 100-m relay* | *4 × 400-m relay* | *High jump* | *Pole vault* | *Long jump* |
| 1983 | R. Weigel (E.Ger.) | United States | U.S.S.R. | G. Avdeyenko (U.S.S.R.) | S. Bubka (U.S.S.R.) | C. Lewis (U.S.) |
| 1987 | H. Gauder (E.Ger.) | United States | United States | P. Sjöberg (Swed.) | S. Bubka (U.S.S.R.) | C. Lewis (U.S.) |
| 1991 | A. Potashov (U.S.S.R.) | United States | United Kingdom | C. Austin (U.S.) | S. Bubka (U.S.S.R.) | M. Powell (U.S.) |
| 1993 | J.A. Garcia (Spain) | United States | United States | J. Sotomayor (Cuba) | S. Bubka (Ukr.) | M. Powell (U.S.) |
| 1995 | V. Kononen (Fin.) | Canada | United States | T. Kemp (Bahamas) | S. Bubka (Ukr.) | I. Pedroso (Cuba) |
| 1997 | R. Korzeniowski (Pol.) | Canada | United States | J. Sotomayor (Cuba) | S. Bubka (Ukr.) | I. Pedroso (Cuba) |
| 1999 | G. Skurygin (Russia) | United States | United States | V. Voronin (Russia) | M. Tarasov (Russia) | I. Pedroso (Cuba) |
| 2001 | R. Korzeniowski (Pol.) | United States | United States | M. Buss (Ger.) | D. Markov (Austl.) | I. Pedroso (Cuba) |
| 2003 | R. Korzeniowski (Pol.) | United States | United States | J. Freitag (S.Af.) | G. Gibilisco (Italy) | D. Phillips (U.S.) |
| | *Triple jump* | *Shot put* | *Discus throw* | *Hammer throw* | *Javelin throw* | *Decathlon* |
| 1983 | Z. Hoffman (Pol.) | E. Sarul (Pol.) | I. Bugar (Czech.) | S. Litvinov (U.S.S.R.) | D. Michel (E.Ger.) | D. Thompson (U.K.) |
| 1987 | C. Markov (Bulg.) | W. Günthör (Switz.) | J. Schult (E.Ger.) | S. Litvinov (U.S.S.R.) | S. Raty (Fin.) | T. Voss (E.Ger.) |
| 1991 | K. Harrison (U.S.) | W. Günthör (Switz.) | L. Riedel (Ger.) | Y. Sedykh (U.S.S.R.) | K. Kinnunen (Fin.) | D. O'Brien (U.S.) |
| 1993 | M. Conley (U.S.) | W. Günthör (Switz.) | L. Riedel (Ger.) | A. Abduvaliyev (Tajik.) | J. Zelezny (Cz.Rep.) | D. O'Brien (U.S.) |
| 1995 | J. Edwards (U.K.) | J. Godina (U.S.) | L. Riedel (Ger.) | A. Abduvaliyev (Tajik.) | J. Zelezny (Cz.Rep.) | D. O'Brien (U.S.) |
| 1997 | Y. Quesada (Cuba) | J. Godina (U.S.) | L. Riedel (Ger.) | H. Weis (Ger.) | M. Corbett (S.Af.) | T. Dvorak (Cz.Rep.) |
| 1999 | C.M. Friedek (Ger.) | C.J. Hunter (U.S.) | A. Washington (U.S.) | K. Kobs (Ger.) | A. Parviainen (Fin.) | T. Dvorak (Cz.Rep.) |
| 2001 | J. Edwards (U.K.) | J. Godina (U.S.) | L. Riedel (Ger.) | S. Ziolkowski (Pol.) | J. Zelezny (Cz.Rep.) | T. Dvorak (Cz.Rep.) |
| 2003 | C. Olsson (Swed.) | A. Mikhnevich (Bela.) | V. Alekna (Lith.) | I. Tikhon (Bela.) | S. Makarov (Russia) | T. Pappas (U.S.) |

## World Track-and-Field Championships—women

| | *100 m* | *200 m* | *400 m* | *800 m* | *1,500 m* | *3,000 m* |
|---|---|---|---|---|---|---|
| 1983 | M. Göhr (E.Ger.) | M. Koch (E.Ger.) | J. Kratochvílová (Czech.) | J. Kratochvílová (Czech.) | M. Decker (U.S.) | M. Decker (U.S.) |
| 1987 | S. Gladisch (E.Ger.) | S. Gladisch (E.Ger.) | O. Bryzgina (U.S.S.R.) | S. Wodars (E.Ger.) | T. Samolenko (U.S.S.R.) | T. Samolenko (U.S.S.R.) |
| 1991 | K. Krabbe (Ger.) | K. Krabbe (Ger.) | M.-J. Pérec (Fr.) | L. Nurutdinova (U.S.S.R.) | H. Boulmerka (Alg.) | T. Dorovskikh (U.S.S.R.) |
| 1993 | G. Devers (U.S.) | M. Ottey (Jam.) | J. Miles (U.S.) | M. Mutola (Mozam.) | Liu Dong (China) | Qu Yunxia (China) |
| 1995 | G. Torrence (U.S.) | M. Ottey (Jam.) | M.-J. Pérec (Fr.) | A. Quirot (Cuba) | H. Boulmerka (Alg.) | S. O'Sullivan (Ire.) |
| 1997 | M. Jones (U.S.) | Z. Pintusevich (Ukr.) | C. Freeman (Austl.) | A. Quirot (Cuba) | C. Sacramento (Port.) | G. Szabo (Rom.) |
| 1999 | M. Jones (U.S.) | I. Miller (U.S.) | C. Freeman (Austl.) | L. Formanova (Cz.Rep.) | S. Masterkova (Russia) | G. Szabo (Rom.) |
| 2001 | Z. Pintusevich (Ukr.) | M. Jones (U.S.) | A. Mbacke Thiam (Seneg.) | M. Mutola (Mozam.) | G. Szabo (Rom.) | O. Yegorova (Russia) |
| 2003 | T. Edwards (U.S.)§ | A. Kapachinskaya (Russia)§ | A. Guevara (Mex.) | M. Mutola (Mozam.) | T. Tomashova (Russia) | T. Dibaba (Eth.) |
| | *10,000 m** | *100-m hurdles* | *400-m hurdles* | *Marathon* | *10-km walk** | *20-km walk‡* |
| 1983 | — | B. Jahn (E.Ger.) | Ye. Fesenko (U.S.S.R.) | G. Waltz (Nor.) | — | — |
| 1987 | I. Kristiansen (Nor.) | G. Zagorcheva (Bul.) | S. Busch (E.Ger.) | R. Mota (Port.) | I. Strakhova (U.S.S.R.) | — |
| 1991 | L. McColgan (U.K.) | L. Narozhilenko (U.S.S.R.) | T. Ledovskaya (U.S.S.R.) | W. Panfil (Pol.) | A. Ivanova (U.S.S.R.) | — |
| 1993 | Wang Junxia (China) | G. Devers (U.S.) | S. Gunnell (U.K.) | Asari Junko (Japan) | S. Essayeh (Fin.) | — |
| 1995 | F. Ribeiro (Port.) | G. Devers (U.S.) | K. Batten (U.S.) | M. Machado (Port.) | I. Stankina (Rus.) | — |
| 1997 | S. Barsosio (Kenya) | L. Engquist (Swed.) | N. Bidouane (Mor.) | H. Suzuki (Japan) | A. Sidoti (Italy) | — |
| 1999 | G. Wami (Eth.) | G. Devers (U.S.) | D. Pernia (Cuba) | Jong Song Ok (N.Kor.) | — | Liu Hongyu (China) |
| 2001 | D. Tulu (Eth.) | A. Kirkland (U.S.) | N. Bidouane (Mor.) | L. Simon (Rom.) | — | O. Ivanova (Russia) |
| 2003 | B. Adere (Eth.) | P. Felicien (Can.) | J. Pittman (Austl.) | C. Ndereba (Kenya) | — | Ye. Nikolayeva (Russia) |
| | *4 × 100-m relay* | *4 × 400-m relay* | *High jump* | *Pole vault‡* | *Long jump* | *Triple jump†* |
| 1983 | East Germany | East Germany | T. Bykova (U.S.S.R.) | — | H. Daute (E.Ger.) | — |
| 1987 | United States | East Germany | S. Kostadinova (Bulg.) | — | J. Joyner-Kersee (U.S.) | — |
| 1991 | Jamaica | U.S.S.R. | H. Henkel (Ger.) | — | J. Joyner-Kersee (U.S.) | — |
| 1993 | Russia | United States | I. Quintero (Cuba) | — | H. Drechsler (Ger.) | A. Biryukova (Russia) |
| 1995 | United States | United States | S. Kostadinova (Bul.) | — | F. May (Italy) | I. Kravets (Ukr.) |
| 1997 | United States | Germany | H. Haugland (Nor.) | — | L. Galkina (Russia) | S. Kasparkova (Cz.Rep.) |
| 1999 | Bahamas | Russia | I. Babakova (Ukr.) | S. Dragila (U.S.) | N. Montalvo (Spain) | P. Tsiamita (Greece) |
| 2001 | United States | Jamaica | H. Cloete (S.Af.) | S. Dragila (U.S.) | F. May (Italy) | T. Lebedeva (Russia) |
| 2003 | France | United States | H. Cloete (S.Af.) | S. Feofanova (Russia) | E. Barber (Fr.) | T. Lebedeva (Russia) |
| | *Shot put* | *Discus throw* | *Hammer throw‡* | *Javelin throw* | *Heptathlon* | |
| 1983 | H. Fibingerová (Czech.) | M. Opitz (E.Ger.) | — | T. Lillak (Fin.) | R. Neubert (E.Ger.) | |
| 1987 | N. Lisovskaya (U.S.S.R.) | M. Hellmann (E.Ger.) | — | F. Whitbread (U.K.) | J. Joyner-Kersee (U.S.) | |
| 1991 | Huang Zhihong (China) | T. Khristova (Bulg.) | — | Xu Demei (China) | S. Braun (Ger.) | |
| 1993 | Huang Zhihong (China) | O. Burova (Russia) | — | T. Hattestad (Nor.) | J. Joyner-Kersee (U.S.) | |
| 1995 | A. Kumbernuss (Ger.) | E. Zvereva (Bel.) | — | N. Shikolenko (Bel.) | G. Shouaa (Syria) | |
| 1997 | A. Kumbernuss (Ger.) | B. Faumuina (N.Z.) | — | T. Hattestad (Nor.) | S. Braun (Ger.) | |
| 1999 | A. Kumbernuss (Ger.) | F. Dietzsch (Ger.) | M. Melinte (Rom.) | M. Tzelili (Greece) | E. Barber (Fr.) | |
| 2001 | Y. Korolchik (Bela.) | N. Sadova (Russia) | Y. Moreno (Cuba) | O. Menéndez (Cuba) | Y. Prokhorova (Russia) | |
| 2003 | S. Krivelyova (Russia) | I. Yachenko (Bela.) | Y. Moreno (Cuba) | M. Manjani (Greece) | C. Klüft (Swed.) | |

*Event added in 1987. †Event added in 1993. ‡Event added in 1999. §Original winner disqualified after failed drug test.

**Boston Marathon**

| year | men* | h:min:s | year | men* | h:min:s | year | men* | h:min:s | women* | h:min:s |
|---|---|---|---|---|---|---|---|---|---|---|
| 1897 | J.J. McDermott | 2:55:10 | 1935 | J.A. Kelley | 2:32:07 | 1969 | Unetani Y. (Japan) | 2:13:49 | | |
| 1898 | R.J. McDonald (Can.) | 2:42:00 | 1936 | E.M. Brown | 2:33:40 | 1970 | R. Hill (Eng.) | 2:10:30 | | |
| 1899 | L.J. Brignoli | 2:54:38 | 1937 | W. Young (Can.) | 2:33:20 | 1971 | A. Mejia (Colom.) | 2:18:45 | | |
| 1900 | J.J. Caffrey (Can.) | 2:39:44 | 1938 | L. Pawson | 2:35:34 | 1972 | O. Suomalainen (Fin.) | 2:15:30 | N. Kuscsik | 3:10:26 |
| 1901 | J.J. Caffrey (Can.) | 2:29:23 | 1939 | E.M. Brown | 2:28:51 | 1973 | I. Anderson | 2:16:03 | J. Hansen | 3:05:59 |
| 1902 | S.A. Mellor | 2:43:12 | 1940 | G. Cote (Can.) | 2:28:28 | 1974 | N. Cusack | 2:13:39 | M. Gorman | 2:47:11 |
| 1903 | J.C. Lorden | 2:41:29 | 1941 | L. Pawson | 2:30:38 | 1975 | B. Rodgers | 2:09:55 | L. Winter (W.Ger.) | 2:42:24 |
| 1904 | M. Spring | 2:39:04 | 1942 | J. Smith | 2:26:51 | 1976 | J. Fultz | 2:20:19 | K. Merritt | 2:47:10 |
| 1905 | F. Lorz | 2:38:25 | 1943 | G. Cote (Can.) | 2:28:25 | 1977 | J. Drayton (Can.) | 2:14:46 | M. Gorman | 2:46:22 |
| 1906 | T. Ford | 2:45:45 | 1944 | G. Cote (Can.) | 2:31:50 | 1978 | B. Rodgers | 2:10:13 | G. Barron | 2:44:52 |
| 1907 | T. Longboat (Can.) | 2:24:24 | 1945 | J.A. Kelley | 2:30:40 | 1979 | B. Rodgers | 2:09:27 | J. Benoit | 2:35:15 |
| 1908 | T.P. Morrissey | 2:25:43 | 1946 | S. Kyriakides | | 1980 | B. Rodgers | 2:12:11 | J. Gareau (Can.) | 2:34:28 |
| 1909 | H. Renaud | 2:53:36 | | (Greece) | 2:29:27 | 1981 | Seko T. (Japan) | 2:09:26 | A. Roe (N.Z.) | 2:26:46 |
| 1910 | F.L. Cameron (Can.) | 2:28:52 | 1947 | Suh Yun Bok (Korea) | 2:25:39 | 1982 | A. Salazar | 2:08:51 | C. Teske (W.Ger.) | 2:29:33 |
| 1911 | C.H. DeMar | 2:21:39 | 1948 | G. Cote (Can.) | 2:31:02 | 1983 | G.A. Meyer | 2:09:00 | J. Benoit | 2:22:42 |
| 1912 | M.J. Ryan | 2:21:18 | 1949 | K.G. Leandersson | | 1984 | G. Smith (Eng.) | 2:10:34 | L. Moller (N.Z.) | 2:29:28 |
| 1913 | F. Carlson | 2:25:14 | | (Swed.) | 2:31:50 | 1985 | G. Smith (Eng.) | 2:14:05 | L. Larsen | 2:34:06 |
| 1914 | J. Duffy (Can.) | 2:25:01 | 1950 | Ham Kee Yong (Korea) | 2:32:39 | 1986 | R. de Castella (Austl.) | 2:07:51 | I. Kristiansen (Nor.) | 2:24:55 |
| 1915 | E. Fabre (Can.) | 2:31:41 | 1951 | Tanaka S. (Japan) | 2:27:45 | 1987 | Seko T. (Japan) | 2:11:50 | R. Mota (Port.) | 2:25:21 |
| 1916 | A.V. Roth | 2:27:16 | 1952 | D. Flores (Guat.) | 2:31:53 | 1988 | I. Hussein (Kenya) | 2:08:43 | R. Mota (Port.) | 2:24:30 |
| 1917 | W.K. Kennedy | 2:28:37 | 1953 | Yamada K. (Japan) | 2:18:51 | 1989 | A. Mekonnen (Eth.) | 2:09:06 | I. Kristiansen (Nor.) | 2:24:33 |
| 1918 | no regular competition | | 1954 | V.L. Karanen (Fin.) | 2:20:39 | 1990 | G. Bordin (Italy) | 2:08:19 | R. Mota (Port.) | 2:25:23 |
| 1919 | C.W.A. Linder | 2:29:13 | 1955 | Hamamura H. (Japan) | 2:18:22 | 1991 | I. Hussein (Kenya) | 2:11:06 | W. Pantil (Pol.) | 2:24:18 |
| 1920 | P. Trivoulides (Greece) | 2:29:31 | 1956 | A. Vilari (Fin.) | 2:14:14 | 1992 | I. Hussein (Kenya) | 2:08:14 | O. Markova (Russia) | 2:23:43 |
| 1921 | F. Zuna | 2:18:57 | 1957 | J.J. Kelley | 2:20:05 | 1993 | C. N'Deti (Kenya) | 2:09:33 | O. Markova (Russia) | 2:25:27 |
| 1922 | C.H. DeMar | 2:18:10 | 1958 | F. Mihalic (Yugos.) | 2:25:54 | 1994 | C. N'Deti (Kenya) | 2:07:15 | U. Pippig (Ger.) | 2:21:45 |
| 1923 | C.H. DeMar | 2:23:47 | 1959 | E. Oksanen (Fin.) | 2:22:42 | 1995 | C. N'Deti (Kenya) | 2:09:22 | U. Pippig (Ger.) | 2:25:11 |
| 1924 | C.H. DeMar | 2:29:40 | 1960 | P. Kotila (Fin.) | 2:20:54 | 1996 | M. Tanui (Kenya) | 2:09:16 | U. Pippig (Ger.) | 2:27:12 |
| 1925 | C.L. Mellor | 2:33:06 | 1961 | E. Oksanen (Fin.) | 2:23:39 | 1997 | L. Aguta (Kenya) | 2:10:34 | F. Roba (Eth.) | 2:26:23 |
| 1926 | J.C. Miles (Can.) | 2:25:40 | 1962 | E. Oksanen (Fin.) | 2:23:48 | 1998 | M. Tanui (Kenya) | 2:07:34 | F. Roba (Eth.) | 2:23:21 |
| 1927 | C.H. DeMar | 2:40:22 | 1963 | A. Vandendriessche | | 1999 | J. Chebet (Kenya) | 2:09:52 | F. Roba (Eth.) | 2:23:25 |
| 1928 | C.H. DeMar | 2:37:07 | | (Belg.) | 2:18:58 | 2000 | E. Lagat (Kenya) | 2:09:47 | C. Ndereba (Kenya) | 2:26:11 |
| 1929 | J.C. Miles (Can.) | 2:33:08 | 1964 | A. Vandendriessche | | 2001 | B.-J. Lee (S.Kor.) | 2:09:43 | C. Ndereba (Kenya) | 2:23:53 |
| 1930 | C.H. DeMar | 2:34:48 | | (Belg.) | 2:19:59 | 2002 | R. Rop (Kenya) | 2:09:02 | M. Okayo (Kenya) | 2:20:43 |
| 1931 | J.P. Hennigan | 2:46:45 | 1965 | Shigematsu M. (Japan) | 2:16:33 | 2003 | R.K. Cheruiyot (Kenya) | 2:10:11 | S. Zakharova (Russia) | 2:25:20 |
| 1932 | P. deBruyn | 2:33:36 | 1966 | Kimihara K. (Japan) | 2:17:11 | 2004 | T. Cherigat (Kenya) | 2:10:37 | C. Ndereba (Kenya) | 2:24:27 |
| 1933 | L. Pawson | 2:31:01 | 1967 | D. McKenzie (N.Z.) | 2:15:45 | | | | | |
| 1934 | D. Komonen (Can.) | 2:32:53 | 1968 | A. Burfoot | 2:22:17 | | | | | |

*Won by a U.S. runner except as indicated.

**New York Marathon**

| year | men* | h:min:s | women* | h:min:s | year | men* | h:min:s | women* | h:min:s |
|---|---|---|---|---|---|---|---|---|---|
| 1970 | G. Muhrcke | 2:31:38 | no finisher | | 1987 | I. Hussein (Kenya) | 2:11:01 | P. Welch (U.K.) | 2:30:17 |
| 1971 | N. Higgins | 2:22:54 | B. Bonner | 2:55:22 | 1988 | S. Jones (Wales) | 2:08:20 | G. Waitz (Nor.) | 2:28:07 |
| 1972 | S. Karlin | 2:27:52 | N. Kuscsik | 3:08:41 | 1989 | J. Ikangaa (Tanz.) | 2:08:01 | I. Kristiansen (Nor.) | 2:25:30 |
| 1973 | T. Fleming | 2:21:54 | N. Kuscsik | 2:57:07 | 1990 | D. Wakiihuri (Kenya) | 2:12:39 | W. Pantil (Pol.) | 2:30:45 |
| 1974 | N. Sander | 2:26:30 | K. Switzer | 3:07:29 | 1991 | S. Garcia (Mex.) | 2:09:28 | L. McColgan (Scot.) | 2:27:23 |
| 1975 | T. Fleming | 2:19:27 | K. Merritt | 2:46:14 | 1992 | W. Mtolo (S.Afr.) | 2:09:29 | L. Ondieki (Austl.) | 2:24:40 |
| 1976 | B. Rodgers | 2:10:30 | M. Gorman | 2:39:11 | 1993 | A. Espinosa (Mex.) | 2:10:04 | U. Pippig (Ger.) | 2:26:24 |
| 1977 | B. Rodgers | 2:11:28 | M. Gorman | 2:43:54 | 1994 | G. Silva (Mex.) | 2:11:21 | T. Loroupe (Kenya) | 2:27:37 |
| 1978 | B. Rodgers | 2:12:12 | G. Waitz (Nor.) | 2:32:30 | 1995 | G. Silva (Mex.) | 2:11:00 | T. Loroupe (Kenya) | 2:28:06 |
| 1979 | B. Rodgers | 2:11:42 | G. Waitz (Nor.) | 2:27:33 | 1996 | G. Leone (Italy) | 2:09:54 | A. Catuna (Rom.) | 2:28:18 |
| 1980 | A. Salazar | 2:09:41 | G. Waitz (Nor.) | 2:25:41 | 1997 | J. Kagwe (Kenya) | 2:08:12 | F. Rochat-Moser (Switz.) | 2:28:43 |
| 1981 | A. Salazar | 2:08:13 | A. Roe (N.Z.) | 2:25:29 | 1998 | J. Kagwe (Kenya) | 2:08:45 | F. Fiacconi (Italy) | 2:25:17 |
| 1982 | A. Salazar | 2:09:29 | G. Waitz (Nor.) | 2:27:14 | 1999 | J. Chebet (Kenya) | 2:09:14 | A. Fernández (Mex.) | 2:25:06 |
| 1983 | R. Dixon | 2:08:59 | G. Waitz (Nor.) | 2:27:00 | 2000 | A. El Mouaziz (Mor.) | 2:10:09 | L. Petrova (Russia) | 2:25:45 |
| 1984 | O. Pizzolato | 2:14:53 | G. Waitz (Nor.) | 2:29:30 | 2001 | T. Jifar (Eth.) | 2:07:43 | M. Okayo (Kenya) | 2:24:21 |
| 1985 | O. Pizzolato | 2:11:34 | G. Waitz (Nor.) | 2:28:34 | 2002 | R. Rop (Kenya) | 2:08:07 | J. Chepchumba (Kenya) | 2:25:56 |
| 1986 | G. Poli (Italy) | 2:11:06 | G. Waitz (Nor.) | 2:28:06 | 2003 | M. Lel (Kenya) | 2:10:30 | M. Okayo (Kenya) | 2:22:31 |

*Won by a U.S. runner except as indicated.

## AUTOMOBILE RACING

Of the various types of automobile races, the closed-circuit, or speedway, course was largely developed in the United States. The Indianapolis 500—which is now the premiere event of the Indy Racing League (IRL) championship series—was first run in 1911. A low-slung, fenderless (open-wheel) car—called an Indy car—is essential for this race; its suspension is as important to a car's performance as its turbocharged engine. Often the chassis manufacturer is different from the engine manufacturer, resulting in cars identified, for example, as a Brabham/Repco. In such cases the chassis-maker is listed first, and the chassis-maker receives any money or awards that the car may win.

Indy car racing began in 1909, when the American Automobile Association (AAA) began sponsoring a 24-race championship series, including three races at the newly opened Indianapolis Motor Speedway. In 1956 the AAA gave up its involvement with auto racing, and the United States Auto Club (USAC) was organized as the sport's governing body. In 1978 two race-car owners broke away from USAC to form a new organization, Championship Auto Racing Teams, Inc. (CART), which sponsored its own series of races. In 1980 CART and USAC joined to form the Championship Racing League, which dissolved after five races. Subsequently CART oversaw all Indy car racing, with the exception of the Indianapolis 500. In 1997 the IRL gained sponsorship of the race and began to challenge CART's dominance.

The standard cars used for Grand Prix road (*i.e.*, closed highway) racing are known as Formula One (or F-1) cars because they are built according to an evolving formula that was established after World War I by the Fédération Internationale de l'Automobile (FIA). Like the Indy car, the Formula One racer is open-wheeled and low-slung, but the F-1 is slightly smaller and more maneuverable.

There are approximately 17 Grand Prix events held worldwide throughout the year. Drivers compete for the World Championship of Drivers (inaugurated in 1950).

Many Grand Prix drivers participate in various endurance races, the most famous of which is the Le Mans Grand Prix d'Endurance, held on the 13.4-kilometre Sarthe circuit, Le Mans, Fr.

Another type of popular driving event is the rally, which was established in 1907. More than 35 such competitions, over a specified route on public roads, take place yearly throughout the world. The classic occasion for rally driving is the Rallye Automobile Monte-Carlo, now started in various European cities with Monaco as its terminal point.

Stock car racing, which began in the United States in the first half of the 20th century, involves the racing of commercial cars that have been altered to increase their speed and maneuverability. The National Association for Stock Car Auto Racing (NASCAR) was founded in 1947 and awards the Nextel Cup to the driver who has achieved the greatest number of points over the stock car racing season. The Daytona 500 is the premiere stock car event.

**Indianapolis 500**

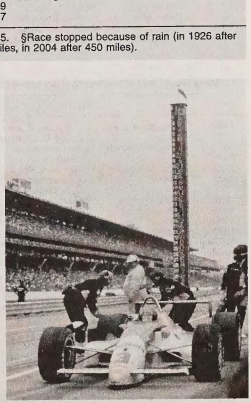
| year | winner* | avg. speed in mph | year | winner* | avg. speed in mph | year | winner* | avg. speed in mph | year | winner* | avg. speed in mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1911 | R. Harroun | 74.602 | 1935 | K. Petillo | 106.240 | 1961 | A.J. Foyt | 139.131 | 1984 | R. Mears | 163.612 |
| 1912 | J. Dawson | 78.719 | 1936 | L. Meyer | 109.069 | 1962 | R. Ward | 140.293 | 1985 | D. Sullivan | 152.982 |
| 1913 | J. Goux (Fr.) | 75.933 | 1937 | W. Shaw | 113.580 | 1963 | P. Jones | 143.137 | 1986 | B. Rahal | 170.722 |
| 1914 | R. Thomas (Fr.) | 82.474 | 1938 | F. Roberts | 117.200 | 1964 | A.J. Foyt | 147.350 | 1987 | A. Unser | 162.175 |
| 1915 | R. DePalma | 89.840 | 1939 | W. Shaw | 115.035 | 1965 | J. Clark (U.K.) | 150.686 | 1988 | R. Mears | 144.809 |
| 1916† | D. Resta (Fr.) | 84.001 | 1940 | W. Shaw | 114.277 | 1966 | G. Hill (U.K.) | 144.317 | 1989 | E. Fittipaldi (Braz.) | 167.581 |
| 1919‡ | H. Wilcox | 88.050 | 1941 | F. Davis, M. Rose | 115.117 | 1967 | A.J. Foyt | 151.207 | 1990 | A. Luyendyk (Neth.) | 185.984 |
| 1920 | G. Chevrolet | 88.618 | | | | 1968 | B. Unser | 152.882 | 1991 | R. Mears | 176.457 |
| 1921 | T. Milton | 89.621 | 1946‡ | G. Robson | 114.820 | 1969 | M. Andretti | 156.867 | 1992 | A. Unser, Jr. | 134.479 |
| 1922 | J. Murphy | 94.484 | 1947 | M. Rose | 116.338 | 1970 | A. Unser | 155.749 | 1993 | E. Fittipaldi (Braz.) | 157.207 |
| 1923 | T. Milton | 90.954 | 1948 | M. Rose | 119.814 | 1971 | A. Unser | 157.735 | 1994 | A. Unser, Jr. | 160.872 |
| 1924 | L.L. Corum, J. Boyer | 98.234 | 1949 | W. Holland | 121.327 | 1972 | M. Donohue | 162.962 | 1995 | J. Villeneuve (Can.) | 153.616 |
| 1925 | P. DePaolo | 101.127 | 1950§ | J. Parsons | 124.002 | 1973§ | G. Johncock | 159.036 | 1996 | B. Lazier | 147.956 |
| 1926§ | F. Lockhart | 95.904 | 1951 | L. Wallard | 126.244 | 1974 | J. Rutherford | 158.589 | 1997 | A. Luyendyk (Neth.) | 145.827 |
| 1927 | G. Souders | 97.545 | 1952 | T. Ruttman | 128.922 | 1975§ | B. Unser | 149.213 | 1998 | E. Cheever, Jr. | 145.155 |
| 1928 | L. Meyer | 99.482 | 1953 | B. Vukovich | 128.740 | 1976§ | J. Rutherford | 148.725 | 1999 | K. Brack (Swed.) | 153.176 |
| 1929 | R. Keech | 97.585 | 1954 | B. Vukovich | 130.840 | 1977 | A.J. Foyt | 161.331 | 2000 | J. Montoya (Colom.) | 167.607 |
| 1930 | W. Arnold | 100.448 | 1955 | R. Sweikert | 128.209 | 1978 | A. Unser | 161.363 | 2001 | H. Castroneves (Braz.) | 153.601 |
| 1931 | L. Schneider | 96.629 | 1956 | P. Flaherty | 128.490 | 1979 | R. Mears | 158.899 | 2002 | H. Castroneves (Braz.) | 166.499 |
| 1932 | F. Frame | 104.144 | 1957 | S. Hanks | 135.601 | 1980 | J. Rutherford | 142.862 | 2003 | G. de Ferran (Braz.) | 156.291 |
| 1933 | L. Meyer | 104.162 | 1959 | R. Ward | 135.857 | 1981 | B. Unser | 139.084 | 2004§ | B. Rice | 138.518 |
| 1934 | W. Cummings | 104.863 | 1960 | J. Rathmann | 138.767 | 1983 | T. Sneva | 162.117 | | | |

*Won by U.S. racer except as indicated. †Scheduled 300-mile race. ‡No competition 1917–18; 1942–45. §Race stopped because of rain (in 1926 after 400 miles, in 1950 after 345 miles, in 1973 after 332.5 miles, in 1975 after 435 miles, in 1976 after 255 miles, in 2004 after 450 miles).

**Indy Car Champion**

| year | driver* | year | driver* | year | driver* | year | driver* |
|---|---|---|---|---|---|---|---|
| AAA | | | | | | | |
| 1909 | G. Robertson | 1920 | T. Milton | 1931 | L. Schneider | 1946† | T. Horn |
| 1910 | R. Harroun | 1921 | T. Milton | 1932 | R. Carey | 1947 | T. Horn |
| 1911 | R. Mulford | 1922 | J. Murphy | 1933 | L. Meyer | 1948 | T. Horn |
| 1912 | R. DePalma | 1923 | E. Hearne | 1934 | W. Cummings | 1949 | J. Parsons |
| 1913 | E. Cooper | 1924 | J. Murphy | 1935 | K. Petillo | 1950 | H. Banks |
| 1914 | R. DePalma | 1925 | P. DePaolo | 1936 | M. Rose | 1951 | T. Bettenhausen |
| 1915 | E. Cooper | 1926 | H. Hartz | 1937 | W. Shaw | 1952 | C. Stevenson |
| 1916 | D. Resta | 1927 | P. DePaolo | 1938 | F. Roberts | 1953 | S. Hanks |
| 1917 | E. Cooper | 1928 | L. Meyer | 1939 | W. Shaw | 1954 | J. Bryan |
| 1918 | R. Mulford | 1929 | L. Meyer | 1940 | R. Mays | 1955 | R. Sweikert |
| 1919 | H. Wilcox | 1930 | W. Arnold | 1941 | R. Mays | | |
| USAC | | | | | | | |
| 1956 | J. Bryan | 1962 | R. Ward | 1968 | B. Unser | 1974 | B. Unser |
| 1957 | J. Bryan | 1963 | A.J. Foyt | 1969 | M. Andretti | 1975 | A.J. Foyt |
| 1958 | T. Bettenhausen | 1964 | A.J. Foyt | 1970 | A. Unser | 1976 | G. Johncock |
| 1959 | R. Ward | 1965 | M. Andretti | 1971 | J. Leonard | 1977 | T. Sneva |
| 1960 | A.J. Foyt | 1966 | M. Andretti | 1972 | J. Leonard | 1978 | T. Sneva |
| 1961 | A.J. Foyt | 1967 | A.J. Foyt | 1973 | R. McCluskey | 1979 | A.J. Foyt |
| CART | | | | | | | |
| 1979 | R. Mears | 1986 | B. Rahal | 1992 | B. Rahal | 1998 | A. Zanardi (Italy) |
| 1980 | J. Rutherford | 1987 | B. Rahal | 1993 | N. Mansell (U.K.) | 1999 | J. Montoya (Colom.) |
| 1981 | R. Mears | 1988 | D. Sullivan | 1994 | A. Unser, Jr. | | |
| 1982 | R. Mears | 1989 | E. Fittipaldi (Braz.) | 1995 | J. Villeneuve (Can.) | 2000 | G. de Ferran (Fr.) |
| 1983 | A. Unser | | | | | 2001 | G. de Ferran (Fr.) |
| 1984 | M. Andretti | 1990 | A. Unser, Jr. | 1996 | J. Vasser | 2002 | C. da Matta (Braz.) |
| 1985 | A. Unser | 1991 | Mi. Andretti | 1997 | A. Zanardi (Italy) | 2003 | P. Tracy (Can.) |
| IRL | | | | | | | |
| 1996 | S. Sharp, B. Calkins | 1998 | K. Brack (Swed.) | 2000 | B. Lazier | 2003 | S. Dixon (N.Z.) |
| 1997 | T. Stewart | 1999 | G. Ray | 2001 | S. Hornish, Jr. | | |
| | | | | 2002 | S. Hornish, Jr. | | |

*Won by U.S. racer except as indicated. †No competition 1942–45.



Rick Mears making a pit stop during the 1991 Indianapolis 500; that year he won for the fourth time

Duomo/Richard Dole

**World Championship of Drivers**

| year | winner | car* | year | winner | car* | year | winner | car* |
|---|---|---|---|---|---|---|---|---|
| 1950 | G. Farina (Italy) | Alfa Romeo | 1968 | G. Hill (U.K.) | Lotus/Ford | 1986 | A. Prost (Fr.) | McLaren/Porsche-TAG |
| 1951 | J. Fangio (Arg.) | Alfa Romeo | 1969 | J. Stewart (U.K.) | Matra/Ford | 1987 | N. Piquet (Braz.) | Williams/Honda |
| 1952 | A. Ascari (Italy) | Ferrari | 1970 | J. Rindt (Austria) | Lotus/Ford | 1988 | A. Senna (Braz.) | McLaren/Honda |
| 1953 | A. Ascari (Italy) | Ferrari | 1971 | J. Stewart (U.K.) | Tyrrell/Ford | 1989 | A. Prost (Fr.) | McLaren/Honda |
| 1954 | J. Fangio (Arg.) | Mercedes & Maserati | 1972 | E. Fittipaldi (Braz.) | John Player Special/Ford | 1990 | A. Senna (Braz.) | McLaren/Honda |
| 1955 | J. Fangio (Arg.) | Mercedes | 1973 | J. Stewart (U.K.) | Tyrrell/Ford | 1991 | A. Senna (Braz.) | McLaren/Honda |
| 1956 | J. Fangio (Arg.) | Lancia/Ferrari | 1974 | E. Fittipaldi (Braz.) | McLaren/Ford | 1992 | N. Mansell (U.K.) | Williams/Renault |
| 1957 | J. Fangio (Arg.) | Maserati | 1975 | N. Lauda (Austria) | Ferrari | 1993 | A. Prost (Fr.) | Williams/Renault |
| 1958 | M. Hawthorn (U.K.) | Ferrari | 1976 | J. Hunt (U.K.) | McLaren/Ford | 1994 | M. Schumacher (Ger.) | Benetton/Ford |
| 1959 | J. Brabham (Austl.) | Cooper/Climax | 1977 | N. Lauda (Austria) | Ferrari | 1995 | M. Schumacher (Ger.) | Benetton/Renault |
| 1960 | J. Brabham (Austl.) | Cooper/Climax | 1978 | M. Andretti (U.S.) | Lotus | 1996 | D. Hill (U.K.) | Williams/Renault |
| 1961 | P. Hill (U.S.) | Ferrari | 1979 | J. Scheckter (S.Af.) | Ferrari | 1997 | J. Villeneuve (Can.) | Williams/Renault |
| 1962 | G. Hill (U.K.) | BRM | 1980 | A. Jones (Austl.) | Williams | 1998 | M. Hakkinen (Fin.) | McLaren/Mercedes |
| 1963 | J. Clark (U.K.) | Lotus/Climax | 1981 | N. Piquet (Braz.) | Brabham | 1999 | M. Hakkinen (Fin.) | McLaren/Mercedes |
| 1964 | J. Surtees (U.K.) | Ferrari | 1982 | K. Rosberg (Fin.) | Williams | 2000 | M. Schumacher (Ger.) | Ferrari |
| 1965 | J. Clark (U.K.) | Lotus/Climax | 1983 | N. Piquet (Braz.) | Brabham | 2001 | M. Schumacher (Ger.) | Ferrari |
| 1966 | J. Brabham (Austl.) | Brabham/Repco | 1984 | N. Lauda (Austria) | McLaren/Porsche-TAG | 2002 | M. Schumacher (Ger.) | Ferrari |
| 1967 | D. Hulme (N.Z.) | Brabham/Repco | 1985 | A. Prost (Fr.) | McLaren/Porsche-TAG | 2003 | M. Schumacher (Ger.) | Ferrari |

*Where chassis and engine are made by different manufacturers, the chassis is given first and separated from the engine name by a slash.

### Monte-Carlo Rally

| year | car | driver, codriver | year | car | driver, codriver | year | car | driver, codriver |
|---|---|---|---|---|---|---|---|---|
| 1911 | Turcat Méry | H. Rougier | 1954 | Lancia Aurelia | Chiron, Basadonna | 1980 | Fiat Abarths | Röhrl, Geistdorfer |
| 1912 | Berliet | J. Beutler | 1955 | Sunbeam-Talbot | Malling, Fadum | 1981 | Renault Turbo | Ragnotti, Andrie |
| 1913–23 | no competition | | 1956 | Jaguar | Adams, Bigger | 1982 | Opel Ascona | Röhrl, Geistdorfer |
| 1924 | Bignan | J. Ledure | 1957 | no competition | | 1983 | Lancia Rally | Röhrl, Geistdorfer |
| 1925 | Renault | F. Repusseau | 1958 | Renault | Monraisse, Feret | 1984 | Audi Quattro | Röhrl, Geistdorfer |
| 1926 | A.C. | V. Bruce | 1959 | Citroën | Coitelloni, Alexandre | 1985 | Peugeot 205 Turbo | Vatanen, Harryman |
| 1927 | Amilcar | Lefèbvre, Despeaux | 1960 | Mercedes | Schock, Moll | 1986 | Lancia Martini Delta | Toivonen, Cresto |
| 1928 | Fiat | J. Bignan | 1961 | Panhard | Martin, Bateau | 1987 | Lancia Delta HF | Biasion, Siviero |
| 1929 | Graham Paige | S. Van Eijk | 1962 | Saab | Carlsson, Häggbom | 1988 | Lancia Delta HF4 | Biasion, Fauchille |
| 1930 | Licorne | H. Petit | 1963 | Saab | Carlsson, Palm | 1989 | Lancia Delta Integrale | Biasion, Siviero |
| 1931 | Invicta | D. Healey | 1964 | Mini-Cooper | Hopkirk, Liddon | 1990 | Lancia Delta Integrale | Auriol, Occelli |
| 1932 | Hotchkiss | M. Vasselle | 1965 | Mini-Cooper | Makinen, Easter | 1991 | Toyota Celica | Sainz, Moya |
| 1933 | Hotchkiss | M. Vasselle | 1966 | Citroën | Toivonen, Mikander | 1992 | Lancia Delta Integrale | Auriol, Occelli |
| 1934 | Hotchkiss | Gas, Trevoux | 1967 | Mini-Cooper | Aaltonen, Liddon | 1993 | Toyota Celica | Auriol, Occelli |
| 1935 | Renault | Lahaye, Quatresous | 1968 | Porsche | Elford, Stone | 1994 | Ford Escort | Delecour |
| 1936 | Ford | Zamfirescu, Cristea | 1969 | Porsche | Waldegaard, Helmer | 1995 | Subaru Impreza | Sainz |
| 1937 | Delahaye | Le Begue, Quinlin | 1970 | Porsche | Waldegaard, Helmer | 1996 | Ford Escort | Bernardini |
| 1938 | Ford | Schut, Ton | 1971 | Renault | Andersson, Stone | 1997 | Subaru | P. Liatti (Italy) |
| 1939 | Hotchkiss | Trevoux, Lesurque | 1972 | Lancia Fulvia | Munari, Mannucci | 1998 | Toyota Corolla | C. Sainz (Spain) |
| | Delahaye | Paul, Contet | 1973 | Alpine-Renault | Andruet, Petit | 1999 | Mitsubishi Lancer | T. Mäkinen (Fin.) |
| 1940–48 | no competition | | 1974 | no competition | | 2000 | Mitsubishi Lancer | T. Mäkinen (Fin.) |
| 1949 | Hotchkiss | Trevoux, Lesurque | 1975 | Lancia Stratos | Munari, Mannucci | 2001 | Mitsubishi Lancer | T. Mäkinen (Fin.) |
| 1950 | Hotchkiss | Becquart, Secret | 1976 | Lancia Stratos | Munari, Maiga | 2002 | Subaru Impreza | T. Mäkinen (Fin.) |
| 1951 | Delahaye | Trevoux, Crovetto | 1977 | Lancia Stratos | Munari, Maiga | 2003 | Citroën | S. Loeb (Fr.), D. Elena (Monaco) |
| 1952 | Allard | Allard, Warburton | 1978 | Porsche Carrera | Nicolas, Laverne | 2004 | Citroën | S. Loeb (Fr.), D. Elena (Monaco) |
| 1953 | Ford Zephyr | Gatsonides, Worledge | 1979 | Lancia Stratos | Darniche, Mahé | | | |

### Le Mans Grand Prix d'Endurance (also called Le Mans 24-Hour Race)

| year | car | drivers | year | car | drivers |
|---|---|---|---|---|---|
| 1923 | Chenard-Walcker | A. Lagache, R. Léonard | 1970 | Porsche | R. Attwood, H. Herrmann |
| 1924 | Bentley | J. Duff, F.C. Clément | 1971 | Porsche | H. Marko, G. van Lennep |
| 1925 | Lorraine-Dietrich | H. de Courcelles, A. Rossignol | 1972 | Matra-Simca | H. Pescarolo, G. Hill |
| | | | 1973 | Matra-Simca | H. Pescarolo, G. Larrousse |
| 1926 | Lorraine-Dietrich | R. Bloch, A. Rossignol | 1974 | Matra-Simca | H. Pescarolo, G. Larrousse |
| 1927 | Bentley | J.D. Benjafield, S.C.H. Davis | 1975 | Gulf-Ford | J. Ickx, D. Bell |
| | | | 1976 | Porsche | J. Ickx, G. van Lennep |
| 1928 | Bentley | W. Barnato, B. Rubin | 1977 | Porsche | J. Ickx, J. Barth, H. Haywood |
| 1929 | Bentley | W. Barnato, H.R.S. Birkin | 1978 | Renault-Alpine | J.-P. Jaussaud, D. Pironi |
| 1930 | Bentley | W. Barnato, G. Kidston | 1979 | Porsche | K. Ludwig, D. Whittington, B. Whittington |
| 1931 | Alfa Romeo | E. Howe, H.R.S. Birkin | | | |
| 1932 | Alfa Romeo | R. Sommer, L. Chinetti | 1980 | Porsche | J. Rondeau, J.-P. Jaussaud |
| 1933 | Alfa Romeo | R. Sommer, T. Nuvolari | 1981 | Porsche | D. Bell, J. Ickx |
| 1934 | Alfa Romeo | L. Chinetti, P. Etancelin | 1982 | Porsche | D. Bell, J. Ickx |
| 1935 | Lagonda | J.S. Hindmarsh, L. Fontés | 1983 | Porsche | A. Holbert, H. Hayward, V. Schuppan |
| 1936 | no competition | | 1984 | Porsche | H. Pescarolo, K. Ludwig |
| 1937 | Bugatti | J.P. Wimille, R. Benoist | 1985 | Porsche | K. Ludwig, J. Winter, P. Barilla |
| 1938 | Delahaye | E. Chaboud, J. Tremoulet | 1986 | Porsche | D. Bell, H. Stuck, A. Holbert |
| | | | 1987 | Porsche | H. Stuck, D. Bell, A. Holbert |
| 1939 | Bugatti | J.P. Wimille, P. Veyron | 1988 | Jaguar | J. Lammers, J. Dumfries, A. Wallace |
| 1940–48 | no competition | | | | |
| 1949 | Ferrari | L. Chinetti, Lord Selsdon | 1989 | Mercedes-Benz | J. Mass, M. Reuter, S. Dickens |
| 1950 | Talbot | L. Rosier, C. Rosier | 1990 | Jaguar | J. Nielsen, P. Cobb, M. Brundle |
| 1951 | Jaguar | P.D. Walker, P.N. Whitehead | 1991 | Mazda | V. Weidler, J. Herbert, B. Gachot |
| 1952 | Mercedes-Benz | H. Lang, F. Riess | | | |
| 1953 | Jaguar | A.P.R. Rolt, J.D. Hamilton | 1992 | Peugeot | Y. Dalmas, M. Blundell, D. Warwick |
| 1954 | Ferrari | J.F. Gonzalez, M. Trintignant | 1993 | Peugeot | G. Brabham, C. Bouchut, E. Helary |
| 1955 | Jaguar | J.M. Hawthorn, I. Bueb | 1994 | Dauer Porsche | Y. Dalmas, H. Haywood, M. Baldi |
| 1956 | Jaguar | R. Flockhart, N. Sanderson | 1995 | McLaren | Y. Dalmas, J.J. Lehto, M. Sekiya |
| 1957 | Jaguar | R. Flockhart, I. Bueb | | | |
| 1958 | Ferrari | P. Hill, O. Gendebien | 1996 | Joest TWR Porsche | M. Reuter, D. Jones, A. Wurz |
| 1959 | Aston Martin | R. Salvadori, C. Shelby | | | |
| 1960 | Ferrari | P. Frère, O. Gendebien | 1997 | Joest Porsche | M. Alboreto, S. Johansson, T. Kristensen |
| 1961 | Ferrari | P. Hill, O. Gendebien | | | |
| 1962 | Ferrari | P. Hill, O. Gendebien | 1998 | Porsche GT1 | A. McNish, L. Aiello, S. Ortelli |
| 1963 | Ferrari | L. Scarfiotti, L. Bandini | 1999 | BMW V12 LMR | Y. Dalmas, P. Martini, J. Winkelhock |
| 1964 | Ferrari | J. Guichet, N. Vaccarella | | | |
| 1965 | Ferrari | M. Gregory, J. Rindt | 2000 | Audi R8 | F. Biela, T. Kristensen, E. Pirro |
| 1966 | Ford Mk II | B. McLaren, C. Amon | 2001 | Audi 3596T | F. Biela, T. Kristensen, E. Pirro |
| 1967 | Ford Mk IV | A.J. Foyt, D. Gurney | 2002 | Audi R8 | F. Biela, T. Kristensen, E. Pirro |
| 1968 | Ford G.T. 40 | P. Rodriguez, L. Bianchi | 2003 | Bentley | T. Kristensen, R. Capello, G. Smith |
| 1969 | Ford G.T. 40 | J. Ickx, J. Oliver | 2004 | Audi R8 | T. Kristensen, R. Capello, S. Ara |

### NASCAR* Winston† Cup Champions

| year | winner | year | winner |
|---|---|---|---|
| 1949 | R. Byron | 1977 | C. Yarborough |
| 1950 | B. Rexford | 1978 | C. Yarborough |
| 1951 | H. Thomas | 1979 | R. Petty |
| 1952 | T. Flock | 1980 | D. Earnhardt |
| 1953 | H. Thomas | 1981 | D. Waltrip |
| 1954 | L. Petty | 1982 | D. Waltrip |
| 1955 | T. Flock | 1983 | B. Allison |
| 1956 | B. Baker | 1984 | T. Labonte |
| 1957 | B. Baker | 1985 | D. Waltrip |
| 1958 | L. Petty | 1986 | D. Earnhardt |
| 1959 | L. Petty | 1987 | D. Earnhardt |
| 1960 | R. White | 1988 | B. Elliott |
| 1961 | N. Jarrett | 1989 | R. Wallace |
| 1962 | J. Weatherly | 1990 | D. Earnhardt |
| 1963 | J. Weatherly | 1991 | D. Earnhardt |
| 1964 | R. Petty | 1992 | A. Kulwicki |
| 1965 | N. Jarrett | 1993 | D. Earnhardt |
| 1966 | D. Pearson | 1994 | D. Earnhardt |
| 1967 | R. Petty | 1995 | J. Gordon |
| 1968 | D. Pearson | 1996 | T. Labonte |
| 1969 | D. Pearson | 1997 | J. Gordon |
| 1970 | B. Isaac | 1998 | J. Gordon |
| 1971 | R. Petty | 1999 | D. Jarrett |
| 1972 | R. Petty | 2000 | B. Labonte |
| 1973 | B. Parsons | 2001 | J. Gordon |
| 1974 | R. Petty | 2002 | T. Stewart |
| 1975 | R. Petty | 2003 | M. Kenseth |
| 1976 | C. Yarborough | | |

*National Association for Stock Car Auto Racing. †In 2004 the competition became the Nextel Cup.

### Daytona 500

| year | winner | avg. speed in mph | year | winner | avg. speed in mph | year | winner | avg. speed in mph | year | winner | avg. speed in mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | L. Petty | 135.521 | 1971 | R. Petty | 144.462 | 1983 | C. Yarborough | 155.979 | 1995 | S. Marlin | 141.71 |
| 1960 | J. Johnson | 124.74 | 1972 | A.J. Foyt | 161.55 | 1984 | C. Yarborough | 150.994 | 1996 | D. Jarrett | 154.308 |
| 1961 | M. Panch | 149.601 | 1973 | R. Petty | 157.205 | 1985 | B. Elliot | 176.263 | 1997 | J. Gordon | 148.295 |
| 1962 | F. Roberts | 152.529 | 1974 | R. Petty | 140.894 | 1986 | G. Bodine | 148.124 | 1998 | D. Earnhardt | 172.712 |
| 1963 | T. Lund | 151.566 | 1975 | B. Parsons | 153.649 | 1987 | B. Elliot | 176.263 | 1999 | J. Gordon | 162.551 |
| 1964 | R. Petty | 154.334 | 1976 | D. Pearson | 152.181 | 1988 | B. Allison | 137.531 | 2000 | D. Jarrett | 155.669 |
| 1965 | F. Lorenzen | 141.539 | 1977 | C. Yarborough | 153.218 | 1989 | D. Waltrip | 148.466 | 2001 | M. Waltrip | 161.783 |
| 1966 | R. Petty | 160.627 | 1978 | B. Allison | 159.73 | 1990 | D. Cope | 165.761 | 2002 | W. Burton | 142.971 |
| 1967 | M. Andretti | 149.926 | 1979 | R. Petty | 143.977 | 1991 | E. Irvan | 148.148 | 2003 | M. Waltrip | 133.870 |
| 1968 | C. Yarborough | 143.251 | 1980 | B. Baker | 177.602 | 1992 | D. Allison | 160.256 | 2004 | D. Earnhardt, Jr. | 156.345 |
| 1969 | L.R. Yarborough | 157.95 | 1981 | R. Petty | 169.651 | 1993 | D. Jarrett | 154.972 | | | |
| 1970 | P. Hamilton | 149.601 | 1982 | B. Allison | 153.991 | 1994 | S. Marlin | 156.931 | | | |

## BADMINTON

The oldest, and still the classic, tournament for badminton is the All-England Badminton Championships, which have been held annually since 1900. The International Badminton Federation (established 1934) first proposed international team badminton for men in 1939, but actual tournament play for the Thomas Cup did not begin until 1948–49. A similar contest for women's teams, the Uber Cup, was inaugurated in 1956–57.

### All-England Championships—singles

| year | men* | women* | year | men* | women* |
|---|---|---|---|---|---|
| 1900 | S.H. Smith | E. Thomson | 1958 | E. Kops (Den.) | J. Devlin (U.S.) |
| 1901 | H.W. Davies | E. Thomson | 1959 | Tan Joe Hok (Indon.) | H.M. Ward |
| 1902 | R. Watling | M. Lucas | 1960 | E. Kops (Den.) | J. Devlin (U.S.) |
| 1903 | R. Watling | E. Thomson | 1961 | E. Kops (Den.) | J. Devlin Hashman (U.S.) |
| 1904 | H.N. Marrett | E. Thomson | 1962 | E. Kops (Den.) | J. Hashman (U.S.) |
| 1905 | H.N. Marrett | M. Lucas | 1963 | E. Kops (Den.) | J. Hashman (U.S.) |
| 1906 | N. Wood | E. Thomson | 1964 | K.A. Nielsen (Den.) | J. Hashman (U.S.) |
| 1907 | N. Wood | M. Lucas | 1965 | E. Kops (Den.) | U.H. Smith |
| 1908 | H.N. Marrett | M. Lucas | 1966 | Tan Aik Huang (Malay.) | J. Hashman (U.S.) |
| 1909 | F. Chesterton | M. Lucas | 1967 | E. Kops (Den.) | J. Hashman (U.S.) |
| 1910 | F. Chesterton | M. Lucas | 1968 | R. Hartono (Indon.) | E. Twedberg (Swed.) |
| 1911 | G.A. Sautter | M. Larminie | 1969 | R. Hartono (Indon.) | Yuki H. (Japan) |
| 1912 | F. Chesterton | M. Larminie Tragett | 1970 | R. Hartono (Indon.) | Takenaka E. (Japan) |
| 1913 | G.A. Sautter | L.C. Radeglia | 1971 | R. Hartono (Indon.) | E. Twedberg (Swed.) |
| 1914 | G.A. Sautter | L.C. Radeglia | 1972 | R. Hartono (Indon.) | Nakayama N. (Japan) |
| 1920† | Sir G.A. Thomas | K. McKane | 1973 | R. Hartono (Indon.) | M. Beck |
| 1921 | Sir G.A. Thomas | K. McKane | 1974 | R. Hartono (Indon.) | Yuki H. (Japan) |
| 1922 | Sir G.A. Thomas | K. McKane | 1975 | S. Pri (Den.) | Yuki H. (Japan) |
| 1923 | Sir G.A. Thomas | L.C. Radeglia | 1976 | R. Hartono (Indon.) | G.M. Gliks |
| 1924 | G.S.B. Mack (Ire.) | K. McKane | 1977 | F. Delfs (Den.) | Yuki H. (Japan) |
| 1925 | J.F. Devlin (Ire.) | Mrs. A.D. Stocks | 1978 | Liem Swie King (Indon.) | G.M. Gliks |
| 1926 | J.F. Devlin (Ire.) | Mrs. F.G. Barrett | 1979 | Liem Swie King (Indon.) | L. Köppen (Den.) |
| 1927 | J.F. Devlin (Ire.) | Mrs. F.G. Barrett | 1980 | P. Padukone (India) | L. Köppen (Den.) |
| 1928 | J.F. Devlin (Ire.) | M. Tragett | 1981 | Liem Swie King (Indon.) | Sun Ai Hwang (S.Kor.) |
| 1929 | J.F. Devlin (Ire.) | Mrs. F.G. Barrett | 1982 | M. Frost (Den.) | Zhang Ailing (China) |
| 1930 | D.C. Hume | Mrs. F.G. Barrett | 1983 | Luan Jin (China) | Zhang Ailing (China) |
| 1931 | J.F. Devlin (Ire.) | Mrs. F.G. Barrett | 1984 | M. Frost (Den.) | Li Lingwei (China) |
| 1932 | R.C.F. Nichols | L.M. Kingsbury | 1985 | Zhao Jianhua (China) | Han Aiping (China) |
| 1933 | R.M. White | A. Woodroffe | 1986 | M. Frost (Den.) | Kim Yun Ja (S.Kor.) |
| 1934 | R.C.F. Nichols | L.M. Kingsbury | 1987 | M. Frost (Den.) | K. Larsen (Den.) |
| 1935 | R.M. White | Mrs. H.S. Uber | 1988 | I. Frederiksen (Den.) | Gu Jiaming (China) |
| 1936 | R.C.F. Nichols | T. Kingsbury | 1989 | Yang Yang (China) | Li Lingwei (China) |
| 1937 | R.C.F. Nichols | T. Kingsbury | 1990 | Zhao Jianhua (China) | S. Susanti (Indon.) |
| 1938 | R.C.F. Nichols | D.M.C. Young | 1991 | A. Wiranata (Indon.) | S. Susanti (Indon.) |
| 1939 | T. Madsen (Den.) | Mrs. W.R. Walton, Jr. (Can.) | 1992 | Liu Jun (China) | Tang Jiuhong (China) |
| 1947† | C. Jepsen (Swed.) | M. Ussing (Den.) | 1993 | H. Arbi (Indon.) | S. Susanti (Indon.) |
| 1948 | J. Skaarup (Den.) | K. Thorndahl (Den.) | 1994 | H. Arbi (Indon.) | S. Susanti (Indon.) |
| 1949 | D.G. Freeman (U.S.) | A. Jacobsen (Den.) | 1995 | P.-E. Hoyer-Larsen (Den.) | Lim Xiao Qing (Swed.) |
| 1950 | Wong Peng Soon (Malay.) | T. Ahm (Den.) | 1996 | P.-E. Hoyer-Larsen (Den.) | Bang Soo Hyun (S.Kor.) |
| 1951 | Wong Peng Soon (Malay.) | A. Jacobsen (Den.) | 1997 | Dong Jiong (China) | Ye Zhaoying (China) |
| 1952 | Wong Peng Soon (Malay.) | T. Ahm (Den.) | 1998 | Sun Jun (China) | Ye Zhaoying (China) |
| 1953 | E.B. Choong (Malay.) | M. Ussing (Den.) | 1999 | P. Gade Christensen (Den.) | Ye Zhaoying (China) |
| 1954 | E.B. Choong (Malay.) | J. Devlin (U.S.) | 2000 | Xia Xuanze (China) | Gong Zhichao (China) |
| 1955 | Wong Peng Soon (Malay.) | M. Varner (U.S.) | 2001 | P. Gopichand (India) | Gong Zhichao (China) |
| 1956 | E.B. Choong (Malay.) | M. Varner (U.S.) | 2002 | Chen Hong (China) | C. Martin (Den.) |
| 1957 | E.B. Choong (Malay.) | J. Devlin (U.S.) | | | |

*Won by a British player except as indicated. †No competition 1915–19; 1940–46.

### Thomas Cup

| year | winner | runner-up |
|---|---|---|
| 1948–49 | Malaya | |
| 1951–52 | Malaya | |
| 1954–55 | Malaya | |
| 1957–58 | Indonesia | |
| 1960–61 | Indonesia | |
| 1963–64 | Indonesia | |
| 1966–67 | Malaysia (by default) | |
| 1969–70 | Indonesia | |
| 1972–73 | Indonesia | |
| 1975–76 | Indonesia | |
| 1978–79 | Indonesia | |
| 1981–82 | China | |
| 1983–84 | Indonesia | |
| 1985–86 | China | |
| 1987–88 | China | |
| 1989–90 | China | |
| 1991–92 | Malaysia | |
| 1993–94 | Indonesia | Malaysia |
| 1995–96 | Indonesia | Denmark |
| 1997–98 | Indonesia | Malaysia |
| 1999–2000 | Indonesia | China |
| 2001–02 | Indonesia | Malaysia |

### Uber Cup

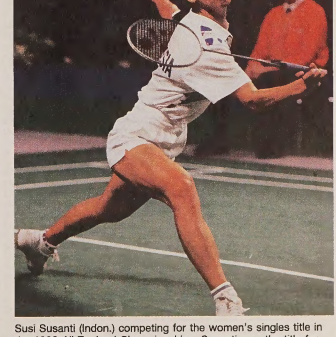
| year | winner | runner-up |
|---|---|---|
| 1956–57 | United States | |
| 1959–60 | United States | |
| 1962–63 | United States | |
| 1965–66 | Japan | |
| 1968–69 | Japan | |
| 1971–72 | Japan | |
| 1974–75 | Indonesia | |
| 1977–78 | Japan | |
| 1980–81 | Japan | |
| 1983–84 | China | |
| 1985–86 | China | |
| 1987–88 | China | |
| 1989–90 | China | |
| 1991–92 | China | |
| 1993–94 | Indonesia | China |
| 1995–96 | Indonesia | China |
| 1997–98 | China | Indonesia |
| 1999–2000 | China | Denmark |
| 2001–02 | China | South Korea |

### World Badminton Championships

| year | men's singles | women's singles |
|---|---|---|
| 1977 | F. Delfs (Den.) | L. Köppen (Den.) |
| 1980 | R. Hartono (Indon.) | W. Verawaty (Indon.) |
| 1983 | I. Sugiarto (Indon.) | Li Lingwei (China) |
| 1985 | Han Jian (China) | Han Aiping (China) |
| 1987 | Yang Yang (China) | Han Aiping (China) |
| 1989 | Yang Yang (China) | Li Lingwei (China) |
| 1991 | Zhao Jianhua (China) | Tang Jiuhong (China) |
| 1993 | J. Suprianto (Indon.) | S. Susanti (Indon.) |
| 1995 | H. Arbi (Indon.) | Ye Zhaoying (China) |
| 1997 | P. Rasmussen (Den.) | Ye Zhaoying (China) |
| 1999 | Sun Jun (China) | C. Martin (Den.) |
| 2001 | Hendrawan (Indon.) | Gong Ruina (China) |

| year | men's doubles | women's doubles |
|---|---|---|
| 1977 | T. Tjun, J. Wahjudi (Indon.) | Toganu E., Ueno E. (Japan) |
| 1980 | A. Chandra, C. Hadinata (Indon.) | N. Perry, J. Webster (U.K.) |
| 1983 | S. Fladberg, J. Helledie (Den.) | Lin Ying, Wu Dixi (China) |
| 1985 | Park Joo Bong, Kim Moon Soo (S.Kor.) | Han Aiping, Li Lingwei (China) |
| 1987 | Li Yongbo, Tian Hinghi (China) | Lin Ying, Guan Weizhen (China) |
| 1989 | Li Yongbo, Tian Bingyi (China) | Lin Ying, Guan Weizhen (China) |
| 1991 | Park Joo Bong, Kim Moon Soo (S.Kor.) | Guan Weizhen, Nong Qunhua (China) |
| 1993 | R. Subagja, R. Gunawan (Indon.) | Nong Qunhua, Zhou Lei (China) |
| 1995 | R. Subagja, R. Mainaky (Indon.) | Gil Young Ah, Jang Hye Ock (S.Kor.) |
| 1997 | B. Sigit, C. Wijaya (Indon.) | Ge Fei, Gu Jun (China) |
| 1999 | Kim Dong Moon, Ha Tae Kwon (S.Kor.) | Ge Fei, Gu Jun (China) |
| 2001 | T. Gunawan, H. Haryanto (Indon.) | Gao Ling, Huang Sui (China) |

| year | mixed doubles |
|---|---|
| 1977 | S. Skovgaard, L. Koppen (Den.) |
| 1980 | C. Hadinata, I. Wiguno (Indon.) |
| 1983 | T. Kihlström, N. Perry (Swed., Eng.) |
| 1985 | P. Bong, Y. Hee (S.Kor.) |
| 1987 | W. Pengren, S. Fangjing (China) |
| 1989 | P. Bong, C. Hee (S.Kor.) |
| 1991 | P. Bong, C. Hee (S.Kor.) |
| 1993 | T. Lund, M.C. Bengtsson (Den., Swed.) |
| 1995 | T. Lund, M. Thomsen (Den.) |
| 1997 | L. Yong, G. Fei (China) |
| 1999 | K. Moon, R. Min (S.Kor.) |
| 2001 | Zhang Jun, Gao Ling (China) |



Susi Susanti (Indon.) competing for the women's singles title in the 1993 All-England Championships; Susanti won the title for the third time

ALLSPORT UK/John Gichigi

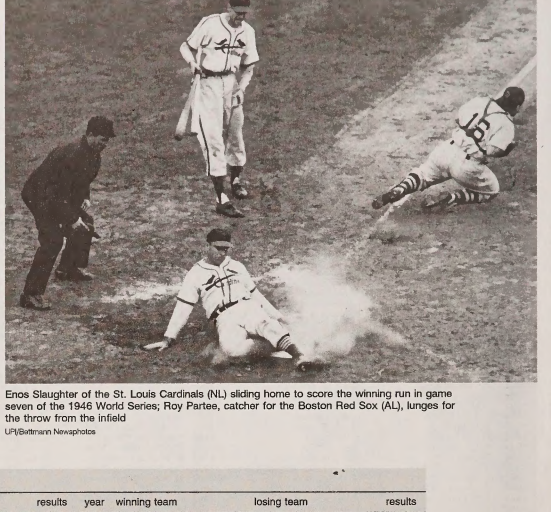
## BASEBALL

The sport of baseball—given its definitive form in the United States in the late 19th century—is popular throughout the world. It is especially popular in Japan and Latin America; it is also one of the national sports of the United States.

On a professional level, the premiere event of baseball in the United States is the seven-game World Series, in which the first team to win four games wins the Series. In fact, the Series is not contested on an international level, but rather it is played between the leading team of the National League (NL; formed 1876 and including, in later years, one Canadian team) and the leading team of the American League (AL; formed 1900 and also including, in later years, one Canadian team).

Professional Japanese baseball teams are organized into two leagues of six teams each. The seven-game Japan Series is contested between the leading team of the Central League (CL) and the leading team of the Pacific League (PL).

The modern Caribbean Series began in 1970 with the winning team from each winter league in the Dominican Republic, Mexico, Puerto Rico, and Venezuela.



Enos Slaughter of the St. Louis Cardinals (NL) sliding home to score the winning run in game seven of the 1946 World Series; Roy Partee, catcher for the Boston Red Sox (AL), lunges for the throw from the infield

UPI/Bettmann Newsphotos

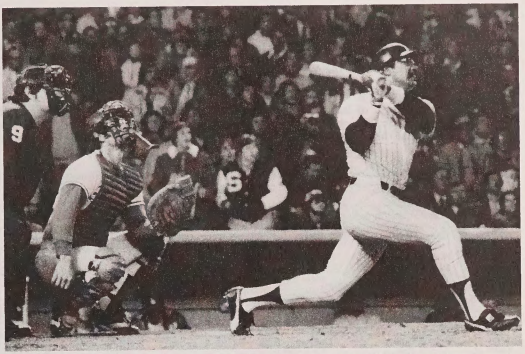
**World Series***

| year | winning team | losing team | results |
|---|---|---|---|
| 1903 | Boston Pilgrims (AL) | Pittsburgh Pirates (NL) | 5–3 |
| 1904 | no series | | |
| 1905 | New York Giants (NL) | Philadelphia Athletics (AL) | 4–1 |
| 1906 | Chicago White Sox (AL) | Chicago Cubs (NL) | 4–2 |
| 1907† | Chicago Cubs (NL) | Detroit Tigers (AL) | 4–0 |
| 1908 | Chicago Cubs (NL) | Detroit Tigers (AL) | 4–1 |
| 1909 | Pittsburgh Pirates (NL) | Detroit Tigers (AL) | 4–3 |
| 1910 | Philadelphia Athletics (AL) | Chicago Cubs (NL) | 4–1 |
| 1911 | Philadelphia Athletics (AL) | New York Giants (NL) | 4–2 |
| 1912† | Boston Red Sox (AL) | New York Giants (NL) | 4–3 |
| 1913 | Philadelphia Athletics (AL) | New York Giants (NL) | 4–1 |
| 1914 | Boston Braves (NL) | Philadelphia Athletics (AL) | 4–0 |
| 1915 | Boston Red Sox (AL) | Philadelphia Phillies (NL) | 4–1 |
| 1916 | Boston Red Sox (AL) | Brooklyn Robins (NL) | 4–1 |
| 1917 | Chicago White Sox (AL) | New York Giants (NL) | 4–2 |
| 1918 | Boston Red Sox (AL) | Chicago Cubs (NL) | 4–2 |
| 1919 | Cincinnati Reds (NL) | Chicago White Sox (AL) | 5–3 |
| 1920 | Cleveland Indians (AL) | Brooklyn Robins (NL) | 5–2 |
| 1921 | New York Giants (NL) | New York Yankees (AL) | 5–3 |
| 1922† | New York Giants (NL) | New York Yankees (AL) | 4–0 |
| 1923 | New York Yankees (AL) | New York Giants (NL) | 4–2 |
| 1924 | Washington Senators (AL) | New York Giants (NL) | 4–3 |
| 1925 | Pittsburgh Pirates (NL) | Washington Senators (AL) | 4–3 |
| 1926 | St. Louis Cardinals (NL) | New York Yankees (AL) | 4–3 |
| 1927 | New York Yankees (AL) | Pittsburgh Pirates (NL) | 4–0 |
| 1928 | New York Yankees (AL) | St. Louis Cardinals (NL) | 4–0 |
| 1929 | Philadelphia Athletics (AL) | Chicago Cubs (NL) | 4–1 |
| 1930 | Philadelphia Athletics (AL) | St. Louis Cardinals (NL) | 4–2 |
| 1931 | St. Louis Cardinals (NL) | Philadelphia Athletics (AL) | 4–3 |
| 1932 | New York Yankees (AL) | Chicago Cubs (NL) | 4–0 |
| 1933 | New York Giants (NL) | Washington Senators (AL) | 4–1 |
| 1934 | St. Louis Cardinals (NL) | Detroit Tigers (AL) | 4–3 |
| 1935 | Detroit Tigers (AL) | Chicago Cubs (NL) | 4–2 |
| 1936 | New York Yankees (AL) | New York Giants (NL) | 4–2 |
| 1937 | New York Yankees (AL) | New York Giants (NL) | 4–1 |
| 1938 | New York Yankees (AL) | Chicago Cubs (NL) | 4–0 |
| 1939 | New York Yankees (AL) | Cincinnati Reds (NL) | 4–0 |
| 1940 | Cincinnati Reds (NL) | Detroit Tigers (AL) | 4–3 |
| 1941 | New York Yankees (AL) | Brooklyn Dodgers (NL) | 4–1 |
| 1942 | St. Louis Cardinals (NL) | New York Yankees (AL) | 4–1 |
| 1943 | New York Yankees (AL) | St. Louis Cardinals (NL) | 4–1 |
| 1944 | St. Louis Cardinals (NL) | St. Louis Browns (AL) | 4–2 |
| 1945 | Detroit Tigers (AL) | Chicago Cubs (NL) | 4–3 |
| 1946 | St. Louis Cardinals (NL) | Boston Red Sox (AL) | 4–3 |
| 1947 | New York Yankees (AL) | Brooklyn Dodgers (NL) | 4–3 |
| 1948 | Cleveland Indians (AL) | Boston Braves (NL) | 4–2 |
| 1949 | New York Yankees (AL) | Brooklyn Dodgers (NL) | 4–1 |
| 1950 | New York Yankees (AL) | Philadelphia Phillies (NL) | 4–0 |
| 1951 | New York Yankees (AL) | New York Giants (NL) | 4–2 |
| 1952 | New York Yankees (AL) | Brooklyn Dodgers (NL) | 4–3 |
| 1953 | New York Yankees (AL) | Brooklyn Dodgers (NL) | 4–2 |
| 1954 | New York Giants (NL) | Cleveland Indians (AL) | 4–0 |
| 1955 | Brooklyn Dodgers (NL) | New York Yankees (AL) | 4–3 |
| 1956 | New York Yankees (AL) | Brooklyn Dodgers (NL) | 4–3 |
| 1957 | Milwaukee Braves (NL) | New York Yankees (AL) | 4–3 |
| 1958 | New York Yankees (AL) | Milwaukee Braves (NL) | 4–3 |
| 1959 | Los Angeles Dodgers (NL) | Chicago White Sox (AL) | 4–2 |
| 1960 | Pittsburgh Pirates (NL) | New York Yankees (AL) | 4–3 |
| 1961 | New York Yankees (AL) | Cincinnati Reds (NL) | 4–1 |
| 1962 | New York Yankees (AL) | San Francisco Giants (NL) | 4–3 |
| 1963 | Los Angeles Dodgers (NL) | New York Yankees (AL) | 4–0 |
| 1964 | St. Louis Cardinals (NL) | New York Yankees (AL) | 4–3 |
| 1965 | Los Angeles Dodgers (NL) | Minnesota Twins (AL) | 4–3 |
| 1966 | Baltimore Orioles (AL) | Los Angeles Dodgers (NL) | 4–0 |
| 1967 | St. Louis Cardinals (NL) | Boston Red Sox (AL) | 4–3 |
| 1968 | Detroit Tigers (AL) | St. Louis Cardinals (NL) | 4–3 |
| 1969 | New York Mets (NL) | Baltimore Orioles (AL) | 4–1 |
| 1970 | Baltimore Orioles (AL) | Cincinnati Reds (NL) | 4–1 |
| 1971 | Pittsburgh Pirates (NL) | Baltimore Orioles (AL) | 4–3 |
| 1972 | Oakland Athletics (AL) | Cincinnati Reds (NL) | 4–3 |
| 1973 | Oakland Athletics (AL) | New York Mets (NL) | 4–3 |
| 1974 | Oakland Athletics (AL) | Los Angeles Dodgers (NL) | 4–1 |
| 1975 | Cincinnati Reds (NL) | Boston Red Sox (AL) | 4–3 |
| 1976 | Cincinnati Reds (NL) | New York Yankees (AL) | 4–0 |
| 1977 | New York Yankees (AL) | Los Angeles Dodgers (NL) | 4–2 |
| 1978 | New York Yankees (AL) | Los Angeles Dodgers (NL) | 4–2 |
| 1979 | Pittsburgh Pirates (NL) | Baltimore Orioles (AL) | 4–3 |
| 1980 | Philadelphia Phillies (NL) | Kansas City Royals (AL) | 4–2 |
| 1981 | Los Angeles Dodgers (NL) | New York Yankees (AL) | 4–2 |
| 1982 | St. Louis Cardinals (NL) | Milwaukee Brewers (AL) | 4–3 |
| 1983 | Baltimore Orioles (AL) | Philadelphia Phillies (NL) | 4–1 |
| 1984 | Detroit Tigers (AL) | San Diego Padres (NL) | 4–1 |
| 1985 | Kansas City Royals (AL) | St. Louis Cardinals (NL) | 4–3 |
| 1986 | New York Mets (NL) | Boston Red Sox (AL) | 4–3 |
| 1987 | Minnesota Twins (AL) | St. Louis Cardinals (NL) | 4–3 |
| 1988 | Los Angeles Dodgers (NL) | Oakland Athletics (AL) | 4–1 |
| 1989 | Oakland Athletics (AL) | San Francisco Giants (NL) | 4–0 |
| 1990 | Cincinnati Reds (NL) | Oakland Athletics (AL) | 4–0 |
| 1991 | Minnesota Twins (AL) | Atlanta Braves (NL) | 4–3 |
| 1992 | Toronto Blue Jays (AL) | Atlanta Braves (NL) | 4–2 |
| 1993 | Toronto Blue Jays (AL) | Philadelphia Phillies (NL) | 4–2 |
| 1994 | not held | | |
| 1995 | Atlanta Braves (NL) | Cleveland Indians (AL) | 4–2 |
| 1996 | New York Yankees (AL) | Atlanta Braves (NL) | 4–2 |
| 1997 | Florida Marlins (NL) | Cleveland Indians (AL) | 4–3 |
| 1998 | New York Yankees (AL) | San Diego Padres (NL) | 4–0 |
| 1999 | New York Yankees (AL) | Atlanta Braves (NL) | 4–0 |
| 2000 | New York Yankees (AL) | New York Mets (NL) | 4–1 |
| 2001 | Arizona Diamondbacks (NL) | New York Yankees (AL) | 4–3 |
| 2002 | Anaheim Angels (AL) | San Francisco Giants (NL) | 4–3 |
| 2003 | Florida Marlins (NL) | New York Yankees (AL) | 4–2 |

*AL—American League; NL—National League. †One tied game.

**Caribbean Series (modern)**

| year | winning team | country |
|---|---|---|
| 1970 | Magallanes Navigators | Venezuela |
| 1971 | Licey Tigers | Dominican Republic |
| 1972 | Ponce Lions | Puerto Rico |
| 1973 | Licey Tigers | Dominican Republic |
| 1974 | Caguas Creoles | Puerto Rico |
| 1975 | Bayamon Cowboys | Puerto Rico |
| 1976 | Hermosillo Orange Growers | Mexico |
| 1977 | Licey Tigers | Dominican Republic |
| 1978 | Mayaguez Indians | Puerto Rico |
| 1979 | Magallanes Navigators | Venezuela |
| 1980 | Licey Tigers | Dominican Republic |
| 1981 | Not held | |
| 1982 | Caracas Lions | Venezuela |
| 1983 | Arecibo Wolves | Puerto Rico |
| 1984 | Zulia Eagles | Venezuela |
| 1985 | Licey Tigers | Dominican Republic |
| 1986 | Mexicali Eagles | Mexico |
| 1987 | Caguas Creoles | Puerto Rico |
| 1988 | Escogido Lions | Dominican Republic |
| 1989 | Zulia Eagles | Venezuela |
| 1990 | Escogido Lions | Dominican Republic |
| 1991 | Licey Tigers | Dominican Republic |
| 1992 | Mayaguez Indians | Puerto Rico |
| 1993 | Santurce Crabbers | Puerto Rico |
| 1994 | Licey Tigers | Dominican Republic |
| 1995 | San Juan Senators | Puerto Rico |
| 1996 | Culiacán Tomato Growers | Mexico |
| 1997 | Northern Eagles | Dominican Republic |
| 1998 | Northern Eagles | Dominican Republic |
| 1999 | Licey Tigers | Dominican Republic |
| 2000 | Santurce Crabbers | Puerto Rico |
| 2001 | Cibao Eagles | Dominican Republic |
| 2002 | Culiacán Tomato Growers | Mexico |
| 2003 | Cibao Eagles | Dominican Republic |
| 2004 | Licey Tigers | Dominican Republic |



Reggie Jackson, New York Yankees (AL), hitting his third home run in his third consecutive at bat in game six of the 1977 World Series; Steve Yeager, catcher, Los Angeles Dodgers (NL), and John McSherry, the umpire, watch the ball

Louis Requena

**Japan Series***

| year | winning team | losing team | results |
|---|---|---|---|
| 1950 | Mainichi Orions (PL) | Shōchiku Robins (CL) | 4–2 |
| 1951 | Yomiuri Giants (CL) | Nankai Hawks (PL) | 4–1 |
| 1952 | Yomiuri Giants (CL) | Nankai Hawks (PL) | 4–2 |
| 1953† | Yomiuri Giants (CL) | Nankai Hawks (PL) | 4–2 |
| 1954 | Chūnichi Dragons (CL) | Nishitetsu Lions (PL) | 4–3 |
| 1955 | Yomiuri Giants (CL) | Nankai Hawks (PL) | 4–3 |
| 1956 | Nishitetsu Lions (PL) | Yomiuri Giants (CL) | 4–2 |
| 1957† | Nishitetsu Lions (PL) | Yomiuri Giants (CL) | 4–0 |
| 1958 | Nishitetsu Lions (PL) | Yomiuri Giants (CL) | 4–3 |
| 1959 | Nankai Hawks (PL) | Yomiuri Giants (CL) | 4–0 |
| 1960 | Taiyō Whales (CL) | Daimai Orions (PL) | 4–0 |
| 1961 | Yomiuri Giants (CL) | Nankai Hawks (PL) | 4–2 |
| 1962† | Tōei Flyers (PL) | Hanshin Tigers (CL) | 4–2 |
| 1963 | Yomiuri Giants (CL) | Nishitetsu Lions (PL) | 4–3 |
| 1964 | Nankai Hawks (PL) | Hanshin Tigers (CL) | 4–3 |
| 1965 | Yomiuri Giants (CL) | Nankai Hawks (PL) | 4–1 |
| 1966 | Yomiuri Giants (CL) | Nankai Hawks (PL) | 4–2 |
| 1967 | Yomiuri Giants (CL) | Hankyū Braves (PL) | 4–2 |
| 1968 | Yomiuri Giants (CL) | Hankyū Braves (PL) | 4–2 |
| 1969 | Yomiuri Giants (CL) | Hankyū Braves (PL) | 4–2 |
| 1970 | Yomiuri Giants (CL) | Lotte Orions (PL) | 4–1 |
| 1971 | Yomiuri Giants (CL) | Hankyū Braves (PL) | 4–1 |
| 1972 | Yomiuri Giants (CL) | Hankyū Braves (PL) | 4–1 |
| 1973 | Yomiuri Giants (CL) | Nankai Hawks (PL) | 4–1 |
| 1974 | Lotte Orions (PL) | Chūnichi Dragons (CL) | 4–2 |
| 1975‡ | Hankyū Braves (PL) | Hiroshima Tōyō Carp (CL) | 4–0 |
| 1976 | Hankyū Braves (PL) | Yomiuri Giants (CL) | 4–3 |
| 1977 | Hankyū Braves (PL) | Yomiuri Giants (CL) | 4–1 |
| 1978 | Yakult Swallows (CL) | Hankyū Braves (PL) | 4–3 |
| 1979 | Hiroshima Tōyō Carp (CL) | Kintetsu Buffaloes (PL) | 4–3 |
| 1980 | Hiroshima Tōyō Carp (CL) | Kintetsu Buffaloes (PL) | 4–3 |
| 1981 | Yomiuri Giants (CL) | Nippon-Ham Fighters (PL) | 4–2 |
| 1982 | Seibu Lions (PL) | Chūnichi Dragons (CL) | 4–2 |
| 1983 | Seibu Lions (PL) | Yomiuri Giants (CL) | 4–3 |
| 1984 | Hiroshima Tōyō Carp (CL) | Hankyū Braves (PL) | 4–3 |
| 1985 | Hanshin Tigers (CL) | Seibu Lions (PL) | 4–2 |
| 1986 | Seibu Lions (PL) | Hiroshima Tōyō Carp (CL) | 4–3 |
| 1987 | Seibu Lions (PL) | Yomiuri Giants (CL) | 4–2 |
| 1988 | Seibu Lions (PL) | Chunichi Dragons (CL) | 4–1 |
| 1989 | Yomiuri Giants (CL) | Kintetsu Buffaloes (PL) | 4–3 |
| 1990 | Seibu Lions (PL) | Yomiuri Giants (CL) | 4–0 |
| 1991 | Seibu Lions (PL) | Hiroshima Tōyō Carp (CL) | 4–3 |
| 1992 | Seibu Lions (PL) | Yakult Swallows (CL) | 4–3 |
| 1993 | Yakult Swallows (CL) | Seibu Lions (PL) | 4–3 |
| 1994 | Yomiuri Giants (CL) | Seibu Lions (PL) | 4–2 |
| 1995 | Yakult Swallows (CL) | Orix BlueWave (PL) | 4–1 |
| 1996 | Orix BlueWave (PL) | Yomiuri Giants (CL) | 4–1 |
| 1997 | Yakult Swallows (CL) | Seibu Lions (PL) | 4–1 |
| 1998 | Yokohama BayStars (CL) | Seibu Lions (PL) | 4–2 |
| 1999 | Fukuoka Daiei Hawks (PL) | Chūnichi Dragons (CL) | 4–1 |
| 2000 | Yomiuri Giants (CL) | Fukuoka Daiei Hawks (PL) | 4–2 |
| 2001 | Yakult Swallows (CL) | Osaka Kintetsu Buffaloes (PL) | 4–1 |
| 2002 | Yomiuri Giants (CL) | Seibu Lions (PL) | 4–0 |
| 2003 | Fukuoka Daiei Hawks (PL) | Hanshin Tigers (CL) | 4–2 |

*CL—Central League; PL—Pacific League. †One tied game.
‡Two tied games.



Hideki Matsui of the Yomiuri Giants (CL) hits a double off Seibu Lions (PL) pitcher Takashi Ishii in game two of the 2002 Japan Series

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## BASKETBALL

U.S. professional men's basketball is directed by the National Basketball Association (NBA; formed 1949). The NBA began a women's professional league, known as the WNBA, in 1997.

Basketball is organized on an international level. Since the inclusion of basketball as an Olympic sport in 1936, the winners of the Olympic tournament have been considered the world champions. The Fédération Internationale de Basketball Amateur (FIBA; founded 1932) instituted separate world championships in 1950 for men and in 1953 for women.

Amateur basketball in the United States is most closely followed at the collegiate level, where the most important event of the season is the National Collegiate Athletic Association (NCAA) Championship. The NCAA tournament was first contested in 1939 (by men's teams only). Women's college basketball was first played on a national level in 1972, under the auspices of the Association for Intercollegiate Athletics for Women (AIAW), which gave way in 1982 to the NCAA's first tournament for women.

**National Basketball Association (NBA) Championship**

| season | winner | runner-up | results |
|---|---|---|---|
| 1946–47 | Philadelphia Warriors | Chicago Stags | 4–1 |
| 1947–48 | Baltimore Bullets | Philadelphia Warriors | 4–2 |
| 1948–49 | Minneapolis Lakers | Washington Capitols | 4–2 |
| 1949–50 | Minneapolis Lakers | Syracuse Nationals | 4–2 |
| 1950–51 | Rochester Royals | New York Knickerbockers | 4–3 |
| 1951–52 | Minneapolis Lakers | New York Knickerbockers | 4–3 |
| 1952–53 | Minneapolis Lakers | New York Knickerbockers | 4–1 |
| 1953–54 | Minneapolis Lakers | Syracuse Nationals | 4–3 |
| 1954–55 | Syracuse Nationals | Fort Wayne Pistons | 4–3 |
| 1955–56 | Philadelphia Warriors | Fort Wayne Pistons | 4–1 |
| 1956–57 | Boston Celtics | St. Louis Hawks | 4–3 |
| 1957–58 | St. Louis Hawks | Boston Celtics | 4–2 |
| 1958–59 | Boston Celtics | Minneapolis Lakers | 4–0 |
| 1959–60 | Boston Celtics | St. Louis Hawks | 4–3 |
| 1960–61 | Boston Celtics | St. Louis Hawks | 4–1 |
| 1961–62 | Boston Celtics | Los Angeles Lakers | 4–3 |
| 1962–63 | Boston Celtics | Los Angeles Lakers | 4–2 |
| 1963–64 | Boston Celtics | San Francisco Warriors | 4–1 |
| 1964–65 | Boston Celtics | Los Angeles Lakers | 4–1 |
| 1965–66 | Boston Celtics | Los Angeles Lakers | 4–3 |
| 1966–67 | Philadelphia 76ers | San Francisco Warriors | 4–2 |
| 1967–68 | Boston Celtics | Los Angeles Lakers | 4–2 |
| 1968–69 | Boston Celtics | Los Angeles Lakers | 4–3 |
| 1969–70 | New York Knickerbockers | Los Angeles Lakers | 4–3 |
| 1970–71 | Milwaukee Bucks | Baltimore Bullets | 4–0 |
| 1971–72 | Los Angeles Lakers | New York Knickerbockers | 4–1 |
| 1972–73 | New York Knickerbockers | Los Angeles Lakers | 4–1 |
| 1973–74 | Boston Celtics | Milwaukee Bucks | 4–3 |
| 1974–75 | Golden State Warriors | Washington Bullets | 4–0 |
| 1975–76 | Boston Celtics | Phoenix Suns | 4–2 |
| 1976–77 | Portland Trail Blazers | Philadelphia 76ers | 4–2 |
| 1977–78 | Washington Bullets | Seattle SuperSonics | 4–3 |
| 1978–79 | Seattle SuperSonics | Washington Bullets | 4–1 |
| 1979–80 | Los Angeles Lakers | Philadelphia 76ers | 4–2 |
| 1980–81 | Boston Celtics | Houston Rockets | 4–2 |
| 1981–82 | Los Angeles Lakers | Philadelphia 76ers | 4–2 |
| 1982–83 | Philadelphia 76ers | Los Angeles Lakers | 4–0 |
| 1983–84 | Boston Celtics | Los Angeles Lakers | 4–3 |
| 1984–85 | Los Angeles Lakers | Boston Celtics | 4–2 |
| 1985–86 | Boston Celtics | Houston Rockets | 4–2 |
| 1986–87 | Los Angeles Lakers | Boston Celtics | 4–2 |
| 1987–88 | Los Angeles Lakers | Detroit Pistons | 4–3 |
| 1988–89 | Detroit Pistons | Los Angeles Lakers | 4–0 |
| 1989–90 | Detroit Pistons | Portland Trail Blazers | 4–1 |
| 1990–91 | Chicago Bulls | Los Angeles Lakers | 4–1 |
| 1991–92 | Chicago Bulls | Portland Trail Blazers | 4–2 |
| 1992–93 | Chicago Bulls | Phoenix Suns | 4–2 |
| 1993–94 | Houston Rockets | New York Knickerbockers | 4–3 |
| 1994–95 | Houston Rockets | Orlando Magic | 4–0 |
| 1995–96 | Chicago Bulls | Seattle SuperSonics | 4–2 |
| 1996–97 | Chicago Bulls | Utah Jazz | 4–2 |
| 1997–98 | Chicago Bulls | Utah Jazz | 4–2 |
| 1998–99 | San Antonio Spurs | New York Knickerbockers | 4–1 |
| 1999–2000 | Los Angeles Lakers | Indiana Pacers | 4–2 |
| 2000–01 | Los Angeles Lakers | Philadelphia 76ers | 4–1 |
| 2001–02 | Los Angeles Lakers | New Jersey Nets | 4–0 |
| 2002–03 | San Antonio Spurs | New Jersey Nets | 4–2 |
| 2003–04 | Detroit Pistons | Los Angeles Lakers | 4–1 |

**World Amateur Basketball Championship—men**

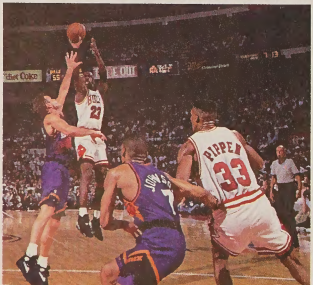
| year | winner | runner-up |
|---|---|---|
| 1936* | United States | Canada |
| 1948* | United States | France |
| 1950 | Argentina | United States |
| 1952* | United States | U.S.S.R. |
| 1954 | United States | Brazil |
| 1956* | United States | U.S.S.R. |
| 1959 | Brazil† | United States |
| 1960* | United States | U.S.S.R. |
| 1963 | Brazil | Yugoslavia |
| 1964* | United States | U.S.S.R. |
| 1967 | U.S.S.R. | Yugoslavia |
| 1968* | United States | Yugoslavia |
| 1970 | Yugoslavia | Brazil |
| 1972* | U.S.S.R. | United States |
| 1974 | U.S.S.R. | Yugoslavia |
| 1976* | United States | Yugoslavia |
| 1978 | Yugoslavia | U.S.S.R. |
| 1980* | Yugoslavia | Italy |
| 1982 | U.S.S.R. | United States |
| 1984* | United States | Spain |
| 1986 | United States | U.S.S.R. |
| 1988* | U.S.S.R. | Yugoslavia |
| 1990 | Yugoslavia | U.S.S.R. |
| 1992* | United States | Croatia |
| 1994 | United States | Russia |
| 1996* | United States | Yugoslavia |
| 1998 | Yugoslavia | Russia |
| 2000* | United States | France |
| 2002 | Yugoslavia | Argentina |
| 2004* | Argentina | Italy |

*Olympic championships, recognized as world championships.
†By default.

**World Amateur Basketball Championship—women**

| year | winner | runner-up |
|---|---|---|
| 1953 | United States | Chile |
| 1957 | United States | U.S.S.R. |
| 1959 | U.S.S.R. | Bulgaria |
| 1964 | U.S.S.R. | Czechoslovakia |
| 1967 | U.S.S.R. | South Korea |
| 1971 | U.S.S.R. | Czechoslovakia |
| 1975 | U.S.S.R. | Japan |
| 1976* | U.S.S.R. | United States |
| 1979 | United States | South Korea |
| 1980* | U.S.S.R. | Bulgaria |
| 1983 | U.S.S.R. | United States |
| 1984* | United States | South Korea |
| 1986 | United States | U.S.S.R. |
| 1988* | United States | Yugoslavia |
| 1990 | United States | Yugoslavia |
| 1992* | Unified Team† | China |
| 1994 | Brazil | China |
| 1996* | United States | Brazil |
| 1998 | United States | Russia |
| 2000* | United States | Australia |
| 2002 | United States | Russia |
| 2004* | United States | Australia |

*Olympic championships, recognized as world championships.
†Athletes from the Commonwealth of Independent States plus Georgia.



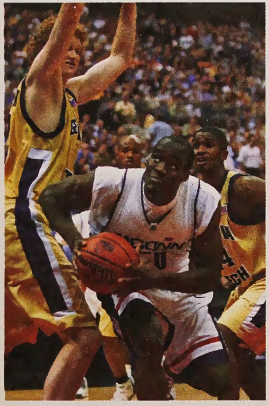



(Above) Anne Donovan (centre) of the United States attempting to shoot over Polona Dornik (left) and Sladjana Golic (right) of Yugoslavia during the 1988 World Amateur Basketball Championship; (left) Dan Majerle of the Phoenix Suns trying to block a shot by Michael Jordan of the Chicago Bulls in the 1992–93 NBA Championship finals; Kevin Johnson and Scottie Pippen look on. The Bulls won the NBA title for the third consecutive time

(Above) Focus on Sports; (left) Manny Millan—Sports Illustrated

**Division I National Collegiate Athletic Association (NCAA) Championship—men**

| year | winner | runner-up | score | year | winner | runner-up | score |
|---|---|---|---|---|---|---|---|
| 1939 | Oregon | Ohio State | 46–43 | 1972 | UCLA | Florida State | 81–76 |
| 1940 | Indiana | Kansas | 60–42 | 1973 | UCLA | Memphis State | 87–66 |
| 1941 | Wisconsin | Washington State | 39–34 | 1974 | North Carolina State | Marquette | 76–64 |
| 1942 | Stanford | Dartmouth | 53–38 | 1975 | UCLA | Kentucky | 92–85 |
| 1943 | Wyoming | Georgetown | 46–34 | 1976 | Indiana | Michigan | 86–68 |
| 1944 | Utah | Dartmouth | 42–40 | 1977 | Marquette | North Carolina | 67–59 |
| 1945 | Oklahoma A & M | New York | 49–45 | 1978 | Kentucky | Duke | 94–88 |
| 1946 | Oklahoma A & M | North Carolina | 43–40 | 1979 | Michigan State | Indiana State | 75–64 |
| 1947 | Holy Cross | Oklahoma | 58–47 | 1980 | Louisville | UCLA | 59–54 |
| 1948 | Kentucky | Baylor | 58–42 | 1981 | Indiana | North Carolina | 63–50 |
| 1949 | Kentucky | Oklahoma State | 46–36 | 1982 | North Carolina | Georgetown | 63–62 |
| 1950 | CCNY | Bradley | 71–68 | 1983 | North Carolina State | Houston | 54–52 |
| 1951 | Kentucky | Kansas State | 68–58 | 1984 | Georgetown | Houston | 84–75 |
| 1952 | Kansas | St. John's (N.Y.) | 80–63 | 1985 | Villanova | Georgetown | 66–64 |
| 1953 | Indiana | Kansas | 69–68 | 1986 | Louisville | Duke | 72–69 |
| 1954 | La Salle | Bradley | 92–76 | 1987 | Indiana | Syracuse | 74–73 |
| 1955 | San Francisco | La Salle | 77–63 | 1988 | Kansas | Oklahoma | 83–79 |
| 1956 | San Francisco | Iowa | 83–71 | 1989 | Michigan | Seton Hall | 80–79 |
| 1957 | North Carolina | Kansas | 54–53 | 1990 | UNLV | Duke | 103–73 |
| 1958 | Kentucky | Seattle | 84–72 | 1991 | Duke | Kansas | 72–65 |
| 1959 | California (Berkeley) | West Virginia | 71–70 | 1992 | Duke | Michigan | 71–51 |
| 1960 | Ohio State | California (Berkeley) | 75–55 | 1993 | North Carolina | Michigan | 77–71 |
| 1961 | Cincinnati | Ohio State | 70–65 | 1994 | Arkansas | Duke | 76–72 |
| 1962 | Cincinnati | Ohio State | 71–59 | 1995 | UCLA | Arkansas | 89–78 |
| 1963 | Loyola (Ill.) | Cincinnati | 60–58 | 1996 | Kentucky | Syracuse | 76–67 |
| 1964 | UCLA | Duke | 98–83 | 1997 | Arizona | Kentucky | 84–79 |
| 1965 | UCLA | Michigan | 91–80 | 1998 | Kentucky | Utah | 78–69 |
| 1966 | Texas Western | Kentucky | 72–65 | 1999 | Connecticut | Duke | 77–74 |
| 1967 | UCLA | Dayton | 79–64 | 2000 | Michigan State | Florida | 89–76 |
| 1968 | UCLA | North Carolina | 78–55 | 2001 | Duke | Arizona | 82–72 |
| 1969 | UCLA | Purdue | 92–72 | 2002 | Maryland | Indiana | 64–52 |
| 1970 | UCLA | Jacksonville | 80–69 | 2003 | Syracuse | Kansas | 81–78 |
| 1971 | UCLA | Villanova | 68–62 | 2004 | Connecticut | Georgia Tech | 82–73 |



University of Connecticut's Emeka Okafor (centre) drives through the defense of Luke Schenscher (left) and Marvin Lewis of Georgia Tech during the 2004 NCAA Championship

Eric Gay—AP/Wide World Photos

**Division I National Collegiate Athletic Association (NCAA) Championship—women**

| year | winner | runner-up | score |
|---|---|---|---|
| 1982 | Louisiana Tech | Cheney (Pa.) | 76–62 |
| 1983 | Southern California | Louisiana Tech | 69–67 |
| 1984 | Southern California | Tennessee | 72–61 |
| 1985 | Old Dominion | Georgia | 70–65 |
| 1986 | Texas | Southern California | 97–81 |
| 1987 | Tennessee | Louisiana Tech | 67–44 |
| 1988 | Louisiana Tech | Auburn | 56–54 |
| 1989 | Tennessee | Auburn | 76–60 |
| 1990 | Stanford | Auburn | 88–81 |
| 1991 | Tennessee | Virginia | 70–67 |
| 1992 | Stanford | Western Kentucky | 78–62 |
| 1993 | Texas Tech | Ohio State | 84–82 |
| 1994 | North Carolina | Louisiana Tech | 60–59 |
| 1995 | Connecticut | Tennessee | 70–64 |
| 1996 | Tennessee | Georgia | 83–65 |
| 1997 | Tennessee | Old Dominion | 68–59 |
| 1998 | Tennessee | Louisiana Tech | 93–75 |
| 1999 | Purdue | Duke | 62–45 |
| 2000 | Connecticut | Tennessee | 71–52 |
| 2001 | Notre Dame | Purdue | 68–66 |
| 2002 | Connecticut | Oklahoma | 82–70 |
| 2003 | Connecticut | Tennessee | 73–68 |
| 2004 | Connecticut | Tennessee | 70–61 |



Diana Taurasi (left) of the University of Connecticut Huskies dribbles against the defense of LaToya Davis of the Tennessee Lady Vols in the 2004 NCAA Championship

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**Association for Intercollegiate Athletics for Women (AIAW) Championship**

| year | winner | runner-up | score |
|---|---|---|---|
| 1972 | Immaculata (Pa.) | Westchester State | 52–48 |
| 1973 | Immaculata (Pa.) | Queens College | 59–52 |
| 1974 | Immaculata (Pa.) | Mississippi College | 68–53 |
| 1975 | Delta State | Immaculata (Pa.) | 90–81 |
| 1976 | Delta State | Immaculata (Pa.) | 69–64 |
| 1977 | Delta State | Louisiana State | 68–55 |
| 1978 | UCLA | Maryland | 90–74 |
| 1979 | Old Dominion | Louisiana Tech | 75–65 |
| 1980 | Old Dominion | Tennessee | 68–53 |
| 1981 | Louisiana Tech | Tennessee | 79–59 |
| 1982 | Rutgers | Texas | 83–77 |



Cynthia Cooper of the Houston Comets makes a layup during game two of the 2000 WNBA finals against the New York Liberty

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**Women's National Basketball Association (WNBA) Championship**

| season | winner | runner-up | results |
|---|---|---|---|
| 1997 | Houston Comets | New York Liberty | 1–0 |
| 1998 | Houston Comets | Phoenix Mercury | 2–1 |
| 1999 | Houston Comets | New York Liberty | 2–1 |
| 2000 | Houston Comets | New York Liberty | 2–0 |
| 2001 | Los Angeles Sparks | Charlotte Sting | 2–0 |
| 2002 | Los Angeles Sparks | New York Liberty | 2–0 |
| 2003 | Detroit Shock | Los Angeles Sparks | 2–1 |

## BILLIARDS

The game of billiards has a surprising number of varieties throughout the world. Factors in that variety include the number and appearance of the billiard balls, the size of the table, the existence of side and corner pockets, and the object of play. The classic form of the game—three-cushion billiards—is played on a pocketless table with one red ball and two white balls, one of which is marked with a spot; it is often known as French billiards, carom, or (simply) billiards.

Pocket billiards, which embraces both snooker and the game sometimes known (for the sake of clarity) as English billiards, is the prevalent form of billiards in the United Kingdom. The world professional snooker championship was first held in 1927; until 1947 it was won each year by Joe Davis (championships were not held during World War II). The championship was discontinued during the 1950s; it was revived during the 1960s, and in 1969 it became a knockout event. The results that are given in the table below begin with that year. Competition is open to both men and women.

The American form of pocket billiards, usually known as pool, differs markedly from the British game. Its most popular variations are eight-ball, nine-ball, and straight (or 14.1) pool. Though earlier straight pool tournaments—those that featured such players as Alfredo DeOro, Willie Mosconi, and Willie Hoppe—were held with regularity, the game has largely fallen into abeyance for national competition, and few national tournaments are held. Since the 1970s nine-ball and eight-ball pool have surpassed straight pool in popularity in the United States, and nine-ball has gained some prominence internationally. In 1990 the World Pool-Billiard Association (WPA; founded 1987) inaugurated the nine-ball world championship.

**World Three-Cushion Championship**

| year | winner | year | winner | year | winner |
|---|---|---|---|---|---|
| 1928 | E. Soussa (Egypt) | 1965 | R. Ceulemans (Belg.) | 1984 | Kobayashi N. (Japan) |
| 1929 | E. Soussa (Egypt) | 1966 | R. Ceulemans (Belg.) | 1985 | R. Ceulemans (Belg.) |
| 1930 | H.J. Robyns (Neth.) | 1967 | R. Ceulemans (Belg.) | 1986 | A. Rico (Spain) |
| 1931 | E. Miro (Spain) | 1968 | R. Ceulemans (Belg.) | 1987 | T. Blomdahl (Swed.) |
| 1932 | H.J. Robyns (Neth.) | 1969 | R. Ceulemans (Belg.) | 1988 | T. Blomdahl (Swed.) |
| 1933 | H.J. Robyns (Neth.) | 1970 | R. Ceulemans (Belg.) | 1989 | T. Blomdahl (Swed.) |
| 1934 | C. Puigvert (Spain) | 1971 | R. Ceulemans (Belg.) | 1990 | L. Dielis (Belg.) |
| 1935 | A. Lagache (Fr.) | 1972 | R. Ceulemans (Belg.) | 1991 | R. Ceulemans (Belg.) |
| 1936 | E.L. Lee (U.S.) | 1973 | R. Ceulemans (Belg.) | 1992 | T. Blomdahl (Swed.) |
| 1937 | A. Lagache (Fr.) | 1974 | Kobayashi N. (Japan) | 1993 | Sang Lee (U.S.) |
| 1938 | A. Vergez (Arg.) | 1975 | R. Ceulemans (Belg.) | 1994 | T. Blomdahl (Swed.) |
| 1948 | R. Vingerhoedt (Belg.) | 1976 | R. Ceulemans (Belg.) | 1995 | T. Blomdahl (Swed.) |
| 1952 | P.L. Carrera (Arg.) | 1977 | R. Ceulemans (Belg.) | 1996 | T. Blomdahl (Swed.) |
| 1953 | E. Navarra (Arg.) | 1978 | R. Ceulemans (Belg.) | 1997 | D. Jaspers (Neth.) |
| 1958 | E. Navarra (Arg.) | 1979 | R. Ceulemans (Belg.) | 1998 | T. Blomdahl (Swed.) |
| 1960 | R. Vingerhoedt (Belg.) | 1980 | R. Ceulemans (Belg.) | 1999 | D. Jaspers (Neth.) |
| 1961 | A. Suarez (Peru) | 1981 | L. Dielis (Belg.) | 2000 | D. Jaspers (Neth.) |
| 1963 | R. Ceulemans (Belg.) | 1982 | R. van Bracht (Neth. | 2001 | R. Ceulemans (Belg.) |
| 1964 | R. Ceulemans (Belg.) | 1983 | R. Ceulemans (Belg.) | | |

**World Professional Snooker Championship**

| year | winner* | year | winner* | year | winner* |
|---|---|---|---|---|---|
| 1969 | J. Spencer | 1981 | S. Davis | 1993 | S. Hendry |
| 1970 | R. Reardon | 1982 | A. Higgins | 1994 | S. Hendry |
| 1971 | J. Spencer | 1983 | S. Davis | 1995 | S. Hendry |
| 1972 | A. Higgins | 1984 | S. Davis | 1996 | S. Hendry |
| 1973 | R. Reardon | 1985 | D. Taylor | 1997 | K. Doherty |
| 1974 | R. Reardon | 1986 | J. Johnson | 1998 | J. Higgins |
| 1975 | R. Reardon | 1987 | S. Davis | 1999 | S. Hendry |
| 1976 | R. Reardon | 1988 | S. Davis | 2000 | M. Williams |
| 1977 | J. Spencer | 1989 | S. Davis | 2001 | R. O'Sullivan |
| 1978 | R. Reardon | 1990 | S. Hendry | 2002 | P. Ebdon |
| 1979 | T. Griffiths | 1991 | J. Parrott | | |
| 1980 | C. Thorburn (Can.) | 1992 | S. Hendry | | |

*Won by a U.K. player unless otherwise noted.

**WPA World Nine-Ball Championships**

| year | men's champion | women's champion |
|---|---|---|
| 1990 | E. Strickland (U.S.) | R. Bell (U.S.) |
| 1991 | E. Strickland (U.S.) | R. Bell (U.S.) |
| 1992 | J. Archer (U.S.) | F. Stark (Ger.) |
| 1993 | Chao Feng-pang (Taiwan) | L.J. Jones (U.S.) |
| 1994 | T. Okumura (Japan) | E. Mataya-Laurance (U.S.) |
| 1995 | O. Ortmann (Ger.) | G. Hofstatter (Austria) |
| 1996 | R. Souquet (Ger.) | A. Fisher (U.K.) |
| 1997 | J. Archer (U.S.) | A. Fisher (U.K.) |
| 1998 | K. Takahashi (Japan) | A. Fisher (U.K.) |
| 1999 | N. Varner (U.S.) | Liu Shin-Mei (Taiwan) |
| 2000 | Fong Pang Chao (Taiwan) | J. Kelly (Ire.) |
| 2001 | M. Immonen (Fin.) | A. Fisher (U.K.) |
| 2002 | E. Strickland (U.S.) | Liu Shin-Mei (Taiwan) |

## BOWLING

The world governing body for bowling is the Fédération Internationale des Quilleurs (FIQ). It has sponsored world bowling championships since 1954. In 1979 the FIQ discontinued the eights for men and fours for women and introduced the triples competition for men and for women.

In the United States, men's bowling is governed by the American Bowling Congress (ABC), which was founded in 1895. Six years later the first national championship was organized; in 1961 the yearly competition was split into two divisions—regular (for those with a combined average score of 851 or higher) and classic for professionals. The classic division was discontinued in 1980. The Women's International Bowling Congress (WIBC) was organized in 1916 and has since sponsored an annual women's championship. The women's open division is for those with a combined average score of 851 or higher, but the highest score in the tournament wins, regardless of division. In both the ABC tournament and the WIBC tournament, competition takes place between teams, doubles, and singles. The all-events category is won by the individual who has the best score of nine games—three team, three doubles, and three singles scores. The Professional Bowlers Association (PBA) was established in 1958. One of its major tournaments is the Firestone Tournament of Champions; the event was not held in 2001 or 2002 but was scheduled for 2003.

**FIQ World Bowling Championships—men**

| year | singles | pairs | triples | fives | eights |
|---|---|---|---|---|---|
| 1954 | G. Algeskog (Swed.) | Finland | | Sweden | Sweden |
| 1955 | N. Backstrom (Swed.) | Sweden | | West Germany | Finland |
| 1958 | K. Asukas (Fin.) | Sweden | | Finland | Sweden |
| 1960 | T. Reynolds (Mex.) | Mexico | | Venezuela | Mexico |
| 1963 | L. Zikes (U.S.) | United States | | United States | United States |
| 1967 | D. Pond (U.K.) | United Kingdom | | Finland | United States |
| 1971 | E. Luther (U.S.) | Puerto Rico | | United States | United States |
| 1975 | M. Stoudt (U.S.) | United Kingdom | | Finland | West Germany |
| 1979* | G. Bugden (U.K.) | Australia | Malaysia | Australia | |
| 1983 | T. Cariello (U.S.) | Australia | Sweden | Finland | |
| 1987 | P. Rolland (Fr.) | Sweden | United States | Sweden | |
| 1991 | Ying Chieh Ma (Taiwan) | United States | United States | Taiwan | |
| 1995 | M. Doi (Can.) | Sweden | The Netherlands | The Netherlands | |
| 1999 | G. Verbruggen (Belg.) | Sweden | Finland | Sweden | |

*In 1979 eights were discontinued altogether and triples were introduced.

**FIQ World Bowling Championships—women**

| year | singles | pairs | triples | fours | fives* |
|---|---|---|---|---|---|
| 1963 | H. Shablis (U.S.) | United States | | Mexico | United States |
| 1967 | H. Weston (U.S.) | Mexico | | Finland | Finland |
| 1971 | A. Gonzalez (P.R.) | Japan | | United States | United States |
| 1975 | A. Haefker (W.Ger.) | Sweden | | Japan | Japan |
| 1979† | L. de la Rosa (Phil.) | The Philippines | United States | | United States |
| 1983 | L. Sulkanen (Swed.) | Denmark | West Germany | | Sweden |
| 1987 | E. Piccini (Mex.) | United States | United States | | United States |
| 1991 | M. Beckel (Ger.) | Japan | Canada | | South Korea |
| 1995 | D. Ship (Can.) | Thailand | Australia | | Finland |
| 1999 | K. Kulick (U.S.) | Australia | South Korea | | South Korea |

*In 1963 this event was played as a four-woman team, European style (either the entire game on one lane or half of game on one lane, balance on accompanying lane). †In 1979 fours were discontinued altogether and triples were introduced.

**ABC Bowling Championships—Regular Division**

| year | singles | score | all-events | score |
|---|---|---|---|---|
| 1901 | F. Brill | 648 | F. Brill | 1,736 |
| 1902 | F. Strong | 649 | J. Koster | 1,841 |
| 1903 | D. Jones | 683 | F. Strong | 1,896 |
| 1904 | M. Kern | 647 | M. Kern | 1,804 |
| 1905 | C.M. Anderson | 651 | J. Reilly | 1,791 |
| 1906 | F. Favour | 669 | J.T. Peacock | 1,794 |
| 1907 | M.T. Levey | 624 | H.C. Ellis | 1,775 |
| 1908 | A. Wengler | 699 | R. Crable | 1,924 |
| 1909 | L. Sutton | 691 | J. Bouin | 1,885 |
| 1910 | T. Haley | 705 | T. Haley | 1,961 |
| 1911 | J. Blouin | 681 | J. Smith | 1,913 |
| 1912 | L. Sutton | 679 | P. Sutton | 1,843 |
| 1913 | F. Peterson | 693 | E. Herrmann | 1,972 |
| 1914 | W. Miller | 675 | W. Miller | 1,897 |
| 1915 | W. Pierce | 711 | M. Faetz | 1,876 |
| 1916 | S. Schliman | 685 | F. Thoma | 1,919 |
| 1917 | O. Kallusch | 698 | H. Miller | 1,945 |
| 1918 | C.J. Styles | 702 | H. Steers | 1,959 |
| 1919 | H. Cavan | 718 | M. Lindsey | 1,933 |
| 1920 | J. Shaw | 713 | J. Smith | 1,915 |
| 1921 | F. Smith | 702 | A. Schleman | 1,909 |
| 1922 | W. Lundgren | 729 | B. Spinella | 1,999 |
| 1923 | C. Baumgartner | 724 | W. Knox | 2,019 |
| 1924 | H. Smyers | 749 | A.F. Weber | 1,975 |
| 1925 | A. Green | 706 | C. Long | 1,977 |
| 1926 | E. Votel | 731 | H. Gesloski | 1,981 |
| 1927 | W. Eggars | 706 | B. Spinella | 2,014 |
| 1928 | H. Summers | 705 | P. Wolf | 1,937 |
| 1929 | A. Unke | 728 | O. Stein, Jr. | 1,974 |
| 1930 | L. Shotwell | 774 | G. Morrison | 1,985 |
| 1931 | W. Lachowski | 712 | M. Mauser | 1,966 |
| 1932 | O. Nitschke | 731 | H. Stewart | 1,980 |
| 1933 | E. Hewitt | 724 | G. Zunker | 2,060 |
| 1934 | J. Vidro | 721 | W. Peppenhagen | 1,972 |
| 1935 | D. Brokaw | 733 | O. Mayer | 2,022 |
| 1936 | C. Warren | 735 | J. Murphy | 2,006 |
| 1937 | E. Gagliardi | 749 | M. Stein | 2,070 |
| 1938 | K. Anderson | 746 | D. Beatty | 1,978 |
| 1939 | J. Danek | 730 | J. Wilman | 2,028 |
| 1940 | R. Brown | 742 | F. Fischer | 2,001 |
| 1941 | F. Ruff, Jr. | 745 | H. Kelly | 2,013 |
| 1942 | J. Stanley | 756 | S. Moskal | 1,973 |
| 1943–45 | no competition | | | |
| 1946 | L. Rollick | 737 | J. Wilman | 2,054 |
| 1947 | J. McMahon | 740 | J. McMahon | 1,965 |
| 1948 | L. Frotich | 721 | N. Day | 1,979 |
| 1949 | B. Rusche | 716 | J. Small | 1,941 |
| 1950 | E. Leins | 757 | F. Santore | 1,981 |
| 1951 | L. Jouglard | 775 | T. Lindemann | 2,005 |
| 1952 | A. Sharkey | 758 | S. Nagy | 2,065 |
| 1953 | F. Santore | 749 | F. Santore | 1,994 |
| 1954 | T. Sparando | 723 | B. Lewis | 1,985 |
| 1955 | E. Gerzine | 738 | F. Bujack | 1,993 |
| 1956 | G. Wade | 744 | D. Lillard | 2,018 |
| 1957 | B. Allen | 729 | J. Spalding | 2,088 |
| 1958 | E. Shay | 733 | A. Faragalli | 2,043 |
| 1959 | E. Lubanski | 764 | E. Lubanski | 2,116 |
| 1960 | P. Kulbaga | 726 | V. Lucci | 1,985 |
| 1961 | L. Spooner | 726 | L. Karan | 1,960 |
| 1962 | A. Renaldy | 720 | B. Young | 2,015 |
| 1963 | F. Delello | 744 | W. Oswalt | 2,055 |
| 1964 | J. Stefanich | 726 | L. Zikes | 2,001 |
| 1965 | K. Roeth | 700 | T. Hathaway | 1,922 |
| 1966 | D. Chapman | 761 | J. Wilcox | 2,004 |
| 1967 | F. Perry | 723 | G. Lewis | 2,010 |
| 1968 | W. Kowalski | 738 | V. Mazzanti | 1,971 |
| 1969 | G. Campbell | 751 | E. Jackson | 1,988 |
| 1970 | J. Yoder | 744 | M. Berlin | 2,004 |
| 1971 | A. Cohn | 738 | A. Cohn | 2,063 |
| 1972 | B. Pointer | 739 | M. Lowry | 2,026 |
| 1973 | E. Thompson | 762 | R. Woolet | 2,104 |
| 1974 | G. Krause | 773 | B. Hart | 2,087 |
| 1975 | J. Setser | 756 | B. Meadows | 2,033 |
| 1976 | M. Putzer | 758 | J. Lindquist | 2,071 |
| 1977 | F. Gadaleto | 738 | B. Debenham | 2,117 |
| 1978 | R. Mersek | 739 | C. Cobus | 1,994 |
| 1979 | R. Peters | 761 | B. Basacchi | 2,097 |
| 1980 | M. Eaton | 782 | S. Fehr | 2,076 |
| 1981 | R. Vital | 780 | R. Toft | 2,107 |
| 1982 | B. Bohm | 748 | R. Wonders | 2,076 |
| 1983 | R. Kendrick | 735 | T. Cariello | 2,059 |
| 1984 | R. Antczak<br>N. Young (tied) | 764 | R. Golke | 2,142 |
| 1985 | G. Harbison | 774 | B. Asher | 2,033 |
| 1986 | J. Mackey | 774 | E. Marzka | 2,116 |
| 1987 | T. Taylor | 749 | R. Shafer | 2,044 |
| 1988 | S. Hutkowski | 774 | R. Steelsmith | 2,053 |
| 1989 | P. Tetreault | 813 | G. Hall | 2,227 |
| 1990 | R. Hochrein | 791 | M. Neumann | 2,168 |
| 1991 | E. Deines | 826 | T. Howery | 2,218 |
| 1992 | G. Blatchford<br>B. Youker (tied) | 801 | M. Tucker | 2,158 |
| 1993 | D. Bock | 798 | J. Nimke | 2,254 |
| 1994 | J. Weltzien | 810 | T. Holt | 2,190 |
| 1995 | M. Surina | 826 | J. Kwiatkowski | 2,191 |
| 1996 | D. Scudder, Jr. | 823 | S. Kurtz | 2,224 |
| 1997 | J. Socha | 847 | J. Richgels | 2,241 |
| 1998 | J. Gaines | 814 | C. Barnes | 2,151 |
| 1999 | D. Winter | 825 | T. Jones | 2,158 |
| 2000 | G. Hein | 811 | R. Daniels | 2,181 |
| 2001 | N. Hoagland | 798 | D.J. Archer | 2,219 |
| 2002 | M. Millsap | 823 | S. Hardy | 2,279 |

**Professional Bowlers Association (PBA) Firestone Tournament of Champions**

| year | champion | year | champion | year | champion | year | champion |
|---|---|---|---|---|---|---|---|
| 1965 | B. Hardwick | 1974 | E. Anthony | 1983 | J. Berardi | 1992 | M. McDowell |
| 1966 | W. Zahn | 1975 | D. Davis | 1984 | M. Durbin | 1993 | G. Branham |
| 1967 | J. Stefanich | 1976 | M. Holman | 1985 | M. Williams | 1994 | N. Duke |
| 1968 | D. Davis | 1977 | M. Berlin | 1986 | M. Holman | 1995 | M. Aulby |
| 1969 | J. Goodman | 1978 | E. Anthony | 1987 | P. Weber | 1996 | D. D'Entremont |
| 1970 | D. Johnson | 1979 | G. Pappas | 1988 | M. Williams | 1997 | J. Gant |
| 1971 | J. Petraglia | 1980 | W. Webb | 1989 | D. Ballard | 1998 | B. Goebel |
| 1972 | M. Durbin | 1981 | S. Cook | 1990 | D. Ferraro | 1999 | J. Couch |
| 1973 | J. Godman | 1982 | M. Durbin | 1991 | D. Ozio | 2000 | J. Couch |

**WIBC Bowling Championships—Open Division**

| year† | singles | score | all-events | score |
|---|---|---|---|---|
| 1916 | Mrs. A.J. Koster | 486 | Mrs. A.J. Koster | 1,423 |
| 1918 | F. Steib | 537 | E. Jaeger | 1,552 |
| 1919 | B. Husk | 594 | B. Husk | 1,580 |
| 1920 | B. Humphreys | 559 | M. Leibrich | 1,606 |
| 1921 | E. Jaeger | 579 | E. Jaeger | 1,557 |
| 1922 | E. Jaeger | 603 | H. Abraham | 1,659 |
| 1923 | E. Jaeger | 594 | D. Fritz | 1,582 |
| 1924 | A. Feeney | 593 | R. Steger | 1,647 |
| 1925 | E. Reich | 622 | G. Hatch | 1,703 |
| 1926 | E. Weismann | 579 | E. Lackey | 1,641 |
| 1927 | E. Anhart | 577 | G. Hatch | 1,644 |
| 1928 | E. Rump | 622 | E. Jaeger | 1,713 |
| 1929 | A. Higgins | 637 | E. Jaeger | 1,700 |
| 1930 | A. Rump | 613 | S. Twyford | 1,727 |
| 1931 | M. Schulte | 650 | M. Schulte | 1,742 |
| 1932 | A. McVay | 668 | M. Warmbier | 1,807 |
| 1933 | S. Twyford | 628 | S. Twyford | 1,765 |
| 1934 | M. Clemensen | 712 | E. Ryan | 1,763 |
| 1935 | M. Warmbier | 652 | M. Warmbier | 1,911 |
| 1936 | E. Mankie | 612 | E. Mankie | 1,683 |
| 1937 | A. Gottstine | 647 | L. Stockdale | 1,761 |
| 1938 | R. Warner | 622 | D. Miller | 1,843 |
| 1939 | H. Hengstler | 626 | R. Troy | 1,724 |
| 1940 | S. Twyford | 626 | T. Small | 1,777 |
| 1941 | N. Huff | 662 | S. Twyford | 1,799 |
| 1942 | T. Taylor | 659 | N. Burns | 1,888 |
| 1946 | V. Mikiel | 682 | C. Fellmeth | 1,835 |
| 1947 | M. Junker | 650 | M. Burdeen | 1,826 |
| 1948 | S. Wernecke | 696 | V. Hupfer | 1,850 |
| 1949 | C. Mataya | 658 | C. Winandy | 1,840 |
| 1950 | C. McGovern | 669 | M. Ladewig | 1,796 |
| 1951 | J. Simpson | 639 | L. Carter | 1,788 |
| 1952 | L. Craig | 672 | V. Turner | 1,854 |
| 1953 | M. Baginski | 637 | D. Knechtges | 1,886 |
| 1954 | H. Bassett | 668 | A. Johnson | 1,880 |
| 1955 | N. Vella | 695 | M. Ladewig | 1,890 |
| 1956 | L. Noe | 708 | D. Knechtges | 1,867 |
| 1957 | E. Towles | 664 | A. Cantaline | 1,859 |
| 1958 | R. Hertel | 622 | M. Bolt | 1,828 |
| 1959 | M. Bolt | 664 | P. McCormick | 1,927 |
| 1960 | M. DeDanieis | 649 | J. Roberts | 1,836 |
| 1961 | E. Newton | 661 | E. Teal | 1,848 |
| 1962 | M. Hoffman | 693 | F. Argent | 1,808 |
| 1963 | D. Wilkinson | 653 | H. Shablis | 1,890 |
| 1964 | J. Havlish | 690 | J. Havlish | 1,980 |
| 1965 | D. Rudell | 659 | D. Zimmerman | 1,833 |
| 1966 | G. Bouvia | 675 | K. Helbig | 1,835 |
| 1967 | S. Faeth | 652 | C. Miller | 1,862 |
| 1968 | N. Parks | 691 | J.S. Reichley | 1,889 |
| 1969 | J. Bender | 690 | H. Duval | 1,927 |
| 1970 | D. Fothergill | 695 | D. Fothergill | 1,984* |
| 1971 | C. Scruggs | 698 | L. Koch | 1,840 |
| 1972 | D.D. Jacobson | 737* | M. Martorella | 1,877 |
| 1973 | B. Buffaloe | 706 | T. Calvery | 1,910 |
| 1974 | S. Garms | 702 | J. Cook Soutar | 1,924 |
| 1975 | L. Leicht | 689 | V. Park Norton | 1,821 |
| 1976 | B. Shonk | 688 | B. Morris | 1,866 |
| 1977 | Yamaga A. (Japan) | 714 | Yamaga A. (Japan) | 1,895 |
| 1978 | M. Bolt | 709 | A. Kelly | 1,896 |
| 1979 | B. Morris | 699 | B. Morris | 1,945 |
| 1980 | B. Morris | 674 | C. Robinson | 1,848 |
| 1981 | V. Norton | 672 | V. Norton | 1,905 |
| 1982 | G. Freeman | 653 | A. Rzepecki | 1,905 |
| 1983 | A. Rzepecki Sill | 726 | V. Norton | 1,922 |
| 1984 | F. Gate | 712 | Saitō S. (Japan) | 1,921 |
| 1985 | P. Schwarzel | 694 | A. Rzepecki Sill | 1,900 |
| 1986 | D. Stewart | 698 | R. Romeo<br>M. Lewis (tied) | 1,877 |
| 1987 | R. Jonak | 728 | L. Barrette | 1,972 |
| 1988 | M. Meyer-Welty | 690 | L. Wagner | 1,988 |
| 1989 | L. Anderson | 683 | N. Fehr | 1,911 |
| 1990 | P. Carter<br>D. Miller-Mackie | 705 | C. Norman | 1,984 |
| 1991 | D. Kuhn | 773 | D. Kuhn | 2,036 |
| 1992 | P. Ann | 680 | Tokimoto M. (Japan) | 1,928 |
| 1993 | K. Collura (Can.)<br>K. Murph (tied) | 747 | A.M. Duggan | 1,990 |
| 1994 | V. Fifield | 716 | W. Macpherson-Papanos | 1,940 |
| 1995 | B. Owen | 749 | B. Owen | 1,983 |
| 1996 | G. Berlanga | 723 | L. Nichols | 1,995 |
| 1997 | J. Schmidt | 765 | K. Cameron | 2,039 |
| 1998 | N. Glandon | 714 | L. Johnson | 1,989 |
| 1999 | N. Gianullas | 746 | H. Mizobuchi | 2,065 |
| 2000 | C. Krasner | 729 | C. Dorin-Ballard | 2,147 |
| 2001 | L. Wagner | 756 | J. Armon | 2,044 |
| 2002 | T. Smith | 752 | C. Honeychurch | 2,150 |

*WIBC tournament. †No competition in 1917 and 1943–45.

## BOXING

Modern boxing is dated to about the 1880s, when the Marquess of Queensberry's rules (or rules derived from them) became more or less standard. John L. Sullivan (U.S.) was the last of the bare-knuckles heavyweight champions and one of the first recognized champions to fight by the "new" rules. Despite an early trend toward some kind of organization, there is no single recognized world governing body in professional boxing. Europe, the Commonwealth, and Great Britain—not to mention a number of Asian boxing federations—all have championships. The World Boxing Association (WBA), formed under a different name in 1920, is basically a U.S. organization. It was once the largely undisputed governing body for the Americas. Since 1963 it has had some competition from the World Boxing Council (WBC), which includes British and European countries as well as Latin-American and Asian countries. In 1983 another organization, the International Boxing Federation (IBF; called the United States Boxing Association International from 1983 to 1984) was born of dissatisfaction with the WBA and the WBC. Other federations, with the exception of the World Boxing Organization (WBO; formed in 1988), have not received international recognition.

The tables below contain the names of the undisputed champions in each weight class, their countries, and the dates of the title bouts. Unless otherwise indicated, a champion retains his title until he is defeated. In the early 1990s the WBA, WBC, and IBF all recognized 17 weight divisions. In the tables below the primary name given for each division is that used by the WBA. If a different name is used by the WBC or the IBF, or by both, that name is given as an alternate.

### World Heavyweight Champions—no weight limit

Undisputed champions (country; title awarded)

John L. Sullivan (U.S.; 8/29/1885)
James J. Corbett (U.S.; 9/7/92)
Bob Fitzsimmons (U.S.*; 3/17/97)
James J. Jeffries (U.S.; 6/9/99)
  retired in 1905
Marvin Hart (U.S.; 7/3/05)
Tommy Burns (Can.; 2/23/06)
Jack Johnson (U.S.; 12/26/08)
Jess Willard (U.S.; 4/5/15)
Jack Dempsey (U.S.; 7/4/19)
Gene Tunney (U.S.; 9/23/26)
  retired in 1928
Max Schmeling (Ger.; 6/12/30)
Jack Sharkey (U.S.; 6/21/32)
Primo Carnera (Italy; 6/29/33)
Max Baer (U.S.; 6/14/34)
James J. Braddock (U.S.; 6/13/35)
Joe Louis (U.S.; 6/22/37)
  retired in 1949
Ezzard Charles (U.S.; 9/27/1950)
Jersey Joe Walcott (U.S.; 7/18/51)
Rocky Marciano (U.S.; 9/23/52)
Floyd Patterson (U.S.; 11/30/56)
Ingemar Johansson (Swed.; 6/26/59)
Floyd Patterson (U.S.; 6/20/60)
Sonny Liston (U.S.; 9/25/62)
Cassius Clay (later Muhammad Ali, U.S.; 2/25/64)
  stripped of WBA title in 1965; stripped of WBC title in 1967; title in dispute

WBA

Ernest Terrell (U.S.; 3/5/1965)
  gave up title in 1967†
Jimmy Ellis (U.S.; 4/27/68)
Joe Frazier (U.S.; 2/16/70)
George Foreman (U.S.; 1/22/73)
Muhammad Ali (U.S.; 10/30/74)
Leon Spinks (U.S.; 2/15/78)
Muhammad Ali (U.S.; 9/15/78)
  retired in 1979
John Tate (U.S.; 10/20/79)
Mike Weaver (U.S.; 3/21/80)
Michael Dokes (U.S.; 12/10/82)
Gerrie Coetzee (S.Af.; 9/23/83)
Greg Page (U.S.; 12/1/84)
Tony Tubbs (U.S.; 4/29/85)
Tim Witherspoon (U.S.; 1/17/86)
James Smith (U.S.; 12/12/86)
Mike Tyson (U.S.; 3/7/87)
James Douglas (U.S.; 2/11/90)
Evander Holyfield (U.S.; 10/26/90)
Riddick Bowe (U.S.; 11/13/92)
Evander Holyfield (U.S.; 11/6/93)
Michael Moorer (U.S.; 4/22/94)
George Foreman (U.S.; 11/5/94)
  stripped of title in 1995
Bruce Seldon (U.S.; 4/8/95)
Mike Tyson (U.S.; 9/7/96)
Evander Holyfield (U.S.; 11/9/96)
Lennox Lewis (U.K.; 11/13/99)
  stripped of title in 2000
Evander Holyfield (U.S.; 8/12/2000)
John Ruiz (P.R.; 3/3/01)
Roy Jones, Jr. (U.S.; 3/1/03)
  gave up title in 2004
John Ruiz (U.S.; 2/24/04)

WBC

Joe Frazier (U.S.; 2/16/1970)
George Foreman (U.S.; 1/22/73)
Muhammad Ali (U.S.; 10/30/74)
  stripped of title in 1979
Ken Norton (U.S.; 3/18/78)
Larry Holmes (U.S.; 6/9/78)
  gave up title in 1983
Tim Witherspoon (U.S.; 3/9/84)
Pinklon Thomas (U.S.; 8/31/84)
Trevor Berbick (Can.; 3/22/86)
Mike Tyson (U.S.; 11/22/86)
James Douglas (U.S.; 2/11/90)
Evander Holyfield (U.S.; 10/26/90)
Riddick Bowe (U.S.; 11/13/92)
  stripped of title in 1992
Lennox Lewis (U.K.; 12/14/92)
Oliver McCall (U.S.; 9/24/94)
Frank Bruno (U.K.; 9/2/95)
Mike Tyson (U.S.; 3/16/96)
  gave up title in 1996
Lennox Lewis (U.K.; 2/7/97)
Hasim Rahman (U.S.; 4/21/2001)
Lennox Lewis (U.K.; 11/17/01)
  gave up title in 2004
Vitaly Klitschko (Ukr.; 4/24/04)

IBF

Larry Holmes‡ (U.S.; 11/1983)
Michael Spinks (U.S.; 9/21/85)
  stripped of title in 1987
Tony Tucker (U.S.; 5/30/87)
Mike Tyson (U.S.; 8/1/87)
James Douglas (U.S.; 2/11/90)
Evander Holyfield (U.S.; 10/25/90)
Riddick Bowe (U.S.; 11/13/92)
Evander Holyfield (U.S.; 11/6/93)
Michael Moorer (U.S.; 4/22/94)
George Foreman (U.S.; 11/5/94)
  gave up title in 1995
Francois Botha (S.Af.; 12/9/95)
  stripped of title in 1996
Michael Moorer (U.S.; 6/22/96)
Evander Holyfield (U.S.; 11/8/97)
Lennox Lewis (U.K.; 11/13/99)
Hasim Rahman (U.S.; 4/21/2001)
Lennox Lewis (U.K.; 11/17/01)
  gave up title in Sept. 2002
Chris Byrd (U.S.; 12/14/02)

*Formerly a British subject. †Defeated by Ali 2/6/67. ‡Recognized as champion in November 1983.

### World Cruiserweight Champions—top weight 200 pounds (90.7 kg)*

WBA* (country; title awarded)

Ossie Ocasio (P.R.; 2/13/1982)
Piet Crous (S.Af.; 12/1/84)
Dwight Muhammad Qawi (U.S.; 7/27/85)
Evander Holyfield (U.S.; 7/12/86)
  gave up title in 1988
Taoufik Belbouli (Fr.; 3/25/89)
  declared vacant in 1989
Robert Daniels (U.S.; 11/28/89)
Bobby Czyz (U.S.; 3/8/91)
vacant
Orlin Norris (U.S.; 11/6/93)
Nate Miller (U.S.; 7/22/95)
Fabrice Tiozzo (Fr.; 11/8/97)
Virgil Hill (U.S.; 12/9/2000)
Jean Marc Mormeck (Fr.; 2/3/2002)

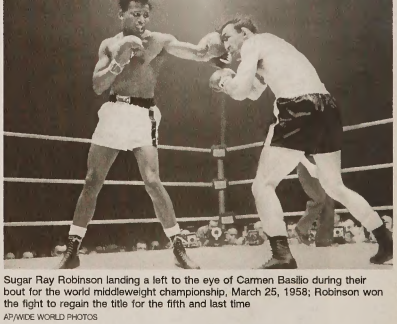
WBC

Marvin Camel (U.S.; 3/31/1980)
Carlos de León (P.R.; 11/25/80)
S.T. Gordon (U.S.; 6/27/1982)
Carlos de León (P.R.; 7/17/85)
Alfonso Ratliff (U.S.; 6/6/85)
Bernard Benton (U.S.; 9/21/85)
Carlos de León (P.R.; 3/22/86)
Evander Holyfield (U.S.; 4/9/88)
  gave up title in 1988
Carlos de León (P.R.; 5/17/89)
Massimiliano Duran (Italy; 7/27/90)
Anaclet Wamba (Fr.; 7/20/91)
Marcelo Dominguez (Arg.; 4/19/96)
Juan Carlos Gomez (Cuba; 2/21/98)
  gave up title in 2002
Wayne Braithwaite (Guyana; 10/11/02)

IBF

Marvin Camel (U.S.; 12/13/1983)
Lee Roy Murphy (U.S.; 10/6/84)
Rickey Parkey (U.S.; 10/25/86)
Evander Holyfield (U.S.; 5/15/87)
Glenn McCrory (U.K.; 6/3/89)
Jeff Lampkin (U.S.; 3/22/90)
  gave up title in 1991
James Warring (U.S.; 9/7/91)
Alfred Cole (U.S.; 7/30/92)
  gave up title in 1996
Adolpho Washington (U.S.; 8/31/96)
Uriah Grant (U.S.; 6/21/97)
Imamu Mayfield (U.S.; 11/8/97)
Arthur Williams (U.S.; 10/30/98)
Vassily Jirov (Kazak.; 6/3/99)
James Toney (U.S.; 4/26/03)
  gave up title in 2003
Kelvin Davis (U.S.; 5/1/04)

*Cruiserweight division was first recognized by WBA in 1982.



Sugar Ray Robinson landing a left to the eye of Carmen Basilio during their bout for the world middleweight championship, March 25, 1958; Robinson won the fight to regain the title for the fifth and last time

AP/WIDE WORLD PHOTOS

## World Light Heavyweight Champions—top weight 175 pounds (79.3 kg)

Undisputed champions (country; title awarded)

Jack Root (Austria; 4/22/1903)
George Gardner (Ire.; 7/4/03)
Bob Fitzsimmons (U.S.*; 11/25/03)
Philadelphia Jack O'Brien (U.S.; 12/20/05)
retired in 1912
Jack Dillon (U.S.; 4/28/14)
Battling Levinsky (U.S.; 10/24/16)
Georges Carpentier (Fr.; 10/12/20)

Battling Siki (Louis Phal, Seneg.; 9/24/22)
Mike McTigue (Ire.; 3/17/23)
Paul Berlenbach (U.S.; 5/30/25)
Jack Delaney (Can.; 7/16/26)
gave up title in 1927
Tommy Loughran (U.S.; 12/12/27)
gave up title in 1929
Maxie Rosenbloom (U.S.; 7/14/32)

Bob Olin (U.S.; 11/16/34)
John Henry Lewis (U.S.; 10/31/35)
retired in 1939
Melio Bettina (U.S., 2/3/39)
Billy Conn (U.S.; 7/13/39)
gave up title in 1941
Gus Lesnevich (U.S.; 5/14/46)
Freddie Mills (U.K., 7/26/48)
Joey Maxim (U.S.; 1/24/50)

Archie Moore (U.S.; 12/17/52)
stripped of title in 1962
Harold Johnson (U.S.; 5/12/62)
Willie Pastrano (U.S.; 6/1/63)
José Torres (P.R.; 3/30/65)
Dick Tiger (Nigeria; 12/16/66)
Bob Foster (U.S.; 5/24/68)
stripped of WBA title in 1970

WBA

Vicente Rondon (Venez.; 2/27/1971)
Bob Foster (U.S.; 4/7/72)
retired in 1974
Victor Galíndez (Arg.; 12/7/74)
Mike Rossman (U.S.; 9/15/78)
Victor Galíndez (Arg.; 4/14/79)

Marvin Johnson (U.S.; 11/30/79)
Eddie Gregory (later Eddie Mustafa Muhammad, U.S.; 3/31/80)
Michael Spinks (U.S.; 7/18/81)
gave up title in 1985
Marvin Johnson (U.S.; 2/9/86)
Leslie Stewart (Trin./Tob.; 5/23/87)

Virgil Hill (U.S.; 9/5/87)
Thomas Hearns (U.S.; 6/3/91)
Iran Barkley (U.S.; 3/21/92)
gave up title in 1992
Virgil Hill (U.S.; 9/92)
Dariusz Michalczewski (Ger.; 6/13/97)
stripped of title in 1997

Lou Del Valle (U.S.; 9/20/97)
Roy Jones, Jr. (U.S.; 7/18/98)
gave up title in 2003
Silvio Branco (Italy; 10/10/03)
Fabrice Tiozzo (Fr.; 3/20/04)

WBC

Bob Foster (U.S.; 5/24/1968)
retired in 1974
John Conteh (U.K.; 10/1/74)
stripped of title in 1977
Miguel Cuello (Arg.; 5/21/77)
Mate Parlov (Yugos.; 1/7/78)
Marvin Johnson (U.S.; 12/2/78)
Matthew Franklin (later Matthew Saad Muhammad, U.S.; 4/22/79)
Dwight Braxton (later Dwight Muhammad Qawi, U.S.; 12/1/81)
Michael Spinks (U.S.; 3/18/83)
gave up title in 1985

J.B. Williamson (U.S.; 12/10/85)
Dennis Andries (U.K.; 4/30/86)
Thomas Hearns (U.S.; 3/7/87)
gave up title in 1988
Don Lalonde (Can.; 11/27/87)
Sugar Ray Leonard (U.S.; 11/7/88)
gave up title in 1987
Dennis Andries (U.K.; 2/2/89)
Jeff Harding (Austl.; 6/24/89)
Dennis Andries (U.K.; 7/8/90)
Jeff Harding (Austl.; 9/11/91)
Mike McCallum (Jam.; 7/23/94)
Fabrice Tiozzo (Fr.; 6/16/95)
Roy Jones, Jr. (U.S.; 11/23/96)

Montell Griffin (U.S.; 3/21/97)
Roy Jones, Jr. (U.S.; 8/7/97)
gave up title in 2003
Antonio Tarver (U.S.; 4/26/03)
Roy Jones, Jr. (U.S.; 11/8/03)
Antonio Tarver (U.S.; 5/15/04)

IBF

Slobodan Kacar (Yugos.; 12/21/1985)
Bobby Czyz (U.S.; 9/6/86)
Charles Williams (U.S.; 10/29/87)
Henry Maske (Ger.; 3/20/93)
Virgil Hill (U.S.; 11/23/96)
Dariusz Michalczewski (Ger.; 6/13/97)
gave up title in 1997
William Guthrie (U.S.; 7/19/97)
Reggie Johnson (U.S.; 2/6/98)
Roy Jones, Jr. (U.S.; 6/5/99)
stripped of title in 2002
Antonio Tarver (U.S.; 4/26/03)
gave up title in 2003
Glencoffe Johnson (U.S.; 2/6/04)

*Formerly a British subject.

## World Super Middleweight Champions—top weight 168 pounds (76.2 kg)*

WBA* (country; title awarded)

Park Chong-Pal (S.Kor.; 12/6/1987)
Fulgencio Obelmejías (Venez.; 5/23/88)
Baek In-chul (S.Kor.; 5/27/89)

Christophe Tiozzo (Fr.; 3/30/90)
Victor Córdoba (Pan.; 4/5/91)
Michael Nunn (U.S.; 9/12/92)
Steve Little (U.S.; 2/26/94)

Frank Liles (U.S.; 8/12/94)
Byron Mitchell (U.S.; 6/12/99)
Bruno Girard (Fr.; 4/8/2000)
stripped of title in 2001

Byron Mitchell (U.S.; 3/3/01)
Sven Ottke (Ger.; 3/15/03)
gave up title in 2004
Manny Siaca (P.R.; 5/5/04)

WBC†

IBF

Sugar Ray Leonard (U.S.; 11/7/1988)
gave up title in 1990
Mauro Galvano (Italy; 12/15/90)
Nigel Benn (U.K.; 10/3/92)
Thulane Malinga (S.Af.; 3/2/96)
Vincenzo Nardiello (Italy; 7/6/96)
Robin Reid (U.K.; 10/12/96)
Thulane Malinga (S.Af.; 12/19/97)
Richie Woodhall (U.K.; 3/27/98)

Markus Beyer (Ger.; 10/23/99)
Glenn Catley (U.K.; 5/6/2000)
Dingaan Thobela (S.Af.; 9/1/00)
Davey Hilton (Can.; 12/15/00)
stripped of title in 2001
Eric Lucas (Can.; 7/10/01)
Markus Beyer (Ger.; 4/5/03)
Cristian Sanavia (Italy; 6/5/04)

Murray Sutherland (U.K.; 3/28/1984)
Park Chong-Pal (S.Kor.; 7/22/84)
gave up title in 1987
Graciano Rocchigiani (Ger.; 3/12/88)
gave up title in 1989
Lindell Holmes (U.S.; 1/27/90)
Darrin Van Horn (U.S.; 5/18/91)

Iran Barkley (U.S.; 1/10/92)
James Toney (U.S.; 2/13/93)
Roy Jones, Jr. (U.S.; 11/18/94)
gave up title in 1997
Charles Brewer (U.S.; 6/21/97)
Sven Ottke (Ger.; 10/24/98)
gave up title in 2004

*Super middleweight division first recognized by WBA in 1987. †Super middleweight division first recognized by WBC in 1988.

## World Middleweight Champions—top weight 160 pounds (72.5 kg)*

Undisputed champions (country; title awarded)

Jack ("the Nonpareil") Dempsey (U.S.; 7/30/1884)
Bob Fitzsimmons (U.K.†; 1/14/91)
gave up title in 1895
Tommy Ryan (U.S.; 10/24/98)
retired in 1907
Stanley Ketchel (U.S.; 5/9/08)
Billy Papke (U.S.; 9/7/08)
Stanley Ketchel (U.S.; 11/26/08)
died in 1910
George Chip (U.S.; 10/11/13)
Al McCoy (U.S.; 4/6/14)

Mike O'Dowd (U.S.; 11/14/17)
Johnny Wilson (U.S.; 5/6/20)
Harry Greb (U.S.; 8/31/23)
Tiger Flowers (U.S.; 2/26/26)
Mickey Walker (U.S.; 12/3/26)
gave up title in 1931;
title in dispute
Tony Zale (U.S.; 11/28/41)
Rocky Graziano (U.S.; 7/16/47)
Tony Zale (U.S.; 6/10/48)
Marcel Cerdan (Fr.; 9/21/48)
Jake La Motta (U.S.; 6/16/49)

Sugar Ray Robinson (U.S.; 2/14/51)
Randy Turpin (U.K.; 7/10/51)
Sugar Ray Robinson (U.S.; 9/12/51)
retired 1952–54
Carl Olson (U.S.; 10/21/53)
Sugar Ray Robinson (U.S.; 12/9/55)
Gene Fullmer (U.S.; 1/2/57)
Sugar Ray Robinson (U.S.; 5/1/57)
Carmen Basilio (U.S.; 9/23/57)
Sugar Ray Robinson (U.S.; 3/25/58)
stripped of NBA (later WBA)
title in 1959

Dick Tiger (Richard Ihetu, Nigeria; 8/10/63)
Joey Giardello (U.S.; 12/7/63)
Dick Tiger (Nigeria; 10/21/65)
Emile Griffith (U.S.; 4/25/66)
Nino Benvenuti (Italy; 4/17/67)
Emile Griffith (U.S.; 9/29/67)
Nino Benvenuti (Italy; 3/4/68)
Carlos Monzón (Arg.; 11/7/70)
stripped of WBC title in 1974

WBA

Carlos Monzón (Arg.; 10/5/1974)
gave up title in 1977
Rodrigo Valdés (Colom.; 11/5/77)
Hugo Corro (Arg.; 4/22/78)
Vito Antuofermo (Italy; 6/30/79)
Alan Minter (U.K.; 3/16/80)
Marvin Hagler (U.S.; 9/27/80)
stripped of title in 1987

Sumbu Kalambay (Italy; 10/23/87)
stripped of title in 1989
Mike McCallum (Jam.; 5/13/89)
stripped of title in 1991
Reggie Johnson (U.S.; 4/22/92)
John David Jackson (U.S.; 10/2/93)
stripped of title in 1994
Jorge Castro (Arg.; 8/12/94)

Shinji Takehara (Japan; 12/19/95)
William Joppy (U.S.; 6/24/96)
Julio César Green (Dom.Rep.; 8/23/97)
William Joppy (U.S.; 1/31/98)
Felix Trinidad (P.R.; 5/13/2001)
Bernard Hopkins (U.S.; 9/29/01)
Bernard Hopkins (U.S.; 12/13/03)

Maselino Masoe (N.Z.; 5/1/04)

WBC

Rodrigo Valdés (Colom.; 5/24/1974)
Carlos Monzón (Arg.; 6/26/76)
gave up title in 1977
Rodrigo Valdés (Colom.; 11/5/77)
Hugo Corro (Arg.; 4/22/78)
Vito Antuofermo (Italy; 6/30/79)
Alan Minter (U.K., 3/16/80)
Marvin Hagler (U.S.; 9/27/80)

Sugar Ray Leonard (U.S.; 4/6/87)
gave up title in 1987
Thomas Hearns (U.S.; 10/29/87)
Iran Barkley (U.S.; 6/6/88)
Roberto Duran (Pan.; 2/24/89)
stripped of title in 1990
Julian Jackson (U.S.; 11/24/90)
Gerald McClellan (U.S.; 5/8/93)
vacant

Julian Jackson (U.S.; 3/17/95)
Quincy Taylor (U.S.; 8/19/95)
Keith Holmes (U.S.; 3/16/96)
Hassine Cherifi (Fr.; 5/2/98)
Keith Holmes (U.S.; 4/24/99)
Bernard Hopkins (U.S.; 4/14/2001)

IBF

Marvin Hagler (U.S.; 5/27/1983)
relinquished title in 1987
Frank Tate (U.S.; 10/10/87)
Michael Nunn (U.S.; 7/28/88)
James Toney (U.S.; 5/10/91)
gave up title in 1993
Roy Jones (U.S.; 5/22/93)
gave up title in 1994
Bernard Hopkins (U.S.; 4/29/95)

*Until 1915 not over 158 pounds. †Later became U.S. citizen.

## World Junior Middleweight Champions—top weight 154 pounds (69.8 kg, also called super welterweight)

### WBA (country; title awarded)

Dennis Moyer (U.S.; 10/20/1962)
Ralph Dupas (U.S.; 4/29/63)
Sandro Mazzinghi (Italy; 9/7/63)
Nino Benvenuti (Italy; 6/18/65)
Kim Ki Soo (S.Kor.; 6/25/66)
Sandro Mazzinghi (Italy; 5/25/68)
  stripped of title in 1969
Freddie Little (U.S.; 3/17/69)
Carmelo Bossi (Italy; 7/9/70)
Wajima Koichi (Japan; 10/31/71)
Oscar Albarado (U.S.; 6/3/74)
Wajima Koichi (Japan; 1/21/75)
Yuh Jae Do (S.Kor.; 6/7/75)
Wajima Koichi (Japan; 2/17/76)
José Durán (Spain; 5/18/76)
Miguel Castellini (Arg.; 10/8/76)
Eddie Gazo (Nic.; 3/5/77)
Kudo Masashi (Japan; 8/9/78)
Ayub Kalule (Den.; 10/24/79)
Sugar Ray Leonard (U.S.; 6/25/81)
  gave up title in 1981
Mihara Tadashi (Japan; 11/7/81)
Davey Moore (U.S.; 2/2/82)
Roberto Durán (Pan.; 6/16/83)
  gave up title in 1984
Mike McCallum (Jam.; 10/19/84)
  gave up title in 1987
Julian Jackson (U.S.; 11/21/87)
  gave up title in 1990
Gilbert Dele (Fr.; 2/23/91)
Vinny Pazienzia (U.S.; 10/11/91)
  gave up title in 1992
Julio César Vásquez (Arg.; 12/22/92)
Pernell Whitaker (U.S.; 3/4/95)
  gave up title in 1995
Cari Daniels (U.S.; 6/16/95)
Julio César Vásquez (Arg.; 12/16/95)
Laurent Boudouani (Fr.; 6/21/96)
David Reid (U.S.; 3/6/99)
Felix Trinidad (P.R.; 3/3/2000)
  gave up title in 2001
Fernando Vargas (U.S.; 9/22/01)
Santiago Samaniego (Pan.; 8/10/02)*
Oscar de la Hoya (U.S.; 9/14/02)
Shane Mosley (U.S.; 9/13/03)
Ronald Wright (U.S.; 3/13/04)

### WBC

Miguel de Oliveira (Braz.; 5/7/1975)
Elisha Obed (Bahamas; 11/13/75)
Eckhard Dagge (W.Ger.; 6/18/76)
Rocco Mattioli (Italy; 8/6/77)
Maurice Hope (U.K.; 3/4/79)
Wilfred Benítez (P.R.; 5/3/81)
Thomas Hearns (U.S.; 12/3/82)
  gave up title in 1986
Duane Thomas (U.S.; 12/5/86)
Lupe Aquino (Mex.; 7/12/87)
Gianfranco Rosi (Italy; 10/2/87)
Donald Curry (U.S.; 7/8/88)
René Jacquot (Fr.; 2/11/89)
John Mugabi (Ugan.; 7/8/89)
Terry Norris (U.S.; 3/31/90)
Simon Brown (U.S.; 12/18/93)
Terry Norris (U.S.; 5/7/94)
Luis Santana (Dom.Rep.; 11/12/94)
Terry Norris (U.S.; 8/19/95)
Keith Mullings (U.S.; 12/6/97)
Javier Castillejo (Spain; 1/29/99)
Oscar de la Hoya (U.S.; 6/23/01)
Shane Mosley (U.S.; 9/13/03)
Ronald Wright (U.S.; 3/13/04)

### IBF

Mark Medal (U.S.; 3/11/1984)
Carlos Santos (P.R.; 11/2/84)
Buster Drayton (U.S.; 6/4/86)
Matthew Hilton (Can.; 6/27/87)
Robert Hines (U.S.; 11/4/88)
Darrin Van Horn (U.S.; 2/4/89)
Gianfranco Rosi (Italy; 7/16/89)
Vincent Pettway (U.S.; 9/17/94)
Paul Vaden (U.S.; 8/12/95)
Terry Norris (U.S.; 12/16/95)
  gave up title in 1997
Raul Marquez (U.S.; 4/12/97)
Yory Boy Campas (Mex.; 12/6/97)
Fernando Vargas (U.S.; 12/12/98)
Felix Trinidad (P.R.; 12/2/2000)
  gave up title in 2001
Ronald Wright (U.S.; 10/12/01)
  stripped of title in 2004
Verno Phillips (U.S.; 6/5/04)

*Won interim title, remained world champion after de la Hoya win.

## World Welterweight Champions—top weight 147 pounds (66.6 kg)*

### Undisputed champions (country; title awarded)

Paddy Duffy (U.S.; 10/30/1888)
  died in 1890
Mysterious Billy Smith (U.S.; 12/14/92)
Tommy Ryan (U.S.; 7/26/94)
  gave up title in 1898
Mysterious Billy Smith (U.S.; 8/25/98)
Jim "Rube") Ferns (U.S.; 1/15/1900)
Matty Matthews (U.S.; 10/18/1900)
Jim "Rube") Ferns (U.S.; 5/24/01)
Joe Walcott (Barbados; 12/18/01)
  title in dispute from 1904
Ted ("Kid") Lewis (U.K.; 8/31/15)
Jack Britton (U.S.; 4/24/16)
Ted ("Kid") Lewis (U.K.; 6/25/17)
Jack Britton (U.S.; 3/17/19)
Mickey Walker (U.S.; 11/1/22)
Pete Latzo (U.S.; 5/20/26)
Joe Dundee (U.S.; 6/3/27)
  stripped of NBA (later WBA) title in 1928
Jackie Fields (U.S.; 7/25/29)
Young Jack Thompson (U.S.; 5/9/30)
Tommy Freeman (U.S.; 9/5/30)
Young Jack Thompson (U.S.; 4/14/31)
Lou Brouillard (Can.; 10/23/31)
Jackie Fields (U.S.; 1/28/32)
Young Corbett III (Rafelle Giordano, U.S.; 2/22/33)
Jimmy McLarnin (Can.; 5/29/33)
Barney Ross (U.S.; 5/28/34)
Jimmy McLarnin (Can.; 9/17/34)
Barney Ross (U.S.; 5/28/35)
Henry Armstrong (U.S.; 5/31/38)
Fritzie Zivic (U.S.; 10/4/40)
Freddie ("Red") Cochrane (U.S.; 7/29/41)
Marty Servo (U.S.; 2/1/46)
  retired in 1946
Sugar Ray Robinson (U.S.; 12/20/46)
  gave up title in 1951
Kid Gavilan (Cuba; 5/18/51)
Johnny Saxton (U.S.; 10/20/54)
Tony DeMarco (U.S.; 4/1/55)
Carmen Basilio (U.S.; 6/10/55)
Johnny Saxton (U.S.; 3/14/56)
Carmen Basilio (U.S.; 9/12/56)
  gave up title in 1957
Virgil Akins (U.S., 6/6/58)
Don Jordan (U.S.; 12/5/58)
Benny ("Kid") Paret (Cuba; 5/27/60)
Emile Griffith (U.S.; 4/1/61)
Benny ("Kid") Paret (Cuba; 9/3/61)
Emile Griffith (U.S.; 3/24/62)
Luis Rodriguez (Cuba; 3/21/63)
Emile Griffith (U.S.; 6/8/63)
  gave up title in 1966
Curtis Cokes (U.S.; 1/28/66)
José Nápoles (Mex.; 4/18/69)
Billy Backus (U.S.; 12/3/70)
José Nápoles (Mex.; 6/4/71)
  stripped of WBA title in 1975

### WBA

Ángel Espada (P.R.; 6/28/1975)
Pipino Cuevas (Mex.; 7/17/76)
Thomas Hearns (U.S.; 8/2/80)
Sugar Ray Leonard (U.S.; 9/16/81)
  retired in 1982
Donald Curry (U.S.; 2/13/83)
Lloyd Honeyghan (U.K.; 9/27/86)
  gave up title in 1986
Mark Breland (U.S.; 2/6/87)
Marlon Starling (U.S.; 8/22/87)
Tomas Molinares (Colom.; 7/29/88)
  gave up title in 1988
Mark Breland (U.S.; 2/4/89)
Aaron Davis (U.S.; 7/8/90)
Meldrick Taylor (U.S.; 1/19/91)
Crisanto España (Venez.; 10/31/92)
Ike Quartey (Ghana; 6/4/94)
  stripped of title in 1998
James Page (U.S.; 10/10/98)
  stripped of title in 2000
Andrew Lewis (Guyana; 2/17/2001)
Ricardo Mayorga (Nic.; 3/30/02)
Cory Spinks (U.S.; 12/13/03)

### IBF

Donald Curry (U.S.; 2/4/1984)
Lloyd Honeyghan (U.K.; 9/27/86)
  stripped of title in 1987
Simon Brown (Jam.; 4/23/88)
  gave up title in 1991
Maurice Blocker (U.S.; 10/4/91)
Felix Trinidad (P.R.; 6/19/93)
  gave up title in 2000
Vernon Forrest (U.S.; 5/13/2001)
  stripped of title in 2001
Michele Piccirillo (Italy; 4/13/02)
Cory Spinks (U.S.; 3/22/03)

### WBC

John Stracey (U.K.; 12/6/1975)
Carlos Palomino (U.S.; 6/22/76)
Wilfred Benítez (P.R.; 1/14/79)
Sugar Ray Leonard (U.S.; 11/30/79)
Roberto Durán (Pan.; 6/20/80)
Sugar Ray Leonard (U.S.; 11/25/80)
  retired in 1982
Milton McCrory (U.S.; 8/13/83)
Donald Curry (U.S.; 12/6/85)
Lloyd Honeyghan (U.K.; 9/27/86)
Jorge Vaca (Mex.; 10/28/87)
Lloyd Honeyghan (U.K.; 3/29/88)
Marlon Starling (U.S.; 2/4/89)
Maurice Blocker (U.S.; 8/19/90)
Simon Brown (Jam.; 3/18/91)
James McGirt (U.S.; 11/29/91)
Pernell Whitaker (U.S.; 3/6/93)
Oscar de la Hoya (U.S.; 4/12/97)
Felix Trinidad (P.R.; 9/18/99)
  gave up title in 2000
Oscar de la Hoya (U.S.; 3/20/2000)
Shane Mosley (U.S.; 6/17/00)
Vernon Forrest (U.S.; 1/26/02)
Ricardo Mayorga (Nic.; 1/25/03)
Cory Spinks (U.S.; 12/13/03)

*Until about 1909 not over 145 pounds.

## World Junior Welterweight Champions—top weight 140 pounds (63.5 kg, also called super lightweight)

### Undisputed champions (country; title awarded)

Myron Mitchell (U.S.; 11/15/1922*)
Mushy Callahan (U.S.; 9/21/26)
Jack ("Kid") Berg (U.K.; 2/18/30)
Tony Canzoneri (U.S.; 4/24/31)
Johnny Jadick (U.S.; 1/18/32)
Battling Shaw (Mex.; 2/20/33)
Tony Canzoneri (U.S.; 5/21/33)
Barney Ross (U.S.; 6/23/33)
  gave up title in 1935; title vacant
Tippy Larkin (U.S.; 4/29/46)
  title vacant from 1946
Carlos Ortiz (P.R.; 6/12/59)
Duilio Loi (Italy; 9/1/60)
Eddie Perkins (U.S.; 9/14/62)
Duilio Loi (Italy; 12/15/62)
  retired in 1963
Eddie Perkins (U.S.; 6/15/63)
Carlos Hernandez (Venez.; 1/18/65)
Sandro Lopopolo (Italy; 4/29/66)
Paul Takeshi Fujii (U.S.; 4/30/67)

### WBA

Nicolino Loche (Arg.; 12/12/1968)
Alfonso Frazer (Pan.; 3/10/72)
Antonio Cervantes (Colom.; 10/28/72)
Wilfred Benítez (P.R.; 3/6/76)
  stripped of title in 1976
Antonio Cervantes (Colom., 6/25/77)
Aaron Pryor (U.S.; 8/2/80)
  retired in 1983
Johnny Bumphus (U.S.; 1/22/84)
Gene Hatcher (U.S.; 6/1/84)
Ubaldo Sacco (Arg.; 7/21/85)
Patrizio Oliva (Italy; 3/15/86)
Juan Martin Coggi (Arg.; 7/4/87)
Loreto Garza (U.S.; 8/17/90)
Edwin Rosario (P.R.; 6/15/91)
Hiranaka Akinobu (Japan; 4/10/92)
Morris East (Phil.; 9/9/92)
Juan Martin Coggi (Arg.; 1/12/93)
Frankie Randall (U.S.; 9/17/94)
Juan Martin Coggi (Arg.; 1/13/96)
Frankie Randall (U.S.; 8/16/96)
Khalid Rahilou (Fr.; 1/11/97)
Sharmba Mitchell (U.S.; 10/10/98)
Kostya Tszyu (Austl.; 2/3/2001)
Vivian Harris (Guyana; 10/19/02)

### WBC

Pedro Adigue (Phil.; 12/14/1968)
Bruno Arcari (Italy; 1/31/70)
  gave up title in 1974
Perico Fernandez (Spain, 9/21/74)
Saensak Muangsurin (Thai.; 7/15/75)
Miguel Velasquez (Spain; 8/30/76)
Saensak Muangsurin (Thai.; 10/29/76)
Kim Sang Hyun (S.Kor.; 12/30/78)
Saoul Mamby (U.S.; 2/23/80)
Leroy Haley (U.S.; 6/26/82)
Bruce Curry (U.S.; 5/18/83)
Bill Costello (U.S.; 1/29/84)
Lonnie Smith (U.S.; 8/21/85)
René Arredondo (Mex.; 5/6/86)
Hamada Tsuyoshi (Japan; 7/24/86)
René Arredondo (Mex.; 7/22/87)
Roger Mayweather (U.S.; 11/12/87)
Julio César Chávez (Mex.; 5/13/89)
Frankie Randall (U.S.; 1/29/94)
Julio César Chávez (Mex.; 5/7/94)
Oscar de la Hoya (U.S.; 6/7/96)
  gave up title in 1997
Kostya Tszyu (Austl.; 8/21/99)
  gave up title in 2003
Arturo Gatti (Can.; 1/24/04)

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**World Junior Welterweight Champions—top weight 140 pounds (63.5 kg, also called super lightweight) (continued)**

IBF

Aaron Pryor (U.S.; 1984†)
stripped of title in 1985
Gary Hinton (U.S.; 4/26/86)
Joe Louis Manley (U.S.; 10/30/86)
Terry Marsh (U.K.; 3/4/87)
gave up title in 1987
James McGirt (U.S.; 2/14/88)

Meldrick Taylor (U.S.; 9/3/88)
Julio César Chávez (Mex.; 3/17/90)
gave up title in 1991
Rafael Pineda (Colom.; 12/7/91)
Pernell Whitaker (U.S.; 7/18/92)
gave up title in 1993
Charles Murray (U.S.; 5/15/93)

Jake Rodriguez (P.R.; 2/13/94)
Kostya Tszyu (Austl.; 1/28/95)
Vince Phillips (U.S.; 5/31/97)
Terronn Millett (U.S.; 2/20/99)
stripped of title in 2000
Zab Judah (U.S.; 2/12/2000)

Kostya Tszyu (Austl.; 11/3/01)

*Proclaimed champion as the result of a poll taken by *The Boxing Blade*. †Recognized as champion by the IBF.

**World Lightweight Champions—top weight 135 pounds (61.235 kg)***

Undisputed champions (country; title awarded)

George ("Kid") Lavigne (U.S.; 6/1/1896)
Frank Erne (U.S.; 7/3/99)
Joe Gans (U.S.; 5/12/02)
Battling Nelson (U.S.; 7/4/08)
Ad Wolgast (U.S.; 2/22/10)
Willie Ritchie (U.S.; 11/28/12)
Freddie Welsh (U.K.; 7/7/14)
Benny Leonard (U.S.; 5/28/17)
retired in 1925

Jimmy Goodrich (U.S.; 7/13/25)
Rocky Kansas (U.S.; 12/7/25)
Sammy Mandell (U.S.; 7/3/26)
Al Singer (U.S.; 7/17/30)
Tony Canzoneri (U.S.; 11/14/30)
Barney Ross (U.S.; 6/23/33)
gave up title in 1933
Tony Canzoneri (U.S.; 5/10/35)
Lou Ambers (U.S.; 9/3/36)
Henry Armstrong (U.S.; 8/17/38)

Lou Ambers (U.S., 8/22/39)
Lew Jenkins (U.S.; 5/10/40)
Sammy Angott (U.S.; 12/19/41)
retired in 1942
Ike Williams (U.S.; 8/4/47)
Jimmy Carter (U.S.; 5/25/51)
Lauro Salas (Mex.; 5/14/52)
Jimmy Carter (U.S.; 10/15/52)
Paddy DeMarco (U.S.; 3/5/54)
Jimmy Carter (U.S.; 11/17/54)

Wallace ("Bud") Smith (U.S.; 6/29/55)
Joe Brown (U.S.; 8/24/56)
Carlos Ortiz (P.R.; 4/21/62)
Ismael Laguna (Pan.; 4/10/65)
Carlos Ortiz (P.R.; 11/13/65)
Carlos Teo Cruz (Dom.Rep.; 6/29/68)
Armando Ramos (U.S.; 2/18/69)
Ismael Laguna (Pan.; 3/3/70)
stripped of WBC title in 1970

WBA

Ken Buchanan (U.K.; 9/26/1970)
Roberto Durán (Pan.; 6/26/72)
gave up title in 1979
Ernesto España (Venez.; 6/16/79)
Hilmer Kenty (U.S.; 3/2/80)
Sean O'Grady (U.S.; 4/12/81)
stripped of title in 1981
Claude Noel (Trinidad; 9/12/81)
Arturo Frias (U.S.; 12/5/81)
Ray Mancini (U.S.; 5/8/82)
Livingstone Bramble (Vir.Is.; 6/1/84)

Edwin Rosario (P.R.; 9/26/86)
Julio César Chávez (Mex.; 11/21/87)
gave up title in 1989
Edwin Rosario (P.R.; 7/9/89)
Juan Nazario (P.R.; 4/4/90)
Pernell Whitaker (U.S.; 8/11/90)
gave up title in 1992
Joey Gamache (U.S.; 6/13/92)
Tony Lopez (U.S.; 10/24/92)
Dingaan Thobela (S.Af.; 6/26/93)
Olzúbek Nazarov (Rus.; 10/30/93)

Jean-Baptiste Mendy (Fr.; 5/16/98)
Julien Lorcy (Fr.; 4/10/99)
Stefano Zoff (Italy; 8/7/99)
Gilberto Serrano (Venez.; 11/13/99)
Takanori Hatakeyama (Japan; 6/11/2000)
Julien Lorcy (Fr.; 7/1/01)
Raul Balbi (Arg.; 10/8/01)
Leonard Dorin (Rom.; 1/5/02)
stripped of title in 2003
Lakva Sim (Mong.; 4/10/04)
Juan Diaz (U.S.; 7/17/04)

IBF

Charlie Brown (U.S.; 1/30/1984)
Harry Arroyo (U.S.; 9/15/84)
Jimmy Paul (U.S.; 4/6/85)
Greg Haugen (U.S., 12/6/86)
Vincent Pazienzia (U.S.; 6/7/87)
Greg Haugen (U.S.; 2/6/88)
Pernell Whitaker (U.S.; 2/20/89)
gave up title in 1992
Fred Pendleton (U.S.; 1/10/93)
Rafael Ruelas (U.S.; 2/19/94)
Oscar de la Hoya (U.S.; 5/6/95)
gave up title in 1995
Philip Holiday (S.Af.; 8/19/95)
Shane Mosley (U.S.; 8/2/97)
gave up title in 1999
Paul Spadafora (U.S.; 8/20/99)
gave up title in 2003
Javier Jauregui (Mex., 11/22/03)
Julio Diaz (U.S.; 5/13/04)

WBC

Rodolfo Gonzáles (Mex.; 11/10/1972)
Suzuki Ishimatsu (Japan; 4/11/74)
Esteban de Jesus (P.R.; 5/8/76)
Roberto Durán (Pan.; 1/21/78)
gave up title in 1979
Jim Watt (U.K.; 4/17/79)
Alexis Argüello (Nic.; 8/20/81)
gave up title in 1983
Edwin Rosario (P.R., 5/1/83)
José Luis Ramírez (Mex., 11/3/84)

Hector Camacho (P.R.; 8/10/85)
stripped of title in 1987
José Luis Ramirez (Mex.; 7/19/87)
Julio César Chávez (Mex.; 10/29/88)
gave up title in 1989
Pernell Whitaker (U.S.; 8/20/89)
gave up title in 1992
Miguel Gonzalez (Mex.; 8/24/92)
gave up title in 1996
Jean-Baptiste Mendy (Fr.; 4/20/96)

Steve Johnston (U.S.; 3/1/97)
Cesar Bazan (Mex.; 6/13/98)
Steve Johnston (U.S.; 2/27/99)
Jose Luis Castillo (Mex.; 6/17/2000)
Floyd Mayweather (U.S.; 4/20/02)
gave up title in 2004
José Luis Castillo (Mex.; 6/5/04)

*Until 1912 usually 133 pounds, but sometimes as high as 140 pounds.

**World Junior Lightweight Champions—top weight 130 pounds (58.9 kg, also called super featherweight)**

Undisputed champions (country; title awarded)

Johnny Dundee (U.S.; 11/18/1921)
Jack Bernstein (U.S.; 5/30/23)
Johnny Dundee (U.S.; 12/17/23)
Steve ("Kid") Sullivan (U.S.; 6/20/24)
Mike Ballerino (U.S.; 4/1/25)
Tod Morgan (U.S.; 12/2/25)
Benny Bass (U.S.; 12/20/29)
Kid Chocolate (Eligio Sardinias, Cuba; 7/15/31)
Frankie Klick (U.S.; 12/25/33)
title vacant from 1934
Sandy Saddler (U.S.; 12/6/49)
title vacant from 1951
Harold Gomes (U.S.; 2/20/59)
Gabriel ("Flash") Elorde (Phil.; 3/16/60)
Numata Yoshiaki (Japan; 6/15/67)
Kobayashi Hiroshi (Japan; 12/14/67)
stripped of WBC title in 1969

WBA

Alfredo Marcano (Venez.; 7/29/1971)
Ben Villaflor (Phil.; 4/25/72)
Shibata Kuniaki (Japan; 3/12/73)
Ben Villaflor (Phil.; 10/17/73)
Samuel Serrano (P.R., 10/16/76)
Uehara Yasutsune (Japan; 8/2/80)
Samuel Serrano (P.R.; 4/9/81)
Roger Mayweather (U.S.; 1/19/83)
Rocky Lockridge (U.S., 2/26/84)
Wilfredo Gómez (P.R.; 5/19/85)
Alfredo Layne (Pan.; 5/24/86)
Brian Mitchell (S.Af.; 9/27/86)
gave up title in 1991
Joey Gamache (U.S.; 6/28/91)
gave up title in 1991
Genaro Hernandez (U.S.; 11/22/91)
gave up title in 1995
Choi Yong Soo (S.Kor.; 10/21/95)
Takanori Hatakeyama (Japan; 9/5/98)
Lakva Sim (Mong.; 6/27/99)
Jong Kwon Baek (S.Kor.; 10/31/99)
Joel Casamayor (Cuba; 5/21/2000)
Acelino Freitas (Braz.; 1/12/2002)

WBC

Rene Barrientos (Phil.; 2/15/1969)
Rumata Yoshiaki (Japan; 4/5/70)
Ricardo Arredondo (Mex.; 10/10/71)
Shibata Kuniaki (Japan; 2/28/74)
Alfredo Escalera (P.R.; 7/5/75)
Alexis Argüello (Nic.; 1/28/78)
gave up title in 1980
Rafael Limón (Mex.; 12/11/80)
Cornelius Boza-Edwards (Ugan.; 3/8/81)
Rolando Navarette (Phil.; 8/29/81)
Rafael Limón (Mex.; 5/29/82)
Bobby Chacon (U.S.; 12/11/82)
stripped of title in 1983
Hector Camacho (U.S.; 8/7/83)
gave up title in 1984
Julio César Chávez (Mex.; 9/13/84) vacant
Azumah Nelson (Ghana; 2/29/88)
Jesse James Leija (U.S.; 5/7/94)
Gabriel Ruelas (U.S., 9/17/94)
Azumah Nelson (Ghana; 12/1/95)
Genaro Hernandez (U.S.; 3/22/97)
Floyd Mayweather (U.S.; 10/3/98)
vacated title in 2002
Sirimongkol Singmanassuk (Thai.; 8/24/02)
Jesús Chávez (Mex.; 8/15/03)
Erik Morales (Mex.; 2/28/04)

IBF

Yuh Hwan-Kil (S.Kor.; 4/2/1984)
Lester Ellis (Austl.; 2/15/85)
Barry Michael (Austl.; 7/12/85)
Rocky Lockridge (U.S.; 8/9/87)
Tony Lopez (U.S.; 7/27/88)
Juan Molina (P.R.; 10/7/89)
Tony Lopez (U.S.; 5/20/90)
Brian Mitchell (S.Af.; 9/13/91)
gave up title in 1992
Juan Molina (P.R.; 2/22/92)
vacant
Eddie Hopson (U.S.; 4/22/95)
Tracy Patterson (U.S.; 7/9/95)
Arturo Gatti (U.S.; 12/15/95)
gave up title in 1998
Roberto Garcia (U.S.; 3/13/98)
Diego Corrales (U.S.; 10/23/99)
gave up title in 2000
Steve Forbes (U.S.; 12/3/2000)
stripped of title in 2002
Carlos Hernández (El Sal.; 2/1/03)
Erik Morales (Mex.; 7/31/04)

**World Featherweight Champions—top weight 126 pounds (57.1 kg)***

Undisputed champions (country; title awarded)

Billy Murphy (N.Z.; 1/13/1890)
Young Griffo (Austl.; 2/2/90)
vacant
George Dixon (Can.; 6/27/92)
Solly Smith (U.S.; 10/4/97)
Dave Sullivan (U.K.; 9/26/98)
George Dixon (Can.; 11/11/98)
Terry McGovern (U.S.; 1/19/1900)
Young Corbett (U.S., 11/28/01)
Jimmy Britt (U.S.; 3/25/04)
title vacant in 1904

Tommy Sullivan (U.S.; 10/13/04)
title vacant from 1905
Abe Atell (U.S.; 2/22/06)
Johnny Kilbane (U.S.; 2/22/12)
Eugène Criqui (Fr.; 6/2/23)
Johnny Dundee (U.S.; 7/26/23)
gave up title in 1924
Louis ("Kid") Kaplan (U.S.; 1/2/25)
gave up title in 1926
Tony Canzoneri (U.S.; 10/24/27)
André Routis (Fr.; 9/28/28)

Battling Battalino (U.S.; 9/23/29)
gave up title in 1932
Henry Armstrong (U.S.; 10/29/37)
gave up title in 1938
Joey Archibald (U.S.; 4/18/39)
Harry Jeffra (U.S.; 5/20/40)
Joey Archibald (U.S.; 5/12/41)
Chalky Wright (U.S.; 9/11/41)
Willie Pep (U.S., 11/20/42)
Sandy Saddler (U.S.; 10/29/48)
Willie Pep (U.S., 2/11/49)

Sandy Saddler (U.S.; 6/8/50)
retired in 1957
Hogan Bassey (Nigeria; 6/24/57)
Davey Moore (U.S.; 3/18/59)
Sugar Ramos (Cuba; 3/21/63)
Vicente Saldívar (Mex.; 9/26/64)
retired 1967–70

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**World Featherweight Champions—top weight 126 pounds (57.1 kg)* (continued)**

WBA

Raoul Rojas (U.S.; 3/28/1968)
Saijo Shozo (Japan; 9/28/68)
Antonio Gómez (Venez.; 9/2/71)
Ernesto Marcel (Pan.; 8/19/72)
retired in 1974
Rubén Olivares (Mex.; 7/9/74)
Alexis Argüello (Nic.; 11/23/74)
gave up title in 1976
Rafael Ortega (Pan.; 1/15/77)
Cecilio Lastra (Spain; 12/17/77)
Eusebio Pedroza (Pan.; 4/15/78)
Barry McGuigan (N.Ire.; 6/8/85)
Steve Cruz (U.S.; 6/23/86)
Antonio Esparragoza (Venez.; 3/6/87)
Park Yung Kyun (S.Kor.; 3/30/91)
Eloy Rojas (Venez.; 12/4/93)
Wilfredo Vasquez (P.R.; 5/18/96)
gave up title in 1998
Freddie Norwood (U.S.; 4/3/98)
stripped of title in 1998
Antonio Cermeno (Venez.; 10/3/98)
Freddie Norwood (U.S.; 5/29/99)
Derrick Gainer (U.S.; 9/9/2000)
Juan Manuel Márquez (Mex.; 11/1/03)

WBC

José Legra (Cuba; 7/24/1968)
Johnny Famechon (Austl.; 1/21/69)
Vicente Saldivar (Mex.; 5/9/70)
Shibata Kuniaki (Japan; 12/1/70)
Clemente Sánchez (Mex.; 5/19/72)
José Legra (Spain; 12/16/72)
Eder Jofre (Braz.; 5/5/73)
stripped of title in 1974
Bobby Chacon (U.S.; 9/7/74)
Rubén Olivares (Mex.; 6/20/75)
David Kotey (Ghana; 9/20/75)
Danny López (U.S.; 11/5/76)
Salvador Sánchez (Mex.; 2/2/80)
died in 1982

IBF

Juan LaPorte (P.R.; 9/15/82)
Wilfredo Gómez (P.R.; 3/31/84)
Azumah Nelson (Ghana; 12/8/84)
gave up title in 1988
Jeff Fenech (Austl.; 3/7/88)
gave up title in 1990
Marcos Villasana (Mex.; 6/2/90)
Paul Hodkinson (U.K.; 11/13/91)
Gregorio Vargas (Mex.; 4/28/93)
Kevin Kelley (U.S.; 12/4/93)
Alejandro González (Mex.; 1/7/95)
Manuel Medina (Mex.; 9/23/95)
Luisito Espinosa (Phil.; 12/11/95)
César Soto (Mex.; 5/15/99)

Naseem Hamed (U.K.; 10/22/99)
stripped of title in 1999
Gustavo Espadas (Mex.; 4/14/2000)
Erik Morales (Mex.; 2/17/01)
Marco Antonio Barrera (Mex.;
6/22/02)
declined title; declared vacant
Erik Morales (Mex.; 11/16/02)
gave up title in 2004
Chi In Jin (S.Kor.; 4/10/04)

Oh Min-kuem (S.Kor.; 3/4/1984)
Chung Ki-young (S.Kor.; 11/29/85)
Antonio Rivera (P.R.; 8/30/86)
Calvin Grove (U.S.; 1/23/88)
Jorge Paez (Mex.; 8/4/88)
gave up title in 1991
Troy Dorsey (U.S.; 6/3/91)

Manuel Medina (Mex.; 8/12/91)
Tom Johnson (U.S.; 2/26/93)
Naseem Hamed (U.K.; 2/8/97)
gave up title in 1997
Hector Lizarraga (U.S.; 12/13/97)
Manuel Medina (Mex.; 4/24/98)
Paul Ingle (U.K.; 11/13/99)

Mbutelo Botile (S.Af.; 12/16/2000)
Frankie Toledo (U.S.; 4/6/01)
Manuel Medina (Mex.; 11/16/01)
Johnny Tapia (U.S.; 4/27/02)
stripped of title on Oct. 1, 2002
Juan Manuel Márquez (Mex.;
2/1/03)

*Until 1901 weight varied between 115 and 122 pounds.

**World Junior Featherweight Champions—top weight 122 pounds* (55.3 kg, also called super bantamweight)**

WBA (country; title awarded)

Hong Soo Hwan (S.Kor.; 11/26/1977)
Ricardo Cardona (Colom.; 5/7/78)
Leo Randolph (U.S.; 5/4/80)
Sergio Palma (Arg.; 8/9/80)
Leonardo Cruz (Dom.Rep.; 6/12/82)
Loris Stecca (Italy; 2/22/84)
Victor Callejas (P.R.; 5/26/84)
stripped of title in 1986
Louie Espinoza (U.S.; 1/16/87)
Julio Gervacio (Dom.Rep.; 11/28/87)
Bernardo Pinango (Venez.; 3/5/88)
Juan José Estrada (Mex.; 5/28/88)
Jesus Salud (U.S.; 12/11/89)
stripped of title in 1990
Luis Mendoza (Colom.; 9/11/90)
Raul Pérez (Mex.; 10/7/91)
Wilfredo Vásquez (P.R.; 3/27/92)
Antonio Cermeno (Venez.; 5/13/95)
gave up title in 1997
Enrique Sanchez (Mex.; 2/8/98)
vacant
Nestor Garza (Mex.; 12/12/98)

Clarence Adams (U.S.; 3/4/2000)
stripped of title in 2001
Yober Ortega (Venez.; 11/17/01)
Yoddamrong Sithyodthong (Thai.;
2/21/02)
Osamu Sato (Japan; 5/16/02)
Salim Medjkoune (Fr.; 10/9/02)
Mahyar Monshipour (Fr.; 7/4/03)

WBC

Rigoberto Riasco (Pan.; 4/3/1976)
Kobayashi Kazuo (Japan; 10/10/76)
Yum Dong Kyun (S.Kor.; 11/24/76)
Wilfredo Gómez (P.R.; 5/21/77)
gave up title in 1983
Jaime Garza (U.S.; 6/15/83)
Juan Meza (Mex.; 11/3/84)
Guadalupe Pintor (Mex.; 8/18/85)
Samart Payakaroon (Thai.; 1/18/86)
Jeff Fenech (Austl.; 5/8/87)
Daniel Zaragoza (Mex.; 2/29/88)
Paul Banke (U.S.; 4/23/90)
Pedro Decima (Arg.; 11/5/90)
Hatanaka Kiyoshi (Japan; 2/3/91)
Daniel Zaragoza (Mex.; 5/14/91)
Thierry Jacob (Fr.; 3/20/92)
Tracy Patterson (U.S.; 6/23/92)
Hector Acero-Sánchez (U.S.; 8/26/94)
Daniel Zaragoza (Mex.; 11/6/95)
Erik Morales (Mex.; 9/6/97)
gave up title in 2000
Willie Jorrin (U.S., 9/9/2000)
Oscar Larios (Mex.; 11/1/02)

IBF

Bobby Berna (Phil.; 12/4/1983)
Suh Seung-il (S.Kor.; 4/15/84)
Kim Ji-won (S.Kor.; 1/3/85)
vacant
Lee Seung-hoon (S.Kor.; 1/18/87)
gave up title in 1988
José Sanabria (Venez.; 5/21/88)
Fabrice Benichou (Fr.; 3/10/89)
Welcome Ncita (S.Af.; 3/10/90)
Kennedy McKinney (U.S.; 12/2/92)
Vuyani Bungu (S.Af.; 8/20/94)
gave up title in 1999
Lehlohonolo Ledwaba (S.Af.; 5/29/99)
Manny Pacquiao (Phil.; 6/23/01)
gave up title in 2004
Israel Vasquez (Mex.; 9/25/04)

*Weight division at first recognized only by WBC.

**World Bantamweight Champions—top weight 118 pounds (53.3 kg)***

Undisputed champions (country; title awarded)

Terry-McGovern (U.S.; 9/12/1899)
gave up title in 1900
Harry Harris (U.S.; 3/18/01)
gave up title in 1901
Harry Forbes (U.S.; 4/2/01)
Frankie Neil (U.S.; 8/13/03)
Joe Bowker (U.K.; 10/17/04)
gave up title in 1905;
title in dispute
Kid Williams (U.S.; 6/9/14)
Pete Herman (U.S.; 1/9/17)
Joe Lynch (U.S., 12/22/20)

Pete Herman (U.S.; 7/25/21)
Johnny Buff (U.S.; 9/23/21)
Joe Lynch (U.S.; 7/10/22)
Abe Goldstein (U.S.; 3/21/24)
Eddie Martin (U.S.; 12/19/24)
Charlie Rosenberg (U.S.; 3/20/25)
stripped of title in 1927;
title in dispute
Panama Al Brown (Pan.; 6/18/29)
stripped of NBA (later WBA)
title in 1934;
title in dispute

Sixto Escobar (P.R.; 8/31/36)
Harry Jeffra (U.S.; 9/23/37)
Sixto Escobar (P.R.; 2/20/38)
gave up title in 1939
Lou Salica (U.S.; 1/13/41)
Manuel Ortiz (U.S.; 8/7/42)
Harold Dade (U.S.; 1/6/47)
Manuel Ortiz (U.S.; 3/11/47)
Vic Toweel (S.Af.; 5/31/50)
Jimmy Carruthers (Austl.; 11/15/52)
retired in 1954;
title in dispute

Alphonse Halimi (Alg.; 11/6/57)
José Becerra (Mex.; 7/8/59)
retired in 1961
Eder Jofre (Braz.; 1/18/62)
Harada Mashiko (Japan; 5/17/65)
Lionel Rose (Austl.; 2/26/68)
Rubén Olivares (Mex.; 8/22/69)
Chucho Castillo (Mex.; 10/16/70)
Rubén Olivares (Mex.; 4/3/71)
Rafael Herrera (Mex.; 3/19/72)
Enrique Pinder (Pan.; 7/30/72)
stripped of WBC title in 1972

WBA

Romeo Anaya (Mex.; 1/20/1973)
Arnold Taylor (S.Af.; 11/3/73)
Hong Soo Hwan (S.Kor., 7/3/74)
Alfonso Zamora (Mex.; 3/14/75)
Jorge Luján (Pan.; 11/19/77)
Julian Solis (P.R.; 8/29/80)
Jeff Chandler (U.S.; 11/14/80)
Richie Sandoval (U.S.; 4/7/84)
Gaby Canizales (U.S.; 3/10/86)
Bernardo Pinango (Venez.; 6/4/86)
gave up title in 1987
Takuyama Muguruma (Japan; 3/29/87)

Prak Chan-Young (S.Kor.; 5/24/87)
Wilfredo Vasquez (P.R.; 10/4/87)
Khaokor Galaxy (Thai.; 5/9/88)
Moon Sung Kil (S.Kor.; 8/14/88)
Khaokor Galaxy (Thai.; 7/9/89)
Luisito Espinosa (Phil.; 10/18/89)
Israel Contreras (Venez.; 10/19/91)
Eddie Cook (U.S.; 3/15/92)
Eliecer Julio (Colom.; 10/10/92)
Junior Jones (U.S.; 10/23/93)
John Michael Johnson (U.S.;
4/22/94)

Daorung Chuvatana Siriwat (Thai.;
7/16/94)
Veeraphol Sahaprom (Thai.; 9/17/95)
Nana Konadu (Ghana; 1/28/96)
Daorung Chuvatana Siriwat
(Thai.; 10/26/96)
Nana Konadu (Ghana; 6/21/97)
Johnny Tapia (U.S.; 12/6/98)
Paulie Ayala (U.S.; 6/26/99)
stripped of title in 2001
Eidy Moya (Venez.; 10/14/01)
Johnny Bredahl (Den.; 4/19/02)

Satoshi Shingaki (Japan;
4/15/1984)
Jeff Fenech (Austl.; 4/26/85)
vacant
Kelvin Seabrooks (U.S.; 5/16/87)
Orlando Canizales (U.S.; 7/9/88)
gave up title in 1994
Harold Mestre (Colom.; 1/21/95)
Mbulelo Botile (S.Af.; 4/29/95)
Tim Austin (U.S.; 7/19/97)
Rafael Márquez (Mex.; 2/15/03)

WBC

Rafael Herrera (Mex.; 4/15/1973)
Rudolfo Martínez (Mex.; 12/7/74)
Carlos Zárate (Mex.; 5/8/76)
Guadalupe Pintor (Mex.; 6/3/79)
stripped of title in 1983
Alberto Davila (U.S.; 9/1/83)
stripped of title in 1985

Daniel Zaragoza (Mex.; 5/4/85)
Miguel Lora (Colom.; 8/9/85)
Raul Pérez (Mex.; 10/29/88)
Greg Richardson (U.S.; 2/25/91)
Tatsuyoshi Joichiro (Japan; 9/19/91)
vacant
Victor Rabañales (Mex.; 3/30/92)

Byun Jong-Il (S.Kor.; 3/28/93)
Yasuei Yakushiji (Japan; 12/22/93)
Wayne McCullough (N.Ire.; 7/30/95)
Sirimongkol Singmanasuk (Thai.;
8/10/96)
Joichiro Tatsuyoshi (Japan; 11/22/97)
Veeraphol Nakhontuang (Thai.; 12/29/98)

*Until 1920 weight limits varied between 105 and 116 pounds.

## World Junior Bantamweight Champions—top weight 115 pounds (52.1 kg, also called super flyweight)

| WBA (country; title awarded) | WBC | | |
|---|---|---|---|
| Gustavo Ballas (Arg.; 9/12/1981) | Rafael Orono (Venez.; 2/1/1980) | Santos Laciar (Arg.; 5/16/87) | Hiroshi Kawashima (Japan; 5/4/94) |
| Rafael Pedroza (Pan.; 12/5/81) | Kim Chul Ho (S.Kor.; 1/24/81) | Jesús Rojas (Colom.; 8/9/87) | Gerry Penalosa (Phil.; 2/20/97) |
| Watanabe Jiro (Japan; 4/8/82) stripped of title in 1984 | Rafael Orono (Venez.; 11/28/82) | Gilberto Román (Mex.; 4/8/88) | Cho In Joo (S.Kor.; 8/29/98) |
| Khaosai Galaxy (Thai.; 11/21/84) gave up title in 1991 | Payao Poontarat (Thai.; 11/27/83) | Nana Konadu (Ghana; 11/7/89) | Masanori Tokuyama (Japan; 8/27/2000) |
| Onizuka Katsuya (Japan; 4/10/92) | Watanabe Jiro (Japan; 7/5/84) | Moon Sung Kil (S.Kor.; 1/20/90) | Katsushige Kawashima (Japan; 6/28/04) |
| Lee Hyung Chul (S.Kor.; 9/18/94) | Gilberto Román (Mex.; 3/30/86) | José Luis Bueno (Mex.; 11/13/93) | |
| Alima Yonta (Venez.; 7/22/95) | IBF | | |
| Yokthai Sithoar (Thai.; 8/24/96) | Chun Joo-do (S.Kor.; 12/10/1983) | Juan Polo Pérez (Colom.; 10/14/89) | Danny Romero (U.S.; 8/24/96) |
| Satoshi Iida (Japan; 12/23/97) | Ellyas Pical (Indon.; 5/3/85) | Robert Quiroga (U.S.; 4/21/90) | Johnny Tapia (U.S.; 7/18/97) gave up title in 1998 |
| Jesús Rojas (Venez.; 12/23/98) | Oscar Palomec (Dom.Rep.; 2/15/86) | Julio Borboa (Mex.; 1/16/93) | Mark Johnson (U.S.; 4/24/99) stripped of title in 2000 |
| Hideki Todaka (Japan; 7/31/99) | Ellyas Pical (Indon.; 7/6/96) | Harold Grey (Colom.; 8/29/94) | Felix Machado (Venez.; 7/22/2000) |
| Leo Gamez (Venez.; 10/9/2000) | vacant | Carlos Salazar (Arg.; 10/7/95) | Luis Pérez (Nic.; 1/4/03) |
| Shoji Kobayashi (Japan; 3/11/01) | Chang Tae-il (S.Kor.; 5/17/87) | Harold Grey (Colom.; 4/27/96) | |
| Alexander Muñoz (Ven.; 3/9/2002) | Ellyas Pical (Indon.; 10/17/87) | | |

## World Flyweight Champions—top weight 112 pounds (50.8 kg)

| Undisputed champions (country; title awarded) | WBA | | |
|---|---|---|---|
| Jimmy Wilde (U.K.; 12/18/1916) | Horacio Accavallo (Arg.; 3/1/1966) | Luis Ibarra (Pan.; 11/17/79) | Elvis Alvarez (Colom.; 3/14/91) |
| Pancho Villa (Francisco Guilledo, Phil.; 6/18/23) | retired in 1968 | Kim Tae Shik (S.Kor.; 2/16/80) | Kim Yong Kang (S.Kor.; 6/1/91) |
| died in 1925 | Ebihara Hiroyuki (Japan; 3/30/69) | Peter Mathebula (S.Af.; 12/13/80) | Aquiles Guzman (Venez.; 9/26/92) |
| Fidel La Barba (U.S.; 1/21/27) | Bernabe Villacampo (Phil.; 10/19/69) | Santos Laciar (Arg.; 3/28/81) | David Griman (Venez.; 12/92) |
| retired in 1927; title in dispute | Berkrerk Chartvanchai (Thai.; 4/14/70) | Luis Ibarra (Pan.; 6/6/81) | San Sow Ploenchit (Thai.; 2/13/94) |
| Benny Lynch (U.K.; 1/19/37) | Ohba Masao (Japan; 10/22/70) | Juan Herrera (Mex.; 9/26/81) | José Bonilla (Venez.; 11/14/96) |
| gave up title in 1938; | died in 1973 | Santos Laciar (Arg.; 5/1/82) | Hugo Soto (Arg.; 5/29/98) |
| Peter Kane (U.K.; 9/22/38) | Chartchai Chionoi (Thai.; 5/17/73) | gave up title in 1985 | Leo Gamez (Venez.; 3/13/99) |
| Jackie Paterson (U.K.; 6/19/43) | Hanagata Susumu (Japan; 10/18/74) | Hilario Zapata (Pan.; 10/5/85) | Sornpichai Kratchingdaeng (Thai.; 9/3/99) |
| title in dispute from 1947 | Erbito Salavarria (Phil.; 4/1/75) | Fidel Bassa (Colom.; 2/13/87) | Eric Morel (U.S.; 8/5/2000) |
| Rinty Monaghan (Ire.; 3/23/48) | Alfonso López (Pan.; 2/27/76) | Jésus Rojas (Venez.; 9/30/89) | Lorenzo Parra (Venez.; 12/6/03) |
| retired in 1950 | Gustavo Espadas (Mex.; 10/2/76) | Lee Yul Woo (S.Kor.; 3/10/90) | |
| Terry Allen (U.K.; 4/25/50) | Betulio González (Venez.; 8/12/78) | Leopard Tamakuma (Japan; 7/29/90) | |
| Dado Marino (Hawaii; 8/1/50) | WBC | | |
| Shirai Yoshio (Japan; 5/19/52) | Walter McGowan (U.K.; 6/14/1966) | Miguel Canto (Mex.; 1/8/75) | Sot Chitalada (Thai.; 10/8/84) |
| Pascual Pérez (Arg.; 11/26/54) | Chartchai Chionoi (Thai.; 12/30/66) | Park Chan Hee (S.Kor.; 3/18/79) | Kim Young Kang (S.Kor.; 7/24/88) |
| Pone Kingpetch (Thai.; 4/16/60) | Efren Torres (Mex.; 2/23/69) | Oguma Shoji (Japan; 5/18/80) | Sot Chitalada (Thai.; 6/3/89) |
| Harada Masahiko (Japan; 10/10/62) | Chartchai Chionoi (Thai.; 3/20/70) | Antonio Avelar (Mex.; 5/12/81) | Muangchai Kittikasem (Thai.; 2/15/91) |
| Pone Kingpetch (Thai.; 1/12/63) | Erbito Salavarria (Phil.; 12/7/70) | Prudencio Cardona (Colom.; 3/20/82) | Yury Arbachakov (Russia; 6/23/92) |
| Ebihara Hiroyuki (Japan; 9/18/63) | stripped of title in 1971 | Freddie Castillo (Mex.; 7/24/82) | Chatchai Dutchboygym (Sasakul) (Thai.; 5/9/97) |
| Pone Kingpetch (Thai.; 1/23/64) | Betulio González (Venez.; 11/20/71) | Eleoncio Mercedes (Dom.Rep.; 11/6/82) | Manny Pacquiao (Phil.; 12/4/98) |
| Salvatore Burruni (Italy; 4/23/65) | Venice Borkorsor (Thai.; 9/29/72) | Charlie Magri (U.K.; 3/15/83) | stripped of title in 1999 |
| title in dispute from 1965 | gave up title in 1973 | Frank Cedeno (Phil.; 9/27/83) | Medgeon Singsurat (Thai.; 9/17/99) |
| | Betulio González (Venez.; 8/4/73) | Kobayashi Koji (Japan; 1/18/84) | Malcolm Tunacao (Phil.; 5/19/2000) |
| | Oguma Shoji (Japan; 10/1/74) | Gabriel Bernal (Mex.; 4/9/84) | Wonjongkam Pongsaklek (Thai.; 3/2/01) |
| IBF | | | |
| Kwon Soon Chun (S.Kor.; 12/24/1983) | Dodie Penalosa (Phil.; 2/22/87) | Phichit Sithbangprachan (Thai.; 11/29/92) | Mark Johnson (U.S.; 5/4/96) gave up title in 1999 |
| Chung Chong Kwan (S.Kor.; 12/20/85) | Choi Chang Ho (S.Kor.; 9/5/87) | vacant | Irene Pacheco (Colom.; 4/10/99) |
| Chung Bi Won (S.Kor.; 4/27/86) | Rolando Bohol (Phil.; 1/16/88) | Francisco Tejedor (Colom.; 2/95) | |
| Shin Hi Sup (S.Kor.; 8/2/86) | Duke McKenzie (U.K.; 10/5/88) | Danny Romero (U.S.; 4/22/95) | |
| | Dave McAuley (U.K.; 6/7/89) | gave up title in 1996 | |
| | Rodolfo Blanco (Colom.; 6/11/92) | | |

## World Junior Flyweight Champions—top weight 108 pounds (48.9 kg, also called light flyweight)

| WBA (country; title awarded) | WBC | |
|---|---|---|
| Jaime Rios (Pan.; 8/23/1975) | Franco Udella (Italy; 4/4/1975) | Ioka Hiroki (Japan; 10/18/1987) |
| Juan Guzmán (Dom.Rep.; 7/1/76) | stripped of title in 1975 | Napa Kiatwanchai (Thai.; 11/13/88) |
| Gushiken Yoko (Japan; 10/10/76) | Luis Alberto Estaba (Venez.; 9/13/75) | Choi Jum Hwan (S.Kor.; 11/12/89) |
| Pedro Flores (Mex.; 3/8/81) | Freddie Castillo (Mex.; 2/19/78) | Ohashi Hideyuki (Japan; 2/7/90) |
| Kim Hwan Jin (S.Kor.; 7/19/81) | Netrnoi Sor Vorasingh (Thai.; 5/6/78) | Ricardo López (Mex.; 10/25/90) |
| Yokashiki Katsuo (Japan; 12/16/81) | Kim Sung Jun (S.Kor.; 9/30/78) | gave up title in 1999 |
| Lupe Madera (Mex.; 7/10/83) | Nakajima Shigeo (Japan; 1/3/80) | Wande Chareon (Thai.; 5/4/99) |
| Francisco Quiroz (Dom.Rep.; 5/19/84) | Hilario Zapata (Pan.; 3/24/80) | Jose Antonio Aguirre (Mex.; 2/11/2000) |
| Joey Olivo (U.S.; 3/29/85) | Amado Ursua (Mex.; 2/6/82) | Eagle Akakura (Japan; 1/10/04) |
| Yuh Myung Woo (S.Kor.; 12/8/85) | Tomori Tadashi (Japan; 4/13/82) | |
| Ioka Hiroki (Japan; 12/17/91) | Hilario Zapata (Pan.; 7/20/82) | |
| Yuh Myung Woo (S.Kor.; 11/18/92) | Chang Jung Koo (S.Kor.; 3/28/83) | |
| gave up title in 1993 | gave up title in 1988 | |
| Leo Gamez (Venez.; 10/21/93) | German Torres (Mex.; 12/11/88) | |
| Choi Hi Yong (S.Kor.; 2/4/95) | Lee Yul Woo (S.Kor.; 3/19/89) | |
| Carlos Murillo (Pan.; 1/13/96) | Humberto Gonzalez (Mex.; 6/25/89) | |
| Keiji Yamaguchi (Japan; 5/21/96) | Rolando Pascua (Phil.; 12/19/90) | |
| Pichitnoi Siriwat (Thai.; 12/3/96) | Melchor Cob Castro (Mex.; 3/25/91) | |
| vacant | Humberto Gonzalez (Mex.; 6/4/91) | |
| Bebis Mendoza (Colom.; 8/12/2000) | Michael Carbajal (U.S.; 3/13/93) | |
| Rosendo Alvarez (Nic.; 3/3/01) | Chiquita Gonzalez (Mex.; 2/19/94) | |
| | Samuth Sorjaturong (Thai.; 7/15/95) | |
| | Choi Yo Sam (S.Kor.; 10/17/99) | |
| | Jorge Arce (Mex.; 7/6/2002) | |
| IBF | | |
| Dodie Penalosa (Phil.; 12/10/1983) stripped of title in 1986 | Michael Carbajal (U.S., 3/16/96) | |
| Choi Chong Hwon (S.Kor.; 12/7/86) | Mauricio Pastrana (Colom.; 1/18/97) | |
| Tacy Macalos (Phil.; 11/5/88) | stripped of title in 1997 | |
| Muangchai Kittikasem (Thai.; 5/2/89) | Mauricio Pastrana (Colom.; 12/13/97) | |
| Michael Carbajal (U.S.; 7/29/90) | stripped of title in 1998 | |
| Chiquita Gonzalez (Mex.; 2/19/94) | Will Grigsby (U.S.; 12/18/98) | |
| Saman Sorjaturong (Thai.; 7/15/95) | Ricardo López (Mex.; 10/2/99) | |
| vacant | gave up title in 2003 | |
| | Victor Burgos (Mex.; 2/15/03) | |

## World Mini-Flyweight Champions—top weight 105 pounds (47.6 kg, also called straw weight)

| WBA* (country; title awarded) | WBC† | |
|---|---|---|
| Leo Gamez (Venez.; 1/10/1988) | Ioka Hiroki (Japan; 10/18/1987) | |
| vacant | Napa Kiatwanchai (Thai.; 11/13/88) | |
| Kim Bong Jun (S.Kor.; 4/16/89) | Choi Jum Hwan (S.Kor.; 11/12/89) | |
| Choi Hi Yong (S.Kor.; 2/2/91) | Ohashi Hideyuki (Japan; 2/7/90) | |
| Ohashi Hideyuki (Japan; 10/14/92) | Ricardo López (Mex.; 10/25/90) | |
| Chana Porpaoin (Thai.; 2/10/93) | gave up title in 1999 | |
| Rosendo Alvarez (Nic.; 12/2/95) | Wande Chareon (Thai.; 5/4/99) | |
| Ricardo López (Mex.; 11/13/98) | Jose Antonio Aguirre (Mex.; 2/11/2000) | |
| gave up title in 1999 | Eagle Akakura (Japan; 1/10/04) | |
| Noel Arambulet (Venez.; 10/9/99) | | |
| stripped of title in 2000 | | |
| Joma Gamboa (Phil.; 8/20/2000) | | |
| Keitaro Hoshino (Japan; 12/6/00) | | |
| Chana Porpaoin (Thai.; 4/16/01) | | |
| Yutaka Niida (Japan; 8/25/01) | | |
| gave up title in 2001 | | |
| Keitaro Hoshino (Japan; 1/29/02) | | |
| Noel Arambulet (Ven.; 7/29/02) | | |
| Yutaka Niida (Japan; 7/3/04) | | |
| IBF† | | |
| Lee Kyung Yun (6/14/1987) | Ratanapol Vorapin (Thai.; 5/16/96) | |
| vacant | Zolani Petelo (S.Af.; 12/27/97) | |
| Samuth Sithnaruepol (Thai.; 3/24/88) | gave up title in 2000 | |
| Nico Thomas (Indon.; 6/17/89) | Roberto Leyva (Mex.; 4/29/2001) | |
| Eric Chavez (Phil.; 9/21/89) | Miguel Barrera (Colo.; 8/9/2002) | |
| Falan Lookmingkwan (Thai.; 2/21/90) | Edgar Cárdenas (Mex.; 5/31/03) | |
| Manny Melchor (Phil.; 9/6/92) | Daniel Reyes (Colom.; 10/4/03) | |
| Ratanapol Vorapin (Thai.; 12/10/92) stripped of title in 1996 | | |

*Division first recognized by WBA in 1988. †Division first recognized by WBC and IBF in 1987.

## CRICKET

Cricket is one of the national sports of England, and consequently it is played in nearly all the countries with which England has been associated. The most important international cricket matches are the Test matches, which have been played since 1877. The Test-playing countries are England, Australia, South Africa (banned from international competition between about 1970 and 1992), West Indies, New Zealand, India, Pakistan, Sri Lanka, Zimbabwe (since 1992), and Bangladesh (since 2000).

The Test table is designed to be read from left to right across the columns. This will indicate, for example, that in Test match play against England, South Africa has won 23 games, has had 47 drawn matches, and has lost 50 games.

The World Cup is a one-day, limited-overs competition. It was first held in 1975.



D.M. Jones, batsman for Australia, placing the ball to the leg side against England in the Fourth Test of the 1988–89 cricket season; Australia won the six-match series 5–0

Colorsport

**All-Time First-Class Test Cricket Standings (as of September 30, 2003)**

| | England | | | Australia | | | South Africa | | | West Indies | | | New Zealand | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | wins | draws | losses | w | d | l | w | d | l | w | d | l | w | d | l |
| England *v.* | | | | 95 | 86 | 125 | 52 | 48 | 25 | 31 | 43* | 52 | 38 | 40 | 7 |
| Australia *v.* | 125 | 86 | 95 | | | | 39 | 17 | 15 | 45 | 22† | 32 | 16 | 15 | 7 |
| South Africa *v.* | 25 | 48 | 52 | 15 | 17 | 39 | | | | 7 | 2 | 2 | 15 | 9 | 3 |
| West Indies *v.* | 52 | 43* | 31 | 32 | 22† | 45 | 2 | 2 | 7 | | | | 10 | 15 | 7 |
| New Zealand *v.* | 6 | 40 | 38 | 7 | 15 | 16 | 3 | 9 | 15 | 7 | 15 | 10 | | | |
| India *v.* | 16 | 42 | 33 | 13 | 18† | 29 | 2 | 5 | 7 | 10 | 38 | 30 | 14 | 20* | 9 |
| Pakistan *v.* | 10 | 34 | 16 | 11 | 17 | 21 | 1 | 1 | 4 | 12 | 14 | 13 | 20 | 17 | 6 |
| Sri Lanka *v.* | 3 | 2 | 7 | 1 | 5 | 7 | 1 | 4 | 8 | 3 | 3 | 2 | 4 | 9 | 7 |
| Zimbabwe *v.* | 0 | 3 | 3 | 0 | 0 | 1 | 0 | 1 | 4 | 0 | 1 | 3 | 0 | 6 | 5 |
| Bangladesh *v.* | ‡ | ‡ | ‡ | 0 | 0 | 2 | 0 | 0 | 4 | 0 | 0 | 2 | 0 | 0 | 2 |

| | India | | | Pakistan | | | Sri Lanka | | | Zimbabwe | | | Bangladesh | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | w | d | l | w | d | l | w | d | l | w | d | l | w | d | l |
| England *v.* | 33 | 42 | 16 | 16 | 34 | 10 | 7 | 2 | 3 | 3 | 3 | 0 | ‡ | ‡ | ‡ |
| Australia *v.* | 29 | 18† | 13 | 21 | 17 | 11 | 7 | 5 | 1 | 1 | 0 | 0 | 2 | 0 | 0 |
| South Africa *v.* | 7 | 5 | 2 | 4 | 1 | 1 | 8 | 4 | 1 | 4 | 1 | 0 | 4 | 0 | 0 |
| West Indies *v.* | 30 | 38 | 10 | 13 | 14 | 12 | 2 | 3 | 3 | 3 | 1 | 0 | 2 | 0 | 0 |
| New Zealand *v.* | 9 | 20* | 14 | 6 | 17 | 20 | 7 | 9 | 4 | 5 | 6 | 0 | 2 | 0 | 0 |
| India *v.* | | | | 5 | 33 | 9 | 8 | 12 | 3 | 5 | 2 | 2 | 1 | 0 | 0 |
| Pakistan *v.* | 9 | 33 | 5 | | | | 13 | 9* | 6 | 8 | 5* | 2 | 6 | 0 | 0 |
| Sri Lanka *v.* | 3 | 12 | 8 | 6 | 9* | 13 | | | | 8 | 5 | 0 | 3 | 0 | 0 |
| Zimbabwe *v.* | 2 | 2 | 5 | 2 | 5* | 8 | 0 | 5 | 8 | | | | 3 | 1 | 0 |
| Bangladesh *v.* | 0 | 0 | 1 | 0 | 0 | 6 | 0 | 0 | 3 | 0 | 1 | 3 | | | |

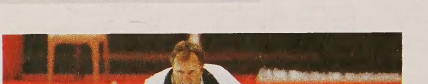
*Including one match abandoned. †Including one tie. ‡No matches.

**World Cup (finals)**

| year | result | | |
|---|---|---|---|
| 1975 | West Indies | 291–8 | Australia 274 |
| 1979 | West Indies | 286–9 | England 194 |
| 1983 | India | 183 | West Indies 140 |
| 1987 | Australia | 253–5 | England 246–8 |
| 1992 | Pakistan | 249–6 | England 227 |
| 1996 | Sri Lanka | 245–3 | Australia 241 |
| 1999 | Australia | 133–2 | Pakistan 132 |
| 2003 | Australia | 359–2 | India 234 |

## CURLING

The game of curling is somewhat akin to bowls in its object of play, though, unlike bowls, it varies little from country to country—except perhaps in the type of broom used and in other pieces of equipment (excluding the standardized curling stone). The men's world curling championship was instituted in 1959 and has been successively known as the Scotch Whisky Cup (1959–67), the Silver Broom (1968–85), the International Olympic Committee President's Cup (1986–87), and the World Curling Championship. Although curling has been played among women of many countries since at least the mid-20th century, the first women's world curling championship was not held until 1979.



Russ Howard, skip of the Canada men's curling team, yelling for teammates to sweep as he watches his stone curl in the opening game of the 1993 World Curling Championship; Canada won the game and the cup, bringing its record number of wins to 19

Canapress Photo Service (Chuck Stoody)

**World Curling Championship—men**

| year | winner | year | winner | year | winner |
|---|---|---|---|---|---|
| 1959 | Canada | 1974 | United States | 1989 | Canada |
| 1960 | Canada | 1975 | Switzerland | 1990 | Canada |
| 1961 | Canada | 1976 | United States | 1991 | Scotland |
| 1962 | Canada | 1977 | Sweden | 1992 | Switzerland |
| 1963 | Canada | 1978 | United States | 1993 | Canada |
| 1964 | Canada | 1979 | Norway | 1994 | Canada |
| 1965 | United States | 1980 | Canada | 1995 | Canada |
| 1966 | Canada | 1981 | Switzerland | 1996 | Canada |
| 1967 | Scotland | 1982 | Canada | 1997 | Sweden |
| 1968 | Canada | 1983 | Canada | 1998 | Canada |
| 1969 | Canada | 1984 | Norway | 1999 | Scotland |
| 1970 | Canada | 1985 | Canada | 2000 | Canada |
| 1971 | Canada | 1986 | Canada | 2001 | Sweden |
| 1972 | Canada | 1987 | Canada | 2002 | Canada |
| 1973 | Sweden | 1988 | Norway | | |

**World Curling Championship—women**

| year | winner | year | winner |
|---|---|---|---|
| 1979 | Switzerland | 1991 | Norway |
| 1980 | Canada | 1992 | Sweden |
| 1981 | Sweden | 1993 | Canada |
| 1982 | Denmark | 1994 | Canada |
| 1983 | Switzerland | 1995 | Sweden |
| 1984 | Canada | 1996 | Canada |
| 1985 | Canada | 1997 | Canada |
| 1986 | Canada | 1998 | Sweden |
| 1987 | Canada | 1999 | Sweden |
| 1988 | West Germany | 2000 | Canada |
| 1989 | Canada | 2001 | Canada |
| 1990 | Norway | 2002 | Scotland |

## CYCLING

By all accounts, the greatest cycling event of all is the Tour de France road race (founded 1903). It is raced in several stages over distances usually exceeding 3,500 km (2,175 miles). From 1911 to 1929 distances exceeded 5,300 km. A Tour de France for women was first held, over an 18-stage course of 991 km, in 1984.

In addition to this and a great number of other road races held yearly, there are annual world championship road races. Track racing championships are also held. The oldest events of track racing are the sprint (in which only the last part of the race can actually be considered sprinting) and the pursuit (both a team and individual event in which contestants start the race on opposite sides of the track and attempt to catch each other). Mountain bike racing and cyclo-cross, a cross-country bicycle race that requires cyclists to carry their bikes over parts of the course, developed in the latter part of the 20th century. World championships were established for these sports in 1997.

**Cycling World Road-Racing Championships**

| year | men (amateur) | men (professional) | women (amateur) |
|---|---|---|---|
| 1921 | G. Skold (Swed.) | | |
| 1922 | D. Marsch (Eng.) | | |
| 1923 | L. Ferrario (Italy) | | |
| 1924 | A. Leducq (Fr.) | | |
| 1925 | H. Hoevanaers (Belg.) | | |
| 1926 | O. Dayen (Fr.) | | |
| 1927 | J. Aerts (Belg.) | A. Binda (Italy) | |
| 1928 | Grandi (Italy) | G. Ronsse (Belg.) | |
| 1929 | P. Bertolassi (Italy) | G. Ronsse (Belg.) | |
| 1930 | G. Martano (Italy) | A. Binda (Italy) | |
| 1931 | H. Hansen (Den.) | P. Guerra (Italy) | |
| 1932 | G. Martano (Italy) | A. Binda (Italy) | |
| 1933 | P. Egli (Switz.) | G. Speicher (Fr.) | |
| 1934 | K. Pellenaars (Neth.) | K. Kaers (Belg.) | |
| 1935 | I. Mancini (Italy) | J. Aerts (Belg.) | |
| 1936 | E. Buchwalder (Switz.) | A. Magne (Fr.) | |
| 1937 | A. Leoni (Italy) | E. Meulenberg (Belg.) | |
| 1938 | H. Knecht (Switz.) | M. Kint (Belg.) | |
| 1939–45 | no competition | | |
| 1946 | H. Aubry (Fr.) | H. Knecht (Switz.) | |
| 1947 | A. Ferrari (Italy) | T. Middelkamp (Neth.) | |
| 1948 | H. Snell (Swed.) | A. Schotte (Belg.) | |
| 1949 | H.J. Faanhof (Neth.) | H. Van Steenbergen (Belg.) | |
| 1950 | J. Hoobin (Austl.) | A. Schotte (Belg.) | |
| 1951 | G. Ghidini (Italy) | F. Kubler (Switz.) | |
| 1952 | L. Ciancola (Italy) | H. Müller (W.Ger.) | |
| 1953 | R. Filippi (Italy) | F. Coppi (Italy) | |
| 1954 | E. van Cautier (Belg.) | L. Bobet (Fr.) | |
| 1955 | S. Ranucci (Italy) | S. Ockers (Belg.) | |
| 1956 | F. Mahn (Neth.) | R. Van Steenbergen (Belg.) | |
| 1957 | L. Proost (Belg.) | R. Van Steenbergen (Belg.) | |
| 1958 | G. Schur (E.Ger.) | E. Baldini (Italy) | E. Jacobs (Luxem.) |
| 1959 | G. Schur (E.Ger.) | A. Darrigade (Fr.) | Y. Reynders (Belg.) |
| 1960 | B. Eckstein (E.Ger.) | R. Van Looy (Belg.) | B. Burton (U.K.) |
| 1961 | J. Jourden (Fr.) | R. Van Looy (Belg.) | Y. Reynders (Belg.) |
| 1962 | R. Bongioni (Italy) | J. Stablenski (Fr.) | M.R. Gaillard (Belg.) |
| 1963 | F. Vicentini (Italy) | B. Beheyt (Belg.) | Y. Reynders (Belg.) |
| 1964 | E. Merckx (Belg.) | J. Janssen (Neth.) | E. Sonk (U.S.S.R.) |
| 1965 | J. Bothelet (Fr.) | T. Simpson (U.K.) | E. Eicholz (E.Ger.) |
| 1966 | E. Dolman (Neth.) | R. Altig (W.Ger.) | Y. Reynders (Belg.) |
| 1967 | G. Webb (U.K.) | E. Merckx (Belg.) | B. Burton (U.K.) |
| 1968 | V. Marcelli (Italy) | V. Adorni (Italy) | K. Hage (Neth.) |
| 1969 | L. Mortensen (Den.) | H. Ottenbros (Neth.) | A. McElmury (U.S.) |
| 1970 | J. Schmidt (Den.) | J. Montseré (Belg.) | A. Konkina (U.S.S.R.) |
| 1971 | R. Ovion (Fr.) | E. Merckx (Belg.) | A. Konkina (U.S.S.R.) |
| 1972 | * | M. Basso (Italy) | G. Gambillon (Fr.) |
| 1973 | R. Szurkowski (Pol.) | F. Gimondi (Italy) | N. Van Den Broeck (Belg.) |
| 1974 | J. Kowalski (Pol.) | E. Merckx (Belg.) | G. Gambillon (Fr.) |
| 1975 | A. Gevers (Neth.) | H. Kuiper (Neth.) | T. Fopma (Neth.) |
| 1976 | * | F. Maertens (Belg.) | K. van Oosten-Hage (Neth.) |
| 1977 | C. Corti (Italy) | F. Moser (Italy) | J. Best (Fr.) |
| 1978 | G. Glaus (Switz.) | G. Knetemann (Neth.) | B. Habetz (W.Ger.) |
| 1979 | G. Giacomini (Italy) | J. Raas (Neth.) | P. de Bruin (Neth.) |
| 1980 | * | B. Hinault (Fr.) | B. Heiden (U.S.) |
| 1981 | A. Vedernikov (U.S.S.R.) | F. Maertens (Belg.) | U. Enzenauer (W.Ger.) |
| 1982 | B. Drogan (E.Ger.) | G. Saronni (Italy) | A. Jones (U.K.) |
| 1983 | U. Raab (E.Ger.) | G. LeMond (U.S.) | M. Berglund (Swed.) |
| 1984 | * | C. Criquelion (Belg.) | * |
| 1985 | L. Piasecki (Pol.) | J. Zoetemelk (Neth.) | J. Longo (Fr.) |
| 1986 | U. Ampler (E.Ger.) | M. Argentin (Italy) | J. Longo (Fr.) |
| 1987 | R. Vivien (Fr.) | S. Roche (Ire.) | J. Longo (Fr.) |
| 1988 | O. Ludwig (E.Ger.) | M. Fondriest (Italy) | M. Knol (Neth.) |
| 1989 | J. Halupczok (Pol.) | G. LeMond (U.S.) | J. Longo (Fr.) |
| 1990 | M. Gualdi (Italy) | R. Dhaenens (Belg.) | C. Marsal (Fr.) |
| 1991 | V. Pjaksinski (U.S.S.R.) | G. Bugno (Italy) | L. van Moorsel (Neth.) |
| 1992 | F. Casartelli (Italy) | G. Bugno (Italy) | K. Watt (Austl.) |
| 1993 | J. Ullrich (Ger.) | L. Armstrong (U.S.) | L. van Moorsel (Neth.) |
| 1994 | A. Pedersen (Den.) | L. Leblanc (Fr.) | M. Valvik (Nor.) |
| 1995 | D. Neliissen (Neth.) | A. Olano (Spain) | J. Longo (Fr.) |
| 1996† | | J. Museeuw (Belg.) | B. Heeb (Switz.) |
| 1997 | | L. Brochard (Fr.) | A. Cappellotto (Italy) |
| 1998 | | O. Camenzind (Switz.) | D. Ziliute (Lith.) |
| 1999 | | O. Freire Gómez (Spain) | E. Pucinskaite (Lith.) |
| 2000 | | R. Vainsteins (Latvia) | Z. Stahurskaia (Belarus) |
| 2001 | | O. Freire Gómez (Spain) | R. Polikeviciute (Lith.) |
| 2002 | | M. Cipollini (Italy) | S. Ljungskog (Swed.) |
| 2003 | | I. Astarloa (Spain) | S. Ljungskog (Swed.) |

*Not held because of Olympic championships. †From 1996 professionals and amateurs competed in the same event.



Spectators cheer as the pack rides by during the men's road race at the 2000 Cycling World Championships in Plouay, France
Patrick Kovarik—AP Photo/POOL

**Cycling World Track Championships**

| year | sprint (amateur) | sprint (professional) |
|---|---|---|
| 1893* | A. Zimmerman (U.S.) | |
| 1893† | A. Zimmerman (U.S.) | |
| 1894* | A. Lehr (Ger.) | |
| 1894‡ | J. Eden (Neth.) | |
| 1895 | J. Eden (Neth.) | R.T.C. Protin (Belg.) |
| 1896 | H. Reynolds (Ire.) | P. Bourrilon (Fr.) |
| 1897 | E. Schrader (Den.) | W. Arend (Ger.) |
| 1898 | P. Albert (Ger.) | G.A. Banker (U.S.) |
| 1899 | T. Summersgill (Eng.) | Major Taylor (U.S.) |
| 1900 | A. Didier-Nauts (Belg.) | E. Jacquelin (Fr.) |
| 1901 | E. Maitrot (Fr.) | T. Ellegaard (Den.) |
| 1902 | C. Piard (Fr.) | T. Ellegaard (Den.) |
| 1903 | A.L. Reed (Eng.) | T. Ellegaard (Den.) |
| 1904 | M. Hurley (U.S.) | I. Lawson (U.S.) |
| 1905 | J.S. Benyon (Eng.) | G. Poulain (Fr.) |
| 1906 | F. Verri (Italy) | T. Ellegaard (Den.) |
| 1907 | J. Devoissoux (Fr.) | E. Friol (Fr.) |
| 1908 | V.L. Johnson (Eng.) | T. Ellegaard (Den.) |
| 1909 | W.J. Bailey (Eng.) | V. Dupre (Fr.) |
| 1910 | W.J. Bailey (Eng.) | E. Friol (Fr.) |
| 1911 | W.J. Bailey (Eng.) | T. Ellegaard (Den.) |
| 1912 | D. MacDougall (U.S.) | F.L. Kramer (U.S.) |
| 1913 | W.J. Bailey (Eng.) | W. Rutt (Ger.) |
| 1914–19 | no competition | no competition |
| 1920 | M. Peeters (Neth.) | R. Spears (Austl.) |
| 1921 | B. Andersen (Den.) | P. Moeskops (Neth.) |
| 1922 | H.T. Johnson (Eng.) | P. Moeskops (Neth.) |
| 1923 | L. Michard (Fr.) | P. Moeskops (Neth.) |
| 1924 | L. Michard (Fr.) | P. Moeskops (Neth.) |
| 1925 | J. Meyer (Neth.) | E. Kauffman (Switz.) |
| 1926 | A. Martinetti (Italy) | P. Moeskops (Neth.) |
| 1927 | M. Engel (Ger.) | L. Michard (Fr.) |
| 1928 | W.F. Hansen (Den.) | L. Michard (Fr.) |
| 1929 | A. Mazairac (Neth.) | L. Michard (Fr.) |
| 1930 | L. Gerardin (Fr.) | L. Michard (Fr.) |
| 1931 | H. Harder (Den.) | W.F. Hansen (Den.) |
| 1932 | A. Richter (Ger.) | J. Scherens (Belg.) |
| 1933 | J. van Egmond (Neth.) | J. Scherens (Belg.) |
| 1934 | B. Pola (Italy) | J. Scherens (Belg.) |
| 1935 | T. Merkens (Ger.) | J. Scherens (Belg.) |
| 1936 | A. van Vliet (Neth.) | J. Scherens (Belg.) |
| 1937 | J. van der Vijver (Neth.) | J. Scherens (Belg.) |
| 1938 | J. van der Vijver (Neth.) | A. van Vliet (Neth.) |
| 1939 | J. Derksen (Neth.) | no competition |
| 1940–45 | no competition | |

(continued on p. 134)

Cycling World Track Championships (continued)

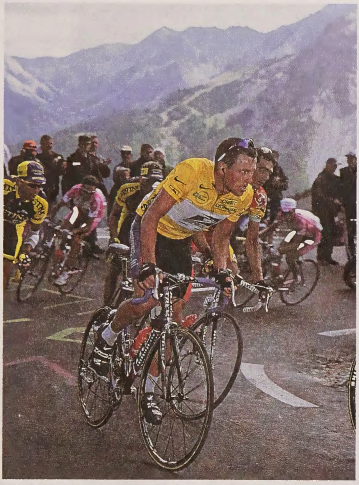
| year | sprint (amateur) | sprint (professional) | pursuit (amateur) | pursuit (professional) | sprint–women (amateur) | 3-km pursuit–women (amateur) |
|---|---|---|---|---|---|---|
| 1946 | O. Plattner (Switz.) | J. Derksen (Neth.) | R. Rioland (Fr.) | G. Peters (Neth.) | | |
| 1947 | R. Harris (U.K.) | J. Scherens (Belg.) | G. Messina (Italy) | F. Coppi (Italy) | | |
| 1948 | M. Ghella (Italy) | A. van Vliet (Neth.) | G. Messina (Italy) | G. Schulte (Neth.) | | |
| 1949 | S. Patterson (Austl.) | R. Harris (U.K.) | K.E. Anderson (Den.) | F. Coppi (Italy) | | |
| 1950 | M. Verdeun (Fr.) | R. Harris (U.K.) | S. Patterson (Austl.) | A. Bevilacqua (Italy) | | |
| 1951 | E. Sacchi (Italy) | R. Harris (U.K.) | N. de Rossi (Italy) | A. Bevilacqua (Italy) | | |
| 1952 | E. Sacchi (Italy) | O. Plattner (Switz.) | P. van Heusden (Neth.) | S. Patterson (Austl.) | | |
| 1953 | M. Morettini (Italy) | A. van Vliet (Neth.) | G. Messina (Italy) | S. Patterson (Austl.) | | |
| 1954 | C. Peacock (U.K.) | R. Harris (U.K.) | L. Faggin (Italy) | G. Messina (Italy) | | |
| 1955 | G. Ogna (Italy) | A. Maspes (Italy) | N. Sheil (U.K.) | G. Messina (Italy) | | |
| 1956 | M. Rousseau (Fr.) | A. Maspes (Italy) | E. Baldini (Italy) | G. Messina (Italy) | | |
| 1957 | M. Rousseau (Fr.) | J. Derksen (Neth.) | C. Simonigh (Italy) | R. Rivière (Fr.) | | |
| 1958 | V. Gasparella (Italy) | M. Rousseau (Fr.) | N. Sheil (U.K.) | R. Rivière (Fr.) | G. Yermolayeva (U.S.S.R.) | L. Kochetova (U.S.S.R.) |
| 1959 | V Gasparella (Italy) | A. Maspes (Italy) | R. Altig (W.Ger.) | R. Rivière (Fr.) | G. Yermolayeva (U.S.S.R.) | B. Burton (U.K.) |
| 1960 | S. Gaiardoni (Italy) | A. Maspes (Italy) | M. Delattre (Fr.) | R. Altig (W.Ger.) | G. Yermolayeva (U.S.S.R.) | B. Burton (U.K.) |
| 1961 | S. Bianchetto (Italy) | A. Maspes (Italy) | H. Nydam (Neth.) | R. Altig (W.Ger.) | G. Yermolayeva (U.S.S.R.) | Y. Reynders (Belg.) |
| 1962 | S. Bianchetto (Italy) | A. Maspes (Italy) | K. Jensen (Den.) | H. Nydam (Neth.) | V. Savina (U.S.S.R.) | B. Burton (U.K.) |
| 1963 | P. Sercu (Belg.) | S. Gaiardoni (Italy) | J. Walschaerts (Belg.) | L. Faggin (Italy) | G. Yermolayeva (U.S.S.R.) | B. Burton (U.K.) |
| 1964 | P. Trentin (Fr.) | A. Maspes (Italy) | T. Groen (Neth.) | F. Bracke (Belg.) | I. Kirichenko (U.S.S.R.) | Y. Reynders (Belg.) |
| 1965 | O. Fakadze (U.S.S.R.) | G. Beghetto (Italy) | T. Groen (Neth.) | L. Faggin (Italy) | V. Savina (U.S.S.R.) | Y. Reynders (Belg.) |
| 1966 | D. Morelon (Fr.) | G. Beghetto (Italy) | T. Groen (Neth.) | L. Faggin (Italy) | I. Kirichenko (U.S.S.R.) | B. Burton (U.K.) |
| 1967 | D. Morelon (Fr.) | P. Sercu (Belg.) | G. Bongers (Neth.) | T. Groen (Neth.) | V. Savina (U.S.S.R.) | T. Garkushina (U.S.S.R.) |
| 1968 | L. Borghetti (Italy) | G. Beghetto (Italy) | M. Frey-Jensen (Den.) | H. Porter (U.K.) | A. Bagulnyantz (U.S.S.R.) | R. Obodovskaya (U.S.S.R.) |
| 1969 | D. Morelon (Fr.) | P. Sercu (Belg.) | X. Kurmann (Switz.) | F. Bracke (Belg.) | G. Tsaryova (U.S.S.R.) | R. Obodovskaya (U.S.S.R.) |
| 1970 | D. Morelon (Fr.) | G. Johnson (Austl.) | X. Kurmann (Switz.) | H. Porter (U.K.) | G. Tsaryova (U.S.S.R.) | T. Garkushina (U.S.S.R.) |
| 1971 | D. Morelon (Fr.) | L. Loeveseijn (Neth.) | M. Rodriguez (Colom.) | D. Baert (Belg.) | G. Tsaryova (U.S.S.R.) | T. Garkushina (U.S.S.R.) |
| 1972 | § | R. Van Lancker (Belg.) | § | H. Porter (U.K.) | G. Yermolayeva (U.S.S.R.) | T. Garkushina (U.S.S.R.) |
| 1973 | D. Morelon (Fr.) | R. Van Lancker (Belg.) | K. Knudsen (Nor.) | H. Porter (U.K.) | S. Young (U.S.) | T. Garkushina (U.S.S.R.) |
| 1974 | A. Tkac (Czech.) | P. Pedersen (Den.) | H. Lutz (W.Ger.) | R. Schuiten (Neth.) | T. Plishchikova (U.S.S.R.) | T. Garkushina (U.S.S.R.) |
| 1975 | D. Morelon (Fr.) | J. Nicholson (Austl.) | T. Huschke (E.Ger.) | R. Schuiten (Neth.) | S. Novarra (U.S.) | K. van Oosten-Hage (Neth.) |
| 1976 | § | J. Nicholson (Austl.) | § | F. Moser (Italy) | S. Young (U.S.) | K. van Oosten-Hage (Neth.) |
| 1977 | H.J. Geschke (E.Ger.) | Nakano K. (Japan) | N. Durpisch (E.Ger.) | G. Braun (W.Ger.) | G. Tsaryova (U.S.S.R.) | V. Kuznetsova (U.S.S.R.) |
| 1978 | A. Tkac (Czech.) | Nakano K. (Japan) | D. Macha (E.Ger.) | G. Braun (W.Ger.) | G. Tsaryova (U.S.S.R.) | K. van Oosten-Hage (Neth.) |
| 1979 | L. Hesslich (E.Ger.) | Nakano K. (Japan) | N. Marakov (U.S.S.R.) | B. Oosterbosch (Neth.) | G. Tsaryova (U.S.S.R.) | K. van Oosten-Hage (Neth.) |
| 1980 | § | Nakano K. (Japan) | § | A. Doyle (U.K.) | S. Novarra-Reber (U.S.) | N. Kibardina (U.S.S.R.) |
| 1981 | S. Kopylov (U.S.S.R.) | Nakano K. (Japan) | D. Macha (E.Ger.) | A. Bondue (Fr.) | S. Young-Ochowicz (U.S.) | N. Kibardina (U.S.S.R.) |
| 1982 | S. Kopylov (U.S.S.R.) | Nakano K. (Japan) | D. Macha (E.Ger.) | A. Bondue (Fr.) | C. Paraskevin (U.S.) | R. Twigg (U.S.) |
| 1983 | L. Hesslich (E.Ger.) | Nakano K. (Japan) | V. Kupovets (U.S.S.R.) | S. Bishop (Austl.) | C. Paraskevin (U.S.) | C. Carpenter (U.S.) |
| 1984 | § | Nakano K. (Japan) | § | H.-H. Oersted (Den.) | C. Paraskevin (U.S.) | R. Twigg (U.S.) |
| 1985 | L. Hesslich (E.Ger.) | Nakano K. (Japan) | V. Ekimov (U.S.S.R.) | H.-H. Oersted (Den.) | I. Nicoloso (Fr.) | R. Twigg (U.S.) |
| 1986 | M. Hübner (E.Ger.) | Nakano K. (Japan) | V. Ekimov (U.S.S.R.) | T. Doyle (U.K.) | C. Rothenburger (E.Ger.) | J. Longo (Fr.) |
| 1987 | L. Hesslich (E.Ger.) | Tawara N. (Japan) | G. Umaras (U.S.S.R.) | H.-H. Oersted (Den.) | E. Salumae (U.S.S.R.) | R. Twigg-Whitehead (U.S.) |
| 1988 | § | S. Pate (Austl.) | § | L. Pisecki (Pol.) | E. Salumae (U.S.S.R.) | J. Longo (Fr.) |
| 1989 | B. Huck (E.Ger.) | C. Golinelli (Italy) | V. Ekimov (U.S.S.R.) | C. Sturgess (U.K.) | E. Salumae (U.S.S.R.) | J. Longo (Fr.) |
| 1990 | B. Huck (E.Ger.) | M. Hübner (E.Ger.) | Ye. Berzin (U.S.S.R.) | V. Ekimov (U.S.S.R.) | C. Young (U.S.) | J. Longo (Fr.) |
| 1991 | J. Fiedler (Ger.) | not awarded | J. Lehmann (Ger.) | F. Moreau (Fr.) | I. Haringa (Neth.) | P. Rossner (Ger.) |
| 1992 | § | M. Hübner (Ger.) | § | M. McCarthy (U.S.) | E. Salumae (Est.) | P. Rossner (Ger.) |
| 1993‖ | G. Niewand (Austl.) | | G. Obree (U.K.) | | T. Dubnicoff (Can.) | R. Twigg (U.S.) |
| 1994 | M. Mothstein (U.S.) | | C. Boardman (U.K.) | | G. Yonyukhina (Russia) | M. Clignet (Fr.) |
| 1995 | D. Hill (Austl.) | | G. Obree (U.K.) | | F. Ballanger (Fr.) | R. Twigg (U.S.) |
| 1996 | F. Rousseau (Fr.) | | C. Boardman (U.K.) | | F. Ballanger (Fr.) | M. Clignet (Fr.) |
| 1997 | F. Rousseau (Fr.) | | P. Ermenault (Fr.) | | F. Ballanger (Fr.) | J. Arndt (Ger.) |
| 1998 | F. Rousseau (Fr.) | | P. Ermenault (Fr.) | | F. Ballanger (Fr.) | L. Tyler-Sharman (Austl.) |
| 1999 | L. Gane (Fr.) | | R. Bartko (Ger.) | | F. Ballanger (Fr.) | M. Clignet (Fr.) |
| 2000 | J. Van Eijden (Ger.) | | J. Lehmann (Ger.) | | N. Markovnichenko (Belarus) | Y. McGregor (U.K.) |
| 2001 | A. Tournant (Fr.) | | O. Symonenko (Ukr.) | | S. Grankovskaya (Russia) | L. Zijlaard-Van Moorsel (Neth.) |
| 2002 | S. Eadie (Austl.) | | B. McGee (Austl.) | | N. Tsylinskaya (Belarus) | L. Zijlaard-van Moorsel (Neth.) |
| 2003 | L. Gané (Fr.) | | B. Wiggins (U.K.) | | S. Grankovskaya (Rus.) | L. Zijlaard-van Moorsel (Neth.) |
| 2004 | T. Bos (Neth.) | | S. Roure (Spain) | | S. Grankovskaya (Rus.) | S. Ulmer (N.Z.) |

*1-mile race. †10-mile race. ‡10-kilometre race. §Not held because of Olympic championships. ‖From 1993 professionals and amateurs competed in the same event.




Felicia Ballanger of France after winning the 1995 Cycling World Championships in the women's 500 metres

Laurent Rebours—AP Photo



In 2000 Lance Armstrong of the United States won his second consecutive Tour de France; he again triumphed in 2001, 2002, 2003, and 2004, becoming the first cyclist to win the event six times
Mike Powell—Allsport

**Tour de France**

| year | winner | km | year | winner | km |
|---|---|---|---|---|---|
| 1903 | M. Garin (Fr.) | 2,428 | 1959 | F. Bahamontes (Spain) | 4,355 |
| 1904 | H. Cornet (Fr.) | 2,388 | 1960 | G. Nencini (Italy) | 4,173 |
| 1905 | L. Trousselier (Fr.) | 2,975 | 1961 | J. Anquetil (Fr.) | 4,397 |
| 1906 | R. Pottier (Fr.) | 4,637 | 1962 | J. Anquetil (Fr.) | 4,274 |
| 1907 | L. Petit-Breton (Fr.) | 4,488 | 1963 | J. Anquetil (Fr.) | 4,137 |
| 1908 | L. Petit-Breton (Fr.) | 4,487 | 1964 | J. Anquetil (Fr.) | 4,504 |
| 1909 | F. Faber (Lux.) | 4,507 | 1965 | F. Gimondi (Italy) | 4,183 |
| 1910 | O. Lapize (Fr.) | 4,474 | 1966 | L. Aimar (Fr.) | 4,303 |
| 1911 | G. Garrigou (Fr.) | 5,344 | 1967 | R. Pingeon (Fr.) | 4,780 |
| 1912 | O. Defraye (Belg.) | 5,319 | 1968 | J. Janssen (Neth.) | 4,662 |
| 1913 | P. Thys (Belg.) | 5,387 | 1969 | E. Merckx (Belg.) | 4,110 |
| 1914 | P. Thys (Belg.) | 5,405 | 1970 | E. Merckx (Belg.) | 4,366 |
| 1915–18 | not held | | 1971 | E. Merckx (Belg.) | 3,689 |
| 1919 | F. Lambot (Belg.) | 5,560 | 1972 | E. Merckx (Belg.) | 3,846 |
| 1920 | P. Thys (Belg.) | 5,519 | 1973 | L. Ocana (Spain) | 4,140 |
| 1921 | L. Seleur (Belg.) | 5,484 | 1974 | E. Merckx (Belg.) | 4,098 |
| 1922 | F. Lambot (Belg.) | 5,375 | 1975 | B. Thévenet (Fr.) | 4,000 |
| 1923 | H. Pélissier (Fr.) | 5,386 | 1976 | L. Van Impe (Belg.) | 4,050 |
| 1924 | O. Bottecchia (Italy) | 5,425 | 1977 | B. Thévenet (Fr.) | 4,098 |
| 1925 | O. Bottecchia (Italy) | 5,430 | 1978 | B. Hinault (Fr.) | 3,920 |
| 1926 | L. Buysse (Belg.) | 5,745 | 1979 | B. Hinault (Fr.) | 3,719 |
| 1927 | N. Frantz (Lux.) | 5,341 | 1980 | J. Zoetemelk (Neth.) | 3,948 |
| 1928 | N. Frantz (Lux.) | 5,377 | 1981 | B. Hinault (Fr.) | 3,765 |
| 1929 | M. De Waele (Belg.) | 5,286 | 1982 | B. Hinault (Fr.) | 3,489 |
| 1930 | A. Leducq (Fr.) | 4,818 | 1983 | L. Fignon (Fr.) | 3,568 |
| 1931 | A. Magne (Fr.) | 5,095 | 1984 | L. Fignon (Fr.) | 3,880 |
| 1932 | A. Leducq (Fr.) | 4,520 | 1985 | B. Hinault (Fr.) | 4,100 |
| 1933 | G. Speicher (Fr.) | 4,395 | 1986 | G. LeMond (U.S.) | 4,091 |
| 1934 | A. Magne (Fr.) | 4,363 | 1987 | S. Roche (Ire.) | 4,100 |
| 1935 | R. Maes (Belg.) | 4,338 | 1988 | P. Delgado (Spain) | 3,300 |
| 1936 | S. Maes (Belg.) | 4,442 | 1989 | G. LeMond (U.S.) | 3,215 |
| 1937 | R. Lapébie (Fr.) | 4,415 | 1990 | G. LeMond (U.S.) | 3,399 |
| 1938 | G. Bartali (Italy) | 4,694 | 1991 | M. Indurain (Spain) | 3,935 |
| 1939 | S. Maes (Belg.) | 4,224 | 1992 | M. Indurain (Spain) | 3,983 |
| 1940–46 | not held | | 1993 | M. Indurain (Spain) | 3,700 |
| 1947 | J. Robic (Fr.) | 4,640 | 1994 | M. Indurain (Spain) | 3,978 |
| 1948 | G. Bartali (Italy) | 4,922 | 1995 | M. Indurain (Spain) | 3,635 |
| 1949 | F. Coppi (Italy) | 4,808 | 1996 | B. Riis (Den.) | 3,764 |
| 1950 | F. Kubler (Switz.) | 4,775 | 1997 | J. Ullrich (Ger.) | 3,944 |
| 1951 | H. Koblet (Switz.) | 4,697 | 1998 | M. Pantani (Italy) | 3,831 |
| 1952 | F. Coppi (Italy) | 4,807 | 1999 | L. Armstrong (U.S.) | 3,687 |
| 1953 | L. Bobet (Fr.) | 4,479 | 2000 | L. Armstrong (U.S.) | 3,663 |
| 1954 | L. Bobet (Fr.) | 4,469 | 2001 | L. Armstrong (U.S.) | 3,454 |
| 1955 | L. Bobet (Fr.) | 4,855 | 2002 | L. Armstrong (U.S.) | 3,272 |
| 1956 | R. Walkowiak (Fr.) | 4,495 | 2003 | L. Armstrong (U.S.) | 3,428 |
| 1957 | J. Anquetil (Fr.) | 4,686 | 2004 | L. Armstrong (U.S.) | 3,390 |
| 1958 | C. Gaul (Lux.) | 4,319 | | | |

## FENCING

What had been the European fencing championship from 1921 to 1935 was officially recognized as the world fencing championship at the Olympic Games of 1936. The only event that does not reflect Olympics winners in the designated years is the women's team foil competition, which was not an Olympic event until 1960. Women's épée competition has been part of the world championships since 1989 and sabre since 1999.

Men's fencing bouts last about six minutes, and the first man to score five hits with the designated portion of the weapon (for foil and épée, only hits made with the point of the weapon are scored) is the winner. Women's bouts last about five minutes, and only four hits must be scored.

Each weapon has a different target area: for the foil, it is the torso; for the épée, the entire body; and for the sabre, roughly the upper half of the body (including the head and arms).

**World Fencing Championships—women's foil**

| year | individual | team | year | individual | team |
|---|---|---|---|---|---|
| 1936* | I. Elek (Hung.) | Germany | 1973 | V. Nikonova (U.S.S.R.) | Hungary |
| 1937 | H. Mayer (Ger.) | Hungary | 1974 | I. Bobis (Hung.) | U.S.S.R. |
| 1938 | M. Sedlva (Czech.) | — | 1975 | K. Jencsik-Stahl (Rom.) | U.S.S.R. |
| 1939–46 | not held | | 1976* | I. Schwarczenberger (Hung.) | U.S.S.R. |
| 1947 | E. Müller-Preis (Austria) | Denmark | 1977 | V. Sidorova (U.S.S.R) | U.S.S.R. |
| 1948* | I. Elek (Hung.) | Denmark | 1978 | V. Sidorova (U.S.S.R.) | U.S.S.R. |
| 1949 | E. Müller-Preis (Austria) | — | 1979 | C. Hanisch (W.Ger.) | U.S.S.R. |
| 1950 | R. Garilhe (Fr.) | France | 1980* | P. Trinquet (Fr.) | France |
| | E. Müller-Preis (Austria) | | 1981 | C. Hanisch (W.Ger.) | U.S.S.R. |
| 1951 | I. Elek (Hung.) | France | 1982 | N. Gillyazova (U.S.S.R.) | Italy |
| 1952* | I. Camber (Italy) | — | 1983 | D. Vaccaroni (Italy) | Italy |
| 1953 | I. Camber (Italy) | Hungary | 1984* | Luan Jujio (China) | West Germany |
| 1954 | K. Lachmann (Den.) | Hungary | 1985 | C. Hanisch (W.Ger.) | West Germany |
| 1955 | A. Domolki (Hung.) | Hungary | 1986 | A. Fichtel (W.Ger.) | U.S.S.R. |
| 1956* | G. Sheen (U.K.) | — | 1987 | E. Tufan (Rom.) | Hungary |
| 1957 | A. Zabelina (U.S.S.R.) | Italy | 1988* | A. Fichtel (W.Ger.) | West Germany |
| 1958 | V. Kiseleva (U.S.S.R.) | U.S.S.R. | 1989 | O. Velitchko (U.S.S.R.) | West Germany |
| 1959 | E. Efimova (U.S.S.R.) | Hungary | 1990 | A. Fichtel (W.Ger.) | Italy |
| 1960* | H. Schmid (Ger.)† | U.S.S.R. | 1991 | G. Trillini (Italy) | Italy |
| 1961 | H. Schmid (W.Ger.) | U.S.S.R. | 1992* | G. Trillini (Italy) | Italy |
| 1962 | O. Orban-Szabo (Rom.) | Hungary | 1993 | F. Bortolozzi (Italy) | Germany |
| 1963 | I. Rejtö (Hung.) | Hungary | 1994 | B. Szabo (Rom.) | Romania |
| 1964* | I. Ujlaki-Rejtö (Hung.) | Hungary | 1995 | L. Badea (Rom.) | Italy |
| 1965 | G. Gorokhova (U.S.S.R.) | U.S.S.R. | 1996 | L. Badea (Rom.) | Italy |
| 1966 | T. Samusenko (U.S.S.R.) | U.S.S.R. | 1997 | G. Trillini (Italy) | Italy |
| 1967 | A. Zabelina (U.S.S.R.) | Hungary | 1998 | S. Bau (Ger.) | Italy |
| 1968* | E. Novikova (U.S.S.R.) | U.S.S.R. | 1999 | V. Vezzali (Italy) | Germany |
| 1969 | E. Novikova (U.S.S.R.) | Romania | 2000 | V. Vezzali (Italy) | Italy |
| 1970 | G. Gorokhova (U.S.S.R.) | U.S.S.R. | 2001 | V. Vezzali (Italy) | Italy |
| 1971 | M.C. Demaille (Fr.) | U.S.S.R. | 2002 | S. Bojko (Russia) | Russia |
| 1972* | A. Ragno Lonzi (Italy) | U.S.S.R. | | | |

*Olympic titles are recognized as world championships. †Joint East-West German team.



Giovanna Trillini (rear) of Italy successfully defending her world champion foil title against Wang Huifeng of China at the 1992 Olympics
ALLSPORT USA/Pascal Rondeau

**World Fencing Championships—women's épée**

| year | individual | team | year | individual | team |
|---|---|---|---|---|---|
| 1989 | A. Straub (Switz.) | Hungary | 1996 | L. Flessel (Fr.) | France |
| 1990 | T. Chappe (Cuba) | West Germany | 1997 | M. Garcia-Soto (Cuba) | Hungary |
| 1991 | M. Horvath (Hung.) | Hungary | 1998 | L. Flessel (Fr.) | France |
| 1992 | not held | | 1999 | L. Flessel-Colovic (Fr.) | Hungary |
| 1993 | O. Jermakova (Est.) | Hungary | 2000 | T. Nagy (Hung.) | Russia |
| 1994 | L. Chiesa (Italy) | Spain | 2001 | C. Bokel (Ger.) | Russia |
| 1995 | J. Jakimiuk (Pol.) | Hungary | 2002 | H. Hyun (S.Kor.) | Hungary |

**World Fencing Championships—women's sabre**

| year | individual | team |
|---|---|---|
| 1999 | E. Jemaeva (Azer.) | Italy |
| 2000 | E. Jemaeva (Azer.) | United States |
| 2001 | A-L. Touya (Fr.) | Russia |
| 2002 | X. Tan (Chn.) | Russia |

**World Fencing Championships—men**

| year | individual | | | team | | |
|---|---|---|---|---|---|---|
| | foil | épée | sabre | foil | épée | sabre |
| 1936* | G. Gaudini (Italy) | F. Riccardi (Italy) | E. Kabos (Hung.) | Italy | Italy | Hungary |
| 1937 | G. Marzi (Italy) | B. Schmetz (Fr.) | G. Kovács (Hung.) | Italy | Italy | Italy |
| 1938 | G. Guaragna (Italy) | M. Pecheux (Fr.) | A. Montano (Italy) | Italy | — | — |
| 1939–46 | not held | | | | | |
| 1947 | C. d'Oriola (Fr.) | E. Artigas (Fr.) | A. Montano (Italy) | France | France | Italy |
| 1948* | J. Buhan (Fr.) | L. Cantone (Italy) | A. Gerevich (Hung.) | France | France | Hungary |
| 1949 | C. d'Oriola (Fr.) | D. Mangiarotti (Italy) | G. Daré (Italy) | Italy | Italy | Italy |
| 1950 | R. Nostini (Italy) | M. Luchow (Den.) | J. Levavasseur (Fr.) | Italy | Italy | Italy |
| 1951 | M. di Rosa (Italy) | E. Mangiarotti (Italy) | A. Gerevich (Hung.) | France | France | Hungary |
| 1952* | C. d'Oriola (Fr.) | E. Mangiarotti (Italy) | P. Kovács (Hung.) | France | Italy | Hungary |
| 1953 | C. d'Oriola (Fr.) | J. Bakoulis (Fr.) | P. Kovács (Hung.) | France | Italy | Hungary |
| 1954 | C. d'Oriola (Fr.) | E. Mangiarotti (Italy) | R. Kárpáti (Hung.) | Italy | Italy | Hungary |
| 1955 | J. Gyuricza (Hung.) | G. Anglesio (Italy) | A. Gerevich (Hung.) | Italy | Italy | Hungary |
| 1956* | C. d'Oriola (Fr.) | C. Pavesi (Italy) | R. Kárpáti (Hung.) | Italy | Italy | Hungary |
| 1957 | M. Fulop (Hung.) | A. Movyat (Fr.) | J. Pawlowski (Pol.) | Hungary | Italy | Hungary |
| 1958 | G.C. Bergamini (Italy) | H.W.F. Hoskyns (U.K.) | Y. Rylsky (U.S.S.R.) | France | Italy | Hungary |
| 1959 | A. Jay (U.K.) | G. Lafranc (Fr.) | R. Kárpáti (Hung.) | U.S.S.R. | Hungary | Poland |
| 1960* | V. Zhdanovich (U.S.S.R.) | G. Delfino (Italy) | R. Kárpáti (Hung.) | U.S.S.R. | Italy | Hungary |
| 1961 | R. Parulski (Pol.) | J. Guittet (Fr.) | Y. Rylsky (U.S.S.R.) | U.S.S.R. | U.S.S.R. | Poland |
| 1962 | G. Sveshnikov (U.S.S.R.) | I. Kausz (Hung.) | Z. Horvath (Hung.) | U.S.S.R. | France | Poland |
| 1963 | J.C. Magnan (Fr.) | R. Losert (Austria) | Y. Rylsky (U.S.S.R.) | U.S.S.R. | Poland | Poland |
| 1964* | E. Franke (Pol.) | G. Kriss (U.S.S.R.) | T. Pezsa (Hung.) | U.S.S.R. | Hungary | U.S.S.R. |
| 1965 | J.C. Magnan (Fr.) | Z. Nemere (Hung.) | J. Pawlowski (Pol.) | U.S.S.R. | France | U.S.S.R. |
| 1966 | G. Sveshnikov (U.S.S.R.) | A. Nikanchikov (U.S.S.R.) | J. Pawlowski (Pol.) | U.S.S.R. | France | Hungary |
| 1967 | V. Putyatin (U.S.S.R.) | A. Nikanchikov (U.S.S.R.) | M. Rakita (U.S.S.R.) | Romania | U.S.S.R. | U.S.S.R. |
| 1968* | I. Drimba (Rom.) | G. Kulcsar (Hung.) | J. Pawlowski (Pol.) | France | Hungary | U.S.S.R. |
| 1969 | F. Wessel (W.Ger.) | B. Andrejevski (Pol.) | V. Sidyak (U.S.S.R.) | U.S.S.R. | U.S.S.R. | U.S.S.R. |
| 1970 | F. Wessel (W.Ger.) | A. Nikanchikov (U.S.S.R.) | T. Pézsa (Hung.) | U.S.S.R. | Hungary | U.S.S.R. |
| 1971 | V. Stankovich (U.S.S.R.) | G. Kriss (U.S.S.R.) | M. Maffei (Italy) | France | Hungary | U.S.S.R. |
| 1972* | W. Woyda (Pol.) | C. Fenyvési (Hung.) | V. Sidyak (U.S.S.R.) | Poland | Hungary | Italy |
| 1973 | C. Noel (Fr.) | R. Edling (Swed.) | A. Montano (Italy) | U.S.S.R. | West Germany | Hungary |
| 1974 | A. Romankov (U.S.S.R.) | R. Edling (Swed.) | A. Montano (Italy) | U.S.S.R. | Sweden | U.S.S.R. |
| 1975 | C. Noel (Fr.) | A. Pusch (W.Ger.) | V. Nazlymov (U.S.S.R.) | France | Sweden | U.S.S.R. |
| 1976* | F. dal Zotto (Italy) | A. Pusch (W.Ger.) | V. Krovopuskov (U.S.S.R.) | West Germany | Sweden | U.S.S.R. |
| 1977 | A. Romankov (U.S.S.R.) | J. Harmenberg (Swed.) | P. Gerevich (Hung.) | West Germany | Sweden | U.S.S.R. |
| 1978 | D. Flament (Fr.) | A. Pusch (W.Ger.) | V. Krovopuskov (U.S.S.R.) | Poland | Hungary | Hungary |
| 1979 | A. Romankov (U.S.S.R.) | P. Riboud (Fr.) | V. Nazlymov (U.S.S.R.) | U.S.S.R. | U.S.S.R. | U.S.S.R. |
| 1980* | V. Smirnov (U.S.S.R.) | J. Harmenberg (Swed.) | V. Krovopuskov (U.S.S.R.) | France | France | U.S.S.R. |
| 1981 | V. Smirnov (U.S.S.R.) | Z. Szekely (Hung.) | M. Wodke (Pol.) | U.S.S.R. | U.S.S.R. | Hungary |
| 1982 | A. Romankov (U.S.S.R.) | J. Pap (Hung.) | V. Krovopuskov (U.S.S.R.) | U.S.S.R. | France | Hungary |
| 1983 | A. Romankov (U.S.S.R.) | E. Bormann (W.Ger.) | V. Etropolski (Bulg.) | West Germany | France | U.S.S.R. |
| 1984* | M. Numa (Italy) | P. Boisse (Fr.) | J.-F. Lamour (Fr.) | Italy | West Germany | Italy |
| 1985 | M. Numa (Italy) | P. Boisse (Fr.) | G. Nebald (Hung.) | Italy | West Germany | U.S.S.R. |
| 1986 | A. Borella (Italy) | P. Riboud (Fr.) | S. Mindigasov (U.S.S.R.) | Italy | West Germany | U.S.S.R. |
| 1987 | M. Gey (W.Ger.) | V. Fischer (W.Ger.) | J.-F. Lamour (Fr.) | West Germany | U.S.S.R. | U.S.S.R. |
| 1988* | S. Cerioni (Italy) | A. Schmitt (W.Ger.) | J.-F. Lamour (Fr.) | U.S.S.R. | France | Hungary |
| 1989 | A. Koch (W.Ger.) | M. Pereira (Spain) | G. Kirienko (U.S.S.R.) | U.S.S.R. | Italy | U.S.S.R. |
| 1990 | P. Omnès (Fr.) | T. Genull (W.Ger.) | G. Nebald (Hung.) | Italy | Italy | U.S.S.R. |
| 1991 | I. Weissenborn (Ger.) | A. Shuvalov (U.S.S.R.) | G. Kirienko (U.S.S.R.) | Cuba | U.S.S.R. | Hungary |
| 1992* | P. Omnès (Fr.) | E. Srecki (Fr.) | B. Szabo (Hung.) | Germany | Germany | Unified Team† |
| 1993 | A. Koch (Ger.) | P. Kolobkov (Russia) | G. Kirienko (Russia) | Germany | Italy | Hungary |
| 1994 | R. Tucker (Cuba) | P. Kolobkov (Russia) | F. Becker (Ger.) | Germany | France | Russia |
| 1995 | D. Chevtchenko (Russia) | E. Srecki (Fr.) | G. Kirienko (Russia) | Cuba | Germany | Italy |
| 1996 | A. Puccini (Italy) | A. Beketov (Russia) | S. Pozdnyakov (Russia) | Russia | Italy | Russia |
| 1997 | S. Golubitsky (Ukr.) | E. Srecki (Fr.) | S. Pozdnyakov (Russia) | France | Cuba | France |
| 1998 | S. Golubitsky (Ukr.) | H. Obry (Fr.) | L. Tarantino (Italy) | Poland | Hungary | Hungary |
| 1999 | S. Golubitsky (Ukr.) | A. Schmitt (Ger.) | D. Touya (Fr.) | France | France | France |
| 2000 | Kim Young Ho (S.Kor.) | P. Kolobkov (Russia) | M.C. Covallu (Rom.) | France | Italy | Russia |
| 2001 | S. Sanzo (Italy) | P. Milanoli (Italy) | S. Pozdnyakov (Russia) | France | Hungary | Russia |
| 2002 | S. Vanni (Italy) | P. Kolobkov (Russia) | S. Pozdnyakov (Russia) | Germany | France | Russia |

*Olympic titles are recognized as world championships. †Consisting of athletes from the Commonwealth of Independent States and Georgia.

## FIELD HOCKEY

The sport of field hockey is quite popular in the United Kingdom, India, Pakistan, and much of Europe. Curiously, the sport was not seriously promoted among U.S. men, and, in the United States, field hockey has been largely regarded as a sport for women.

Despite its recognizable origins in the mid-19th century the game was not organized on an international level until the mid-20th century. One of a number of international tournaments is the World Cup, which is organized by the Fédération Internationale de Hockey sur Gazon (FIH; founded 1924).

**World Cup Field Hockey Championship—men**

| year | winner | runner-up |
|---|---|---|
| 1971 | Pakistan | India |
| 1973 | The Netherlands | India |
| 1975 | India | Pakistan |
| 1978 | Pakistan | The Netherlands |
| 1982 | Pakistan | West Germany |
| 1986 | Australia | England |
| 1990 | The Netherlands | Pakistan |
| 1994 | Pakistan | The Netherlands |
| 1998 | The Netherlands | Spain |
| 2002 | Germany | Australia |



The teams of The Netherlands (orange and blue) and West Germany maneuvering for the ball at the 1986 World Cup Field Hockey Championships

© ANP Foto

**World Cup Field Hockey Championship—women**

| year | winner | runner-up |
|---|---|---|
| 1974 | The Netherlands | Argentina |
| 1976 | West Germany | Argentina |
| 1978 | The Netherlands | West Germany |
| 1981 | West Germany | The Netherlands |
| 1983 | The Netherlands | Canada |
| 1986 | The Netherlands | West Germany |
| 1990 | The Netherlands | Australia |
| 1994 | Australia | Argentina |
| 1998 | Australia | The Netherlands |

## FOOTBALL

Many types of games are known as football, among them association football (also called soccer), gridiron football (also called U.S. football and known in the United States as, simply, football), Canadian football (also called rugby football), and Rugby Union and Rugby League football (also known as rugby, or rugger). Each of these games is unique, although some—such as U.S. football and Canadian football—bear more than a little resemblance, and each has its own distinct following.

*Association football.* The game of association football is governed by the Fédération Internationale de Football Association (FIFA; founded 1904). The FIFA World Cup (organized as the World Cup in 1930) was the first official internationally contested association football match. The popularity of the World Cup led to the development of several regional cup competitions, including the African Cup of Nations, the Asian Cup, the Copa América, and the European Championship Cup. Competition for the FIFA Women's World Cup began in 1991.



Diego Maradona of Argentina in the opening game of the 1986 World Cup, during which Maradona set up all three goals in Argentina's 3–1 victory over South Korea

Colorsport

**FIFA World Cup—men**

| year | result | | | |
|---|---|---|---|---|
| 1930 | Uruguay | 4 | Argentina | 2 |
| 1934 | Italy | 2 | Czechoslovakia | 1 |
| 1938 | Italy | 4 | Hungary | 2 |
| 1950 | Uruguay | 2 | Brazil | 1 |
| 1954 | West Germany | 3 | Hungary | 2 |
| 1958 | Brazil | 5 | Sweden | 2 |
| 1962 | Brazil | 3 | Czechoslovakia | 1 |
| 1966 | England | 4 | West Germany | 2 |
| 1970 | Brazil | 4 | Italy | 1 |
| 1974 | West Germany | 2 | The Netherlands | 1 |
| 1978 | Argentina | 3 | The Netherlands | 1 |
| 1982 | Italy | 3 | West Germany | 1 |
| 1986 | Argentina | 3 | West Germany | 2 |
| 1990 | West Germany | 1 | Argentina | 0 |
| 1994 | Brazil* | 0 | Italy | 0 |
| 1998 | France | 3 | Brazil | 0 |
| 2002 | Brazil | 2 | Germany | 0 |

*Won on penalty kicks.

**FIFA World Cup—women**

| year | result | | | |
|---|---|---|---|---|
| 1991 | United States | 2 | Norway | 1 |
| 1995 | Norway | 2 | Germany | 0 |
| 1999 | United States* | 0 | China | 0 |
| 2003 | Germany | 2 | Sweden | 1 |

*Won on penalty kicks.

**European Championship Cup**

| year | result | | | |
|---|---|---|---|---|
| 1960 | U.S.S.R. | 2 | Yugoslavia | 1 |
| 1964 | Spain | 2 | U.S.S.R. | 1 |
| 1968 | Italy | 2 | Yugoslavia | 0 |
| 1972 | West Germany | 3 | U.S.S.R. | 0 |
| 1976 | Czechoslovakia* | 2 | West Germany | 2 |
| 1980 | West Germany | 2 | Belgium | 1 |
| 1984 | France | 2 | Spain | 0 |
| 1988 | The Netherlands | 2 | U.S.S.R. | 0 |
| 1992 | Denmark | 2 | Germany | 0 |
| 1996 | Germany | 2 | Czech Republic | 1 |
| 2000 | France | 2 | Italy | 1 |
| 2004 | Greece | 1 | Portugal | 0 |

*Czechoslovakia won penalty shoot-out 5–3.

**Asian Cup**

| year | winner | runner-up |
|---|---|---|
| 1956 | S. Korea | Israel |
| 1960 | S. Korea | Israel |
| 1964 | Israel | India |
| 1968 | Iran | Burma |
| 1972 | Iran | S. Korea |
| 1976 | Iran | Kuwait |
| 1980 | Kuwait | S. Korea |
| 1984 | Saudi Arabia | China |
| 1988 | Saudi Arabia | S. Korea |
| 1992 | Japan | Saudi Arabia |
| 1996 | Saudi Arabia | United Arab Emirates |
| 2000 | Japan | Saudi Arabia |
| 2004 | Japan | China |

**African Cup of Nations**

| year | winner | year | winner |
|---|---|---|---|
| 1957 | Egypt | 1982 | Ghana |
| 1959 | Egypt | 1984 | Cameroon |
| 1962 | Ethiopia | 1986 | Egypt |
| 1963 | Ghana | 1988 | Cameroon |
| 1965 | Ghana | 1990 | Algeria |
| 1968 | Congo (Kinshasa) | 1992 | Côte d'Ivoire |
| 1970 | Sudan | 1994 | Nigeria |
| 1972 | Congo (Brazzaville) | 1996 | South Africa |
| 1974 | Zaire | 1998 | Egypt |
| 1976 | Morocco | 2000 | Cameroon |
| 1978 | Ghana | 2002 | Cameroon |
| 1980 | Nigeria | 2004 | Tunisia |

**Copa América**

| year | result | | | |
|---|---|---|---|---|
| 1995 | Uruguay* | 2 | Brazil | 2 |
| 1997 | Brazil | 3 | Bolivia | 1 |
| 1999 | Brazil | 3 | Uruguay | 1 |
| 2001 | Colombia | 1 | Mexico | 0 |
| 2004 | Brazil† | 2 | Argentina | 2 |

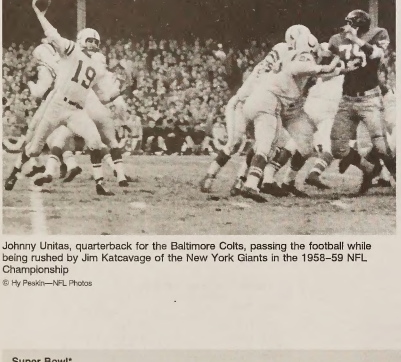
*Uruguay won penalty shoot-out 5–3.
†Brazil won penalty shoot-out 4–2.

*American Football—professional.* The National Football League (NFL) championship playoffs were organized in 1933. The American Football League (founded 1959) was a rival organization until 1970, when it merged with the NFL. The resulting reorganization added a few new teams (1976) and divided the reconstituted NFL into two conferences, the American Football Conference and the National Football Conference. The playoff winner in each conference becomes that conference's representative in the Super Bowl, the final game of the professional football season.

**National Football League Champions***

| season | result | | | season | result | | | season | result | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1933–34 | Chicago Bears | 23 | New York Giants | 21 | 1952–53 | Detroit Lions | 17 | Cleveland Browns | 7 |
| 1934–35 | New York Giants | 30 | Chicago Bears | 13 | 1953–54 | Detroit Lions | 17 | Cleveland Browns | 16 |
| 1935–36 | Detroit Lions | 26 | New York Giants | 7 | 1954–55 | Cleveland Browns | 56 | Detroit Lions | 10 |
| 1936–37 | Green Bay Packers | 21 | Boston Redskins | 6 | 1955–56 | Cleveland Browns | 38 | Los Angeles Rams | 14 |
| 1937–38 | Washington Redskins | 28 | Chicago Bears | 21 | 1956–57 | New York Giants | 47 | Chicago Bears | 7 |
| 1938–39 | New York Giants | 23 | Green Bay Packers | 17 | 1957–58 | Detroit Lions | 59 | Cleveland Browns | 14 |
| 1939–40 | Green Bay Packers | 27 | New York Giants | 0 | 1958–59 | Baltimore Colts | 23† | New York Giants | 17 |
| 1940–41 | Chicago Bears | 73 | Washington Redskins | 0 | 1959–60 | Baltimore Colts | 31 | New York Giants | 16 |
| 1941–42 | Chicago Bears | 37 | New York Giants | 9 | 1960–61 | Philadelphia Eagles | 17 | Green Bay Packers | 13 |
| 1942–43 | Washington Redskins | 14 | Chicago Bears | 6 | 1961–62 | Green Bay Packers | 37 | New York Giants | 0 |
| 1943–44 | Chicago Bears | 41 | Washington Redskins | 21 | 1962–63 | Green Bay Packers | 16 | New York Giants | 7 |
| 1944–45 | Green Bay Packers | 14 | New York Giants | 7 | 1963–64 | Chicago Bears | 14 | New York Giants | 10 |
| 1945–46 | Cleveland Rams | 15 | Washington Redskins | 14 | 1964–65 | Cleveland Browns | 27 | Baltimore Colts | 0 |
| 1946–47 | Chicago Bears | 24 | New York Giants | 14 | 1965–66 | Green Bay Packers | 23 | Cleveland Browns | 12 |
| 1947–48 | Chicago Cardinals | 28 | Philadelphia Eagles | 21 | 1966–67 | Green Bay Packers | 34 | Dallas Cowboys | 27 |
| 1948–49 | Philadelphia Eagles | 7 | Chicago Cardinals | 0 | 1967–68 | Green Bay Packers | 21 | Dallas Cowboys | 17 |
| 1949–50 | Philadelphia Eagles | 14 | Los Angeles Rams | 0 | 1968–69 | Baltimore Colts | 34 | Cleveland Browns | 0 |
| 1950–51 | Cleveland Browns | 30 | Los Angeles Rams | 28 | 1969–70 | Minnesota Vikings | 27 | Cleveland Browns | 7 |
| 1951–52 | Los Angeles Rams | 24 | Cleveland Browns | 17 | | | | | |

*League was divided into American and National conferences 1950–52; in 1970 it became the National Football Conference of the National Football League. †Won at 8:15 of sudden-death overtime period.



Johnny Unitas, quarterback for the Baltimore Colts, passing the football while being rushed by Jim Katcavage of the New York Giants in the 1958–59 NFL Championship

© Hy Peskin—NFL Photos

**American Football League Champions***

| season | result | | | |
|---|---|---|---|---|
| 1960–61 | Houston Oilers | 24 | Los Angeles Chargers | 16 |
| 1961–62 | Houston Oilers | 10 | San Diego Chargers | 3 |
| 1962–63 | Dallas Texans | 20† | Houston Oilers | 17 |
| 1963–64 | San Diego Chargers | 51 | Boston Patriots | 10 |
| 1964–65 | Buffalo Bills | 20 | San Diego Chargers | 7 |
| 1965–66 | Buffalo Bills | 23 | San Diego Chargers | 0 |
| 1966–67 | Kansas City Chiefs | 31 | Buffalo Bills | 7 |
| 1967–68 | Oakland Raiders | 40 | Houston Oilers | 7 |
| 1968–69 | New York Jets | 27 | Oakland Raiders | 23 |
| 1969–70 | Kansas City Chiefs | 17 | Oakland Raiders | 7 |

*League became American Football Conference of National Football League in 1970. †Won at 2:54 of second sudden-death overtime period.

**Super Bowl***

| | season | result | | | | season | result | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| I | 1966–67 | Green Bay Packers (NFL) | 35 | Kansas City Chiefs (AFL) | 10 | XX | 1985–86 | Chicago Bears (NFC) | 46 | New England Patriots (AFC) 10 |
| II | 1967–68 | Green Bay Packers (NFL) | 33 | Oakland Raiders (AFL) | 14 | XXI | 1986–87 | New York Giants (NFC) | 39 | Denver Broncos (AFC) 20 |
| III | 1968–69 | New York Jets (AFL) | 16 | Baltimore Colts (NFL) | 7 | XXII | 1987–88 | Washington Redskins (NFC) | 42 | Denver Broncos (AFC) 10 |
| IV | 1969–70 | Kansas City Chiefs (AFL) | 23 | Minnesota Vikings (NFL) | 7 | XXIII | 1988–89 | San Francisco 49ers (NFC) | 20 | Cincinnati Bengals (AFC) 16 |
| V | 1970–71 | Baltimore Colts (AFC) | 16 | Dallas Cowboys (NFC) | 13 | XXIV | 1989–90 | San Francisco 49ers (NFC) | 55 | Denver Broncos (AFC) 10 |
| VI | 1971–72 | Dallas Cowboys (NFC) | 24 | Miami Dolphins (AFC) | 3 | XXV | 1990–91 | New York Giants (NFC) | 20 | Buffalo Bills (AFC) 19 |
| VII | 1972–73 | Miami Dolphins (AFC) | 14 | Washington Redskins (NFC) | 7 | XXVI | 1991–92 | Washington Redskins (NFC) | 37 | Buffalo Bills (AFC) 24 |
| VIII | 1973–74 | Miami Dolphins (AFC) | 24 | Minnesota Vikings (NFC) | 7 | XXVII | 1992–93 | Dallas Cowboys (NFC) | 52 | Buffalo Bills (AFC) 17 |
| IX | 1974–75 | Pittsburgh Steelers (AFC) | 16 | Minnesota Vikings (NFC) | 6 | XXVIII | 1993–94 | Dallas Cowboys (NFC) | 30 | Buffalo Bills (AFC) 13 |
| X | 1975–76 | Pittsburgh Steelers (AFC) | 21 | Dallas Cowboys (NFC) | 17 | XXIX | 1994–95 | San Francisco 49ers (NFC) | 49 | San Diego Chargers (AFC) 26 |
| XI | 1976–77 | Oakland Raiders (AFC) | 32 | Minnesota Vikings (NFC) | 14 | XXX | 1995–96 | Dallas Cowboys (NFC) | 27 | Pittsburgh Steelers (AFC) 17 |
| XII | 1977–78 | Dallas Cowboys (NFC) | 27 | Denver Broncos (AFC) | 10 | XXXI | 1996–97 | Green Bay Packers (NFC) | 35 | New England Patriots (AFC) 21 |
| XIII | 1978–79 | Pittsburgh Steelers (AFC) | 35 | Dallas Cowboys (NFC) | 31 | XXXII | 1997–98 | Denver Broncos (AFC) | 31 | Green Bay Packers (NFC) 24 |
| XIV | 1979–80 | Pittsburgh Steelers (AFC) | 31 | Los Angeles Rams (NFC) | 19 | XXXIII | 1998–99 | Denver Broncos (AFC) | 34 | Atlanta Falcons (NFC) 19 |
| XV | 1980–81 | Oakland Raiders (AFC) | 27 | Philadelphia Eagles (NFC) | 10 | XXXIV | 1999–2000 | St. Louis Rams (NFC) | 23 | Tennessee Titans (AFC) 16 |
| XVI | 1981–82 | San Francisco 49ers (NFC) | 26 | Cincinnati Bengals (AFC) | 21 | XXXV | 2000–01 | Baltimore Ravens (AFC) | 34 | New York Giants (NFC) 7 |
| XVII | 1982–83 | Washington Redskins (NFC) | 27 | Miami Dolphins (AFC) | 17 | XXXVI | 2001–02 | New England Patriots (AFC) | 20 | St. Louis Rams (NFC) 17 |
| XVIII | 1983–84 | Los Angeles Raiders (AFC) | 38 | Washington Redskins (NFC) | 9 | XXXVII | 2002–03 | Tampa Bay Buccaneers (NFC) | 48 | Oakland Raiders (AFC) 21 |
| XIX | 1984–85 | San Francisco 49ers (NFC) | 38 | Miami Dolphins (AFC) | 16 | XXXVIII | 2003–04 | New England Patriots (AFC) | 32 | Carolina Panthers (NFC) 29 |

*NFL-AFL championship 1966–70; NFL championship from 1971–72 season.

*American Football—college.* Historically the national champion of college football has been informally selected by two rival opinion polls—one based on a survey of collegiate football coaches (currently conducted by USA Today/ESPN) and the other by sports writers (conducted by the Associated Press [AP]). The AP sports writers' poll began in 1936. The coaches' poll was begun in 1950 by the United Press (now United Press International [UPI]). Where polls designated different teams, both are listed. Desire for a clear-cut national champion led to the creation of the Bowl Championship Series (BCS) in 1999. The BCS uses a formula involving team records, strength of schedule, and rankings to determine the top two teams, who then meet in a national championship game. The site of the game annually shifts between the four major Bowls—Fiesta, Orange, Rose, and Sugar. The first of the Bowl games, the Rose Bowl, was played in 1902 during the 12th annual Tournament of Roses festival in Pasadena, Calif. In 1935 the Sugar Bowl (played in New Orleans, La.) and the Orange Bowl (played in Miami, Fla.) were inaugurated. The Fiesta Bowl (played in Phoenix, Ariz.) began play in 1971.

**Rose Bowl**

| season | result | | | | season | result | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1901–02 | Michigan | 49 | Stanford | 0 | 1959–60 | Washington | 44 | Wisconsin | 8 |
| 1915–16 | Washington State | 14 | Brown | 0 | 1960–61 | Washington | 17 | Minnesota | 7 |
| 1916–17 | Oregon | 14 | Pennsylvania | 0 | 1961–62 | Minnesota | 21 | UCLA | 3 |
| 1917–18 | Mare Island | 19 | Camp Lewis | 7 | 1962–63 | Southern California | 42 | Wisconsin | 37 |
| 1918–19 | Great Lakes | 17 | Mare Island | 0 | 1963–64 | Illinois | 17 | Washington | 7 |
| 1919–20 | Harvard | 7 | Oregon | 6 | 1964–65 | Michigan | 34 | Oregon State | 7 |
| 1920–21 | California | 28 | Ohio State | 0 | 1965–66 | UCLA | 14 | Michigan State | 12 |
| 1921–22 | California | 0 | Washington & Jefferson | 0 | 1966–67 | Purdue | 14 | Southern California | 13 |
| 1922–23 | Southern California | 14 | Penn State | 3 | 1967–68 | Southern California | 14 | Indiana | 3 |
| 1923–24 | Washington | 14 | Navy | 14 | 1968–69 | Ohio State | 27 | Southern California | 16 |
| 1924–25 | Notre Dame | 27 | Stanford | 10 | 1969–70 | Southern California | 10 | Michigan | 3 |
| 1925–26 | Alabama | 20 | Washington | 19 | 1970–71 | Stanford | 27 | Ohio State | 17 |
| 1926–27 | Alabama | 7 | Stanford | 7 | 1971–72 | Stanford | 13 | Michigan | 12 |
| 1927–28 | Stanford | 7 | Pittsburgh | 6 | 1972–73 | Southern California | 42 | Ohio State | 17 |
| 1928–29 | Georgia Tech | 8 | California | 7 | 1973–74 | Ohio State | 42 | Southern California | 21 |
| 1929–30 | Southern California | 47 | Pittsburgh | 14 | 1974–75 | Southern California | 18 | Ohio State | 17 |
| 1930–31 | Alabama | 24 | Washington State | 0 | 1975–76 | UCLA | 23 | Ohio State | 10 |
| 1931–32 | Southern California | 21 | Tulane | 12 | 1976–77 | Southern California | 14 | Michigan | 6 |
| 1932–33 | Southern California | 35 | Pittsburgh | 0 | 1977–78 | Washington | 27 | Michigan | 20 |
| 1933–34 | Columbia | 7 | Stanford | 0 | 1978–79 | Southern California | 17 | Michigan | 10 |
| 1934–35 | Alabama | 29 | Stanford | 13 | 1979–80 | Southern California | 17 | Ohio State | 16 |
| 1935–36 | Stanford | 7 | Southern Methodist | 0 | 1980–81 | Michigan | 23 | Washington | 6 |
| 1936–37 | Pittsburgh | 21 | Washington | 0 | 1981–82 | Washington | 28 | Iowa | 0 |
| 1937–38 | California | 13 | Alabama | 0 | 1982–83 | UCLA | 24 | Michigan | 14 |
| 1938–39 | Southern California | 7 | Duke | 3 | 1983–84 | UCLA | 45 | Illinois | 9 |
| 1939–40 | Southern California | 14 | Tennessee | 0 | 1984–85 | Southern California | 20 | Ohio State | 17 |
| 1940–41 | Stanford | 21 | Nebraska | 13 | 1985–86 | UCLA | 45 | Iowa | 28 |
| 1941–42 | Oregon State | 20 | Duke | 16 | 1986–87 | Arizona State | 22 | Michigan | 15 |
| 1942–43 | Georgia | 9 | UCLA | 0 | 1987–88 | Michigan State | 20 | Southern California | 17 |
| 1943–44 | Southern California | 29 | Washington | 0 | 1988–89 | Michigan | 22 | Southern California | 14 |
| 1944–45 | Southern California | 25 | Tennessee | 0 | 1989–90 | Southern California | 17 | Michigan | 10 |
| 1945–46 | Alabama | 34 | Southern California | 14 | 1990–91 | Washington | 46 | Iowa | 34 |
| 1946–47 | Illinois | 45 | UCLA | 14 | 1991–92 | Washington | 34 | Michigan | 14 |
| 1947–48 | Michigan | 49 | Southern California | 0 | 1992–93 | Michigan | 38 | Washington | 31 |
| 1948–49 | Northwestern | 20 | California | 14 | 1993–94 | Wisconsin | 21 | UCLA | 16 |
| 1949–50 | Ohio State | 17 | California | 14 | 1994–95 | Penn State | 38 | Oregon | 20 |
| 1950–51 | Michigan | 14 | California | 6 | 1995–96 | Southern California | 41 | Northwestern | 32 |
| 1951–52 | Illinois | 40 | Stanford | 7 | 1996–97 | Ohio State | 20 | Arizona State | 17 |
| 1952–53 | Southern California | 7 | Wisconsin | 0 | 1997–98 | Michigan | 21 | Washington State | 16 |
| 1953–54 | Michigan State | 28 | UCLA | 20 | 1998–99 | Wisconsin | 38 | UCLA | 31 |
| 1954–55 | Ohio State | 20 | Southern California | 7 | 1999–2000 | Wisconsin | 17 | Stanford | 9 |
| 1955–56 | Michigan State | 17 | UCLA | 14 | 2000–01 | Washington | 34 | Purdue | 24 |
| 1956–57 | Iowa | 35 | Oregon State | 19 | 2001–02 | Miami (Fla.) | 37 | Nebraska | 14 |
| 1957–58 | Ohio State | 10 | Oregon | 7 | 2002–03 | Oklahoma | 34 | Washington State | 14 |
| 1958–59 | Iowa | 38 | California | 12 | 2003–04 | Southern California | 28 | Michigan | 14 |



Charles White (right), tailback, University of Southern California, trying to evade Calvin O'Neal, linebacker, University of Michigan, in the 1976–77 Rose Bowl
University of Southern California, Sports Information

**Fiesta Bowl**

| season | result | | | |
|---|---|---|---|---|
| 1971–72 | Arizona State | 45 | Florida State | 38 |
| 1972–73 | Arizona State | 28 | Missouri | 35 |
| 1973–74 | Arizona State | 28 | Pittsburgh | 7 |
| 1974–75 | Oklahoma State | 16 | Brigham Young | 6 |
| 1975–76 | Arizona State | 17 | Nebraska | 14 |
| 1976–77 | Oklahoma | 41 | Wyoming | 7 |
| 1977–78 | Penn State | 42 | Arizona State | 30 |
| 1978–79 | Arkansas | 10 | UCLA | 10 |
| 1979–80 | Pittsburgh | 16 | Arizona | 10 |
| 1980–81 | Penn State | 31 | Ohio State | 19 |
| 1981–82 | Penn State | 26 | Southern California | 10 |
| 1982–83 | Arizona State | 32 | Oklahoma | 21 |
| 1983–84 | Ohio State | 28 | Pittsburgh | 23 |
| 1984–85 | UCLA | 39 | Miami (Fla.) | 37 |
| 1985–86 | Michigan | 27 | Nebraska | 23 |
| 1986–87 | Penn State | 14 | Miami (Fla.) | 10 |
| 1987–88 | Florida State | 31 | Nebraska | 28 |
| 1988–89 | Notre Dame | 34 | West Virginia | 21 |
| 1989–90 | Florida State | 41 | Nebraska | 17 |
| 1990–91 | Louisville | 34 | Alabama | 7 |
| 1991–92 | Penn State | 42 | Tennessee | 17 |
| 1992–93 | Syracuse | 26 | Colorado | 22 |
| 1993–94 | Arizona | 29 | Miami (Fla.) | 0 |
| 1994–95 | Colorado | 41 | Notre Dame | 24 |
| 1995–96 | Nebraska | 62 | Florida | 24 |
| 1996–97 | Penn State | 38 | Texas | 15 |
| 1997–98 | Kansas State | 35 | Syracuse | 18 |
| 1998–99 | Tennessee | 23 | Florida State | 16 |
| 1999–2000 | Nebraska | 31 | Tennessee | 21 |
| 2000–01 | Oregon State | 41 | Notre Dame | 9 |
| 2001–02 | Oregon | 38 | Colorado | 16 |
| 2002–03 | Ohio State | 31 | Miami (Fla.) | 24 |
| 2003–04 | Ohio State | 35 | Kansas State | 28 |

## College Football National Champion

| season | champion | season | champion | season | champion |
|---|---|---|---|---|---|
| 1924 | Notre Dame | 1954 | Ohio State (AP), | 1978 | Alabama (AP), |
| 1925 | Dartmouth | | UCLA (UP) | | Southern California (UPI) |
| 1926 | Stanford | 1955 | Oklahoma | 1979 | Alabama |
| 1927 | Illinois | 1956 | Oklahoma | 1980 | Georgia |
| 1928 | Southern California | 1957 | Auburn (AP), | 1981 | Clemson |
| 1929 | Notre Dame | | Ohio State (UP) | 1982 | Penn State |
| 1930 | Notre Dame | 1958 | Louisiana State | 1983 | Miami (Fla.) |
| 1931 | Southern California | 1959 | Syracuse | 1984 | Brigham Young |
| 1932 | Michigan | 1960 | Minnesota | 1985 | Oklahoma |
| 1933 | Michigan | 1961 | Alabama | 1986 | Penn State |
| 1934 | Minnesota | 1962 | Southern California | 1987 | Miami (Fla.) |
| 1935 | Southern Methodist | 1963 | Texas | 1988 | Notre Dame |
| 1936 | Minnesota | 1964 | Alabama | 1989 | Miami (Fla.) |
| 1937 | Pittsburgh | 1965 | Alabama (AP), | 1990 | Colorado (AP), |
| 1938 | Texas Christian | | Michigan State (UPI) | | Georgia Tech (UPI) |
| 1939 | Texas A&M | 1966 | Notre Dame | 1991 | Miami (Fla.; AP), |
| 1940 | Minnesota | 1967 | Southern California | | Washington (UPI) |
| 1941 | Minnesota | 1968 | Ohio State | 1992 | Alabama |
| 1942 | Ohio State | 1969 | Texas | 1993–94 | Florida State |
| 1943 | Notre Dame | 1970 | Nebraska (AP), | 1994–95 | Nebraska |
| 1944 | Army | | Texas (UPI) | 1995–96 | Nebraska |
| 1945 | Army | 1971 | Nebraska | 1996–97 | Florida |
| 1946 | Notre Dame | 1972 | Southern California | 1997–98 | Michigan/Nebraska* |
| 1947 | Notre Dame | 1973 | Notre Dame (AP), | 1998–99 | Tennessee |
| 1948 | Michigan | | Alabama (UPI) | 1999–2000 | Florida State |
| 1949 | Notre Dame | 1974 | Oklahoma (AP), | 2000–01 | Oklahoma |
| 1950 | Oklahoma | | Southern California (UPI) | 2001–02 | Miami (Fla.) |
| 1951 | Tennessee | 1975 | Oklahoma | 2002–03 | Ohio State |
| 1952 | Michigan State | 1976 | Pittsburgh | 2003–04 | Louisiana State (BCS), |
| 1953 | Maryland | 1977 | Notre Dame | | Southern California (AP) |

*Tied.

## Sugar Bowl

| season | result | | | season | result | | | season | result | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1934–35 | Tulane | 20 | Temple | 14 | 1958–59 | Louisiana State | 7 | Clemson | 0 | 1982–83 | Penn State | 27 | Georgia | 23 |
| 1935–36 | Texas Christian | 3 | Louisiana State | 2 | 1959–60 | Mississippi | 21 | Louisiana State | 0 | 1983–84 | Auburn | 9 | Michigan | 7 |
| 1936–37 | Santa Clara | 21 | Louisiana State | 14 | 1960–61 | Mississippi | 14 | Rice | 6 | 1984–85 | Nebraska | 28 | Louisiana State | 10 |
| 1937–38 | Santa Clara | 6 | Louisiana State | 0 | 1961–62 | Alabama | 10 | Arkansas | 3 | 1985–86 | Tennessee | 35 | Miami (Fla.) | 7 |
| 1938–39 | Texas Christian | 15 | Carnegie Tech | 7 | 1962–63 | Mississippi | 17 | Arkansas | 13 | 1986–87 | Nebraska | 30 | Louisiana State | 15 |
| 1939–40 | Texas A&M | 14 | Tulane | 13 | 1963–64 | Alabama | 12 | Mississippi | 7 | 1987–88 | Auburn | 16 | Syracuse | 16 |
| 1940–41 | Boston College | 19 | Tennessee | 13 | 1964–65 | Louisiana State | 13 | Syracuse | 10 | 1988–89 | Florida State | 13 | Auburn | 7 |
| 1941–42 | Fordham | 2 | Missouri | 0 | 1965–66 | Missouri | 20 | Florida | 18 | 1989–90 | Miami (Fla.) | 33 | Alabama | 25 |
| 1942–43 | Tennessee | 14 | Tulsa | 7 | 1966–67 | Alabama | 34 | Nebraska | 7 | 1990–91 | Tennessee | 23 | Virginia | 22 |
| 1943–44 | Georgia Tech | 20 | Tulsa | 18 | 1967–68 | Louisiana State | 20 | Wyoming | 13 | 1991–92 | Notre Dame | 39 | Florida | 28 |
| 1944–45 | Duke | 29 | Alabama | 26 | 1968–69 | Arkansas | 16 | Georgia | 2 | 1992–93 | Alabama | 34 | Miami (Fla.) | 13 |
| 1945–46 | Oklahoma A&M | 33 | St. Mary's | 13 | 1969–70 | Mississippi | 27 | Arkansas | 22 | 1993–94 | Florida | 41 | West Virginia | 7 |
| 1946–47 | Georgia | 20 | North Carolina | 10 | 1970–71 | Tennessee | 34 | Air Force | 13 | 1994–95 | Florida State | 23 | Florida | 17 |
| 1947–48 | Texas | 27 | Alabama | 7 | 1971–72 | Oklahoma | 40 | Auburn | 22 | 1995–96 | Virginia Tech | 28 | Texas | 10 |
| 1948–49 | Oklahoma | 14 | North Carolina | 6 | 1972–73 | Oklahoma | 14 | Penn State | 0 | 1996–97 | Florida | 52 | Florida State | 20 |
| 1949–50 | Oklahoma | 35 | Louisiana State | 0 | 1973–74 | Notre Dame | 24 | Alabama | 23 | 1997–98 | Florida State | 31 | Ohio State | 14 |
| 1950–51 | Kentucky | 13 | Oklahoma | 7 | 1974–75 | Nebraska | 13 | Florida | 10 | 1998–99 | Ohio State | 24 | Texas A&M | 14 |
| 1951–52 | Maryland | 28 | Tennessee | 13 | 1975–76 | Alabama | 13 | Penn State | 6 | 1999–2000 | Florida State | 46 | Virginia Tech | 29 |
| 1952–53 | Georgia Tech | 24 | Mississippi | 7 | 1976–77 | Pittsburgh | 27 | Georgia | 3 | 2000–01 | Miami (Fla.) | 37 | Florida | 20 |
| 1953–54 | Georgia Tech | 42 | West Virginia | 19 | 1977–78 | Alabama | 35 | Ohio State | 6 | 2001–02 | Louisiana State | 47 | Illinois | 34 |
| 1954–55 | Navy | 21 | Mississippi | 0 | 1978–79 | Alabama | 14 | Penn State | 7 | 2002–03 | Georgia | 26 | Florida State | 13 |
| 1955–56 | Georgia Tech | 7 | Pittsburgh | 0 | 1979–80 | Alabama | 24 | Arkansas | 9 | 2003–04 | Louisiana State | 21 | Oklahoma | 14 |
| 1956–57 | Baylor | 13 | Tennessee | 7 | 1980–81 | Georgia | 17 | Notre Dame | 10 | | | | | |
| 1957–58 | Mississippi | 39 | Texas | 7 | 1981–82 | Pittsburgh | 24 | Georgia | 20 | | | | | |

## Orange Bowl

| season | result | | | season | result | | | season | result | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1934–35 | Bucknell | 26 | Miami (Fla.) | 0 | 1958–59 | Oklahoma | 21 | Syracuse | 6 | 1982–83 | Nebraska | 21 | Louisiana State | 20 |
| 1935–36 | Catholic | 20 | Mississippi | 19 | 1959–60 | Georgia | 14 | Missouri | 0 | 1983–84 | Miami (Fla.) | 31 | Nebraska | 30 |
| 1936–37 | Duquesne | 13 | Mississippi State | 12 | 1960–61 | Missouri | 21 | Navy | 14 | 1984–85 | Washington | 28 | Oklahoma | 17 |
| 1937–38 | Auburn | 6 | Michigan State | 0 | 1961–62 | Louisiana State | 25 | Colorado | 7 | 1985–86 | Oklahoma | 25 | Penn State | 10 |
| 1938–39 | Tennessee | 17 | Oklahoma | 0 | 1962–63 | Alabama | 17 | Oklahoma | 0 | 1986–87 | Oklahoma | 42 | Arkansas | 8 |
| 1939–40 | Georgia Tech | 21 | Missouri | 7 | 1963–64 | Nebraska | 13 | Auburn | 7 | 1987–88 | Miami (Fla.) | 20 | Oklahoma | 14 |
| 1940–41 | Mississippi State | 14 | Georgetown | 7 | 1964–65 | Texas | 21 | Alabama | 17 | 1988–89 | Miami (Fla.) | 23 | Nebraska | 3 |
| 1941–42 | Georgia | 40 | Texas Christian | 26 | 1965–66 | Alabama | 39 | Nebraska | 28 | 1989–90 | Notre Dame | 21 | Colorado | 6 |
| 1942–43 | Alabama | 37 | Boston College | 21 | 1966–67 | Florida | 27 | Georgia Tech | 12 | 1990–91 | Colorado | 10 | Notre Dame | 9 |
| 1943–44 | Louisiana State | 19 | Texas A&M | 14 | 1967–68 | Oklahoma | 26 | Tennessee | 24 | 1991–92 | Miami (Fla.) | 22 | Nebraska | 0 |
| 1944–45 | Tulsa | 26 | Georgia Tech | 12 | 1968–69 | Penn State | 15 | Kansas | 14 | 1992–93 | Florida State | 27 | Nebraska | 14 |
| 1945–46 | Miami (Fla.) | 13 | Holy Cross | 6 | 1969–70 | Penn State | 10 | Missouri | 3 | 1993–94 | Florida State | 18 | Nebraska | 16 |
| 1946–47 | Rice | 8 | Tennessee | 0 | 1970–71 | Nebraska | 17 | Louisiana State | 12 | 1994–95 | Nebraska | 24 | Miami (Fla.) | 17 |
| 1947–48 | Georgia Tech | 20 | Kansas | 14 | 1971–72 | Nebraska | 38 | Alabama | 6 | 1995–96 | Florida State | 31 | Notre Dame | 26 |
| 1948–49 | Texas | 41 | Georgia | 28 | 1972–73 | Nebraska | 40 | Notre Dame | 6 | 1996–97 | Nebraska | 41 | Virginia Tech | 21 |
| 1949–50 | Santa Clara | 21 | Kentucky | 13 | 1973–74 | Penn State | 16 | Louisiana State | 9 | 1997–98 | Nebraska | 42 | Tennessee | 17 |
| 1950–51 | Clemson | 15 | Miami (Fla.) | 14 | 1974–75 | Notre Dame | 13 | Alabama | 11 | 1998–99 | Florida | 31 | Syracuse | 10 |
| 1951–52 | Georgia Tech | 17 | Baylor | 14 | 1975–76 | Oklahoma | 14 | Michigan | 6 | 1999–2000 | Michigan | 35 | Alabama | 34 |
| 1952–53 | Alabama | 61 | Syracuse | 6 | 1976–77 | Ohio State | 27 | Colorado | 10 | 2000–01 | Oklahoma | 13 | Florida State | 2 |
| 1953–54 | Oklahoma | 7 | Maryland | 0 | 1977–78 | Arkansas | 31 | Oklahoma | 6 | 2001–02 | Florida | 56 | Maryland | 23 |
| 1954–55 | Duke | 34 | Nebraska | 7 | 1978–79 | Oklahoma | 31 | Nebraska | 24 | 2002–03 | Southern | 38 | Iowa | 17 |
| 1955–56 | Oklahoma | 20 | Maryland | 6 | 1979–80 | Oklahoma | 24 | Florida State | 7 | | California | | | |
| 1956–57 | Colorado | 27 | Clemson | 21 | 1980–81 | Oklahoma | 18 | Florida State | 17 | 2003-04 | Miami (Fla.) | 16 | Florida State | 14 |
| 1957–58 | Oklahoma | 48 | Duke | 21 | 1981–82 | Clemson | 22 | Nebraska | 15 | | | | | |

*Canadian football—professional.* Since 1959, the Canadian Football League has been divided into two conferences, Eastern and Western. The two teams that win the division championships meet for the championship of the League, the Grey Cup (instituted in 1909). The game did not become strictly professional (note the university teams listed) until 1935.

**Grey Cup**

| year | result | | | year | result | | | |
|---|---|---|---|---|---|---|---|---|
| 1909 | U. of Toronto | | | 1958 | Winnipeg Blue Bombers | 35 | Hamilton Tiger-Cats | 28 |
| 1910 | U. of Toronto | | | 1959 | Winnipeg Blue Bombers (WFC) | 21 | Hamilton Tiger-Cats (EFC) | 7 |
| 1911 | U. of Toronto | | | 1960 | Ottawa Rough Riders (EFC) | 16 | Edmonton Eskimos (WFC) | 6 |
| 1912 | Hamilton Alerts | | | 1961 | Winnipeg Blue Bombers (WFC) | 21 | Hamilton Tiger-Cats (EFC) | 14 |
| 1913 | Hamilton Tigers | | | 1962 | Winnipeg Blue Bombers (WFC) | 28 | Hamilton Tiger-Cats (EFC) | 27 |
| 1914 | Toronto Argonauts | | | 1963 | Hamilton Tiger-Cats (EFC) | 21 | British Columbia Lions (WFC) | 10 |
| 1915 | Hamilton Tigers | | | 1964 | British Columbia Lions (WFC) | 34 | Hamilton Tiger-Cats (EFC) | 24 |
| 1916–19 | no competition | | | 1965 | Hamilton Tiger-Cats (EFC) | 22 | Winnipeg Blue Bombers (WFC) | 16 |
| 1920 | U. of Toronto | | | 1966 | Saskatchewan Roughriders (WFC) | 29 | Ottawa Rough Riders (EFC) | 14 |
| 1921* | Toronto Argonauts | | | 1967 | Hamilton Tiger-Cats (EFC) | 24 | Saskatchewan Roughriders (WFC) | 1 |
| 1922 | Queen's University | 13 | Edmonton Eskimos | 1 | 1968 Ottawa Rough Riders (EFC) | 24 | Calgary Stampeders (WFC) | 21 |
| 1923 | Queen's University | 54 | Regina Roughriders | 0 | 1969 Ottawa Rough Riders (EFC) | 29 | Saskatchewan Roughriders (WFC) | 11 |
| 1924 | Queen's University | 11 | Toronto Balmy Beach | 3 | 1970 Montreal Alouettes (EFC) | 23 | Calgary Stampeders (WFC) | 10 |
| 1925 | Ottawa Rough Riders | 24 | Winnipeg Blue Bombers | 1 | 1971 Calgary Stampeders (WFC) | 14 | Toronto Argonauts (EFC) | 11 |
| 1926 | Ottawa Rough Riders | 10 | U. of Toronto | 7 | 1972 Hamilton Tiger-Cats (EFC) | 13 | Saskatchewan Roughriders (WFC) | 10 |
| 1927 | Toronto Balmy Beach | 9 | Hamilton Tigers | 6 | 1973 Ottawa Rough Riders (EFC) | 22 | Edmonton Eskimos (WFC) | 18 |
| 1928 | Hamilton Tigers | 30 | Regina Roughriders | 0 | 1974 Montreal Alouettes (EFC) | 20 | Edmonton Eskimos (WFC) | 7 |
| 1929 | Hamilton Tigers | 14 | Regina Roughriders | 3 | 1975 Edmonton Eskimos (WFC) | 9 | Montreal Alouettes (EFC) | 8 |
| 1930 | Toronto Balmy Beach | 11 | Regina Roughriders | 6 | 1976 Ottawa Rough Riders (EFC) | 23 | Saskatchewan Roughriders (WFC) | 20 |
| 1931 | Montreal AAA | 22 | Regina Roughriders | 0 | 1977 Montreal Alouettes (EFC) | 41 | Edmonton Eskimos (WFC) | 6 |
| 1932 | Hamilton Tigers | 25 | Regina Roughriders | 6 | 1978 Edmonton Eskimos (WFC) | 20 | Montreal Alouettes (EFC) | 13 |
| 1933 | Toronto Argonauts | 4 | Sarnia Imperials | 3 | 1979 Edmonton Eskimos (WFC) | 17 | Montreal Alouettes (EFC) | 9 |
| 1934 | Sarnia Imperials | 20 | Regina Roughriders | 12 | 1980 Edmonton Eskimos (WFC) | 48 | Hamilton Tiger-Cats (EFC) | 10 |
| 1935 | Winnipeg Blue Bombers | 18 | Hamilton Tigers | 12 | 1981 Edmonton Eskimos (WFC) | 26 | Ottawa Rough Riders (EFC) | 23 |
| 1936 | Sarnia Imperials | 26 | Ottawa Rough Riders | 20 | 1982 Edmonton Eskimos (WFC) | 32 | Toronto Argonauts (EFC) | 16 |
| 1937 | Toronto Argonauts | 4 | Winnipeg Blue Bombers | 3 | 1983 Toronto Argonauts (EFC) | 18 | British Columbia Lions (WFC) | 17 |
| 1938 | Toronto Argonauts | 30 | Winnipeg Blue Bombers | 7 | 1984 Winnipeg Blue Bombers (WFC) | 47 | Hamilton Tiger-Cats (EFC) | 17 |
| 1939 | Winnipeg Blue Bombers | 8 | Ottawa Rough Riders | 7 | 1985 British Columbia Lions (WFC) | 37 | Hamilton Tiger-Cats (EFC) | 24 |
| 1940 | Ottawa Rough Riders | † | Toronto Balmy Beach | † | 1986 Hamilton Tiger-Cats (EFC) | 39 | Edmonton Eskimos (WFC) | 15 |
| 1941 | Winnipeg Blue Bombers | 18 | Ottawa Rough Riders | 16 | 1987 Edmonton Eskimos (WFC) | 38 | Toronto Argonauts (EFC) | 36 |
| 1942 | Toronto RCAF Hurricanes | 8 | Winnipeg Blue Bombers | 5 | 1988 Winnipeg Blue Bombers (EFC) | 22 | British Columbia Lions (WFC) | 21 |
| 1943 | Hamilton Flying Wildcats | 23 | Winnipeg Blue Bombers | 14 | 1989 Saskatchewan Roughriders (WFC) | 43 | Hamilton Tiger-Cats (EFC) | 40 |
| 1944 | Montreal | 7 | Hamilton Wildcats | 6 | 1990 Winnipeg Blue Bombers (EFC) | 50 | Edmonton Eskimos (WFC) | 11 |
| | S. Hyacinthe-Donnaconna | | | | 1991 Toronto Argonauts (EFC) | 36 | Calgary Stampeders (WFC) | 21 |
| 1945 | Toronto Argonauts | 35 | Winnipeg Blue Bombers | 0 | 1992 Calgary Stampeders (WFC) | 24 | Winnipeg Blue Bombers (EFC) | 10 |
| 1946 | Toronto Argonauts | 28 | Winnipeg Blue Bombers | 0 | 1993 Edmonton Eskimos (WFC) | 33 | Winnipeg Blue Bombers (EFC) | 23 |
| 1947 | Toronto Argonauts | 10 | Winnipeg Blue Bombers | 9 | 1994 British Columbia Lions (WFC) | 26 | Baltimore Stallions (EFC) | 23 |
| 1948 | Calgary Stampeders | 12 | Ottawa Rough Riders | 7 | 1995 Baltimore Stallions (SD) | 37 | Calgary Stampeders (ND) | 20 |
| 1949 | Montreal Alouettes | 28 | Calgary Stampeders | 15 | 1996 Toronto Argonauts (ED) | 43 | Edmonton Eskimos (WD) | 37 |
| 1950 | Toronto Argonauts | 13 | Winnipeg Blue Bombers | 0 | 1997 Toronto Argonauts (ED) | 47 | Saskatchewan Roughriders (WD) | 23 |
| 1951 | Ottawa Rough Riders | 21 | Saskatchewan Roughriders | 14 | 1998 Calgary Stampeders (WD) | 26 | Hamilton Tiger-Cats (ED) | 24 |
| 1952 | Toronto Argonauts | 21 | Edmonton Eskimos | 11 | 1999 Hamilton Tiger-Cats (ED) | 32 | Calgary Stampeders (WD) | 21 |
| 1953 | Hamilton Tiger-Cats | 12 | Winnipeg Blue Bombers | 6 | 2000 British Columbia Lions (WD) | 28 | Montreal Alouettes (ED) | 26 |
| 1954 | Edmonton Eskimos | 26 | Montreal Alouettes | 25 | 2001 Calgary Stampeders (WD) | 27 | Winnipeg Blue Bombers (ED) | 19 |
| 1955 | Edmonton Eskimos | 34 | Montreal Alouettes | 19 | 2002 Montreal Alouettes (ED) | 25 | Edmonton Eskimos (WD) | 16 |
| 1956 | Edmonton Eskimos | 50 | Montreal Alouettes | 27 | 2003 Edmonton Eskimos (WD) | 34 | Montreal Alouettes (ED) | 22 |
| 1957 | Hamilton Tiger-Cats | 32 | Winnipeg Blue Bombers | 7 | | | | |

*East-West playoff began in 1921. †Ottawa won the two-game total-point series 8–2 and 12–5.



Edmonton Eskimos running back Troy Mills leaping over the pile during the third quarter of the 2003 Grey Cup against the Montreal Alouettes

Adrian Wyld—AP/Wide World Photos

*Rugby Union football.* Rugby Union football is open to amateurs only. The Six Nations Championship is organized by the Fédération Internationale de Rugby Amateur (FIRA) and is contested by England, France, Ireland, Italy, Scotland, and Wales. The international Test matches, organized by the International Rugby Football League, further include South Africa, New Zealand, and Australia. Super 12 Rugby, which originated in 1993 as Super 10, is a competition between club teams in Australia, New Zealand, and South Africa.

The table of Test matches is designed to be read horizontally. If read as it was designed, it will reveal the number of games won, the number of draws, and the number of games lost to each of the countries shown on the horizontal axis.

The World Cup was inaugurated in 1987. The competition is held every four years.



Wales (red) and England (white) during a line-out in the Five Nations Championship, 1986
Sporting Pictures (U.K.)

**Six Nations Championship***

| year | result | year | result | year | result |
|---|---|---|---|---|---|
| 1947 | England, Wales† | 1967 | France | 1987 | France II |
| 1948 | Ireland‡ | 1968 | France II | 1988 | Wales‡ |
| 1949 | Ireland§ | 1969 | Wales§ | 1989 | France |
| 1950 | Wales‡ | 1970 | France, Wales† | 1990 | Scotland II |
| 1951 | Ireland | 1971 | Wales‡ | 1991 | England II |
| 1952 | Wales‡ | 1972 | not completed | 1992 | England II |
| 1953 | England | 1973 | quintuple tie | 1993 | France |
| 1954 | England§, France, Wales† | 1974 | Ireland | 1994 | Wales |
| 1955 | France, Wales† | 1975 | Wales | 1995 | England II |
| 1956 | Wales | 1976 | Wales‡ | 1996 | England |
| 1957 | England‡ | 1977 | France II¶ | 1997 | France II |
| 1958 | England | 1978 | Wales‡ | 1998 | France II |
| 1959 | France | 1979 | Wales§ | 1999 | Scotland |
| 1960 | England§, France† | 1980 | England‡ | 2000 | England |
| 1961 | France | 1981 | France II | 2001 | England |
| 1962 | France | 1982 | Ireland§ | 2002 | France II |
| 1963 | England | 1983 | France, Ireland† | 2003 | England II |
| 1964 | Scotland, Wales† | 1984 | Scotland‡ | 2004 | France II |
| 1965 | Wales§ | 1985 | Ireland‡ | | |
| 1966 | Wales | 1986 | France, Scotland† | | |

*Five Nations until 2000. †Tied. ‡Triple Crown (all three matches, excluding France) and Grand Slam (all four matches) winner. §Triple Crown winner. ||Grand Slam winner. ¶Triple Crown won by Wales.

**World Cup**

| year | result | | | |
|---|---|---|---|---|
| 1987 | New Zealand | 29 | France | 9 |
| 1991 | Australia | 12 | England | 6 |
| 1995 | South Africa | 15 | New Zealand | 12 |
| 1999 | Australia | 35 | France | 12 |
| 2003 | England | 20 | Australia | 17 |

**Super 12 Rugby Championship**

| year | result | | | |
|---|---|---|---|---|
| 1993 | Transvaal | 20 | Auckland | 17 |
| 1994 | Queensland | 21 | Natal | 10 |
| 1995 | Queensland | 30 | Transvaal | 16 |
| 1996 | Auckland | 45 | Natal | 21 |
| 1997 | Auckland Blues | 23 | ACT Brumbies | 7 |
| 1998 | Canterbury Crusaders | 20 | Auckland Blues | 13 |
| 1999 | Canterbury Crusaders | 24 | Otago Highlanders | 19 |
| 2000 | Canterbury Crusaders | 20 | ACT Brumbies | 19 |
| 2001 | ACT Brumbies | 36 | Natal Sharks | 6 |
| 2002 | Canterbury Crusaders | 31 | ACT Brumbies | 13 |
| 2003 | Auckland Blues | 21 | Canterbury Crusaders | 17 |
| 2004 | ACT Brumbies | 47 | Canterbury Crusaders | 38 |

**Record of International Rugby Union Test matches 1871 to Oct. 31, 2001**

| | England | | | Scotland | | | Ireland | | | Wales | | | British Isles* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | wins | draws | losses | w | d | l | w | d | l | w | d | l | w | d | l |
| England *v.* | | | | 61 | 17 | 40 | 67 | 8 | 39 | 46 | 12 | 49 | | | |
| Scotland *v.* | 40 | 17 | 61 | | | | 61 | 5 | 46 | 45 | 3 | 57 | | | |
| Ireland *v.* | 39 | 8 | 67 | 46 | 5 | 61 | | | | 39 | 6 | 60 | | | |
| Wales *v.* | 49 | 12 | 46 | 57 | 3 | 45 | 60 | 6 | 39 | | | | | | |
| British Isles* *v.* | | | | | | | | | | | | | | | |
| South Africa *v.* | 12 | 1 | 7 | 9 | 0 | 3 | 12 | 1 | 1 | 12 | 1 | 1 | 19 | 4 | 10 |
| New Zealand *v.* | 18 | 1 | 4 | 21 | 2 | 0 | 13 | 1 | 0 | 14 | 0 | 3 | 23 | 2 | 6 |
| Australia *v.* | 16 | 1 | 8 | 12 | 0 | 7 | 14 | 0 | 6 | 12 | 0 | 8 | 4 | 0 | 9 |
| France *v.* | 28 | 7 | 43 | 37 | 3 | 33 | 43 | 5 | 27 | 33 | 3 | 41 | † | † | † |

| | South Africa | | | New Zealand | | | Australia | | | France | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | w | d | l | w | d | l | w | d | l | w | d | l |
| England *v.* | 7 | 1 | 12 | 4 | 1 | 18 | 8 | 1 | 16 | 43 | 7 | 28 |
| Scotland *v.* | 3 | 0 | 9 | 0 | 2 | 21 | 7 | 0 | 12 | 33 | 3 | 37 |
| Ireland *v.* | 1 | 1 | 12 | 0 | 1 | 13 | 6 | 0 | 14 | 27 | 5 | 43 |
| Wales *v.* | 1 | 1 | 12 | 3 | 0 | 14 | 8 | 0 | 12 | 41 | 3 | 33 |
| British Isles* *v.* | 10 | 4 | 19 | 6 | 2 | 23 | 9 | 0 | 4 | † | † | † |
| South Africa *v.* | | | | 25 | 3 | 25 | 27 | 1 | 14 | 19 | 5 | 6 |
| New Zealand *v.* | 25 | 3 | 25 | | | | 71 | 5 | 33 | 26 | 0 | 9 |
| Australia *v.* | 14 | 1 | 27 | 33 | 5 | 71 | | | | 11 | 2 | 13 |
| France *v.* | 6 | 5 | 19 | 9 | 0 | 26 | 13 | 2 | 11 | | | |

*The British Isles ("British Lions") is a combined team from the four "Home Unions" (England, Ireland, Scotland, and Wales). †No matches.

*Rugby League football.* World Cup competition began in 1954 between professionals from Australia, France, Great Britain, and New Zealand. In 1975 it was renamed the International Championship. Competition was discontinued after 1977 but revived during the 1980s; the match is held quadrennially. Papua New Guinea, which became a full member of the sport's International Board in 1978, now participates.

**World Cup**

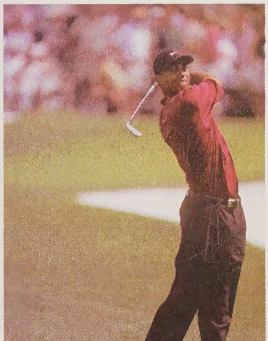
| year | result | | | | year | result | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1954 | Great Britain | 16 | France | 12 | 1975† | Australia‡ | | | |
| 1957 | Australia | 29 | Great Britain | 21 | 1977† | Australia | 13 | Great Britain | 12 |
| 1960 | Great Britain | 66 | Australia | 37 | 1988 | Australia | 25 | New Zealand | 12 |
| 1968 | Australia | 20 | France | 2 | 1992 | Australia | 10 | Great Britain | 6 |
| 1970 | Australia | 12 | Great Britain | 7 | 1995 | Australia | 16 | England | 8 |
| 1972 | Great Britain | 10* | Australia | 10 | 2000 | Australia | 40 | New Zealand | 12 |

*Great Britain won on match points. †Called International Championship from 1975 to 1977. ‡Championships played without a grand final match; England was the runner-up.

## GOLF

*Individual events.* Two of the major golf championships, the British and U.S. Open tournaments, are played annually at a variety of golf courses in their respective countries. The Professional Golfers' Association (PGA) championship and the invitational Masters Tournament (which is held annually at the Augusta [Georgia] National Golf Course) are also top tournaments. Events for amateurs include the U.S. and British Amateur championships.

Women's golf has been around nearly as long as men's golf, but until the late 1940s, it was limited to amateurs. Thus, for women, the British and U.S. Amateur championships were the major tournaments. The U.S. Women's Open Championship started in 1946, and the Ladies' Professional Golf Association (LPGA) was formed in 1950. In 1976 the Women's British Open Championship was added to the golf calendar.



Tiger Woods of the United States on his way to winning the 2001 Masters Tournament
Dave Cannon—Allsport

**British Open Golf Tournament—men**

| year | winner | year | winner | year | winner |
|---|---|---|---|---|---|
| 1860 | W. Park (U.K.) | 1906 | J. Braid (U.K.) | 1961 | A. Palmer (U.S.) |
| 1861 | T. Morris, Sr. (U.K.) | 1907 | A. Massy (Fr.) | 1962 | A. Palmer (U.S.) |
| 1862 | T. Morris, Sr. (U.K.) | 1908 | J. Braid (U.K.) | 1963 | R.J. Charles (N.Z.) |
| 1863 | W. Park (U.K.) | 1909 | J.H. Taylor (U.K.) | 1964 | T. Lema (U.S.) |
| 1864 | T. Morris, Sr. (U.K.) | 1910 | J. Braid (U.K.) | 1965 | P.W. Thomson (Austl.) |
| 1865 | A. Strath (U.K.) | 1911 | H. Vardon (U.K.) | 1966 | J. Nicklaus (U.S.) |
| 1866 | W. Park (U.K.) | 1912 | E. Ray (U.K.) | 1967 | R. de Vicenzo (Arg.) |
| 1867 | T. Morris, Sr. (U.K.) | 1913 | J.H. Taylor (U.K.) | 1968 | G. Player (S.Af.) |
| 1868 | T. Morris, Jr. (U.K.) | 1914 | H. Vardon (U.K.) | 1969 | A. Jacklin (U.K.) |
| 1869 | T. Morris, Jr. (U.K.) | 1915–19 | not held | 1970 | J. Nicklaus (U.S.) |
| 1870 | T. Morris, Jr. (U.K.) | 1920 | G. Duncan (U.K.) | 1971 | L. Trevino (U.S.) |
| 1871 | not held | 1921 | J. Hutchison (U.S.) | 1972 | L. Trevino (U.S.) |
| 1872 | T. Morris, Jr. (U.K.) | 1922 | W. Hagen (U.S.) | 1973 | T. Weiskopf (U.S.) |
| 1873 | T. Kidd (U.K.) | 1923 | A.G. Havers (U.K.) | 1974 | G. Player (S.Af.) |
| 1874 | M. Park (U.K.) | 1924 | W. Hagen (U.S.) | 1975 | T. Watson (U.S.) |
| 1875 | W. Park (U.K.) | 1925 | J. Barnes (U.S.) | 1976 | J. Miller (U.S.) |
| 1876 | B. Martin (U.K.) | 1926 | B. Jones (U.S.) | 1977 | T. Watson (U.S.) |
| 1877 | J. Anderson (U.K.) | 1927 | B. Jones (U.S.) | 1978 | J. Nicklaus (U.S.) |
| 1878 | J. Anderson (U.K.) | 1928 | W. Hagen (U.S.) | 1979 | S. Ballesteros (Spain) |
| 1879 | J. Anderson (U.K.) | 1929 | W. Hagen (U.S.) | 1980 | T. Watson (U.S.) |
| 1880 | B. Ferguson (U.K.) | 1930 | B. Jones (U.S.) | 1981 | B. Rogers (U.S.) |
| 1881 | B. Ferguson (U.K.) | 1931 | T.D. Armour (U.S.) | 1982 | T. Watson (U.S.) |
| 1882 | B. Ferguson (U.K.) | 1932 | G. Sarazen (U.S.) | 1983 | T. Watson (U.S.) |
| 1883 | W. Fernie (U.K.) | 1933 | D. Shute (U.S.) | 1984 | S. Ballesteros (Spain) |
| 1884 | J. Simpson (U.K.) | 1934 | T.H. Cotton (U.K.) | 1985 | S. Lyle (Scot.) |
| 1885 | B. Martin (U.K.) | 1935 | A. Perry (U.K.) | 1986 | G. Norman (Austl.) |
| 1886 | D. Brown (U.K.) | 1936 | A.H. Padgham (U.K.) | 1987 | N. Faldo (U.K.) |
| 1887 | W. Park, Jr. (U.K.) | 1937 | T.H. Cotton (U.K.) | 1988 | S. Ballesteros (Spain) |
| 1888 | J. Burns (U.K.) | 1938 | R.A. Whitcombe (U.K.) | 1989 | M. Calcavecchia (U.S.) |
| 1889 | W. Park, Jr. (U.K.) | 1939 | R. Burton (U.K.) | 1990 | N. Faldo (U.K.) |
| 1890 | J. Ball (U.K.) | 1940–45 | not held | 1991 | I. Baker-Finch (Austl.) |
| 1891 | H. Kirkaldy (U.K.) | 1946 | S. Snead (U.S.) | 1992 | N. Faldo (U.K.) |
| 1892 | H.H. Hilton (U.K.) | 1947 | F. Daly (Ire.) | 1993 | G. Norman (Austl.) |
| 1893 | W. Auchterlonie (U.K.) | 1948 | T.H. Cotton (U.K.) | 1994 | N. Price (Zimb.) |
| 1894 | J.H. Taylor (U.K.) | 1949 | B. Locke (S.Af.) | 1995 | J. Daly (U.S.) |
| 1895 | J.H. Taylor (U.K.) | 1950 | B. Locke (S.Af.) | 1996 | T. Lehman (U.S.) |
| 1896 | H. Vardon (U.K.) | 1951 | M. Faulkner (U.K.) | 1997 | J. Leonard (U.S.) |
| 1897 | H.H. Hilton (U.K.) | 1952 | B. Locke (S.Af.) | 1998 | M. O'Meara (U.S.) |
| 1898 | H. Vardon (U.K.) | 1953 | B. Hogan (U.S.) | 1999 | P. Lawrie (Scot.) |
| 1899 | H. Vardon (U.K.) | 1954 | P.W. Thomson (Austl.) | 2000 | T. Woods (U.S.) |
| 1900 | J.H. Taylor (U.K.) | 1955 | P.W. Thomson (Austl.) | 2001 | D. Duval (U.S.) |
| 1901 | J. Braid (U.K.) | 1956 | P.W. Thomson (Austl.) | 2002 | E. Els (S.Af.) |
| 1902 | A. Herd (U.K.) | 1957 | B. Locke (S.Af.) | 2003 | B. Curtis (U.S.) |
| 1903 | H. Vardon (U.K.) | 1958 | P.W. Thomson (Austl.) | 2004 | T. Hamilton (U.S.) |
| 1904 | J. White (U.K.) | 1959 | G. Player (S.Af.) | | |
| 1905 | J. Braid (U.K.) | 1960 | K.D.G. Nagle (Austl.) | | |

**U.S. Professional Golfers' Association (PGA) championship**

| year | winner* | year | winner* | year | winner* |
|---|---|---|---|---|---|
| 1916 | J. Barnes | 1947 | J. Ferrier | 1977 | L. Wadkins |
| 1917–18 | not held | 1948 | B. Hogan | 1978 | J. Mahaffey† |
| 1919 | J. Barnes | 1949 | S. Snead | 1979 | D. Graham (Austl.)† |
| 1920 | J. Hutchison | 1950 | C. Harper | | |
| 1921 | W. Hagen | 1951 | S. Snead | 1980 | J. Nicklaus |
| 1922 | G. Sarazen | 1952 | J. Turnesa | 1981 | L. Nelson |
| 1923 | G. Sarazen | 1953 | W. Burkemo | 1982 | R. Floyd |
| 1924 | W. Hagen | 1954 | C. Harbert | 1983 | H. Sutton |
| 1925 | W. Hagen | 1955 | D. Ford | 1984 | L. Trevino |
| 1926 | W. Hagen | 1956 | J. Burke | 1985 | H. Green |
| 1927 | W. Hagen | 1957 | L. Hebert | 1986 | B. Tway |
| 1928 | L. Diegel | 1958 | D. Finsterwald | 1987 | L. Nelson |
| 1929 | L. Diegel | 1959 | R. Rosburg | 1988 | J. Sluman |
| 1930 | T. Armour | 1960 | J. Hebert | 1989 | P. Stewart |
| 1931 | T. Creavy | 1961 | J. Barbert | 1990 | W. Grady (Austl.) |
| 1932 | O. Dutra | 1962 | G. Player (S.Af.) | 1991 | J. Daly |
| 1933 | G. Sarazen | 1963 | J. Nicklaus | 1992 | N. Price (Zimb.) |
| 1934 | P. Runyan | 1964 | B. Nichols | 1993 | P. Azinger |
| 1935 | J. Revolta | 1965 | D. Marr | 1994 | N. Price (Zimb.) |
| 1936 | D. Shute | 1966 | A. Geiberger | 1995 | S. Elkington (Austl.) |
| 1937 | D. Shute | 1967 | D. January† | 1996 | M. Brooks |
| 1938 | P. Runyan | 1968 | J. Boros | 1997 | D. Love III |
| 1939 | H. Picard | 1969 | R. Floyd | 1998 | V. Singh (Fiji) |
| 1940 | B. Nelson | 1970 | D. Stockton | 1999 | T. Woods |
| 1941 | V. Ghezzi | 1971 | J. Nicklaus | 2000 | T. Woods |
| 1942 | S. Snead | 1972 | G. Player (S.Af.) | 2001 | D. Toms |
| 1943 | not held | 1973 | J. Nicklaus | 2002 | R. Beem |
| 1944 | B. Hamilton | 1974 | L. Trevino | 2003 | S. Micheel |
| 1945 | B. Nelson | 1975 | J. Nicklaus | 2004 | V. Singh (Fiji) |
| 1946 | B. Hogan | 1976 | D. Stockton | | |

*Won by a U.S. golfer except as indicated. † Winner by play-off.

**United States Open Golf Championship—men**

| year | winner* | year | winner* |
|---|---|---|---|
| 1895 | H. Rawlins | 1952 | J. Boros |
| 1896 | J. Foulis | 1953 | B. Hogan |
| 1897 | J. Lloyd | 1954 | E. Furgol |
| 1898 | F. Herd | 1955 | J. Fleck |
| 1899 | W. Smith | 1956 | C. Middlecoff |
| 1900 | H. Vardon (U.K.) | 1957 | D. Mayer |
| 1901 | W. Anderson | 1958 | T. Bolt |
| 1902 | L. Auchterlonie | 1959 | B. Casper |
| 1903 | W. Anderson | 1960 | A. Palmer |
| 1904 | W. Anderson | 1961 | G. Littler |
| 1905 | W. Anderson | 1962 | J. Nicklaus |
| 1906 | A. Smith | 1963 | J. Boros |
| 1907 | A. Ross | 1964 | K. Venturi |
| 1908 | F. McLeod | 1965 | G. Player (S.Af.) |
| 1909 | G. Sargent | 1966 | B. Casper |
| 1910 | A. Smith | 1967 | J. Nicklaus |
| 1911 | J.J. McDermott | 1968 | L. Trevino |
| 1912 | J.J. McDermott | 1969 | O. Moody |
| 1913 | F. Ouimet | 1970 | A. Jacklin (U.K.) |
| 1914 | W. Hagen | 1971 | L. Trevino |
| 1915 | J.D. Travers | 1972 | J. Nicklaus |
| 1916 | C. Evans | 1973 | J. Miller |
| 1917–18 | not held | 1974 | H. Irwin |
| 1919 | W. Hagen | 1975 | L. Graham |
| 1920 | E. Ray (U.K.) | 1976 | J. Pate |
| 1921 | J. Barnes | 1977 | H. Green |
| 1922 | G. Sarazen | 1978 | A. North |
| 1923 | B. Jones | 1979 | H. Irwin |
| 1924 | C. Walker | 1980 | J. Nicklaus |
| 1925 | W. MacFarlane, Jr. | 1981 | D. Graham (Austl.) |
| 1926 | B. Jones | 1982 | T. Watson |
| 1927 | T.D. Armour | 1983 | L. Nelson |
| 1928 | J. Farrell | 1984 | F. Zoeller |
| 1929 | B. Jones | 1985 | A. North |
| 1930 | B. Jones | 1986 | R. Floyd |
| 1931 | B. Burke | 1987 | S. Simpson |
| 1932 | G. Sarazen | 1988 | C. Strange |
| 1933 | J. Goodman | 1989 | C. Strange |
| 1934 | O. Dutra | 1990 | H. Irwin |
| 1935 | S. Parks | 1991 | P. Stewart |
| 1936 | T. Manero | 1992 | T. Kite |
| 1937 | R. Guldahl | 1993 | L. Janzen |
| 1938 | R. Guldahl | 1994 | E. Els (S.Af.) |
| 1939 | B. Nelson | 1995 | S. Pavin |
| 1940 | W.L. Little, Jr. | 1996 | S. Jones |
| 1941 | C. Wood | 1997 | E. Els (S.Af.) |
| 1942–45 | not held | 1998 | L. Janzen |
| 1946 | L. Mangrum | 1999 | P. Stewart |
| 1947 | L. Worsham | 2000 | T. Woods |
| 1948 | B. Hogan | 2001 | R. Goosen (S.Af.) |
| 1949 | C. Middlecoff | 2002 | T. Woods |
| 1950 | B. Hogan | 2003 | J. Furyk |
| 1951 | B. Hogan | 2004 | R. Goosen (S.Af.) |

*Won by a U.S. golfer except as indicated.

### Masters Tournament

| year | winner* | year | winner* | year | winner* | year | winner* | year | winner* |
|---|---|---|---|---|---|---|---|---|---|
| 1934 | H. Smith | 1950 | J. Demaret | 1964 | A. Palmer | 1978 | G. Player (S.Af.) | 1992 | F. Couples |
| 1935 | G. Sarazen | 1951 | B. Hogan | 1965 | J. Nicklaus | 1979 | F. Zoeller‡ | 1993 | B. Langer (Ger.) |
| 1936 | H. Smith | 1952 | S. Snead | 1966 | J. Nicklaus | 1980 | S. Ballesteros (Spain) | 1994 | J. Olazábal (Spain) |
| 1937 | B. Nelson | 1953 | B. Hogan | 1967 | G. Brewer | 1981 | T. Watson | 1995 | B. Crenshaw |
| 1938 | H. Picard | 1954 | S. Snead | 1968 | R. Goalby† | 1982 | C. Stadler§ | 1996 | N. Faldo (U.K.) |
| 1939 | R. Guldahl | 1955 | C. Middlecoff | 1969 | G. Archer | 1983 | S. Ballesteros (Spain) | 1997 | T. Woods |
| 1940 | J. Demaret | 1956 | J. Burke | 1970 | W. Casper | 1984 | B. Crenshaw | 1998 | M. O'Meara |
| 1941 | C. Wood | 1957 | D. Ford | 1971 | C. Coody | 1985 | B. Langer (W.Ger.) | 1999 | J.-M. Olazábal (Spain) |
| 1942 | B. Nelson | 1958 | A. Palmer | 1972 | J. Nicklaus | 1986 | J. Nicklaus | 2000 | V. Singh (Fiji) |
| 1943–45 | not held | 1959 | A. Wall | 1973 | T. Aaron | 1987 | L. Mize | 2001 | T. Woods |
| 1946 | H. Keiser | 1960 | A. Palmer | 1974 | G. Player (S.Af.) | 1988 | S. Lyle (Scot.) | 2002 | T. Woods |
| 1947 | J. Demaret | 1961 | G. Player (S.Af.) | 1975 | J. Nicklaus | 1989 | N. Faldo (U.K.) | 2003 | M. Weir (Can.) |
| 1948 | C. Harmon | 1962 | A. Palmer | 1976 | R. Floyd | 1990 | N. Faldo (U.K.) | 2004 | P. Mickelson |
| 1949 | S. Snead | 1963 | J. Nicklaus | 1977 | T. Watson | 1991 | I. Woosnam (U.K.) | | |

*Won by a U.S. golfer except as indicated. †Play-off averted when R. de Vincenzo was penalized for signing an incorrect scorecard. ‡Sudden death play-off against T. Watson and E. Sneed. §Won on the first hole of a play-off against D. Pohl.

### British Amateur Golf Championship—men

| year | winner | year | winner | year | winner | year | winner |
|---|---|---|---|---|---|---|---|
| 1885 | A.F. Macfie (U.K.) | 1913 | H.H. Hilton (U.K.) | 1950 | F.R. Stranahan (U.S.) | 1978 | P. McEvoy (U.K.) |
| 1886 | H.G. Hutchinson (U.K.) | 1914 | J.L.C. Jenkins (U.K.) | 1951 | R.D. Chapman (U.S.) | 1979 | J. Sigel (U.S.) |
| 1887 | H.G. Hutchinson (U.K.) | 1915–19 | not held | 1952 | E.H. Ward (U.S.) | 1980 | D. Evans (U.K.) |
| 1888 | J. Ball (U.K.) | 1920 | C.J.H. Tolley (U.K.) | 1953 | J.B. Carr (Ire.) | 1981 | P. Ploujoux (Fr.) |
| 1889 | J.E. Laidlay (U.K.) | 1921 | W.I. Hunter (U.K.) | 1954 | D.W. Bachli (U.K.) | 1982 | M. Thompson (U.K.) |
| 1890 | J. Ball (U.K.) | 1922 | E.W.E. Holderness (U.K.) | 1955 | J.W. Conrad (U.S.) | 1983 | P. Parkin (U.K.) |
| 1891 | J.E. Laidlay (U.K.) | 1923 | R.H. Wethered (U.K.) | 1956 | J.C. Beharrell (U.K.) | 1984 | J.-M. Olazábal (Spain) |
| 1892 | J. Ball (U.K.) | 1924 | E.W.E. Holderness (U.K.) | 1957 | R. Reid Jack (U.K.) | 1985 | G. McGimpsey (Ire.) |
| 1893 | P. Anderson (U.K.) | 1925 | R. Harris (U.K.) | 1958 | J.B. Carr (Ire.) | 1986 | D. Curry (U.K.) |
| 1894 | J. Ball (U.K.) | 1926 | J. Sweetser (U.S.) | 1959 | D. Beman (U.S.) | 1987 | P. Mayo (U.K.) |
| 1895 | J.M. Melville (U.K.) | 1927 | W. Tweddell (U.K.) | 1960 | J.B. Carr (Ire.) | 1988 | C. Hardin (Swed.) |
| 1896 | F.G. Tait (U.K.) | 1928 | T.P. Perkins (U.K.) | 1961 | M.F. Bonallack (U.K.) | 1989 | S. Richardson (U.K.) |
| 1897 | A.J.T. Allan (U.K.) | 1929 | C.J.H. Tolley (U.K.) | 1962 | R.D. Davies (U.S.) | 1990 | R. Muntz (Neth.) |
| 1898 | F.G. Tait (U.K.) | 1930 | B. Jones (U.S.) | 1963 | M.S.R. Lunt (U.K.) | 1991 | R. Willison (U.K.) |
| 1899 | J. Ball (U.K.) | 1931 | E. Martin Smith (U.K.) | 1964 | G.J. Clark (U.K.) | 1992 | S. Dundas (U.K.) |
| 1900 | H.H. Hilton (U.K.) | 1932 | J. de Forest (U.K.) | 1965 | M.F. Bonallack (U.K.) | 1993 | I. Pyman (U.K.) |
| 1901 | H.H. Hilton (U.K.) | 1933 | M. Scott (U.K.) | 1966 | R. Cole (S.Af.) | 1994 | L. James (U.K.) |
| 1902 | C. Hutchings (U.K.) | 1934 | W. Little (U.S.) | 1967 | B. Dickson (U.S.) | 1995 | G. Sherry (U.K.) |
| 1903 | R. Maxwell (U.K.) | 1935 | W. Little (U.S.) | 1968 | M.F. Bonallack (U.K.) | 1996 | W. Bladon (U.K.) |
| 1904 | W.J. Travis (U.S.) | 1936 | H. Thomson (U.K.) | 1969 | M.F. Bonallack (U.K.) | 1997 | C. Watson (U.K.) |
| 1905 | A.G. Barry (U.K.) | 1937 | R. Sweeny, Jr. (U.S.) | 1970 | M.F. Bonallack (U.K.) | 1998 | S. Garcia (Spain) |
| 1906 | J. Robb (U.K.) | 1938 | C.R. Yates (U.S.) | 1971 | S. Melnyk (U.S.) | 1999 | G. Storm (U.K.) |
| 1907 | J. Ball (U.K.) | 1939 | A.T. Kyle (U.K.) | 1972 | T. Homer (U.K.) | 2000 | M. Ilonen (Fin.) |
| 1908 | E.A. Lassen (U.K.) | 1940–45 | not held | 1973 | R. Siderowf (U.S.) | 2001 | M. Hoey (Ire.) |
| 1909 | R. Maxwell (U.K.) | 1946 | J. Bruen (U.K.) | 1974 | T. Homer (U.K.) | 2002 | M. Sell (U.K.) |
| 1910 | J. Ball (U.K.) | 1947 | W.P. Turnesa (U.S.) | 1975 | M. Giles (U.S.) | 2003 | G. Wolstenholme (U.K.) |
| 1911 | H.H. Hilton (U.K.) | 1948 | F.R. Stranahan (U.S.) | 1976 | R. Siderowf (U.S.) | | |
| 1912 | J. Ball (U.K.) | 1949 | S.M. M'Cready (U.K.) | 1977 | P. McEvoy (U.K.) | | |

### United States Amateur Golf Championship—men

| year | winner* | year | winner* | year | winner* |
|---|---|---|---|---|---|
| 1895 | C.B. Macdonald | 1932 | C.R. Somerville | 1971 | G. Cowan (Can.) |
| 1896 | H.J. Whigham | 1933 | G.T. Dunlap | 1972 | M. Giles |
| 1897 | H.J. Whigham | 1934 | W.L. Little, Jr. | 1973 | C. Stadler |
| 1898 | F.S. Douglas | 1935 | W.L. Little, Jr. | 1974 | J. Pate |
| 1899 | H.M. Harriman | 1936 | J. Fischer | 1975 | F. Ridley |
| 1900 | W.J. Travis | 1937 | J. Goodman | 1976 | W. Sander |
| 1901 | W.J. Travis | 1938 | W.P. Turnesa | 1977 | J. Fought |
| 1902 | L.N. James | 1939 | M.H. Ward | 1978 | J. Cook |
| 1903 | W.J. Travis | 1940 | R.D. Chapman | 1979 | M. O'Meara |
| 1904 | H.C. Egan | 1941 | M.H. Ward | 1980 | H. Sutton |
| 1905 | H.C. Egan | 1942–45 | not held | 1981 | N. Crosby |
| 1906 | E.M. Byers | 1946 | S.E. Bishop | 1982 | J. Sigel |
| 1907 | J.D. Travers | 1947 | R.H. Riegel | 1983 | J. Sigel |
| 1908 | J.D. Travers | 1948 | W.P. Turnesa | 1984 | S. Verplank |
| 1909 | R. Gardner | 1949 | C.R. Coe | 1985 | S. Randolph |
| 1910 | W.C. Fownes, Jr. | 1950 | S. Urzetta | 1986 | B. Alexander |
| 1911 | H.H. Hilton | 1951 | W.J. Maxwell | 1987 | B. Mayfair |
| 1912 | J.D. Travers | 1952 | J. Westland | 1988 | E. Meeks |
| 1913 | J.D. Travers | 1953 | G. Littler | 1989 | C. Patton |
| 1914 | F. Ouimet | 1954 | A. Palmer | 1990 | P. Mickelson |
| 1915 | R.A. Gardner | 1955 | J.H. Ward | 1991 | M. Voges |
| 1916 | C. Evans | 1956 | J.H. Ward | 1992 | J. Leonard |
| 1917–18 | not held | 1957 | H. Robbins | 1993 | J. Harris |
| 1919 | S.D. Herron | 1958 | C.R. Coe | 1994 | T. Woods |
| 1920 | C. Evans | 1959 | J. Nicklaus | 1995 | T. Woods |
| 1921 | J. Guildford | 1960 | D.R. Beman | 1996 | T. Woods |
| 1922 | J. Sweetser | 1961 | J. Nicklaus | 1997 | M. Kuchar |
| 1923 | M. Marston | 1962 | L.E. Harris, Jr. | 1998 | H. Kuehne |
| 1924 | B. Jones | 1963 | D.R. Beman | 1999 | D. Gossett |
| 1925 | B. Jones | 1964 | W. Campbell | 2000 | J. Quinney |
| 1926 | G. von Elm | 1965 | R. Murphy | 2001 | B. Dickerson |
| 1927 | B. Jones | 1966 | G. Cowan (Can.) | 2002 | R. Barnes |
| 1928 | B. Jones | 1967 | B. Dickson | 2003 | N. Flanagan |
| 1929 | H.R. Johnston | 1968 | B. Fleisher | | (Austl.) |
| 1930 | B. Jones | 1969 | S. Melnyk | 2004 | R. Moore |
| 1931 | F. Ouimet | 1970 | L. Wadkins | | |

*Won by a U.S. golfer except as indicated.



Jack Nicklaus blasting out of a sand trap during the second round of his record sixth win at the Masters Tournament, 1986

ALLSPORT USA/David Cannon



Patty Sheehan advancing toward the green on her way to victory at the 1992 U.S. Women's Open; she also won the Women's British Open, becoming the first woman to win both championships in the same year

Focus on Sports

**United States Women's Amateur Championship**

| year | winner* | year | winner* | year | winner* | year | winner* | year | winner* |
|---|---|---|---|---|---|---|---|---|---|
| 1895 | C.S. Brown | 1917–18 | not held | 1940 | B. Jameson | 1965 | J. Ashley | 1987 | K. Cockerill |
| 1896 | B. Hoyt | 1919 | A. Stirling | 1941 | B.H. Newell | 1966 | J. Gunderson Carner | 1988 | P. Sinn |
| 1897 | B. Hoyt | 1920 | A. Stirling | 1942–45 | not held | 1967 | L. Dill | 1989 | V. Goetze |
| 1898 | B. Hoyt | 1921 | M. Hollins | 1946 | B.D. Zaharias | 1968 | J. Carner | 1990 | P. Hurst |
| 1899 | R. Underhill | 1922 | G. Collett | 1947 | L. Suggs | 1969 | C. Lacoste (Fr.) | 1991 | A. Fruhwirth |
| 1900 | F.C. Griscom | 1923 | E. Cummings | 1948 | G. Lenczyk | 1970 | M. Wilkinson | 1992 | V. Goetze |
| 1901 | G. Hecker | 1924 | D.C. Hurd | 1949 | D.G. Porter | 1971 | L. Baugh | 1993 | J. McGill |
| 1902 | G. Hecker | 1925 | G. Collett | 1950 | B. Hanson | 1972 | M. Budke | 1994 | W. Ward |
| 1903 | B. Anthony | 1926 | H.B. Stetson | 1951 | D. Kirby | 1973 | C. Semple | 1995 | K. Kuehne |
| 1904 | G.M. Bishop | 1927 | M.B. Horn | 1952 | J. Pung | 1974 | C. Hill | 1996 | K. Kuehne |
| 1905 | P. Mackay | 1928 | G. Collett | 1953 | M.L. Faulk | 1975 | B. Daniel | 1997 | S. Cavalleri (Italy) |
| 1906 | H.S. Curtis | 1929 | G. Collett | 1954 | B. Romack | 1976 | D. Horton | 1998 | G. Park (S.Kor.) |
| 1907 | M. Curtis | 1930 | G. Collett | 1955 | P. Lesser | 1977 | B. Daniel | 1999 | D. Delasin |
| 1908 | K.C. Harley | 1931 | H. Hicks | 1956 | M. Stewart (Can.) | 1978 | C. Sherk (Can.) | 2000 | M. Newton |
| 1909 | D.I. Campbell | 1932 | V. van Wie | 1957 | J. Gunderson | 1979 | C. Hill | 2001 | M. Duncan |
| 1910 | D.I. Campbell | 1933 | V. van Wie | 1958 | A. Quast | 1980 | J. Inkster | 2002 | B. Lucidi |
| 1911 | M. Curtis | 1934 | V. van Wie | 1959 | B. McIntire | 1981 | J. Inkster | 2003 | V. Nirapathpong-porn (Thai.) |
| 1912 | M. Curtis | 1935 | G. Collett Vare | 1960 | J. Gunderson | 1982 | J. Inkster | 2004 | J. Park |
| 1913 | G. Ravenscroft | 1936 | P. Barton (U.K.) | 1961 | A. Quast Decker | 1983 | J. Pacillo | | |
| 1914 | K. Jackson | 1937 | E.L. Page | 1962 | J. Gunderson | 1984 | D. Richard | | |
| 1915 | C.H. Vanderbeck | 1938 | P. Berg | 1963 | A. Quast Welts | 1985 | Hattori M. (Japan) | | |
| 1916 | A. Stirling | 1939 | B. Jameson | 1964 | B. McIntire | 1986 | K. Cockerill | | |

*Won by a U.S. golfer except as indicated.

**United States Women's Open champions**

| year | winner* | year | winner* | year | winner* | year | winner* | year | winner* | year | winner* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1946 | P. Berg | 1956 | K. Cornelius | 1966 | S. Spuzich | 1976 | J. Carner | 1986 | J. Geddes | 1996 | A. Sörenstam (Swed.) |
| 1947 | B. Jameson | 1957 | B. Rawls | 1967 | C. Lacoste (Fr.)† | 1977 | H. Stacy | 1987 | L. Davies (U.K.) | 1997 | A. Nicholas (U.K.) |
| 1948 | B.D. Zaharias | 1958 | M. Wright | 1968 | S. Berning | 1978 | H. Stacy | 1988 | L. Neumann (Swed.) | 1998 | Pak Se Ri (S.Kor.) |
| 1949 | L. Suggs | 1959 | M. Wright | 1969 | D. Caponi | 1979 | J. Britz | 1989 | B. King | 1999 | J. Inkster |
| 1950 | B.D. Zaharias | 1960 | B. Rawls | 1970 | D. Caponi | 1980 | A. Alcott | 1990 | B. King | 2000 | K. Webb (Austl.) |
| 1951 | B. Rawls | 1961 | M. Wright | 1971 | J. Gunderson Carner | 1981 | P. Bradley | 1991 | M. Mallon | 2001 | K. Webb (Austl.) |
| 1952 | L. Suggs | 1962 | M. Lindstrom | 1972 | S. Berning | 1982 | J. Alex | 1992 | P. Sheehan | 2002 | J. Inkster |
| 1953 | B. Rawls | 1963 | M. Mills | 1973 | S. Berning | 1983 | J. Stephenson (Austl.) | 1993 | L. Merten | 2003 | H. Lunke |
| 1954 | B.D. Zaharias | 1964 | M. Wright | 1974 | S. Haynie | 1984 | H. Stacy | 1994 | P. Sheehan | 2004 | M. Mallon |
| 1955 | F. Crocker | 1965 | C. Mann | 1975 | S. Palmer | 1985 | K. Baker | 1995 | A. Sörenstam (Swed.) | | |

*Won by a U.S. golfer except as indicated. †Amateur.

**Ladies' British Open Amateur Championship**

| year | winner* | year | winner* | year | winner* | year | winner* | year | winner* |
|---|---|---|---|---|---|---|---|---|---|
| 1893 | M. Scott | 1914 | C. Leitch | 1939 | P. Barton | 1964 | C. Sorenson (U.S.) | 1985 | L. Behan (Ire.) |
| 1894 | M. Scott | 1915–19 | not held | 1940–45 | not held | 1965 | B. Varangot (Fr.) | 1986 | J. Thornhill |
| 1895 | M. Scott | 1920 | C. Leitch | 1946 | J. Hetherington | 1966 | E. Chadwick | 1987 | J. Collingham |
| 1896 | A.B. Pascoe | 1921 | C. Leitch | 1947 | B.D. Zaharias (U.S.) | 1967 | E. Chadwick | 1988 | J. Furby |
| 1897 | E.C. Orr | 1922 | J. Wethered | 1948 | L. Suggs (U.S.) | 1968 | B. Varangot (Fr.) | 1989 | H. Dobson |
| 1898 | L. Thomson | 1923 | D. Chambers | 1949 | F. Stephens | 1969 | C. Lacoste (Fr.) | 1990 | J. Hall |
| 1899 | M. Hezlet | 1924 | J. Wethered | 1950 | Viscomtesse de Saint Sauveur (Fr.) | 1970 | D. Oxley | 1991 | J. Morley |
| 1900 | R.K. Adair | 1925 | J. Wethered | | | 1971 | M. Walker | 1992 | P. Pedersen (Den.) |
| 1901 | M.A. Graham | 1926 | C. Leitch | 1951 | P.G. MacCann | 1972 | M. Walker | 1993 | C. Lambert |
| 1902 | M. Hezlet | 1927 | S.T. de la Chaume (Fr.) | 1952 | M. Paterson | 1973 | A. Irvin | 1994 | E. Duggleby |
| 1903 | R.K. Adair | 1928 | N. le Blan (Fr.) | 1953 | M. Stewart (Can.) | 1974 | C. Semple (U.S.) | 1995 | J. Hall |
| 1904 | L. Dod | 1929 | J. Wethered | 1954 | F. Stephens | 1975 | N. Roth Syms (U.S.) | 1996 | K. Kuehne (U.S.) |
| 1905 | B. Thompson | 1930 | D. Fishwick | 1955 | J. Valentine | 1976 | C. Panton | 1997 | A. Rose |
| 1906 | L. Kennion | 1931 | E. Wilson | 1956 | M. Smith (U.S.) | 1977 | A. Uzielli | 1998 | K. Rostron |
| 1907 | M. Hezlet | 1932 | E. Wilson | 1957 | P. Garvey | 1978 | E. Kennedy (Austl.) | 1999 | M. Monnet (Fr.) |
| 1908 | M. Titterton | 1933 | E. Wilson | 1958 | J. Valentine | 1979 | M. Madill | 2000 | R. Hudson |
| 1909 | D. Campbell | 1934 | A.M. Holm | 1959 | E. Price | 1980 | A. Sander (U.S.) | 2001 | M. Prieto (Spain) |
| 1910 | E. Suttie | 1935 | W. Morgan | 1960 | B. McIntire (U.S.) | 1981 | B. Robertson | 2002 | R. Hudson |
| 1911 | D. Campbell | 1936 | P. Barton | 1961 | M. Spearman | 1982 | K. Douglas | 2003 | E. Serramia (Spain) |
| 1912 | G. Ravenscroft | 1937 | J. Anderson | 1962 | M. Spearman | 1983 | J. Thornhill | 2004 | L. Stahle (Swed.) |
| 1913 | M. Dodd | 1938 | A.M. Holm | 1963 | B. Varangot (Fr.) | 1984 | J. Rosenthal (U.S.) | | |

*Won by a British golfer except as indicated.

### Women's British Open Championship

| year | winner | year | winner |
|---|---|---|---|
| 1976 | J. Lee Smith (U.K.) | 1991 | P. Grice-Whittaker (U.K.) |
| 1977 | V. Saunders (U.K.) | 1992 | P. Sheehan (U.S.) |
| 1978 | J. Melville (U.K.) | 1993 | K. Lunn (Austl.) |
| 1979 | A. Sheard (S.Af.) | 1994 | L. Neumann (Swed.) |
| 1980 | D. Massey (U.S.) | 1995 | K. Webb (Austl.) |
| 1981 | D. Massey (U.S.) | 1996 | E. Klein (U.S.) |
| 1982 | M. Figueras-Dotti (Spain) | 1997 | K. Webb (Austl.) |
| 1983 | not held | 1998 | S. Steinhauer (U.S.) |
| 1984 | Okamoto A. (Japan) | 1999 | S. Steinhauer (U.S.) |
| 1985 | B. King (U.S.) | 2000 | S. Gustafson (Swed.) |
| 1986 | L. Davies (U.K.) | 2001 | Pak Se Ri (S.Kor.) |
| 1987 | A. Nicholas (U.K.) | 2002 | K. Webb (Austl.) |
| 1988 | C. Dibnah (Austl.) | 2003 | A. Sörenstam (Swed.) |
| 1989 | J. Geddes (U.S.) | 2004 | K. Stupples (U.K.) |
| 1990 | H. Alfredsson (Swed.) | | |

### Ladies' Professional Golf Association (LPGA) champions

| year | winner* | year | winner* | year | winner* |
|---|---|---|---|---|---|
| 1955 | B. Hanson | 1972 | K. Ahern | 1989 | N. Lopez |
| 1956 | M. Hagge | 1973 | M. Mills | 1990 | B. Daniel |
| 1957 | L. Suggs | 1974 | S. Haynie | 1991 | M. Mallon |
| 1958 | M. Wright | 1975 | K. Whitworth | 1992 | B. King |
| 1959 | B. Rawls | 1976 | B. Burfeindt | 1993 | P. Sheehan |
| 1960 | M. Wright | 1977 | C. Higuchi | 1994 | J. Davies (U.K.) |
| 1961 | M. Wright | 1978 | N. Lopez | 1995 | K. Robbins |
| 1962 | J. Kimball | 1979 | D. Caponi Young | 1996 | L. Davies (U.K.) |
| 1963 | M. Wright | 1980 | S. Little | 1997 | D. Johnson |
| 1964 | M. Mills | 1981 | D. Caponi | 1998 | Pak Se Ri (S.Kor.) |
| 1965 | S. Haynie | 1982 | J. Stephenson (Austl.) | 1999 | J. Inkster |
| 1966 | G. Ehret | 1983 | P. Sheehan | 2000 | J. Inkster |
| 1967 | K. Whitworth | 1984 | P. Sheehan | 2001 | K. Webb (Austl.) |
| 1968 | S. Post | 1985 | N. Lopez | 2002 | Pak Se Ri (S.Kor.) |
| 1969 | B. Rawls | 1986 | P. Bradley | 2003 | A. Sörenstam (Swed.) |
| 1970 | S. Englehorn | 1987 | J. Geddes | 2004 | A. Sörenstam (Swed.) |
| 1971 | K. Whitworth | 1988 | S. Turner | | |

*Won by a U.S. golfer except as indicated.

*Team events.* The Ryder Cup was originally a biennial match between the United States and Great Britain, but, beginning in 1979, it was expanded into a biennial match between the United States and Europe. Teams of British and U.S. women golfers compete every two years for the Curtis Cup, which since 1964 has involved two days' play of three 18-hole foursomes and six 18-hole singles. The World Cup, formerly known as the Canada Cup, is a men's tournament for two-man professional teams.

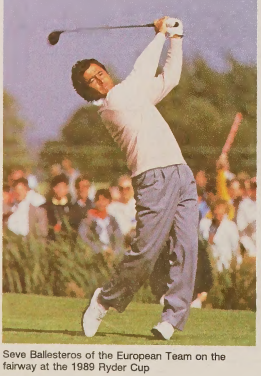
### Ryder Cup

| year | result | year | result |
|---|---|---|---|
| 1927 | United States 9½, Great Britain 2½ | 1971 | United States 18½, Great Britain 13½ |
| 1929 | Great Britain 7, United States 5 | 1973 | United States 19, Great Britain 13 |
| 1931 | United States 9, Great Britain 3 | 1975 | United States 21, Great Britain 11 |
| 1933 | Great Britain 6½, United States 5½ | 1977 | United States 12½, Great Britain 7½ |
| 1935 | United States 9, Great Britain 3 | 1979 | United States 17, Europe 11 |
| 1937 | United States 8, Great Britain 4 | 1981 | United States 18½, Europe 9½ |
| 1939–45 | not held | 1983 | United States 14½, Europe 13½ |
| 1947 | United States 11, Great Britain 1 | 1985 | Europe 16½, United States 11½ |
| 1949 | United States 7, Great Britain 5 | 1987 | Europe 15, United States 13 |
| 1951 | United States 9½, Great Britain 2½ | 1989 | Europe 14, United States 14 |
| 1953 | United States 6½, Great Britain 5½ | 1991 | United States 14½, Europe 13½ |
| 1955 | United States 8, Great Britain 4 | 1993 | United States 15, Europe 13 |
| 1957 | Great Britain 7½, United States 4½ | 1995 | Europe 14½, United States 13½ |
| 1959 | United States 8½, Great Britain 3½ | 1997 | Europe 14½, United States 13½ |
| 1961 | United States 14½, Great Britain 9½ | 1999 | United States 14½, Europe 13½ |
| 1963 | United States 23, Great Britain 9 | 2001 | postponed until 2002 |
| 1965 | United States 19½, Great Britain 12½ | 2002 | Europe 15½, United States 12½ |
| 1967 | United States 23½, Great Britain 8½ | 2004 | Europe 18½, United States 9½ |
| 1969 | United States 16, Great Britain 16 | | |

### Curtis Cup

| year | result | year | result |
|---|---|---|---|
| 1932 | United States 5½, Britain 3½ | 1972 | United States 10, Britain and Ireland 8 |
| 1934 | United States 6½, Britain and Ireland 2½ | 1974 | United States 13, Britain and Ireland 5 |
| 1936 | United States* 4½, Britain and Ireland 4½ | 1976 | United States 11½, Britain and Ireland 6½ |
| 1938 | United States 5½, Britain and Ireland 3½ | 1978 | United States 12, Britain and Ireland 6 |
| 1940–46 | not held | 1980 | United States 13, Britain and Ireland 5 |
| 1948 | United States 6½, Britain and Ireland 2½ | 1982 | United States 14½, Britain and Ireland 3½ |
| 1950 | United States 7½, Britain and Ireland 2½ | 1984 | United States 9½, Britain and Ireland 8½ |
| 1952 | Britain and Ireland 5, United States 4 | 1986 | Britain and Ireland 13, United States 5 |
| 1954 | United States 6, Britain and Ireland 3 | 1988 | Britain and Ireland 11, United States 7 |
| 1956 | Britain and Ireland 5, United States 4 | 1990 | United States 14, Britain and Ireland 4 |
| 1958 | Britain and Ireland* 4½, United States 4½ | 1992 | Britain and Ireland 10, United States 8 |
| 1960 | United States 6½, Britain and Ireland 2½ | 1994 | Britain and Ireland 9, United States 9 |
| 1962 | United States 8, Britain and Ireland 1 | 1996 | Britain and Ireland 11½, United States 6½ |
| 1964 | United States 10½, Britain and Ireland 7½ | 1998 | United States 10, Britain and Ireland 8 |
| 1966 | United States 13, Britain and Ireland 5 | 2000 | United States 10, Britain and Ireland 8 |
| 1968 | United States 10½, Britain and Ireland 7½ | 2002 | United States 11, Britain and Ireland 7 |
| 1970 | United States 11½, Britain and Ireland 6½ | 2004 | United States 10, Britain and Ireland 8 |

*In case of a tie the defenders retain the cup.



Seve Ballesteros of the European Team on the fairway at the 1989 Ryder Cup

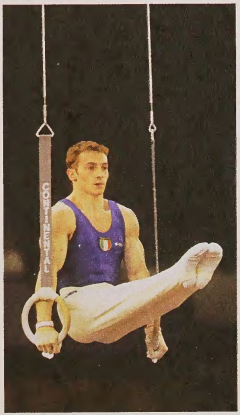
Duomo

### World Cup

| year | winner | year | winner |
|---|---|---|---|
| 1953 | Argentina (A. Cerda and R. de Vicenzo) | 1979 | United States (H. Irwin and J. Mahaffey) |
| 1954 | Australia (P.W. Thomson and K. Nagle) | 1980 | Canada (D. Halldorson and J. Nelford) |
| 1955 | United States (C. Harbert and E. Furgol) | 1981 | not held |
| 1956 | United States (B. Hogan and S. Snead) | 1982 | Spain (M. Piñero and J.-M. Cañizares) |
| 1957 | Japan (Nakamura T. and Ono K.) | 1983 | United States (R. Caldwell and J. Cook) |
| 1958 | Ireland (H. Bradshaw and C. O'Connor) | 1984 | Spain (J.-M. Cañizares and J. Rivero) |
| 1959 | Australia (P.W. Thomson and K. Nagle) | 1985 | Canada (D. Halldorson and D. Barr) |
| 1960 | United States (S. Snead and A. Palmer) | 1986 | not held |
| 1961 | United States (S. Snead and J. Demaret) | 1987 | Wales (I. Woosnam and D. Llewellyn) |
| 1962 | United States (S. Snead and A. Palmer) | 1988 | United States (B. Crenshaw and M. McCumber) |
| 1963 | United States (A. Palmer and J. Nicklaus) | 1989 | Australia (P. Fowler and W. Grady) |
| 1964 | United States (A. Palmer and J. Nicklaus) | 1990 | Germany (B. Langer and T. Giedeon) |
| 1965 | South Africa (G. Player and H.R. Henning) | 1991 | Sweden (A. Forsbrand and P.-U. Johansson) |
| 1966 | United States (A. Palmer and J. Nicklaus) | 1992 | United States (F. Couples and D. Love III) |
| 1967 | United States (A. Palmer and J. Nicklaus) | 1993 | United States (F. Couples and D. Love III) |
| 1968 | Canada (A. Balding and G. Knudson) | 1994 | United States (F. Couples and D. Love III) |
| 1969 | United States (O. Moody and L. Trevino) | 1995 | United States (F. Couples and D. Love III) |
| 1970 | Australia (D. Graham and B. Devlin) | 1996 | South Africa (E. Els and W. Westner) |
| 1971 | United States (J. Nicklaus and L. Trevino) | 1997 | Ireland (P. Harrington and P. McGinley) |
| 1972 | Taiwan (Hsieh Min-nan and Lu Liang-huan) | 1998 | England (N. Faldo and D. Carter) |
| 1973 | United States (J. Miller and J. Nicklaus) | 1999 | United States (T. Woods and M. O'Meara) |
| 1974 | South Africa (B. Cole and D. Hayes) | 2000 | United States (T. Woods and D. Duval) |
| 1975 | United States (J. Miller and L. Graham) | 2001 | South Africa (E. Els and R. Goosen) |
| 1976 | Spain (S. Ballesteros and M. Piñero) | 2002 | Japan (Izawa T. and Maruyama S.) |
| 1977 | Spain (S. Ballesteros and A. Garrido) | 2003 | South Africa (T. Immelman and R. Sabbatini) |
| 1978 | United States (J. Mahaffey and A. North) | | |

## GYMNASTICS

Aside from the gymnastics events in Olympic Games, the most popular venue for gymnastics competition is the world championship games. Men's events are six in number with all-around individual and all-around team awards in addition. The latter two awards are given on a cumulative points basis. Women also have all-around team and individual awards, determined by their performance in four individual events.



Yuri Chechi (Italy) performing on the rings and winning first place at the 1993 World Gymnastics Championships

ALLSPORT USA/Chris Cole



Li Jing (China) performing on the parallel bars at the 1992 World Gymnastics Championships, winning first place for the third year in a row

ALLSPORT USA/Vandystadt/Yann Guichaoua

**World Gymnastics Championships—men**

| year | all-around team | all-around individual | horizontal bar | parallel bars |
|---|---|---|---|---|
| 1950 | Switzerland | W. Lehmann (Switz.) | P. Aaltonen (Fin.) | H. Eugster (Switz.) |
| 1952* | U.S.S.R. | V. Chukarin (U.S.S.R.) | J. Günthard (Switz.) | H. Eugster (Switz.) |
| 1954 | U.S.S.R. | V. Muratov (U.S.S.R.) | V. Muratov (U.S.S.R.) | V. Chukarin (U.S.S.R.) |
| 1956* | U.S.S.R. | V. Chukarin (U.S.S.R.) | Ono T. (Japan) | V. Chukarin (U.S.S.R.) |
| 1958 | U.S.S.R. | B. Shakhlin (U.S.S.R.) | B. Shakhlin (U.S.S.R.) | B. Shakhlin (U.S.S.R.) |
| 1960* | Japan | B. Shakhlin (U.S.S.R.) | Ono T. (Japan) | B. Shakhlin (U.S.S.R.) |
| 1962 | Japan | Y. Titov (U.S.S.R.) | Ono T. (Japan) | M. Cerar (Yugos.) |
| 1964* | Japan | Endo Y. (Japan) | B. Shakhlin (U.S.S.R.) | Endo Y. (Japan) |
| 1966 | Japan | M. Voronin (U.S.S.R.) | Nakayama A. (Japan) | S. Diomidov (U.S.S.R.) |
| 1968* | Japan | Kato S. (Japan) | M. Voronin (U.S.S.R.)† Nakayama A. (Japan)† | Nakayama A. (Japan) |
| 1970 | Japan | Kenmotsu E. (Japan) | Kenmotsu E. (Japan) | Nakayama A. (Japan) |
| 1972* | Japan | Kato S. (Japan) | Tsukahara M. (Japan) | Kato S. (Japan) |
| 1974 | Japan | Kasamatsu S. (Japan) | E. Gienger. (W.Ger.) | Kenmotsu E. (Japan) |
| 1976* | Japan | N. Andrianov (U.S.S.R.) | Tsukahara M. (Japan) | Kato S. (Japan) |
| 1978 | Japan | N. Andrianov (U.S.S.R.) | Kasamatsu S. (Japan) | Kenmotsu E. (Japan) |
| 1979 | U.S.S.R. | A. Dityatin (U.S.S.R.) | K. Thomas (U.S.) | B. Conner (U.S.) |
| 1980* | U.S.S.R. | A. Dityatin (U.S.S.R.) | S. Delchev (Bulg.) | A. Tkachev (U.S.S.R.) |
| 1981 | U.S.S.R. | Y. Korolyov (U.S.S.R.) | A. Tkachev (U.S.S.R.) | A. Dityatin (U.S.S.R.)† Gushiken K. (Japan)† |
| 1983 | China | D. Bilozerchev (U.S.S.R.) | D. Bilozerchev (U.S.S.R.) | Lou Yun (China)† V. Artemov (U.S.S.R.)† |
| 1984* | United States | Gushiken K. (Japan) | Morisue S. (Japan) | B. Conner (U.S.) |
| 1985 | U.S.S.R. | Y. Korolyov (U.S.S.R.) | Tong Fei (China) | S. Kroll (E.Ger.)† V. Mogilny (U.S.S.R.)† |
| 1987 | U.S.S.R. | D. Bilozerchev (U.S.S.R.) | D. Bilozerchev (U.S.S.R.) | V. Artemov (U.S.S.R.) |
| 1988* | U.S.S.R. | V. Artemov (U.S.S.R.) | V. Artemov (U.S.S.R.)† V. Lyukin (U.S.S.R.)† | V. Artemov (U.S.S.R.) |
| 1989 | U.S.S.R. | I. Korobchinsky (U.S.S.R.) | Li Chunyang (China) | V. Artemov (U.S.S.R.)† Li Jing (China)† |
| 1991 | U.S.S.R. | G. Misutin (U.S.S.R.) | R. Buechner (Ger.)† Li Chunyang (China)† | Li Jing (China) |
| 1992 | ‡ | ‡ | G. Misutin (CIS§) | Li Jing (China)† V. Voropayev (CIS§)† |
| 1993 | ‡ | V. Sherbo (Bela.) | S. Charkov (Russia) | V. Sherbo (Bela.) |
| 1994 | China | I. Ivankov (Bela.) | V. Sherbo (Bela.) | Liping Huang (China) |
| 1995 | China | Li Xiaoshuang (China) | A. Wecker (Ger.) | V. Sherbo (Bela.) |
| 1996 | ‡ | ‡ | J. Carballo (Spain) | R. Charipov (Ukr.) |
| 1997 | China | I. Ivankov (Bela.) | J. Tanskanen (Fin.) | Zhang Jinjing (China) |
| 1999 | China | N. Krukov (Russia) | J. Carballo (Spain) | Lee Joo Hyung (S.Kor.) |
| 2000 | China | A. Nemov (Russia) | A. Nemov (Russia) | Li Xiaopeng (China) |
| 2001 | Belarus | Feng Jing (China) | V. Maras (Green.) | S. Townsend (U.S.) |

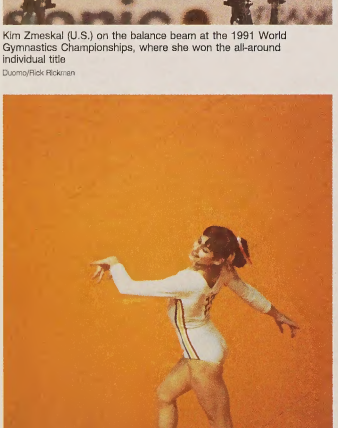
| year | pommel horse | rings | vault | floor exercise |
|---|---|---|---|---|
| 1950 | J. Stalder (Switz.) | W. Lehmann (Switz.) | E. Gebendinger (Switz.) | J. Stalder (Switz.) |
| 1952* | V. Chukarin (U.S.S.R.) | G. Shaginyan (U.S.S.R.) | V. Chukarin (U.S.S.R.) | W. Thoresson (Swed.) |
| 1954 | G. Shaginyan (U.S.S.R.) | A. Azaryan (U.S.S.R.) | L. Sotornik (Czech.) | V. Muratov (U.S.S.R.)† Takemoto M. (Japan)† |
| 1956* | B. Shakhlin (U.S.S.R.) | A. Azaryan (U.S.S.R.) | V. Muratov (U.S.S.R.)† | V. Muratov (U.S.S.R.) H. Bantz (Ger.)† |
| 1958 | B. Shakhlin (U.S.S.R.) | A. Azaryan (U.S.S.R.) | Y. Titov (U.S.S.R.) | Takemoto M. (Japan) |
| 1960* | B. Shakhlin (U.S.S.R.)† | A. Azaryan (U.S.S.R.) E. Ekman (Fin.)† | Ono T. (Japan)† | Aihara N. (Japan) B. Shakhlin (U.S.S.R.)† |
| 1962 | M. Cerar (Yugos.) | Y. Titov (U.S.S.R.) | P. Krbec (Czech.) | Aihara N. (Japan)† Endo Y. (Japan)† |
| 1964* | M. Cerar (Yugos.) | Hayata T. (Japan) | Yamasita H. (Japan) | F. Menichelli (Italy) |
| 1966 | M. Cerar (Yugos.) | M. Voronin (U.S.S.R.) | Matsuda H. (Japan) | Nakayama A. (Japan) |
| 1968* | M. Cerar (Yugos.) | Nakayama A. (Japan) | M. Voronin (U.S.S.R.) | Kato S. (Japan) |
| 1970 | M. Cerar (Yugos.) | Nakayama A. (Japan) | Tsukahara M. (Japan) | Nakayama A. (Japan) |
| 1972* | V. Klimenko (U.S.S.R.) | Nakayama A. (Japan) | K. Koeste (E.Ger.) | N. Andrianov (U.S.S.R.) |
| 1974 | Z. Magyar (Hung.) | D. Grecu (Rom.)† | Kasamatsu S. (Japan) N. Andrianov (U.S.S.R.)† | Kasamatsu S. (Japan) |
| 1976* | Z. Magyar (Hung.) | N. Andrianov (U.S.S.R.) | N. Andrianov (U.S.S.R.) | N. Andrianov (U.S.S.R.) |
| 1978 | Z. Magyar (Hung.) | N. Andrianov (U.S.S.R.) | Shimizu J. (Japan) | K. Thomas (U.S.) |
| 1979 | Z. Magyar (Hung.) | A. Dityatin (U.S.S.R.) | A. Dityatin (U.S.S.R.) | K. Thomas (U.S.)† R. Bruckner (E.Ger.)† |
| 1980* | Z. Magyar (Hung.) | A. Dityatin (U.S.S.R.) | N. Andrianov (U.S.S.R.) | R. Bruckner (E.Ger.) |
| 1981 | Li Xiaoping (China)† | A. Dityatin (U.S.S.R.) M. Nikolai (E.Ger.)† | R. Hemmann (E.Ger.) | Li Yuijiu (China)† Y. Korolyov (U.S.S.R.)† |
| 1983 | D. Bilozerchev (U.S.S.R.) | D. Bilozerchev (U.S.S.R.)† Gushiken K. (Japan)† | A. Akopyan (U.S.S.R.) | Tong Fei (China) |
| 1984* | Li Ning (China)† P. Vidmar (U.S.)† | Gushiken K. (Japan)† Li Ning (China)† | Lou Yun (China) | Li Ning (China) |
| 1985 | V. Mogilny (U.S.S.R.) | Li Ning (China)† Y. Korolyov (U.S.S.R.)† | Y. Korolyov (U.S.S.R.) | Tong Fei (China) |
| 1987 | D. Bilozerchev (U.S.S.R.)† Z. Borkai (Hung.)† | Y. Korolyov (U.S.S.R.) | S. Kroll (E.Ger.)† Lou Yun (China)† | Lou Yun (China) |
| 1988* | D. Bilozerchev (U.S.S.R.)† Z. Borkai (Hung.)† L. Gueraskov (Bulg.)† | H. Behrendt (E.Ger.)† D. Bilozerchev (U.S.S.R.)† | Lou Yun (China) | S. Kharkov (U.S.S.R.) |
| 1989 | V. Mogilny (U.S.S.R.) | A. Aguilar (W.Ger.) | J. Behrend (E.Ger.) | I. Korobchinsky (U.S.S.R.) |
| 1991 | V. Belenky (U.S.S.R.) | G. Misutin (U.S.S.R.) | You Ok Youl (S.Kor.) | I. Korobchinsky (U.S.S.R.) |
| 1992 | Pae Gil Su (N.Kor.)† Li Jing (China)† | V. Sherbo (CIS§) V. Sherbo (CIS§)† | You Ok Youl (S.Kor.) | I. Korobchinsky (CIS§) |
| 1993 | Pae Gil Su (N.Kor.) | Y. Chechi (Italy) | V. Sherbo (Bela.) | G. Misutin (Ukr.) |
| 1994 | M. Urzica (Rom.)† | Y. Chechi (Italy) | V. Sherbo (Bela.) | V. Sherbo (Bela.) |
| 1995 | Li Donghua (Switz.) | Y. Chechi (Italy) | A. Nemov (Russia)† G. Misutin (Ukr.)† | V. Sherbo (Bela.) |
| 1996 | Pae Gil Su (N.Kor.) | Y. Chechi (Italy) | A. Nemov (Russia) | V. Sherbo (Bela.) |
| 1997 | V. Belenki (Ger.) | Y. Chechi (Italy) | S. Fedorchenko (Kazak.) | A. Nemov (Russia) |
| 1999 | A. Nemov (Russia) | Dong Zhen (China) | Li Xiaopeng (China) | A. Nemov (Russia) |
| 2000 | M. Urzica (Rom.) | S. Csollany (Hung.) | G. Deferr (Spain) | I. Vihrons (Latvia) |
| 2001 | M. Urzica (Rom.) | J. Jovtchev (Bulg.) | M. Dragulescu (Rom.) | J. Jovtchev (Bulg.), M. Dragulescu (Rom.)† |

*Olympic championships, recognized as world championships until 1992 (for Olympic results 1896–1948, and from 1992, *see* Olympic Games). †Tied. ‡Not held. §Commonwealth of Independent States.



Kim Zmeskal (U.S.) on the balance beam at the 1991 World Gymnastics Championships, where she won the all-around individual title

Duomo/Rick Rickman



Nadia Comăneci (Rom.) performing her floor exercise at the 1976 Olympics, where she was champion in three events including the all-around individual competition

Duomo/Steven E. Sutton

**World Gymnastics Championships—women**

| year | all-around team | all-around individual | balance beam |
|---|---|---|---|
| 1950 | Sweden | H. Rakoczy (Pol.) | H. Rakoczy (Pol.) |
| 1952* | U.S.S.R. | M. Gorokhovskaya (U.S.S.R.) | N. Bocharova (U.S.S.R.) |
| 1954 | U.S.S.R. | G. Rudiko (U.S.S.R.) | Tanaka K. (Japan) |
| 1956* | U.S.S.R. | L. Latynina (U.S.S.R.) | Á. Keleti (Hung.) |
| 1958 | U.S.S.R. | L. Latynina (U.S.S.R.) | L. Latynina (U.S.S.R.) |
| 1960* | U.S.S.R. | L. Latynina (U.S.S.R.) | E. Bosáková (Czech.) |
| 1962 | U.S.S.R. | L. Latynina (U.S.S.R.) | E. Bosáková (Czech.) |
| 1964* | U.S.S.R. | V. Čáslavská (Czech.) | V. Čáslavská (Czech.) |
| 1966 | Czechoslovakia | V. Čáslavská (Czech.) | N. Kuchinskaya (U.S.S.R.) |
| 1968* | U.S.S.R. | V. Čáslavská (Czech.) | N. Kuchinskaya (U.S.S.R.) |
| 1970 | U.S.S.R. | L. Turishcheva (U.S.S.R.) | E. Zuchold (E.Ger.) |
| 1972* | U.S.S.R. | L. Turishcheva (U.S.S.R.) | O. Korbut (U.S.S.R.) |
| 1974 | U.S.S.R. | L. Turishcheva (U.S.S.R.) | L. Turishcheva (U.S.S.R.) |
| 1976* | U.S.S.R. | N. Comăneci (Rom.) | N. Comăneci (Rom.) |
| 1978 | U.S.S.R. | E. Mukhina (U.S.S.R.) | N. Comăneci (Rom.) |
| 1979 | Romania | N. Kim (U.S.S.R.) | V. Cerna (Czech.) |
| 1980* | U.S.S.R. | Ye. Davydova (U.S.S.R.) | N. Comăneci (Rom.) |
| 1981 | U.S.S.R. | O. Bicherova (U.S.S.R.) | M. Gnauck (E.Ger.) |
| 1983 | U.S.S.R. | N. Yurchenko (U.S.S.R.) | O. Mostepanova (U.S.S.R.) |
| 1984* | Romania | M.L. Retton (U.S.) | E. Szabo (Rom.)† |
| | | | S. Pauca (Rom.)† |
| 1985 | U.S.S.R. | E. Shushunova (U.S.S.R.)† | D. Silivas (Rom.) |
| | | O. Omelyanchik (U.S.S.R.)† | |
| 1987 | Romania | A. Dobre (Rom.) | A. Dobre (Rom.) |
| 1988* | U.S.S.R. | Y. Shushunova (U.S.S.R.) | D. Silivas (Rom.) |
| 1989 | U.S.S.R. | S. Boginskaya (U.S.S.R.) | D. Silivas (Rom.) |
| 1991 | U.S.S.R. | K. Zmeskal (U.S.) | S. Boginskaya (U.S.S.R.) |
| 1992 | ‡ | ‡ | K. Zmeskal (U.S.) |
| 1993 | ‡ | S. Miller (U.S.) | L. Milosovici (Rom.) |
| 1994 | Romania | S. Miller (U.S.) | S. Miller (U.S.) |
| 1995 | Romania | L. Podkopayeva (Ukr.) | Mo Huilan (China) |
| 1996 | ‡ | ‡ | D. Kochetkova (Russia) |
| 1997 | Romania | S. Khorkina (Russia) | G. Gogean (Rom.) |
| 1999 | Romania | M. Olaru (Rom.) | Ling Jie (China) |
| 2000 | Romania | S. Amanar (Rom.) | Liu Xuan (China) |
| 2001 | Romania | S. Khorkina (Russia) | A. Raducan (Rom.) |

| | uneven parallel bars | vault | floor exercise |
|---|---|---|---|
| 1950 | T. Kolar (Austria)† | H. Rakoczy (Pol.) | H. Rakoczy (Pol.) |
| | A.-S. Pettersson (Swed.)† | | |
| 1952* | M. Korondi (Hung.) | Ye. Kalinchuk (U.S.S.R.) | Á. Keleti (Hung.) |
| 1954 | Á. Keleti (Hung.) | A.-S. Pettersson (Swed.)† | T. Manina (U.S.S.R.) |
| | | T. Manina (U.S.S.R.)† | |
| 1956* | Á. Keleti (Hung.) | L. Latynina (U.S.S.R.) | L. Latynina (U.S.S.R.)† |
| | | | Á. Keleti (Hung.)† |
| 1958 | L. Latynina (U.S.S.R.) | L. Latynina (U.S.S.R.) | E. Bosáková (Czech.) |
| 1960* | P. Astakhova (U.S.S.R.) | M. Nikolayeva (U.S.S.R.) | L. Latynina (U.S.S.R.) |
| 1962 | I. Pervushina (U.S.S.R.) | V. Čáslavská (Czech.) | L. Latynina (U.S.S.R.) |
| 1964* | P. Astakhova (U.S.S.R.) | V. Čáslavská (Czech.) | L. Latynina (U.S.S.R.) |
| 1966 | N. Kuchinskaya (U.S.S.R.) | V. Čáslavská (Czech.) | N. Kuchinskaya (U.S.S.R.) |
| 1968* | V. Čáslavská (Czech.) | V. Čáslavská (Czech.) | V. Čáslavská (Czech.)† |
| | | | L. Petrik (U.S.S.R.)† |
| 1970 | K. Janz (E.Ger.) | E. Zuchold (E.Ger.) | L. Turishcheva (U.S.S.R.) |
| 1972* | K. Janz (E.Ger.) | K. Janz (E.Ger.) | O. Korbut (U.S.S.R.) |
| 1974 | A. Zinke (E.Ger.) | O. Korbut (U.S.S.R.) | L. Turishcheva (U.S.S.R.) |
| 1976* | N. Comăneci (Rom.) | N. Kim (U.S.S.R.) | N. Kim (U.S.S.R.) |
| 1978 | M. Frederick (U.S.) | N. Kim (U.S.S.R.) | E. Mukhina (U.S.S.R.)† |
| | | | N. Kim (U.S.S.R.)† |
| 1979 | Ma Yanhong (China)† | D. Turner (Rom.) | E. Eberle (Rom.) |
| | M. Gnauck (E.Ger.)† | | |
| 1980* | M. Gnauck (E.Ger.) | N. Shaposhnikova (U.S.S.R.) | N. Comăneci (Rom.)† |
| | | | N. Kim (U.S.S.R.)† |
| 1981 | M. Gnauck (E.Ger.) | M. Gnauck (E.Ger.) | N. Ilenko (U.S.S.R.) |
| 1983 | M. Gnauck (E.Ger.) | B. Stoyanova (Bulg.) | E. Szabo (Rom.) |
| 1984* | J. McNamara (U.S.)† | E. Szabo (Rom.) | E. Szabo (Rom.) |
| | Ma Yanhong (China)† | | |
| 1985 | G. Fahnrich (E.Ger.) | E. Shushunova (U.S.S.R.) | O. Omelyanchik (U.S.S.R.) |
| 1987 | D. Silivas (Rom.)† | E. Shushunova (U.S.S.R.) | E. Shushunova (U.S.S.R.)† |
| | E. Thuemmler (E.Ger.)† | | D. Silivas (Rom.)† |
| 1988* | D. Silivas (Rom.) | S. Boginskaya (U.S.S.R.) | D. Silivas (Rom.) |
| 1989 | Fan Di (China)† | O. Dudnik (U.S.S.R.) | S. Boginskaya (U.S.S.R.)† |
| | D. Silivas (Rom.)† | | D. Silivas (Rom.)† |
| 1991 | Kim Gwang Suk (N.Kor.) | L. Milosovici (Rom.) | C. Bontas (Rom.)† |
| | | | O. Chusovitina (U.S.S.R.)† |
| 1992 | L. Milosovici (Rom.) | H. Onodi (Hung.) | K. Zmeskal (U.S.) |
| 1993 | S. Miller (U.S.) | Y. Piskun (Bela.) | S. Miller (U.S.) |
| 1994 | Li Luo (China) | G. Gogean (Rom.) | D. Kochetkova (Russia) |
| 1995 | S. Khorkina (Russia) | S. Amanar (Rom.)† | G. Gogean (Rom.) |
| | | L. Podkopayeva (Ukr.)† | |
| 1996 | S. Khorkina (Russia)† | G. Gogean (Rom.) | G. Gogean (Rom.)† |
| | Ye. Piskun (Bela.)† | | Kui Yuanyuan (China)† |
| 1997 | S. Khorkina (Russia) | S. Amanar (Rom.) | G. Gogean (Rom.) |
| 1999 | S. Khorkina (Russia) | Ye. Zamolodchikova (Russia) | A. Raducan (Rom.) |
| 2000 | S. Khorkina (Russia) | Ye. Zamolodchikova (Russia) | Ye. Zamolodchikova (Russia) |
| 2001 | S. Khorkina (Russia) | S. Khorkina (Russia) | A. Raducan (Rom.) |

*Olympic championships, recognized as world championships (for 1896–1952 Olympics, *see* Olympic Games). †Tied. ‡Not held.

## HORSE RACING

In the oldest type of horse racing, the rider sits astride the horse; in the other type of race, best known as harness racing, he sits in a sulky—a two-wheeled vehicle attached by shafts and traces to the horse. In the former type, a Thoroughbred horse is raced over either a track or over a course of jumps and turns (steeplechase). Harness horses can be trotters or pacers and are Standardbred horses raced on a track.

*The English Thoroughbred classics.* The races are run by 3-year-old colts and fillies. The Derby, first run in 1780, is run at Epsom Downs, Surrey, over 1½ miles. The Oaks, also run at Epsom Downs, was first run in 1779; the oldest of the English races, however, is the St. Leger (1776). It is run over 1 mile 6½ furlongs at Doncaster, South Yorkshire. The 2,000 Guineas (1809) is run over 1 mile at Newmarket, Suffolk. A horse that wins the 2,000 Guineas, the Derby, and the St. Leger all in one year is said to have won the British Triple Crown.



Reference Point, with jockey Steve Cauthen in yellow silks, leading the field to win the 1987 Derby at Epsom Downs

Sporting Pictures (UK) Ltd

### The Derby

| year | horse | year | horse | year | horse | jockey | year | horse | jockey |
|---|---|---|---|---|---|---|---|---|---|
| 1780 | Diomed | 1841 | Coronation | 1901 | Volodyovski | L. Reiff | 1962 | Larkspur | N. Sellwood |
| 1781 | Young Eclipse | 1842 | Attila | 1902 | Ard Patrick | J. Martin | 1963 | Relko | Y. Saint-Martin |
| 1782 | Assassin | 1843 | Cotherstone | 1903 | Rock Sand | D. Maher | 1964 | Santa Claus | A. Breasley |
| 1783 | Saltram | 1844 | Orlando | 1904 | St. Amant | K. Cannon | 1965 | Sea Bird II | T.P. Glennon |
| 1784 | Sergeant | 1845 | The Merry Monarch | 1905 | Cicero | D. Maher | 1966 | Charlottown | A. Breasley |
| 1785 | Almwell | 1846 | Pyrrhus the First | 1906 | Spearmint | D. Maher | 1967 | Royal Palace | G. Moore |
| 1786 | Noble | 1847 | The Cossack | 1907 | Orby | J. Reiff | 1968 | Sir Ivor | L. Piggott |
| 1787 | Sir Peter Teazle | 1848 | Surplice | 1908 | Signorinetta | W. Bullock | 1969 | Blakeney | E. Johnson |
| 1788 | Sir Thomas | 1849 | The Flying Dutchman | 1909 | Minoru | H. Jones | 1970 | Nijinsky | L. Piggott |
| 1789 | Skyscraper | 1850 | Voltigeur | 1910 | Lamberg | B. Dillon | 1971 | Mill Reef | G. Lewis |
| 1790 | Rhadamanthus | 1851 | Teddington | 1911 | Sunstar | G. Stern | 1972 | Roberto | L. Piggott |
| 1791 | Eager | 1852 | Daniel O'Rourke | 1912 | Tagalie | J. Reiff | 1973 | Morston | E. Hide |
| 1792 | John Bull | 1853 | West Australian | 1913 | Aboyeur | E. Piper | 1974 | Snow Knight | B. Taylor |
| 1793 | Waxy | 1854 | Andover | 1914 | Durbar II | M. MacGee | 1975 | Grundy | P. Eddery |
| 1794 | Daedalus | 1855 | Wild Dayrell | 1915† | Pommern | S. Donoghue | 1976 | Empery | L. Piggott |
| 1795 | Spread Eagle | 1856 | Ellington | 1916† | Fifinella | J. Childs | 1977 | The Minstrel | L. Piggott |
| 1796 | Didelot | 1857 | Blink Bonny | 1917† | Gay Crusader | S. Donoghue | 1978 | Shirley Heights | G. Starkey |
| 1797 | Br. c. by Fidget | 1858 | Beadsman | 1918† | Gainsborough | J. Childs | 1979 | Troy | W. Carson |
| 1798 | Sir Harry | 1859 | Musjid | 1919† | Grand Parade | F. Templeman | 1980 | Henbit | W. Carson |
| 1799 | Archduke | 1860 | Thormanby | 1920 | Spion Kop | F. O'Neill | 1981 | Shergar | W.R. Swinburn |
| 1800 | Champion | 1861 | Kettledrum | 1921 | Humorist | S. Donoghue | 1982 | Golden Fleece | P. Eddery |
| 1801 | Eleanor | 1862 | Caractacus | 1922 | Captain Cuttle | S. Donoghue | 1983 | Teenoso | L. Piggott |
| 1802 | Tyrant | 1863 | Macaroni | 1923 | Papyrus | S. Donoghue | 1984‡ | Secreto | C. Roche |
| 1803 | Ditto | 1864 | Blair Athol | 1924 | Sansovino | T. Weston | 1985 | Slip Anchor | S. Cauthen |
| 1804 | Hannibal | 1865 | Gladiateur | 1925 | Manna | S. Donoghue | 1986 | Shahrastani | W.R. Swinburn |
| 1805 | Cardinal Beaufort | 1866 | Lord Lyon | 1926 | Coronach | J. Childs | 1987 | Reference Point | S. Cauthen |
| 1806 | Paris | 1867 | Hermit | 1927 | Call Boy | C. Elliott | 1988 | Kahyasi | R. Cochrane |
| 1807 | Election | 1868 | Blue Gown | 1928 | Felstead | H. Wragg | 1989 | Nashwan | W. Carson |
| 1808 | Pan | 1869 | Pretender | 1929 | Trigo | J. Marshall | 1990 | Quest for Fame | P. Eddery |
| 1809 | Pope | 1870 | Kingcraft | 1930 | Blenheim | H. Wragg | 1991 | Generous | A. Munro |
| 1810 | Whalebone | 1871 | Favonius | 1931 | Cameronian | F. Fox | 1992 | Dr Devious | J. Reid |
| 1811 | Phantom | 1872 | Cremorne | 1932 | April the Fifth | F. Lane | 1993 | Commander In Chief | M. Kinane |
| 1812 | Octavius | 1873 | Doncaster | 1933 | Hyperion | T. Weston | 1994 | Erhaab | W. Carson |
| 1813 | Smolensko | 1874 | George Frederick | 1934 | Windsor Lad | C. Smirke | 1995 | Lammtarra | W.R. Swinburn |
| 1814 | Blücher | 1875 | Galopin | 1935 | Bahram | F. Fox | 1996 | Shaamit | M. Hills |
| 1815 | Whisker | 1876 | Kisber | 1936 | Mahmoud | C. Smirke | 1997 | Benny The Dip | W. Ryan |
| 1816 | Prince Leopold | 1877 | Silvio | 1937 | Mid-day Sun | M. Beary | 1998 | High-Rise | O. Peslier |
| 1817 | Azor | 1878 | Sefton | 1938 | Bois Roussel | C. Elliott | 1999 | Oath | K. Fallon |
| 1818 | Sam | 1879 | Sir Bevys | 1939 | Blue Peter | E. Smith | 2000 | Sinndar | J. Murtaugh |
| 1819 | Tiresias | 1880 | Bend Or | 1940 | Pont l'Eveque | S. Wragg | 2001 | Galileo | M. Kinane |
| 1820 | Sailor | 1881 | Iroquois | 1941† | Owen Tudor | W. Nevett | 2002 | High Chaparral | J. Murtagh |
| 1821 | Gustavus | 1882 | Shotover | 1942† | Watling Street | H. Wragg | 2003 | Kris Kin | K. Fallon |
| 1822 | Moses | 1883 | St. Blaise | 1943† | Straight Deal | T. Carey | 2004 | North Light | K. Fallon |
| 1823 | Emilius | 1884* | St. Gatien | 1944† | Ocean Swell | W. Nevett | | | |
| 1824 | Cedric | | Harvester | 1945† | Dante | W. Nevett | | | |
| 1825 | Middleton | 1885 | Melton | 1946 | Airborne | T. Lowrey | | | |
| 1826 | Lapdog | 1886 | Ormonde | 1947 | Pearl Diver | G. Bridgland | | | |
| 1827 | Mameluke | 1887 | Merry Hampton | 1948 | My Love | W. Johnstone | | | |
| 1828 | Cadland | 1888 | Ayrshire | 1949 | Nimbus | C. Elliott | | | |
| 1829 | Frederick | 1889 | Donovan | 1950 | Galcador | W.R. Johnstone | | | |
| 1830 | Priam | 1890 | Sainfoin | 1951 | Arctic Prince | C. Spares | | | |
| 1831 | Spaniel | 1891 | Common | 1952 | Tulyar | C. Smirke | | | |
| 1832 | St. Giles | 1892 | Sir Hugo | 1953 | Pinza | G. Richards | | | |
| 1833 | Dangerous | 1893 | Isinglass | 1954 | Never Say Die | L. Piggott | | | |
| 1834 | Plenipotentiary | 1894 | Ladas | 1955 | Phil Drake | F. Palmer | | | |
| 1835 | Mündig | 1895 | Sir Visto | 1956 | Lavandin | W.R. Johnstone | | | |
| 1836 | Bay Middleton | 1896 | Persimmon | 1957 | Crepello | L. Piggott | | | |
| 1837 | Phosphorus | 1897 | Galtee More | 1958 | Hard Ridden | C. Smirke | | | |
| 1838 | Amato | 1898 | Jeddah | 1959 | Parthia | W. Carr | | | |
| 1839 | Bloomsbury | 1899 | Flying Fox | 1960 | St. Paddy | L. Piggott | | | |
| 1840 | Little Wonder | 1900 | Diamond Jubilee | 1961 | Psidium | R. Poincelet | | | |

*Dead heat. †Races held at Newmarket. ‡Record time—2 min 12 s.

## The St. Leger

| year | horse | year | horse | year | horse | jockey | year | horse | jockey |
|---|---|---|---|---|---|---|---|---|---|
| 1776 | Allabaculia | 1838 | Don John | 1900 | Diamond Jubilee | H. Jones | 1962 | Hethersett | W. Carr |
| 1777 | Bourbon | 1839 | Charles XII | 1901 | Doricles | K. Cannon | 1963 | Ragusa | G. Bougoure |
| 1778 | Hollandaise | 1840 | Launcelot | 1902 | Sceptre | F. Hardy | 1964 | Indiana | J. Lindley |
| 1779 | Tommy | 1841 | Satirist | 1903 | Rock Sand | D. Maher | 1965 | Provoke | J. Mercer |
| 1780 | Ruler | 1842 | Blue Bonnet | 1904 | Pretty Polly | W. Lane | 1966 | Sodium | F. Durr |
| 1781 | Serina | 1843 | Nutwith | 1905 | Challacombe | O. Madden | 1967 | Ribocco | L. Piggott |
| 1782 | Imperatrix | 1844 | Faugh-a-Ballagh | 1906 | Trout Beck | G. Stern | 1968 | Ribero | L. Piggott |
| 1783 | Phenomenon | 1845 | The Baron | 1907 | Wool Winder | W. Halsey | 1969 | Intermezzo | R. Hutchinson |
| 1784 | Omphale | 1846 | Sir Tatton Sykes | 1908 | Your Majesty | W. Griggs | 1970 | Nijinsky | L. Piggott |
| 1785 | Cowslip | 1847 | Van Tromp | 1909 | Bayardo | D. Maher | 1971 | Athens Wood | L. Piggott |
| 1786 | Paragon | 1848 | Surplice | 1910 | Swynford | F. Wootton | 1972 | Boucher | L. Piggott |
| 1787 | Spadille | 1849 | The Flying Dutchman | 1911 | Prince Palatine | F. O'Neill | 1973 | Peleid | F. Durr |
| 1788 | Young Flora | 1850 | Voltigeur | 1912 | Tracery | G. Bellhouse | 1974 | Bustino | J. Mercer |
| 1789 | Powett | 1851 | Newminster | 1913 | Night Hawk | E. Wheatley | 1975 | Bruni | A. Murray |
| 1790 | Ambidexter | 1852 | Stockwell | 1914 | Black Jester | W. Griggs | 1976 | Crow | Y. Saint-Martin |
| 1791 | Young Traveller | 1853 | West Australian | 1915* | Pommern | S. Donoghue | 1977 | Dunfermline | W. Carson |
| 1792 | Tartar | 1854 | Knight of St. George | 1916* | Hurry On | C. Childs | 1978 | Julio Mariner | E. Hide |
| 1793 | Ninety-three | 1855 | Saucebox | 1917* | Gay Crusader | S. Donoghue | 1979 | Son of Love | A. Lequeux |
| 1794 | Beningbrough | 1856 | Warlock | 1918* | Gainsborough | J. Childs | 1980 | Light Cavalry | J. Mercer |
| 1795 | Hambletonian | 1857 | Impérieuse | 1919 | Keysoe | B. Carslake | 1981 | Cut Above | J. Mercer |
| 1796 | Ambrosio | 1858 | Sunbeam | 1920 | Caligula | A. Smith | 1982 | Touching Wood | P. Cook |
| 1797 | Lounger | 1859 | Gamester | 1921 | Polemarch | J. Childs | 1983 | Sun Princess | W. Carson |
| 1798 | Symmetry | 1860 | St. Albans | 1922 | Royal Lancer | R. Jones | 1984 | Comanche Run | L. Piggott |
| 1799 | Cockfighter | 1861 | Caller Ou | 1923 | Tranquil | T. Weston | 1985 | Oh So Sharp | S. Cauthen |
| 1800 | Champion | 1862 | The Marquis | 1924 | Salmon-Trout | B. Carslake | 1986 | Moon Madness | P. Eddery |
| 1801 | Quiz | 1863 | Lord Clifden | 1925 | Solario | J. Childs | 1987 | Reference Point | S. Cauthen |
| 1802 | Orville | 1864 | Blair Athol | 1926† | Coronach | J. Childs | 1988 | Minster Son | W. Carson |
| 1803 | Remembrancer | 1865 | Gladiateur | 1927 | Book Law | H. Jelliss | 1989 | Michelozzo | S. Cauthen |
| 1804 | Sancho | 1866 | Lord Lyon | 1928 | Fairway | T. Weston | 1990 | Snurge | R. Quinn |
| 1805 | Staveley | 1867 | Achievement | 1929 | Trigo | M. Beary | 1991 | Toulon | P. Eddery |
| 1806 | Fyldener | 1868 | Formosa | 1930 | Singapore | G. Richards | 1992 | User Friendly | G. Duffield |
| 1807 | Paulina | 1869 | Pero Gomez | 1931 | Sandwich | H. Wragg | 1993 | Bob's Return | P. Robinson |
| 1808 | Petronius | 1870 | Hawthornden | 1932 | Firdaussi | F. Fox | 1994 | Moonax | P. Eddery |
| 1809 | Ashton | 1871 | Hannah | 1933 | Hyperion | T. Weston | 1995 | Classic Cliché | L. Dettori |
| 1810 | Octavian | 1872 | Wenlock | 1934† | Windsor Lad | C. Smirke | 1996 | Shantou | F. Dettori |
| 1811 | Soothsayer | 1873 | Marie Stuart | 1935 | Bahram | C. Smirke | 1997 | Silver Patriarch | P. Eddery |
| 1812 | Ottrington | 1874 | Apology | 1936 | Boswell | P. Beasley | 1998 | Nedawi | J. Reid |
| 1813 | Altisidora | 1875 | Craig Millar | 1937 | Chulmleigh | G. Richards | 1999 | Mutafaweq | R. Hills |
| 1814 | William | 1876 | Petrarch | 1938 | Scottish Union | B. Carslake | 2000 | Millenary | R. Quinn |
| 1815 | Filho da Puta | 1877 | Silvio | 1939 | no race held | | 2001 | Milan | M. Kinane |
| 1816 | The Duchess | 1878 | Jannette | 1940* | Turkhan | G. Richards | 2002 | Bollin Eric | K. Darley |
| 1817 | Ebor | 1879 | Rayon d'Or | 1941* | Sun Castle | G. Bridgland | 2003 | Brian Boru | J. Spencer |
| 1818 | Reveller | 1880 | Robert the Devil | 1942* | Sun Chariot | G. Richards | 2004 | Rule of Law | K. McEvoy |
| 1819 | Antonio | 1881 | Iroquois | 1943* | Herringbone | H. Wragg | | | |
| 1820 | St. Patrick | 1882 | Dutch Oven | 1944* | Tehran | G. Richards | | | |
| 1821 | Jack Spigot | 1883 | Ossian | 1945 | Chamossaire | T. Lowrey | | | |
| 1822 | Theodore | 1884 | The Lambkin | 1946* | Airborne | T. Lowrey | | | |
| 1823 | Barefoot | 1885 | Melton | 1947 | Sayajirao | E. Britt | | | |
| 1824 | Jerry | 1886 | Ormonde | 1948 | Black Tarquin | E. Britt | | | |
| 1825 | Memnon | 1887 | Kilwarlin | 1949 | Ridge Wood | M. Beary | | | |
| 1826 | Tarrare | 1888 | Seabreeze | 1950 | Scratch II | W.R. Johnstone | | | |
| 1827 | Matilda | 1889 | Donovan | 1951 | Talma II | W.R. Johnstone | | | |
| 1828 | The Colonel | 1890 | Memoir | 1952 | Tulyar | C. Smirke | | | |
| 1829 | Rowton | 1891 | Common | 1953 | Premonition | E. Smith | | | |
| 1830 | Birmingham | 1892 | La Flèche | 1954 | Never Say Die | C. Smirke | | | |
| 1831 | Chorister | 1893 | Isinglass | 1955 | Meld | W. Carr | | | |
| 1832 | Margrave | 1894 | Throstle | 1956 | Cambremer | F. Palmer | | | |
| 1833 | Rockingham | 1895 | Sir Visto | 1957 | Ballymoss | T.P. Burns | | | |
| 1834 | Touchstone | 1896 | Persimmon | 1958 | Alcide | W. Carr | | | |
| 1835 | Queen of Trumps | 1897 | Galtee More | 1959 | Cantelo | E. Hide | | | |
| 1836 | Elis | 1898 | Wildfowler | 1960 | St. Paddy | L. Piggott | | | |
| 1837 | Mango | 1899 | Flying Fox | 1961 | Aurelius | L. Piggott | | | |

*Race held at Newmarket. †Record time—3 min 1⅘ s; tied in 1934.

## Triple Crown champions—British

| year | winner |
|---|---|
| 1853 | West Australian |
| 1865 | Gladiateur |
| 1866 | Lord Lyon |
| 1886 | Ormonde |
| 1891 | Common |
| 1893 | Isinglass |
| 1897 | Galtee More |
| 1899 | Flying Fox |
| 1900 | Diamond Jubilee |
| 1903 | Rock Sand |
| 1915 | Pommern |
| 1917 | Gay Crusader |
| 1918 | Gainsborough |
| 1935 | Bahram |
| 1970 | Nijinsky |



Willy Carson guiding Nashwan to win the 2,000 Guineas in 1989

Sporting Pictures (UK) Ltd

**2,000 Guineas (1809–99)**

| year | horse | year | horse | year | horse | year | horse | year | horse | year | horse | year | horse |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1809 | Wizard | 1822 | Pastille | 1835 | Ibrahim | 1848 | Flatcatcher | 1861 | Diophantus | 1874 | Atlantic | 1887 | Enterprise |
| 1810 | Hephestion | 1823 | Nicolo | 1836 | Bay Middleton | 1849 | Nunnykirk | 1862 | The Marquis | 1875 | Camballo | 1888 | Ayrshire |
| 1811 | Trophonius | 1824 | Schahriar | 1837 | Achmet | 1850 | Pitsford | 1863 | Macaroni | 1876 | Petrarch | 1889 | Enthusiast |
| 1812 | Cwrw | 1825 | Enamel | 1838 | Grey Momus | 1851 | Hernandez | 1864 | General Peel | 1877 | Chamant | 1890 | Surefoot |
| 1813 | Smolensko | 1826 | Dervise | 1839 | The Corsair | 1852 | Stockwell | 1865 | Gladiateur | 1878 | Pilgrimage | 1891 | Common |
| 1814 | Olive | 1827 | Turcoman | 1840 | Crucifix | 1853 | West Australian | 1866 | Lord Lyon | 1879 | Charibert | 1892 | Bonavista |
| 1815 | Tigris | 1828 | Cadland | 1841 | Ralph | 1854 | The Hermit | 1867 | Vauban | 1880 | Petronel | 1893 | Isinglass |
| 1816 | Nectar | 1829 | Patron | 1842 | Meteor | 1855 | Lord of the Isles | 1868* | Moslem | 1881 | Peregrine | 1894 | Ladas |
| 1817 | Manfred | 1830 | Augustus | 1843 | Cotherstone | 1856 | Fazzoletto | 1869 | Pretender | 1882 | Shotover | 1895 | Kirkconnel |
| 1818 | Interpreter | 1831 | Riddlesworth | 1844 | The Ugly Buck | 1857 | Vedette | 1870 | Macgregor | 1883 | Galliard | 1896 | St. Frusquin |
| 1819 | Antar | 1832 | Archibald | 1845 | Idas | 1858 | Fitz Roland | 1871 | Bothwell | 1884 | Scot Free | 1897 | Galtee More |
| 1820 | Pindarrie | 1833 | Clearwell | 1846 | Sir Tatton Sykes | 1859 | Promised Land | 1872 | Prince Charlie | 1885 | Paradox | 1898 | Disraeli |
| 1821 | Reginald | 1834 | Glencoe | 1847 | Conyngham | 1860 | The Wizard | 1873 | Gang Forward | 1886 | Ormonde | 1899 | Flying Fox |

**2,000 Guineas (1900–present)**

| year | horse | jockey | year | horse | jockey | year | horse | jockey | year | horse | jockey |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1900 | Diamond Jubilee | H. Jones | 1928 | Flamingo | C. Elliott | 1956 | Gilles de Retz | F. Barlow | 1984 | El Gran Señor | P. Eddery |
| 1901 | Handicapper | W. Halsey | 1929 | Mr. Jinks | H. Beasley | 1957 | Crepello | L. Piggott | 1985 | Shadeed | L. Piggott |
| 1902 | Sceptre | H. Randall | 1930 | Diolite | F. Fox | 1958 | Pall Mall | D. Smith | 1986 | Dancing Brave | G. Starkey |
| 1903 | Rock Sand | J. Martin | 1931 | Cameronian | J. Childs | 1959 | Taboun | G. Moore | 1987 | Don't Forget Me | W. Carson |
| 1904 | St. Amant | K. Cannon | 1932 | Orwell | R. Jones | 1960 | Martial | R. Hutchinson | 1988 | Doyoun | W. Swinburn |
| 1905 | Vedas | H. Jones | 1933 | Rodosto | R. Brethes | 1961 | Rockavon | N. Stirk | 1989 | Nashwan | W. Carson |
| 1906 | Gorgos | H. Jones | 1934 | Colombo | W. Johnstone | 1962 | Privy Councillor | W. Rickaby | 1990 | Tirol | M. Kinane |
| 1907 | Slieve Gallion | W. Higgs | 1935 | Bahram | F. Fox | 1963 | Only for Life | J. Lindley | 1991 | Mystiko | M. Roberts |
| 1908 | Norman III | O. Madden | 1936 | Pay Up | R. Dick | 1964 | Baldric II | W. Pyers | 1992 | Rodrigo de Triano | L. Piggott |
| 1909 | Minoru | H. Jones | 1937 | Le Ksar | C. Semblat | 1965 | Niksar | D. Keith | 1993 | Zafonic | P. Eddery |
| 1910 | Neil Gow | D. Maher | 1938 | Bois Roussel | G. Richards | 1966 | Kashmir II | J. Lindley | 1994 | Mister Baileys | J. Weaver |
| 1911 | Sunstar | G. Stern | 1939 | Blue Peter | E. Smith | 1967 | Royal Palace | G. Moore | 1995 | Pennekamp | T. Jarnet |
| 1912 | Sweeper II | D. Maher | 1940 | Djebel | C. Elliott | 1968 | Sir Ivor | L. Piggott | 1996 | Mark of Esteem | F. Dettori |
| 1913 | Louvois | J. Reiff | 1941 | Lambert Simnel | C. Elliott | 1969 | Right Tack | G. Lewis | 1997 | Entrepreneur | M. Kinane |
| 1914 | Kennymore | G. Stern | 1942 | Big Game | G. Richards | 1970 | Nijinsky | L. Piggott | 1998 | King of Kings | M. Kinane |
| 1915 | Pommern | S. Donoghue | 1943 | Kingsway | S. Wragg | 1971 | Brigadier Gerard | J. Mercer | 1999 | Island Sands | L. Dettori |
| 1916 | Clarissimus | J. Clark | 1944 | Garden Path | H. Wragg | 1972 | High Top | W. Carson | 2000 | King's Best | K. Fallon |
| 1917 | Gay Crusader | S. Donoghue | 1945 | Court Martial | C. Richards | 1973 | Mon Fils | F. Durr | 2001 | Golan | K. Fallon |
| 1918 | Gainsborough | J. Childs | 1946 | Happy Knight | T. Weston | 1974 | Nonoalco | Y. Saint-Martin | 2002 | Rock of Gibraltar | J. Murtagh |
| 1919 | The Panther | R. Cooper | 1947 | Tudor Minstrel | G. Richards | 1975 | Bolkonski | G. Dettori | 2003 | Refuse To Bend | P. Smullen |
| 1920 | Tetratema | B. Carslake | 1948† | My Babu | C. Smirke | 1976 | Wollow | G. Dettori | 2004 | Haafhd | R. Hills |
| 1921 | Craig An Eran | J. Brennan | 1949 | Nimbus | C. Elliott | 1977 | Nebbiolo | G. Curran | | | |
| 1922 | St. Louis | G. Archibald | 1950 | Palestine | C. Smirke | 1978 | Roland Gardens | F. Durr | | | |
| 1923 | Ellangowan | C. Elliott | 1951 | Ki Ming | A. Breasley | 1979 | Tap on Wood | S. Cauthen | | | |
| 1924 | Diophon | G. Hulme | 1952 | Thunderhead II | R. Poincelet | 1980 | Known Fact | W. Carson | | | |
| 1925 | Manna | S. Donoghue | 1953 | Nearula | E. Britt | 1981 | To-Agori-Mou | G. Starkey | | | |
| 1926 | Colorado | T. Weston | 1954 | Darius | E. Mercer | 1982 | Zino | F. Head | | | |
| 1927 | Adam's Apple | J. Leach | 1955 | Our Babu | D. Smith | 1983 | Lomond | P. Eddery | | | |

*Won in walk-over after dead heat with Formosa. †Record time—1 min 35⅘ s.

*The American Thoroughbred classics.* The Kentucky Derby, a Triple Crown event and perhaps the best known of American horse races, is raced at Churchill Downs in Louisville, Ky., over a 10-furlong (1¼-mile) track. Another of the Triple Crown classics, the Preakness Stakes, was instituted in 1873; it is run over 9½ furlongs (1³⁄₁₆ miles) at Pimlico Race Track in Baltimore, Md. The third Triple Crown event is the 12-furlong (1½-mile) Belmont Stakes, established in 1867. It is run at Belmont Park Race Track, Long Island, N.Y. All three events are for 3-year-old horses.

**The Kentucky Derby**

| year | horse | jockey | year | horse | jockey | year | horse | jockey | year | horse | jockey |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1875 | Aristides | O. Lewis | 1909 | Wintergreen | V. Powers | 1943 | Count Fleet | J. Longden | 1977 | Seattle Slew | J. Cruguet |
| 1876 | Vagrant | B. Swim | 1910 | Donau | F. Herbert | 1944 | Pensive | C. McCreary | 1978 | Affirmed | S. Cauthen |
| 1877 | Baden-Baden | W. Walker | 1911 | Meridian | G. Archibald | 1945 | Hoop Jr. | E. Arcaro | 1979 | Spectacular Bid | R. Franklin |
| 1878 | Day Star | J. Carter | 1912 | Worth | C.H. Shilling | 1946 | Assault | W. Mehrtens | 1980 | Genuine Risk | J. Vasquez |
| 1879 | Lord Murphy | C. Shauer | 1913 | Donerail | R. Goose | 1947 | Jet Pilot | E. Guerin | 1981 | Pleasant Colony | J. Velasquez |
| 1880 | Fonso | G. Lewis | 1914 | Old Rosebud | J. McCabe | 1948 | Citation | E. Arcaro | 1982 | Gato del Sol | E. Delahoussaye |
| 1881 | Hindoo | J. McLaughlin | 1915 | Regret | J. Nolter | 1949 | Ponder | S. Brooks | 1983 | Sunny's Halo | E. Delahoussaye |
| 1882 | Apollo | B. Hurd | 1916 | George Smith | J. Loftus | 1950 | Middleground | W. Boland | 1984 | Swale | L. Pincay |
| 1883 | Leonatus | W. Donohue | 1917 | Omar Khayyam | C. Borel | 1951 | Count Turf | C. McCreary | 1985 | Spend a Buck | A. Cordero, Jr. |
| 1884 | Buchanan | I. Murphy | 1918 | Exterminator | W. Knapp | 1952 | Hill Gail | E. Arcaro | 1986 | Ferdinand | W. Shoemaker |
| 1885 | Joe Cotton | E. Henderson | 1919 | Sir Barton | J. Loftus | 1953 | Dark Star | H. Moreno | 1987 | Alysheba | C. McCarron |
| 1886 | Ben Ali | P. Duffy | 1920 | Paul Jones | T. Rice | 1954 | Determine | R. York | 1988 | Winning Colors | G. Stevens |
| 1887 | Montrose | L. Lewis | 1921 | Behave Yourself | C. Thompson | 1955 | Swaps | W. Shoemaker | 1989 | Sunday Silence | P. Valenzuela |
| 1888 | Macbeth II | G. Covington | 1922 | Morvich | A. Johnson | 1956 | Needles | D. Erb | 1990 | Unbridled | C. Perret |
| 1889 | Spokane | T. Kiley | 1923 | Zev | E. Sande | 1957 | Iron Liege | W. Hartack | 1991 | Strike the Gold | C. Antley |
| 1890 | Riley | I. Murphy | 1924 | Black Gold | J.D. Mooney | 1958 | Tim Tam | I. Valenzuela | 1992 | Lil E. Tee | P. Day |
| 1891 | Kingman | I. Murphy | 1925 | Flying Ebony | E. Sande | 1959 | Tomy Lee | W. Shoemaker | 1993 | Sea Hero | J. Bailey |
| 1892 | Azra | A. Clayton | 1926 | Bubbling Over | A. Johnson | 1960 | Venetian Way | W. Hartack | 1994 | Go For Gin | C. McCarron |
| 1893 | Lookout | E. Kunze | 1927 | Whiskery | L. McAtee | 1961 | Carry Back | J. Sellers | 1995 | Thunder Gulch | G. Stevens |
| 1894 | Chant | F. Goodale | 1928 | Reigh Count | C. Lang | 1962 | Decidedly | W. Hartack | 1996 | Grindstone | J. Bailey |
| 1895 | Halma | J. Perkins | 1929 | Clyde Van Dusen | L. McAtee | 1963 | Chateaugay | B. Baeza | 1997 | Silver Charm | G. Stevens |
| 1896 | Ben Brush | W. Simms | 1930 | Gallant Fox | E. Sande | 1964 | Northern Dancer | W. Hartack | 1998 | Real Quiet | K. Desormeaux |
| 1897 | Typhoon II | F. Garner | 1931 | Twenty Grand | C. Kurtsinger | 1965 | Lucky Debonair | W. Shoemaker | 1999 | Charismatic | C. Antley |
| 1898 | Plaudit | W. Simms | 1932 | Burgoo King | E. James | 1966 | Kauai King | D. Brumfield | 2000 | Fusaichi Pegasus | K. Desormeaux |
| 1899 | Manuel | F. Taral | 1933 | Brokers Tip | D. Meade | 1967 | Proud Clarion | R. Ussery | 2001 | Monarchos | J. Chavez |
| 1900 | Lieut. Gibson | J. Boland | 1934 | Cavalcade | M. Garner | 1968 | Dancer's Image | I. Valenzuela | 2002 | War Emblem | V. Espinoza |
| 1901 | His Eminence | J. Winkfield | 1935 | Omaha | W. Saunders | 1969 | Majestic Prince | W. Hartack | 2003 | Funny Cide | J. Santos |
| 1902 | Alan-a-Dale | J. Winkfield | 1936 | Bold Venture | I. Hanford | 1970 | Dust Commander | M. Manganello | 2004 | Smarty Jones | S. Elliott |
| 1903 | Judge Himes | H. Booker | 1937 | War Admiral | C. Kurtsinger | 1971 | Canonero II | G. Avila | | | |
| 1904 | Elwood | F. Prior | 1938 | Lawrin | E. Arcaro | 1972 | Riva Ridge | R. Turcotte | | | |
| 1905 | Agile | J. Martin | 1939 | Johnstown | J. Scout | 1973† | Secretariat | R. Turcotte | | | |
| 1906 | Sir Huon | R. Troxler | 1940 | Gallahadion | C. Bierman | 1974 | Cannonade | A. Cordero, Jr. | | | |
| 1907 | Pink Star | A. Minder | 1941 | Whirlaway | E. Arcaro | 1975 | Foolish Pleasure | J. Vasquez | | | |
| 1908 | Stone Street | A. Pickens | 1942 | Shut Out | W.D. Wright | 1976 | Bold Forbes | A. Cordero, Jr. | | | |

*Dancer's Image disqualified but later reinstated. †Fastest time—1 min 59⅘ s. No other horse has raced the Derby in less than 2 min.

**The Preakness Stakes**

| year | horse | jockey | year | horse | jockey | year | horse | jockey | year | horse | jockey |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1873 | Survivor | G. Barbee | 1909 | Effendi | W. Doyle | 1941 | Whirlaway | E. Arcaro | 1974 | Little Current | M. Rivera |
| 1874 | Culpepper | W. Donohue | 1910 | Layminster | R. Estep | 1942 | Alsab | B. James | 1975 | Master Derby | D. McHargue |
| 1875 | Tom Ochiltree | L. Hughes | 1911 | Watervale | E. Dugan | 1943 | Count Fleet | J. Longden | 1976 | Elocutionist | J. Lively |
| 1876 | Shirley | G. Barbee | 1912 | Colonel Holloway | C. Turner | 1944 | Pensive | C. McCreary | 1977 | Seattle Slew | J. Cruguet |
| 1877 | Cloverbrook | C. Holloway | 1913 | Buskin | J. Butwell | 1945 | Polynesian | W.D. Wright | 1978 | Affirmed | S. Cauthen |
| 1878 | Duke of Magenta | C. Holloway | 1914 | Holiday | A. Schuttinger | 1946 | Assault | W. Mehrtens | 1979 | Spectacular Bid | R. Franklin |
| 1879 | Harold | L. Hughes | 1915 | Rhine Maiden | D. Hoffman | 1947 | Faultless | D. Dodson | 1980 | Codex | A. Cordero, Jr. |
| 1880 | Grenada | L. Hughes | 1916 | Damrosch | L. McAtee | 1948 | Citation | E. Arcaro | 1981 | Pleasant Colony | J. Velasquez |
| 1881 | Saunterer | T. Costello | 1917 | Kalitan | Ev. Haynes | 1949 | Capot | T. Atkinson | 1982 | Aloma's Ruler | J. Kaenel |
| 1882 | Vanguard | T. Costello | 1918† | War Cloud | J. Loftus | 1950 | Hill Prince | E. Arcaro | 1983 | Deputed Testamony | D. Miller |
| 1883 | Jacobus | G. Barbee | | Jack Hare, Jr. | C. Peak | 1951 | Bold | E. Arcaro | 1984 | Gate Dancer | A. Cordero, Jr. |
| 1884 | Knight of Ellerslie | Fisher | 1919 | Sir Barton | J. Loftus | 1952 | Blue Man | C. McCreary | 1985‡ | Tank's Prospect | P. Day |
| 1885 | Tucumseh | W. Donohue | 1920 | Man o' War | C. Kummer | 1953 | Native Dancer | E. Guerin | 1986 | Snow Chief | A. Solis |
| 1886 | The Bard | Fisher | 1921 | Broomspun | F. Coltiletti | 1954 | Hasty Road | E. Arcaro | 1987 | Alysheba | C. McCarron |
| 1887 | Dunboyne | W. Donohue | 1922 | Pillory | L. Morris | 1955 | Nashua | W. Hartack | 1988 | Risen Star | E. Delahoussaye |
| 1888 | Refund | F. Littlefield | 1923 | Vigil | B. Marinelli | 1956 | Fabius | E. Arcaro | 1989 | Sunday Silence | P. Valenzuela |
| 1889 | Buddhist | Anderson | 1924 | Nellie Morse | J. Merimee | 1957 | Bold Ruler | I. Valenzuela | 1990 | Summer Squall | P. Day |
| 1890 | Montague | W. Martin | 1925 | Coventry | C. Kummer | 1958 | Tim Tam | J. Adams | 1991 | Hansel | J. Bailey |
| 1894* | Assignee | F. Taral | 1926 | Display | J. Maiben | 1959 | Royal Orbit | W. Harmatz | 1992 | Pine Bluff | C. McCarron |
| 1895 | Belmar | F. Taral | 1927 | Bostonian | A. Abel | 1960 | Bally Ache | R. Ussery | 1993 | Prairie Bayou | M. Smith |
| 1896 | Margrave | H. Griffin | 1928 | Victorian | R. Workman | 1961 | Carry Back | J. Sellers | 1994 | Tabasco Cat | P. Day |
| 1897 | Paul Kauvar | Thorpe | 1929 | Dr. Freeland | L. Schaefer | 1962 | Greek Money | J.L. Rotz | 1995 | Timber Country | P. Day |
| 1898 | Sly Fox | W. Simms | 1930 | Gallant Fox | E. Sande | 1963 | Candy Spots | W. Shoemaker | 1996 | Louis Quatorze | P. Day |
| 1899 | Half Time | R. Clawson | 1931 | Mate | G. Ellis | 1964 | Northern Dancer | W. Hartack | 1997 | Silver Charm | G. Stevens |
| 1900 | Hindus | H. Spencer | 1932 | Burgoo King | E. James | 1965 | Tom Rolfe | R. Turcotte | 1998 | Real Quiet | K. Desormeaux |
| 1901 | The Parader | Landry | 1933 | Head Play | C. Kurtsinger | 1966 | Kauai King | D. Brumfield | 2000 | Charismatic | C. Antley |
| 1902 | Old England | L. Jackson | 1934 | High Quest | R. Jones | 1967 | Damascus | W. Shoemaker | 2000 | Red Bullet | J. Bailey |
| 1903 | Flocarline | W. Gannon | 1935 | Omaha | W. Saunders | 1968 | Forward Pass | I. Valenzuela | 2001 | Point Given | G. Stevens |
| 1904 | Bryn Mawr | E. Hildebrand | 1936 | Bold Venture | G. Woolf | 1969 | Majestic Prince | W. Hartack | 2002 | War Emblem | V. Espinoza |
| 1905 | Cairngorm | W. Davis | 1937 | War Admiral | C. Kurtsinger | 1970 | Personality | E. Belmonte | 2003 | Funny Cide | J. Santos |
| 1906 | Whimsical | W. Miller | 1938 | Daubet | M. Peters | 1971 | Canonero II | G. Avila | 2004 | Smarty Jones | S. Elliott |
| 1907 | Don Enrique | G. Mountain | 1939 | Challedon | G. Seabo | 1972 | Bee Bee Bee | E. Nelson | | | |
| 1908 | Royal Tourist | E. Dugan | 1940 | Bimelech | F.A. Smith | 1973 | Secretariat | R. Turcotte | | | |

*No competition 1891–93. †Run in two divisions in 1918 because of the large number of starters. ‡Fastest time—1 min 53⅕ s.

**The Belmont Stakes**

| year | horse | jockey | year | horse | jockey | year | horse | jockey | year | horse | jockey |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1867 | Ruthless | J. Gilpatrick | 1901 | Commando | H. Spencer | 1937 | War Admiral | C. Kurtsinger | 1971 | Pass Catcher | W. Blum |
| 1868 | General Duke | B. Swim | 1902 | Masterman | J. Bullman | 1938 | Pasteurized | J. Stout | 1972 | Riva Ridge | R. Turcotte |
| 1869 | Fenian | C. Miller | 1903 | Africander | J. Bullman | 1939 | Johnstown | J. Stout | 1973† | Secretariat | R. Turcotte |
| 1870 | Kingfisher | W. Dick | 1904 | Delhi | G. Odom | 1940 | Bimelech | F.A. Smith | 1974 | Little Current | M. Rivera |
| 1871 | Harry Bassett | W. Miller | 1905 | Tanya | E. Hildebrand | 1941 | Whirlaway | E. Arcaro | 1975 | Avatar | W. Shoemaker |
| 1872 | Joe Daniels | J. Roe | 1906 | Burgomaster | L. Lyne | 1942 | Shut Out | E. Arcaro | 1976 | Bold Forbes | A. Cordero, Jr. |
| 1873 | Springbok | J. Roe | 1907 | Peter Pan | G. Mountain | 1943 | Count Fleet | J. Longden | 1977 | Seattle Slew | J. Cruguet |
| 1874 | Saxon | G. Barbee | 1908 | Colin | J. Notter | 1944 | Bounding Home | G.L. Smith | 1978 | Affirmed | S. Cauthen |
| 1875 | Calvin | B. Swim | 1909 | Joe Madden | E. Dugan | 1945 | Pavot | E. Arcaro | 1979 | Coastal | R. Hernandez |
| 1876 | Algerine | B. Donohue | 1910 | Sweep | J. Butwell | 1946 | Assault | W. Mehrtens | 1980 | Temperence Hill | E. Maple |
| 1877 | Cloverbrook | C. Holloway | 1913* | Prince Eugene | R. Troxler | 1947 | Phalanx | R. Donoso | 1981 | Summing | G. Martens |
| 1878 | Duke of Magenta | L. Hughes | 1914 | Luke McLuke | M. Buxton | 1948 | Citation | E. Arcaro | 1982 | Conquistador Cielo | L. Pincay |
| 1879 | Spendthrift | G. Evamns | 1915 | The Finn | G. Byrne | 1949 | Capot | T. Atkinson | 1983 | Caveat | L. Pincay |
| 1880 | Grenada | L. Hughes | 1916 | Friar Rock | E. Haynes | 1950 | Middleground | W. Boland | 1984 | Swale | L. Pincay |
| 1881 | Saunterer | T. Costello | 1917 | Hourless | J. Butwell | 1951 | Counterpoint | D. Gorman | 1985 | Creme Fraiche | E. Maple |
| 1882 | Forester | J. McLaughlin | 1918 | Johren | F. Robinson | 1952 | One Count | E. Arcaro | 1986 | Danzig Connection | C. McCarron |
| 1883 | George Kinney | J. McLaughlin | 1919 | Sir Barton | J. Loftus | 1953 | Native Dancer | E. Guerin | 1987 | Bet Twice | C. Perret |
| 1884 | Panique | J. McLaughlin | 1920 | Man o' War | C. Kummer | 1954 | High Gun | E. Guerin | 1988 | Risen Star | E. Delahoussaye |
| 1885 | Tyrant | P. Duffy | 1921 | Grey Lag | E. Sande | 1955 | Nashua | E. Arcaro | 1989 | Easy Goer | P. Day |
| 1886 | Inspector B | J. McLaughlin | 1922 | Pillory | O.H. Miller | 1956 | Needles | D. Erb | 1990 | Go and Go | M. Kinane |
| 1887 | Hanover | J. McLaughlin | 1923 | Zev | E. Sande | 1957 | Gallant Man | W. Shoemaker | 1991 | Hansel | J. Bailey |
| 1888 | Sir Dixon | J. McLaughlin | 1924 | Mad Play | E. Sande | 1958 | Cavan | P. Anderson | 1992 | A.P. Indy | E. Delahoussaye |
| 1889 | Eric | W. Hayward | 1925 | American Flag | A. Johnson | 1959 | Sword Dancer | W. Shoemaker | 1993 | Colonial Affair | J. Krone |
| 1890 | Burlington | P. Barnes | 1926 | Crusader | A. Johnson | 1960 | Celtic Ash | W. Hartack | 1994 | Tabasco Cat | P. Day |
| 1891 | Foxford | E. Garrison | 1927 | Chance Shot | E. Sande | 1961 | Sherluck | B. Baeza | 1995 | Thunder Gulch | G. Stevens |
| 1892 | Patron | W. Hayward | 1928 | Vito | C. Kummer | 1962 | Jaipur | W. Shoemaker | 1996 | Editor's Note | R. Douglas |
| 1893 | Comanche | W. Simms | 1929 | Blue Larkspur | M. Garner | 1963 | Chateaugay | B. Baeza | 1997 | Touch Gold | C. McCarron |
| 1894 | Henry of Navarre | W. Simms | 1930 | Gallant Fox | E. Sande | 1964 | Quadrangle | M. Yzaza | 1998 | Victory Gallop | G. Stevens |
| 1895 | Belmar | F. Taral | 1931 | Twenty Grand | C. Kurtsinger | 1965 | Hail to All | J. Sellers | 1999 | Lemon Drop Kid | J. Santos |
| 1896 | Hastings | H. Griffin | 1932 | Faireno | T. Malley | 1966 | Amberoid | W. Boland | 2000 | Commendable | P. Day |
| 1897 | Scottish Chieftain | J. Sherrer | 1933 | Hurryoff | M. Garner | 1967 | Damascus | W. Shoemaker | 2001 | Point Given | G. Stevens |
| 1898 | Bowling Brook | F. Littlefield | 1934 | Peace Chance | W.D. Wright | 1968 | Stage Door Johnny | H. Gustines | 2002 | Sarava | E. Prado |
| 1899 | Jean Beraaud | R. Clawson | 1935 | Omaha | W. Saunders | 1969 | Arts and Letters | B. Baeza | 2003 | Empire Maker | J. Bailey |
| 1900 | Ildrim | N. Turner | 1936 | Granville | J. Stout | 1970 | High Echelon | J. Rotz | 2004 | Birdstone | E. Prado |

*No competition 1911–12. †Fastest time—2 min 24 s.

**Triple Crown champions—U.S.**

| year | horse |
|---|---|
| 1919 | Sir Barton |
| 1930 | Gallant Fox |
| 1935 | Omaha |
| 1937 | War Admiral |
| 1941 | Whirlaway |
| 1943 | Count Fleet |
| 1946 | Assault |
| 1948 | Citation |
| 1973 | Secretariat |
| 1977 | Seattle Slew |
| 1978 | Affirmed |



Secretariat pulling away to win the Preakness, the second race of his 1973 Triple Crown victory

Neil Leifer/Sports Illustrated

*Harness racing.* In the United States, the Hambletonian Trot is probably the most prestigious of harness races. It was established in 1926, was raced in New York and Illinois, and is now run at Meadowlands in New Jersey.

**The Hambletonian Trot**

| year | horse | driver | year | horse | driver |
|---|---|---|---|---|---|
| 1926 | Guy McKinney | N. Ray | 1967 | Speedy Streak | A. Cameron |
| 1927 | Iosot's Worthy | M. Childs | 1968 | Nevele Pride | S. Dancer |
| 1928 | Spencer | W.H. Lessee | 1969 | Lindys Pride | H. Beissinger |
| 1929 | Walter Dear | W. Cox | 1970 | Timothy T. | J. Simpson, Sr. |
| 1930 | Hanover's Bertha | T. Berry | 1971 | Speedy Crown | H. Beissinger |
| 1931 | Calumet Butler | R.D. McMahon | 1972 | Super Bowl | S. Dancer |
| 1932 | The Marchioness | W. Caton | 1973 | Flirth | R. Baldwin |
| 1933 | Mary Reynolds | B. White | 1974 | Christopher T. | W. Haughton |
| 1934 | Lord Jim | H.M. Parshall | 1975 | Bonefish | S. Dancer |
| 1935 | Greyhound | S.F. Palin | 1976 | Steve Lobell | W. Haughton |
| 1936 | Rosalind | B. White | 1977 | Green Speed | W. Haughton |
| 1937 | Shirley Hanover | H. Thomas | 1978 | Speedy Somolli | H. Beissinger |
| 1938 | McLin Hanover | H. Thomas | 1979 | Legend Hanover | G. Scholty |
| 1939 | Peter Astra | H.M. Parshall | 1980 | Burgomeister | W. Haughton |
| 1940 | Spencer Scott | F. Egan | 1981 | Shiaway St. Pat | R. Remmen |
| 1941 | Bill Gallon | L. Smith | 1982 | Speed Bowl | T. Haughton |
| 1942 | The Ambassador | B. White | 1983 | Duenna | S. Dancer |
| 1943 | Volo Song | B. White | 1984 | Historic Freight | B. Webster |
| 1944 | Yankee Maid | H. Thomas | 1985 | Prakas | B. O'Donnell |
| 1945 | Titan Hanover | H. Pownall, Sr. | 1986 | Nuclear Kosmos | U. Thoresen |
| 1946 | Chestertown | T. Berry | 1987 | Mack Lobell | J. Campbell |
| 1947 | Hoot Mon | S.F. Palin | 1988 | Armbro Goal | J. Campbell |
| 1948 | Demon Hanover | H. Scott | 1989* | Park Avenue Joe | R. Waples |
| 1949 | Miss Tilly | F. Egan | | Probe | W. Fahy |
| 1950 | Lusty Song | D. Miller | 1990 | Harmonius | J. Campbell |
| 1951 | Mainliner | G. Crippen | 1991 | Giant Victory | J. Moiseyev |
| 1952 | Sharp Note | B. Shively | 1992 | Alf Palema | M. McNicholl |
| 1953 | Helicopter | H. Harvey | 1993 | American Winner | R. Pierce |
| 1954 | Newport Dream | A. Cameron | 1994 | Victory Dream | M. Lachance |
| 1955 | Scott Frost | J. O'Brien | 1995 | Tagliabue | J. Campbell |
| 1956 | The Intruder | N. Bower | 1996 | Continentalvictory | M. Lachance |
| 1957 | Hickory Smoke | J. Simpson, Sr. | 1997 | Malabar Man | M. Burroughs |
| 1958 | Emily's Pride | F. Nipe | 1998 | Muscles Yankee | J. Campbell |
| 1959 | Diller Hanover | F. Ervin | 1999 | Self Possessed | M. Lachance |
| 1960 | Blaze Hanover | J. O'Brien | 2000 | Yankee Paco | T. Ritchie |
| 1961 | Harlan Dean | J. Arthur | 2001 | Scarlet Knight | S. Melander |
| 1962 | A.C.'s Viking | S. Russell | 2002 | Chip Chip Hooray | E. Ledford |
| 1963 | Speedy Scot | R. Baldwin | 2003 | Amigo Hall | M. Lachance |
| 1964 | Ayres | J. Simpson, Sr. | 2004 | Windsong's Legacy | T. Smedshammer |
| 1965 | Egyptian Candor | A. Cameron | | | |
| 1966 | Kerry Way | F. Ervin | | | |

*Tied.



Mack Lobell (number seven), being driven by John Campbell, pulling away at the start of the first heat of the 1987 Hambletonian Trot; the combined times of his two winning heats set a world record of 3:47⅘ sec

U.S. Trotting Association

*Australian Thoroughbred racing.* The Victoria Racing Club's Melbourne Cup, first run in 1861, is one of the world's great handicap races. The day on which it is held (the first Tuesday in November) is a public holiday in Melbourne.

**Melbourne Cup**

| year | horse | year | horse | jockey | year | horse | jockey | year | horse | jockey |
|---|---|---|---|---|---|---|---|---|---|---|
| 1861 | Archer | 1897 | Gaulus | | 1933 | Hall Mark | J. O'Sullivan | 1969 | Rain Lover | J. Johnson |
| 1862 | Archer | 1898 | The Grafter | | 1934 | Peter Pan | D. Munro | 1970 | Baghdad Note | E.J. Oldham |
| 1863 | Banker | 1899 | Merriwee | | 1935 | Marabou | K. Voitre | 1971 | Silver Knight | R.B. Marsh |
| 1864 | Lantern | 1900 | Clean Sweep | Richardson | 1936 | Wotan | O. Phillips | 1972 | Piping Lane | J. Letts |
| 1865 | Tory Boy | 1901 | Revenue | F. Dunn | 1937 | The Trump | A. Reed | 1973 | Gala Supreme | F. Reys |
| 1866 | The Barb | 1902 | The Victory | R. Lewis | 1938 | Catalogue | F. Shean | 1974 | Think Big | H. White |
| 1867 | Tim Whiffler | 1903 | Lord Cardigan | N. Godby | 1939 | Rivette | E. Preston | 1975 | Think Big | H. White |
| 1868 | Glencoe | 1904 | Acrasia | T. Clayton | 1940 | Old Rowley | A. Knox | 1976 | Van Der Hum | R.J. Skelton |
| 1869 | Warrior | 1905 | Blue Spec | F. Bullock | 1941 | Skipton | W. Cook | 1977 | Gold and Black | J. Duggan |
| 1870 | Nimblefoot | 1906 | Poseidon | T. Clayton | 1942 | Colonus | H. McCloud | 1978 | Arwon | H. White |
| 1871 | The Pearl | 1907 | Apologue | W. Evans | 1943 | Dark Felt | V. Hartney | 1979 | Hyperno | H. White |
| 1872 | The Quack | 1908 | Lord Nolan | J.R. Flynn | 1944 | Sirius | D. Munro | 1980 | Arwon | J. Letts |
| 1873 | Don Juan | 1909 | Prince Foote | W.H. McLachlan | 1945 | Rainbird | W. Cook | 1981 | Just a Dash | P. Cook |
| 1874 | Hariot | 1910 | Comedy King | W.H. McLachlan | 1946 | Russia | D. Munro | 1982 | Gurner's Lane | L. Dittman |
| 1875 | Wollomai | 1911 | The Parisian | R. Cameron | 1947 | Hiraji | J. Purtell | 1983 | Kiwi | J. Cassidy |
| 1876 | Briseis | 1912 | Piastre | A. Shanahan | 1948 | Rimfire | R. Neville | 1984 | Black Knight | P. Cook |
| 1877 | Chester | 1913 | Peoinatus | A. Shanahan | 1949 | Foxzarni | W. Fellows | 1985 | What a Nuisance | P. Hyland |
| 1878 | Calamai | 1914 | Kingsburgh | G. Meddick | 1950 | Comic Court | P. Glennon | 1986 | At Talaq | M. Clarke |
| 1879 | Darriwell | 1915 | Patrobus | R. Lewis | 1951 | Delta | N. Sellwood | 1987 | Kensei | L. Olsen |
| 1880 | Grand Flaneur | 1916 | Sasanof | F. Foley | 1952 | Dalray | W. Williamson | 1988 | Empire Rose | T. Allan |
| 1881 | Zulu | 1917 | Westcourt | W.H. McLachlan | 1953 | Wodalla | J. Purtell | 1989 | Tawrific | R.S. Dye |
| 1882 | The Assyrian | 1918 | Nightwatch | W. Duncan | 1954 | Rising Fast | J. Purtell | 1990 | Kingston Rule | D. Beadman |
| 1883 | Martini-Henri | 1919 | Artilleryman | R. Lewis | 1955 | Toparoa | N. Sellwood | 1991 | Let's Elope | S. King |
| 1884 | Malua | 1920 | Poitrel | K. Bracken | 1956 | Evening Peal | G. Podmore | 1992 | Subzero | G. Hall |
| 1885 | Sheet Anchor | 1921 | Sister Olive | E. O'Sullivan | 1957 | Straight Draw | N. McGrowdie | 1993 | Vintage Crop | M. Kinane |
| 1886 | Arsenal | 1922 | King Ingoda | A. Wilson | 1958 | Baradine | M. Schumacher | 1994 | Jeune | W. Harris |
| 1887 | Dunlop | 1923 | Bitalli | A. Wilson | 1959 | Macdougal | P. Glennon | 1995 | Doriemus | D. Oliver |
| 1888 | Mentor | 1924 | Backwood | P. Brown | 1960 | Hi Jinx | W.A. Smith | 1996 | Saintly | D. Beadman |
| 1889 | Bravo | 1925 | Windbag | J. Munro | 1961 | Lord Fury | R. Selkrig | 1997 | Might and Power | J. Cassidy |
| 1890 | Carbine | 1926 | Spearfelt | H. Cairns | 1962 | Even Stevens | L. Coles | 1998 | Jezabeel | C. Munce |
| 1891 | Malvolio | 1927 | Trivaive | R. Lewis | 1963 | Gatum Gatum | J. Johnson | 1999 | Rogan Josh | J. Marshall |
| 1892 | Glenloth | 1928 | Statesman | J. Munro | 1964 | Polo Prince | R. Taylor | 2000 | Brew | K. McEvoy |
| 1893 | Tarcoola | 1929 | Nightmarch | R. Reed | 1965 | Light Fingers | R. Higgins | 2001 | Ethereal | S. Seamer |
| 1894 | Patron | 1930 | Phar Lap | J.E. Pike | 1966 | Galilee | J. Miller | 2002 | Media Puzzle | D. Oliver |
| 1895 | Auraria | 1931 | White Nose | N. Percival | 1967 | Red Handed | R. Higgins | 2003 | Makybe Diva | G. Boss |
| 1896 | Newhaven | 1932 | Peter Pan | W. Duncan | 1968 | Rain Lover | J. Johnson | | | |

## ICE HOCKEY

The National Hockey League (NHL), which was organized in Canada in 1917 with five professional teams, welcomed the first U.S. team, the Boston Bruins, in 1924. Since 1926 the symbol of supremacy in professional hockey has been the Stanley Cup, which is awarded to the winner of a play-off that concludes the season of the National Hockey League. The Stanley Cup was presented to amateur champions from 1893 to 1925.

**World Hockey Championship—women**

| year | winner | year | winner |
|---|---|---|---|
| 1990 | Canada | 2000 | Canada |
| 1992 | Canada | 2001 | Canada |
| 1994 | Canada | 2002 | Canada |
| 1997 | Canada | 2003 | not held† |
| 1998 | United States* | 2004 | Canada |
| 1999 | Canada | | |

*Olympic gold medalists. †Series called because of SARS epidemic.

**World Hockey Championship—men**

| year | winner | year | winner | year | winner | year | winner | year | winner | year | winner |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1930 | Canada | 1948* | Canada | 1960* | United States | 1972† | Czechoslovakia | 1984* | U.S.S.R. | 1996 | Czech Republic |
| 1931 | Canada | 1949 | Czechoslovakia | 1961 | Canada | 1973 | U.S.S.R. | 1985 | Czechoslovakia | 1997 | Canada |
| 1932* | Canada | 1950 | Canada | 1962 | Sweden | 1974 | U.S.S.R. | 1986 | U.S.S.R. | 1998 | Sweden |
| 1933 | United States | 1951 | Canada | 1963 | U.S.S.R. | 1975 | U.S.S.R. | 1987 | Sweden | 1999 | Czech Republic |
| 1934 | Canada | 1952* | Canada | 1964* | U.S.S.R. | 1976 | Czechoslovakia | 1988 | U.S.S.R. | 2000 | Czech Republic |
| 1935 | Canada | 1953 | Sweden | 1965 | U.S.S.R. | 1977 | Czechoslovakia | 1989 | U.S.S.R. | 2001 | Czech Republic |
| 1936* | Great Britain | 1954 | U.S.S.R. | 1966 | U.S.S.R. | 1978 | U.S.S.R. | 1990 | Sweden | 2002 | Slovakia |
| 1937 | Canada | 1955 | Canada | 1967 | U.S.S.R. | 1979 | U.S.S.R. | 1991 | Sweden | 2003 | Canada |
| 1938 | Canada | 1956* | U.S.S.R. | 1968* | U.S.S.R. | 1980* | United States | 1992 | Sweden | 2004 | Canada |
| 1939 | Canada | 1957 | Sweden | 1969 | U.S.S.R. | 1981 | U.S.S.R. | 1993 | Russia | | |
| 1940–46 | no competition | 1958 | Canada | 1970 | U.S.S.R. | 1982 | U.S.S.R. | 1994 | Canada | | |
| 1947 | Czechoslovakia | 1959 | Canada | 1971 | U.S.S.R. | 1983 | U.S.S.R. | 1995 | Finland | | |

*Olympic champions, recognized as world champions (for earlier Olympics, *see* Olympic Games). †In 1972 a separate world championship was held for the first time.

**The Stanley Cup**

| season | winner | runner-up | games |
|---|---|---|---|
| 1892–93 | Montreal Amateur Athletic Association | | |
| 1893–94 | Montreal Amateur Athletic Association | | |
| 1894–95 | Montreal Victorias | | |
| 1895–96 | Winnipeg Victorias (Feb.) | | |
| | Montreal Victorias (Dec.) | | |
| 1896–97 | Montreal Victorias | | |
| 1897–98 | Montreal Victorias | | |
| 1898–99 | Montreal Shamrocks | | |
| 1899–1900 | Montreal Shamrocks | | |
| 1900–01 | Winnipeg Victorias | | |
| 1901–02 | Montreal Amateur Athletic Association | | |
| 1902–03 | Ottawa Silver Seven | | |
| 1903–04 | Ottawa Silver Seven | | |
| 1904–05 | Ottawa Silver Seven | | |
| 1905–06 | Montreal Wanderers | | |
| 1906–07 | Kenora Thistles (Jan.) | | |
| | Montreal Wanderers (March) | | |
| 1907–08 | Montreal Wanderers | | |
| 1908–09 | Ottawa Senators | | |
| 1909–10 | Montreal Wanderers | | |
| 1910–11 | Ottawa Senators | | |
| 1911–12 | Quebec Bulldogs | | |
| 1912–13* | Quebec Bulldogs | | |
| 1913–14 | Toronto Blueshirts | | |
| 1914–15 | Vancouver Millionaires | | |
| 1915–16 | Montreal Canadiens | | |
| 1916–17 | Seattle Metropolitans | | |
| 1917–18 | Toronto Arenas | Vancouver Millionaires | 3–2 |
| 1918–19 | no decision† | | |
| 1919–20 | Ottawa Senators | Seattle Metropolitans | 3–2 |
| 1920–21 | Ottawa Senators | Vancouver Millionaires | 3–2 |
| 1921–22 | Toronto St. Pats | Vancouver Millionaires | 3–2 |
| 1922–23 | Ottawa Senators | Edmonton | 2–0 |
| 1923–24 | Montreal Canadiens | Calgary | 2–0 |
| 1924–25 | Victoria Cougars | Montreal Canadiens | 3–1 |
| 1925–26 | Montreal Maroons | Victoria Cougars | 3–1 |
| 1926–27 | Ottawa Senators | Boston Bruins | 2–0 |
| 1927–28 | New York Rangers | Montreal Maroons | 3–2 |
| 1928–29 | Boston Bruins | New York Rangers | 2–0 |
| 1929–30 | Montreal Canadiens | Boston Bruins | 2–0 |
| 1930–31 | Montreal Canadiens | Chicago Black Hawks | 3–2 |
| 1931–32 | Toronto Maple Leafs | New York Rangers | 3–0 |
| 1932–33 | New York Rangers | Toronto Maple Leafs | 3–1 |
| 1933–34 | Chicago Black Hawks | Detroit Red Wings | 3–1 |
| 1934–35 | Montreal Maroons | Toronto Maple Leafs | 3–0 |
| 1935–36 | Detroit Red Wings | Toronto Maple Leafs | 3–1 |
| 1936–37 | Detroit Red Wings | New York Rangers | 3–2 |
| 1937–38 | Chicago Black Hawks | Toronto Maple Leafs | 3–1 |
| 1938–39 | Boston Bruins | Toronto Maple Leafs | 4–1 |
| 1939–40 | New York Rangers | Toronto Maple Leafs | 4–2 |
| 1940–41 | Boston Bruins | Detroit Red Wings | 4–0 |
| 1941–42 | Toronto Maple Leafs | Detroit Red Wings | 4–3 |
| 1942–43 | Detroit Red Wings | Boston Bruins | 4–0 |
| 1943–44 | Montreal Canadiens | Chicago Black Hawks | 4–0 |
| 1944–45 | Toronto Maple Leafs | Detroit Red Wings | 4–3 |
| 1945–46 | Montreal Canadiens | Boston Bruins | 4–1 |
| 1946–47 | Toronto Maple Leafs | Montreal Canadiens | 4–2 |
| 1947–48 | Toronto Maple Leafs | Detroit Red Wings | 4–0 |
| 1948–49 | Toronto Maple Leafs | Detroit Red Wings | 4–0 |
| 1949–50 | Detroit Red Wings | New York Rangers | 4–3 |
| 1950–51 | Toronto Maple Leafs | Montreal Canadiens | 4–1 |
| 1951–52 | Detroit Red Wings | Montreal Canadiens | 4–0 |
| 1952–53 | Montreal Canadiens | Boston Bruins | 4–1 |
| 1953–54 | Detroit Red Wings | Montreal Canadiens | 4–3 |
| 1954–55 | Detroit Red Wings | Montreal Canadiens | 4–3 |
| 1955–56 | Montreal Canadiens | Detroit Red Wings | 4–1 |
| 1956–57 | Montreal Canadiens | Boston Bruins | 4–1 |
| 1957–58 | Montreal Canadiens | Boston Bruins | 4–2 |
| 1958–59 | Montreal Canadiens | Toronto Maple Leafs | 4–1 |
| 1959–60 | Montreal Canadiens | Toronto Maple Leafs | 4–0 |
| 1960–61 | Chicago Black Hawks | Detroit Red Wings | 4–2 |
| 1961–62 | Toronto Maple Leafs | Chicago Black Hawks | 4–2 |
| 1962–63 | Toronto Maple Leafs | Detroit Red Wings | 4–1 |
| 1963–64 | Toronto Maple Leafs | Detroit Red Wings | 4–3 |
| 1964–65 | Montreal Canadiens | Chicago Black Hawks | 4–3 |
| 1965–66 | Montreal Canadiens | Detroit Red Wings | 4–2 |
| 1966–67 | Toronto Maple Leafs | Montreal Canadiens | 4–2 |
| 1967–68 | Montreal Canadiens | St. Louis Blues | 4–0 |
| 1968–69 | Montreal Canadiens | St. Louis Blues | 4–0 |
| 1969–70 | Boston Bruins | St. Louis Blues | 4–0 |
| 1970–71 | Montreal Canadiens | Chicago Black Hawks | 4–3 |
| 1971–72 | Boston Bruins | New York Rangers | 4–2 |
| 1972–73 | Montreal Canadiens | Chicago Black Hawks | 4–2 |
| 1973–74 | Philadelphia Flyers | Boston Bruins | 4–2 |
| 1974–75 | Philadelphia Flyers | Buffalo Sabres | 4–2 |
| 1975–76 | Montreal Canadiens | Philadelphia Flyers | 4–0 |
| 1976–77 | Montreal Canadiens | Boston Bruins | 4–0 |
| 1977–78 | Montreal Canadiens | Boston Bruins | 4–2 |
| 1978–79 | Montreal Canadiens | New York Rangers | 4–1 |
| 1979–80 | New York Islanders | Philadelphia Flyers | 4–2 |
| 1980–81 | New York Islanders | Minnesota North Stars | 4–1 |
| 1981–82 | New York Islanders | Vancouver Canucks | 4–0 |
| 1982–83 | New York Islanders | Edmonton Oilers | 4–0 |
| 1983–84 | Edmonton Oilers | New York Islanders | 4–1 |
| 1984–85 | Edmonton Oilers | Philadelphia Flyers | 4–1 |
| 1985–86 | Montreal Canadiens | Calgary Flames | 4–1 |
| 1986–87 | Edmonton Oilers | Philadelphia Flyers | 4–3 |
| 1987–88 | Edmonton Oilers | Boston Bruins | 4–0 |
| 1988–89 | Calgary Flames | Montreal Canadiens | 4–2 |
| 1989–90 | Edmonton Oilers | Boston Bruins | 4–1 |
| 1990–91 | Pittsburgh Penguins | Minnesota North Stars | 4–2 |
| 1991–92 | Pittsburgh Penguins | Chicago Black Hawks | 4–0 |
| 1992–93 | Montreal Canadiens | Los Angeles Kings | 4–1 |
| 1993–94 | New York Rangers | Vancouver Canucks | 4–3 |
| 1994–95 | New Jersey Devils | Detroit Red Wings | 4–0 |
| 1995–96 | Colorado Avalanche | Florida Panthers | 4–0 |
| 1996–97 | Detroit Red Wings | Philadelphia Flyers | 4–0 |
| 1997–98 | Detroit Red Wings | Washington Capitals | 4–0 |
| 1998–99 | Dallas Stars | Buffalo Sabres | 4–2 |
| 1999–2000 | New Jersey Devils | Dallas Stars | 4–2 |
| 2000–01 | Colorado Avalanche | New Jersey Devils | 4–3 |
| 2001–02 | Detroit Red Wings | Carolina Hurricanes | 4–1 |
| 2002–03 | New Jersey Devils | Anaheim Mighty Ducks | 4–3 |
| 2003–04 | Tampa Bay Lightning | Calgary Flames | 4–3 |

*Though Victoria defeated Quebec in challenge games, Victoria's win was not officially recognized. †Series called because of flu epidemic.

## ICE SKATING

The world governing body for ice skating, the International Skating Union (ISU; founded 1892), held the first figure skating competition in 1896. Women's figure skating was not a separate event until 1906, and pairs championships were first held in 1908. Until 1991, individual competitors were judged on a set of compulsory figures as well as programs of freestyle moves. In 1991, the compulsory figures portion of the competition was eliminated, and judging was based on a short technical program and a long freestyle program. Ice dancing is based on compulsory and freestyle movements—in this case, dances.

In contrast to figure skating and ice dancing, speed skating involves only two factors—speed and endurance. Men compete over distances of 500 m, 1,500 m, 5,000 m, and 10,000 m. Women, who entered the sport some 40 years after men, compete over 500 m, 1,500 m, 3,000 m, and 5,000 m. World speed-skating sprint championships for both men and women were inaugurated in 1972. Short-track speed skating is held indoors over distances of 500 m, 1,000 m, 1,500 m, and 3,000 m. The skater having the best combined results is the overall winner. Championships were held annually from 1978 to 1980 before being recognized by the ISU in 1981.

**World All-Around Speed-Skating Championship—men**

| year | winner* | year | winner |
|---|---|---|---|
| 1893 | J. Eden (Neth.) | 1957 | K. Johannesen (Nor.) |
| 1895 | J. Eden (Neth.) | 1958 | O. Goncharenko (U.S.S.R.) |
| 1896 | J. Eden (Neth.) | 1959 | J. Jaevinen (Fin.) |
| 1897 | I.K. McCulloch (Can.) | 1960 | B. Stenin (U.S.S.R.) |
| 1898 | P. Ostlund (Nor.) | 1961 | H. van der Grift (Neth.) |
| 1899 | P. Ostlund (Nor.) | 1962 | V. Kosichkin (U.S.S.R.) |
| 1900 | E. Engelsaas (Nor.) | 1963 | J. Nilsson (Swed.) |
| 1901 | F. Wathen (Fin.) | 1964 | K. Johannesen (Nor.) |
| 1904 | S. Mathisen (Nor.) | 1965 | P. Moe (Nor.) |
| 1905 | C.C.J. de Koning (Neth.) | 1966 | K. Verkerk (Neth.) |
| 1908 | O. Mathisen (Nor.) | 1967 | K. Verkerk (Neth.) |
| 1909 | O. Mathisen (Nor.) | 1968 | A. Maier (Nor.) |
| 1910 | N. Strunnikoff (Russia) | 1969 | D. Fornaess (Nor.) |
| 1911 | N. Strunnikoff (Russia) | 1970 | A. Schenk (Neth.) |
| 1912 | O. Mathisen (Nor.) | 1971 | A. Schenk (Neth.) |
| 1913 | O. Mathisen (Nor.) | 1972 | A. Schenk (Neth.) |
| 1914 | O. Mathisen (Nor.) | 1973 | G. Claeson (Swed.) |
| 1915–21 | no competition | 1974 | S. Stensen (Nor.) |
| 1922 | H. Strom (Nor.) | 1975 | H. Kuipers (Neth.) |
| 1923 | C. Thunberg (Fin.) | 1976 | P. Kleine (Neth.) |
| 1924 | R. Larsen (Nor.) | 1977 | E. Heiden (U.S.) |
| 1925 | C. Thunberg (Fin.) | 1978 | E. Heiden (U.S.) |
| 1926 | I. Ballangrud (Nor.) | 1979 | E. Heiden (U.S.) |
| 1927 | B. Evensen (Nor.) | 1980 | H. van der Duim (Neth.) |
| 1928 | C. Thunberg (Fin.) | 1981 | A. Sjobrend (Nor.) |
| 1929 | C. Thunberg (Fin.) | 1982 | H. van der Duim (Neth.) |
| 1930 | M. Staksrud (Nor.) | 1983 | R. Falk-Larssen (Nor.) |
| 1931 | C. Thunberg (Fin.) | 1984 | O. Bozhiev (U.S.S.R.) |
| 1932 | I. Ballangrud (Nor.) | 1985 | H. Vergeer (Neth.) |
| 1933 | H. Engnestangen (Nor.) | 1986 | D. Jansen (U.S.) |
| 1934 | B. Evensen (Nor.) | 1987 | N. Gulyaev (U.S.S.R.) |
| 1935 | M. Staksrud (Nor.) | 1988 | E. Flaim (U.S.) |
| 1936 | I. Ballangrud (Nor.) | 1989 | L. Visser (Neth.) |
| 1937 | M. Staksrud (Nor.) | 1990 | J.O. Koss (Nor.) |
| 1938 | I. Ballangrud (Nor.) | 1991 | J.O. Koss (Nor.) |
| 1939 | B. Wasenius (Fin.) | 1992 | R. Sighel (Italy) |
| 1940–46 | no competition | 1993 | F. Zandstra (Neth.) |
| 1947 | L. Parkkinnen (Fin.) | 1994 | J.O. Koss (Nor.) |
| 1948 | O. Lundberg (Nor.) | 1995 | R. Ritsma (Neth.) |
| 1949 | K. Fajor (Hung.) | 1996 | R. Ritsma (Neth.) |
| 1950 | H. Andersen (Nor.) | 1997 | I. Postma (Neth.) |
| 1951 | H. Andersen (Nor.) | 1998 | I. Postma (Neth.) |
| 1952 | H. Andersen (Nor.) | 1999 | R. Ritsma (Neth.) |
| 1953 | O. Goncharenko (U.S.S.R.) | 2000 | G. Romme (Neth.) |
| 1954 | B. Shilkov (U.S.S.R.) | 2001 | R. Ritsma (Neth.) |
| 1955 | S. Ericsson (Swed.) | 2002 | J. Uytdehaage (Neth.) |
| 1956 | O. Goncharenko (U.S.S.R.) | | |

*No winner in 1894, 1902, 1903, 1906, and 1907; before the points system was established, only a contestant who had won at least three of the four events was considered the all-around champion.

**World All-Around Speed-Skating Championship—women**

| year | winner | year | winner |
|---|---|---|---|
| 1947 | V. Lesche (Fin.) | 1975 | K. Kessow (E.Ger.) |
| 1948 | M. Isakova (U.S.S.R.) | 1976 | S. Burka (Can.) |
| 1949 | M. Isakova (U.S.S.R.) | 1977 | V. Bryndzey (U.S.S.R.) |
| 1950 | M. Isakova (U.S.S.R.) | 1978 | T. Avanina (U.S.S.R.) |
| 1951 | J. Huttunen (Fin.) | 1979 | B. Heiden (U.S.) |
| 1952 | L. Selikhova (U.S.S.R.) | 1980 | N. Petruseva (U.S.S.R.) |
| 1953 | K. Shchegoleva (U.S.S.R.) | 1981 | N. Petruseva (U.S.S.R.) |
| 1954 | L. Selikhova (U.S.S.R.) | 1982 | K. Busch (E.Ger.) |
| 1955 | R. Zhukova (U.S.S.R.) | 1983 | A. Schöne (E.Ger.) |
| 1956 | Z. Kondakova (U.S.S.R.) | 1984 | K. Enke (E.Ger.) |
| 1957 | I. Voronina (U.S.S.R.) | 1985 | A. Schöne (E.Ger.) |
| 1958 | I. Voronina (U.S.S.R.) | 1986 | K. Kania (E.Ger.) |
| 1959 | T. Rylova (U.S.S.R.) | 1987 | K. Kania (E.Ger.) |
| 1960 | V. Stenina (U.S.S.R.) | 1988 | K. Kania (E.Ger.) |
| 1961 | V. Stenina (U.S.S.R.) | 1989 | C. Moser (E.Ger.) |
| 1962 | I. Voronina (U.S.S.R.) | 1990 | J. Börner (E.Ger.) |
| 1963 | L. Skoblikova (U.S.S.R.) | 1991 | G. Kleeman (Ger.) |
| 1964 | L. Skoblikova (U.S.S.R.) | 1992 | G. Niemann (Ger.) |
| 1965 | I. Voronina (U.S.S.R.) | 1993 | G. Niemann (Ger.) |
| 1966 | V. Stenina (U.S.S.R.) | 1994 | E. Hunyady (Aus.) |
| 1967 | S. Kaiser (Neth.) | 1995 | G. Niemann (Ger.) |
| 1968 | S. Kaiser (Neth.) | 1996 | G. Niemann (Ger.) |
| 1969 | L. Kauniste (U.S.S.R.) | 1997 | G. Niemann (Ger.) |
| 1970 | A. Keulen-Deelstra (Neth.) | 1998 | G. Niemann-Stirnemann (Ger.) |
| 1971 | N. Statkevich (U.S.S.R.) | 1999 | G. Niemann-Stirnemann (Ger.) |
| 1972 | A. Keulen-Deelstra (Neth.) | 2000 | C. Pechstein (Ger.) |
| 1973 | A. Keulen-Deelstra (Neth.) | 2001 | A. Friesinger (Ger.) |
| 1974 | A. Keulen-Deelstra (Neth.) | 2002 | A. Friesinger (Ger.) |

**World Speed-Skating Sprint Championships**

| year | men | women |
|---|---|---|
| 1972 | L. Linkovesi (Fin.) | M. Pflug (W.Ger.) |
| 1973 | V. Muratov (U.S.S.R.) | S. Young (U.S.) |
| 1974 | P. Bjorang (Nor.) | L. Poulos (U.S.) |
| 1975 | A. Safronov (U.S.S.R.) | S. Young (U.S.) |
| 1976 | J. Granath (Swed.) | S. Young (U.S.) |
| 1977 | E. Heiden (U.S.) | S. Burka (Can.) |
| 1978 | E. Heiden (U.S.) | L. Sadchikova (U.S.S.R.) |
| 1979 | E. Heiden (U.S.) | L. Poulos-Mueller (U.S.) |
| 1980 | E. Heiden (U.S.) | K. Enke (E.Ger.) |
| 1981 | F. Ronning (Nor.) | K. Enke (E.Ger.) |
| 1982 | S. Khlebnikov (U.S.S.R.) | N. Petruseva (U.S.S.R.) |
| 1983 | Kurowa A. (Japan) | K. Enke (E.Ger.) |
| 1984 | G. Boucher (Can.) | K. Enke (E.Ger.) |
| 1985 | I. Zhelezovsky (U.S.S.R.) | C. Rothenburger (E.Ger.) |
| 1986 | I. Zhelezovsky (U.S.S.R.) | K. Kania (E.Ger.) |
| 1987 | Kurowa A. (Japan) | K. Kania (E.Ger.) |
| 1988 | D. Jansen (U.S.) | C. Rothenburger (E.Ger.) |
| 1989 | I. Zhelezovsky (U.S.S.R.) | B. Blair (U.S.) |
| 1990 | Ki Tae Bae (S.Kor.) | A. Hauck (E.Ger.) |
| 1991 | I. Zhelezovsky (U.S.S.R.) | M. Garbrecht (Ger.) |
| 1992 | I. Zhelezovsky (U.T.*) | Ye Qiaobo (China) |
| 1993 | I. Zhelezovsky (Bela.) | Ye Qiaobo (China) |
| 1994 | D. Jansen (U.S.) | B. Blair (U.S.) |
| 1995 | Kim Yoon Man (S.Kor.) | B. Blair (U.S.) |
| 1996 | S. Klevchenya (Russia) | C. Witty (U.S.) |
| 1997 | S. Klevchenya (Russia) | F. Schenk (Ger.) |
| 1998 | J. Bos (Neth.) | C. LeMay Doan (Can.) |
| 1999 | J. Wotherspoon (Can.) | M. Garbrecht (Ger.) |
| 2000 | J. Wotherspoon (Can.) | M. Garbrecht (Ger.) |
| 2001 | M. Ireland (Can.) | M. Garbrecht-Enfeldt (Ger.) |
| 2002 | J. Wotherspoon (Can.) | C. LeMay Doan (Can.) |

*Unified Team, consisting of athletes from the Commonwealth of Independent States plus Georgia.

**World Short-Track Speed-Skating Championships—overall winners**

| year | men | women |
|---|---|---|
| 1978 | J. Lynch (Austl.) | S. Docter (Can.) |
| 1979 | Toda H. (Japan) | S. Daigle (Can.) |
| 1980 | G. Boucher (Can.) | Kato M. (Japan) |
| 1981 | B. Baril (Can.) | Kato M. (Japan) |
| 1982 | G. Daigneault (Can.) | M. Perreault (Can.) |
| 1983 | L. Grenier (Can.) | S. Daigle (Can.) |
| 1984 | G. Daigneault (Can.) | Kinoshita M. (Japan) |
| 1985 | Kawai T. (Japan) | Shishii E. (Japan) |
| 1986 | Isihara T. (Japan) | B. Blair (U.S.) |
| 1987 | M. Daignault (Can.)* Kawai T. (Japan)* | Shishii E. (Japan) |
| 1988 | P. van der Velde (Neth.) | S. Daigle (Can.) |
| 1989 | M. Daignault (Can.) | S. Daigle (Can.) |
| 1990 | Lee Joon-ho (S.Kor.) | S. Daigle (Can.) |
| 1991 | W. O'Reilly (U.K.) | N. Lambert (Can.) |
| 1992 | Ki Hoon Kim (S.Kor.) | So He Kim (S.Kor.) |
| 1993 | M. Gagnon (Can.) | N. Lambert (Can.) |
| 1994 | M. Gagnon (Can.) | N. Lambert (Can.) |
| 1995 | Chae Ji Hoon (S.Kor.) | Chun Lee Kyung (S.Kor.) |
| 1996 | M. Gagnon (Can.) | Chun Lee Kyung (S.Kor.) |
| 1997 | Kim Dong Sung (S.Kor.) | Chun Lee Kyung (S.Kor.)* Yang Yang (A) (China)* |
| 1998 | M. Gagnon (Can.) | Yang Yang (A) (China) |
| 1999 | Li Jianjun (China) | Yang Yang (A) (China) |
| 2000 | Min Ryung (S.Kor.) | Yang Yang (A) (China) |
| 2001 | Li Jianjun (China) | Yang Yang (A) (China) |
| 2002 | Kim Dong Sung (S.Kor.) | Yang Yang (A) (China) |

*Tied.

**World Figure Skating Championship—men**

| year | winner | year | winner | year | winner | year | winner | year | winner |
|---|---|---|---|---|---|---|---|---|---|
| 1896 | G. Fuchs (Ger.) | 1922 | G. Grafström (Swed.) | 1948 | R. Button (U.S.) | 1968 | E. Danzer (Austria) | 1988 | B. Boitano (U.S.) |
| 1897 | G. Hügel (Austria) | 1923 | F. Kachler (Austria) | 1949 | R. Button (U.S.) | 1969 | T. Wood (U.S.) | 1989 | K. Browning (Can.) |
| 1898 | H. Grenander (Swed.) | 1924 | G. Grafström (Swed.) | 1950 | R. Button (U.S.) | 1970 | T. Wood (U.S.) | 1990 | K. Browning (Can.) |
| 1899 | G. Hügel (Austria) | 1925 | W. Böckl (Austria) | 1951 | R. Button (U.S.) | 1971 | O. Nepela (Czech.) | 1991 | K. Browning (Can.) |
| 1900 | G. Hügel (Austria) | 1926 | W. Böckl (Austria) | 1952 | R. Button (U.S.) | 1972 | O. Nepela (Czech.) | 1992 | V. Petrenko (U.T†) |
| 1901 | U. Salchow (Swed.) | 1927 | W. Böckl (Austria) | 1953 | H. Jenkins (U.S.) | 1973 | O. Nepela (Czech.) | 1993 | K. Browning (Can.) |
| 1902 | U. Salchow (Swed.) | 1928 | W. Böckl (Austria) | 1954 | H. Jenkins (U.S.) | 1974 | J. Hoffmann (E.Ger.) | 1994 | E. Stojko (Can.) |
| 1903 | U. Salchow (Swed.) | 1929 | G. Grafström (Swed.) | 1955 | H. Jenkins (U.S.) | 1975 | S. Volkov (U.S.S.R.) | 1995 | E. Stojko (Can.) |
| 1904 | U. Salchow (Swed.) | 1930 | K. Schäfer (Austria) | 1956 | H. Jenkins (U.S.) | 1976 | J. Curry (U.K.) | 1996 | T. Eldredge (U.S.) |
| 1905 | U. Salchow (Swed.) | 1931 | K. Schäfer (Austria) | 1957 | D. Jenkins (U.S.) | 1977 | V. Kovalev (U.S.S.R.) | 1997 | E. Stojko (Can.) |
| 1906 | G. Fuchs (Ger.) | 1932 | K. Schäfer (Austria) | 1958 | D. Jenkins (U.S.) | 1978 | O. Tickner (U.S.) | 1998 | A. Yagudin (Russia) |
| 1907 | U. Salchow (Swed.) | 1933 | K. Schäfer (Austria) | 1959 | D. Jenkins (U.S.) | 1979 | V. Kovalev (U.S.S.R.) | 1999 | A. Yagudin (Russia) |
| 1908 | U. Salchow (Swed.) | 1934 | K. Schäfer (Austria) | 1960 | A. Giletti (Fr.) | 1980 | J. Hoffmann (E.Ger.) | 2000 | A. Yagudin (Russia) |
| 1909 | U. Salchow (Swed.) | 1935 | K. Schäfer (Austria) | 1961 | not held* | 1981 | S. Hamilton (U.S.) | 2001 | Ye. Plushchenko (Russia) |
| 1910 | U. Salchow (Swed.) | 1936 | K. Schäfer (Austria) | 1962 | D. Jackson (Can.) | 1982 | S. Hamilton (U.S.) | 2002 | A. Yagudin (Russia) |
| 1911 | U. Salchow (Swed.) | 1937 | F. Kaspar (Austria) | 1963 | D. McPherson (Can.) | 1983 | S. Hamilton (U.S.) | 2003 | Ye. Plushchenko (Russia) |
| 1912 | F. Kachler (Austria) | 1938 | F. Kaspar (Austria) | 1964 | M. Schnelldorfer (W.Ger.) | 1984 | S. Hamilton (U.S.) | 2004 | Ye. Plushchenko (Russia) |
| 1913 | F. Kachler (Austria) | 1939 | G. Sharp (U.K.) | 1965 | A. Calmat (Fr.) | 1985 | A. Fadejev (U.S.S.R.) | | |
| 1914 | G. Sandahl (Swed.) | 1940–46 | no competition | 1966 | E. Danzer (Austria) | 1986 | B. Boitano (U.S.) | | |
| 1915–21 | no competition | 1947 | H. Gerschwiler (Switz.) | 1967 | E. Danzer (Austria) | 1987 | B. Orser (Can.) | | |

*The entire U.S. team died in an airplane crash, and the championships were canceled. †Unified Team, consisting of athletes from the Commonwealth of Independent States plus Georgia.

**World Figure Skating Championship—women**

| year | winner | year | winner | year | winner |
|---|---|---|---|---|---|
| 1906 | M. Syers (U.K.) | 1947 | B. Scott (Can.) | 1976 | D. Hamill (U.S.) |
| 1907 | M. Syers (U.K.) | 1948 | B. Scott (Can.) | 1977 | L. Fratianne (U.S.) |
| 1908 | L. Kronberger (Hung.) | 1949 | A. Vrzá ová (Czech.) | 1978 | A. Pötzsch (E.Ger.) |
| 1909 | L. Kronberger (Hung.) | 1950 | A. Vrzá ová (Czech.) | 1979 | L. Fratianne (U.S.) |
| 1910 | L. Kronberger (Hung.) | 1951 | J. Altwegg (U.K.) | 1980 | A. Pötzsch (E.Ger.) |
| 1911 | L. Kronberger (Hung.) | 1952 | J. du Bief (Fr.) | 1981 | D. Biellmann (Switz.) |
| 1912 | M. Horvath (Hung.) | 1953 | T. Albright (U.S.) | 1982 | E. Zayak (U.S.) |
| 1913 | M. Horvath (Hung.) | 1954 | G. Busch (Ger.) | 1983 | R. Sumners (U.S.) |
| 1914 | M. Horvath (Hung.) | 1955 | T. Albright (U.S.) | 1984 | K. Witt (E.Ger.) |
| 1915–21 | no competition | 1956 | C. Heiss (U.S.) | 1985 | K. Witt (E.Ger.) |
| 1922 | J. Szabó-Planck (Austria) | 1957 | C. Heiss (U.S.) | 1986 | D. Thomas (U.S.) |
| 1923 | J. Szabó-Planck (Austria) | 1958 | C. Heiss (U.S.) | 1987 | K. Witt (E.Ger.) |
| 1924 | J. Szabó-Planck (Austria) | 1959 | C. Heiss (U.S.) | 1988 | K. Witt (E.Ger.) |
| 1925 | J. Szabó-Planck (Austria) | 1960 | C. Heiss (U.S.) | 1989 | Ito M. (Japan) |
| 1926 | J. Szabó-Planck (Austria) | 1961 | not held* | 1990 | J. Trenary (U.S.) |
| 1927 | S. Henie (Nor.) | 1962 | S. Dijkstra (Neth.) | 1991 | K. Yamaguchi (U.S.) |
| 1928 | S. Henie (Nor.) | 1963 | S. Dijkstra (Neth.) | 1992 | K. Yamaguchi (U.S.) |
| 1929 | S. Henie (Nor.) | 1964 | S. Dijkstra (Neth.) | 1993 | O. Baiul (Ukr.) |
| 1930 | S. Henie (Nor.) | 1965 | P. Burka (Can.) | 1994 | Y. Sato (Japan) |
| 1931 | S. Henie (Nor.) | 1966 | P. Fleming (U.S.) | 1995 | Chen Lu (China) |
| 1932 | S. Henie (Nor.) | 1967 | P. Fleming (U.S.) | 1996 | M. Kwan (U.S.) |
| 1933 | S. Henie (Nor.) | 1968 | P. Fleming (U.S.) | 1997 | T. Lipinski (U.S.) |
| 1934 | S. Henie (Nor.) | 1969 | G. Seyfert (E.Ger.) | 1998 | M. Kwan (U.S.) |
| 1935 | S. Henie (Nor.) | 1970 | G. Seyfert (E.Ger.) | 1999 | M. Butyrskaya (Russia) |
| 1936 | S. Henie (Nor.) | 1971 | B. Schuba (Austria) | 2000 | M. Kwan (U.S.) |
| 1937 | C. Colledge (U.K.) | 1972 | B. Schuba (Austria) | 2001 | M. Kwan (U.S.) |
| 1938 | M. Taylor (U.K.) | 1973 | K. Magnussen (Can.) | 2002 | I. Slutskaya (Russia) |
| 1939 | M. Taylor (U.K.) | 1974 | C. Errath (E.Ger.) | 2003 | M. Kwan (U.S.) |
| 1940–46 | no competition | 1975 | D. de Leeuw (Neth.) | 2004 | S. Arakawa (Japan) |

*The entire U.S. team died in an airplane crash, and the championships were canceled.



Kurt Browning (Can.) performing his winning program at the World Figure Skating Championships in 1989

ALLSPORT USA/Vandystadt/Yann Guichaoua

**World Figure Skating Championship—pairs**

| year | winners | year | winners | year | winners |
|---|---|---|---|---|---|
| 1908 | A. Hübler, H. Burger (Ger.) | 1949 | A. Kekessy, E. Kiraly (Hung.) | 1978 | I. Rodnina, A. Zaytsev (U.S.S.R.) |
| 1909 | J. Johnson, J. Johnson (U.K.) | 1950 | K. Kennedy, P. Kennedy (U.S.) | 1979 | T. Babilonia, R. Gardner (U.S.) |
| 1910 | A. Hübler, H. Burger (Ger.) | 1951 | R. Baran, P. Falk (W.Ger.) | 1980 | M. Cherkasova, S. Shakhray (U.S.S.R.) |
| 1911 | L. Ellers, W. Jakobsson (Fin.) | 1952 | R. Falk, P. Falk (W.Ger.) | 1981 | I. Vorobyova, I. Lisovsky (U.S.S.R.) |
| 1912 | J. Johnson, J. Johnson (U.K.) | 1953 | J. Nicks, J. Nicks (U.K.) | 1982 | S. Baass, T. Thierbach (E.Ger.) |
| 1913 | N. Engelmann, K. Majstrik (Austria) | 1954 | F. Daloe, N. Bowden (Can.) | 1983 | E. Valova, O. Vasilyev (U.S.S.R.) |
| 1914 | W. Jakobsson, W. Jakobsson (Fin.) | 1955 | F. Daloe, N. Bowden (Can.) | 1984 | B. Underhill, P. Martini (Can.) |
| 1915–21 | no competition | 1956 | E. Schwarz, K. Oppelt (Austria) | 1985 | E. Valova, O. Vasilyev (U.S.S.R.) |
| 1922 | N. Engelmann, A. Berger (Austria) | 1957 | B. Wagner, R. Paul (Can.) | 1986 | Ye. Gordeyeva, S. Grinkov (U.S.S.R.) |
| 1923 | W. Jakobsson, W. Jakobsson (Fin.) | 1958 | B. Wagner, R. Paul (Can.) | 1987 | Ye. Gordeyeva, S. Grinkov (U.S.S.R.) |
| 1924 | N. Engelmann, H. Berger (Austria) | 1959 | B. Wagner, R. Paul (Can.) | 1988 | E. Valova, O. Vasilyev (U.S.S.R.) |
| 1925 | I. Szabó-Planck, L. Wrede (Austria) | 1960 | B. Wagner, R. Paul (Can.) | 1989 | Ye. Gordeyeva, S. Grinkov (U.S.S.R.) |
| 1926 | A. Joly, P. Brunet (Fr.) | 1961 | not held* | 1990 | Ye. Gordeyeva, S. Grinkov (U.S.S.R.) |
| 1927 | J. Szabó-Planck, L. Wrede (Austria) | 1962 | M. Jelinek, O. Jelinek (Can.) | 1991 | N. Mishkutenok, A. Dmitriev (U.S.S.R.) |
| 1928 | A. Joly, P. Brunet (Fr.) | 1963 | M. Kilius, H. Bäumler (W.Ger.) | 1992 | N. Mishkutenok, A. Dmitriev (U.T.†) |
| 1929 | L. Scholz, O. Kaiser (Austria) | 1964 | M. Kilius, H. Bäumler (W.Ger.) | 1993 | I. Brasseur, L. Eisler (Can.) |
| 1930 | A. Brunet, P. Brunet (Fr.) | 1965 | L. Belousova, O. Protopopov (U.S.S.R.) | 1994 | Ye. Shishkova, V. Naumov (Russia) |
| 1931 | E. Rotter, L. Szollas (Hung.) | 1966 | L. Belousova, O. Protopopov (U.S.S.R.) | 1995 | R. Kovarikova, R. Novotny (Cz.Rep.) |
| 1932 | A. Brunet, P. Brunet (Fr.) | 1967 | L. Belousova, O. Protopopov (U.S.S.R.) | 1996 | M. Yeltsova, A. Bushkov (Russia) |
| 1933 | E. Rotter, L. Szollas (Hung.) | 1968 | L. Belousova, O. Protopopov (U.S.S.R.) | 1997 | M. Wötzel, I. Steur (Ger.) |
| 1934 | E. Rotter, L. Szollas (Hung.) | 1969 | I. Rodnina, A. Ulanov (U.S.S.R.) | 1998 | Ye. Berezhnaya, A. Sikharulidze (Russia) |
| 1935 | E. Rotter, L. Szollas (Hung.) | 1970 | I. Rodnina, A. Ulanov (U.S.S.R.) | 1999 | Ye. Berezhnaya, A. Sikharulidze (Russia) |
| 1936 | M. Herber, E. Baier (Ger.) | 1971 | I. Rodnina, A. Ulanov (U.S.S.R.) | 2000 | M. Petrova, A. Tikhonov (Russia) |
| 1937 | M. Herber, E. Baier (Ger.) | 1972 | I. Rodnina, A. Ulanov (U.S.S.R.) | 2001 | J. Sale, D. Pelletier (Can.) |
| 1938 | M. Herber, E. Baier (Ger.) | 1973 | I. Rodnina, A. Zaytsev (U.S.S.R.) | 2002 | Xue Shen, Hongbo Zhao (China) |
| 1939 | M. Herber, E. Baier (Ger.) | 1974 | I. Rodnina, A. Zaytsev (U.S.S.R.) | 2003 | Shen Xue, Zhao Hongbo (China) |
| 1940–46 | no competition | 1975 | I. Rodnina, A. Zaytsev (U.S.S.R.) | 2004 | T. Totmyanina, M. Marinin (Russia) |
| 1947 | M. Lannoy, P. Baugniet (Belg.) | 1976 | I. Rodnina, A. Zaytsev (U.S.S.R.) | | |
| 1948 | M. Lannoy, P. Baugniet (Belg.) | 1977 | I. Rodnina, A. Zaytsev (U.S.S.R.) | | |

*The entire U.S. team died in an airplane crash, and the championships were canceled. †Unified Team, consisting of athletes from the Commonwealth of Independent States plus Georgia.

**World Ice Dancing Championships**

| year | winners | year | winners | year | winners |
|---|---|---|---|---|---|
| 1950 | L. Waring, M. McGean (U.S.) | 1969 | D. Towler, B. Ford (U.K.) | 1988 | N. Bestemyanova, A. Bukin (U.S.S.R.) |
| 1951 | J. Westwood, L. Demmy (U.K.) | 1970 | L. Pakhomova, A. Gorshkov (U.S.S.R.) | 1989 | M. Klimova, S. Ponomarenko (U.S.S.R.) |
| 1952 | J. Westwood, L. Demmy (U.K.) | 1971 | L. Pakhomova, A. Gorshkov (U.S.S.R.) | 1990 | M. Klimova, S. Ponomarenko (U.S.S.R.) |
| 1953 | J. Westwood, L. Demmy (U.K.) | 1972 | L. Pakhomova, A. Gorshkov (U.S.S.R.) | 1991 | I. Duchesnay, P. Duchesnay (Fr.) |
| 1954 | J. Westwood, L. Demmy (U.K.) | 1973 | L. Pakhomova, A. Gorshkov (U.S.S.R.) | 1992 | M. Klimova, S. Ponomarenko (U.T.†) |
| 1955 | J. Westwood, L. Demmy (U.K.) | 1974 | L. Pakhomova, A. Gorshkov (U.S.S.R.) | 1993 | M. Usova, A. Zhulin (Russia) |
| 1956 | P. Weight, P. Thomas (U.K.) | 1975 | I. Moiseyeva, A. Minenkov (U.S.S.R.) | 1994 | O. Grichuk, Ye. Platov (Russia) |
| 1957 | J. Markham, C. Jones (U.K.) | 1976 | L. Pakhomova, A. Gorshkov (U.S.S.R.) | 1995 | O. Grichuk, Ye. Platov (Russia) |
| 1958 | J. Markham, C. Jones (U.K.) | 1977 | I. Moiseyeva, A. Minenkov (U.S.S.R.) | 1996 | O. Grichuk, Ye. Platov (Russia) |
| 1959 | D. Denny, C. Jones (U.K.) | 1978 | N. Linichuk, G. Karponosov (U.S.S.R.) | 1997 | O. Grichuk, Ye. Platov (Russia) |
| 1960 | D. Denny, C. Jones (U.K.) | 1979 | N. Linichuk, G. Karponosov (U.S.S.R.) | 1998 | A. Krylova, O. Ovsyannikov (Russia) |
| 1961 | not held* | 1980 | K. Regóczy, A. Sallay (Hung.) | 1999 | A. Krylova, O. Ovsyannikov (Russia) |
| 1962 | E. Romanová, P. Roman (Czech.) | 1981 | J. Torvill, C. Dean (U.K.) | 2000 | M. Anissina, G. Pelzarat (Fr.) |
| 1963 | E. Romanová, P. Roman (Czech.) | 1982 | J. Torvill, C. Dean (U.K.) | 2001 | B. Fusar Poli, M. Margaglio (Italy) |
| 1964 | E. Romanová, P. Roman (Czech.) | 1983 | J. Torvill, C. Dean (U.K.) | 2002 | I. Lobachyova, I. Averbukh (Russia) |
| 1965 | E. Romanová, P. Roman (Czech.) | 1984 | J. Torvill, C. Dean (U.K.) | 2003 | S. Bourne, V. Kraatz (Can.) |
| 1966 | D. Towler, B. Ford (U.K.) | 1985 | N. Bestemyanova, A. Bukin (U.S.S.R.) | 2004 | T. Navka, R. Kostomarov (Russia) |
| 1967 | D. Towler, B. Ford (U.K.) | 1986 | N. Bestemyanova, A. Bukin (U.S.S.R.) | | |
| 1968 | D. Towler, B. Ford (U.K.) | 1987 | N. Bestemyanova, A. Bukin (U.S.S.R.) | | |

*The entire U.S. team died in an airplane crash, and the championships were canceled. †Unified Team, consisting of athletes from the Commonwealth of Independent States plus Georgia.

## JUDO

World championships for judo were first held in 1956 under the auspices of the International Judo Federation (IJF; founded 1951). At that time all contestants participated on an equal basis. At the fourth world championship match, 65 kg, 78 kg, and 95 kg classes were added to the open weight division; at the next championship match, two more weight classes were added, and in 1979 more were added. World championships for women were first held in 1980; they are contested biennially in eight weight classes.

**World Judo Championships—men***

| year | open weights | 60 kg | 65 kg (66 kg) | 71 kg (73 kg) | 78 kg (81 kg) | 86 kg (90 kg) |
|---|---|---|---|---|---|---|
| 1956† | Natsul S. (Japan) | | | | | |
| 1958† | Sone K. (Japan) | | | | | |
| 1961† | A. Geesink (Neth.) | | | | | |
| 1965‡ | Inokuma I. (Japan) | | Matsuda H. (Japan) | | Okano I. (Japan) | |
| 1967§ | Shinomaki M. (Japan) | | Shigeoka T. (Japan) | Minatoya H. (Japan) | Maruki E. (Japan) | Sato N. (Japan) |
| 1969§ | Shinomaki M. (Japan) | | Sonoda Y. (Japan) | Minatoya H. (Japan | Sonoda I. (Japan) | Sasahara F. (Japan) |
| 1971§ | Shinomaki M. (Japan) | | Kawaguchi T. (Japan) | Tsuzawa H. (Japan) | Fujii S. (Japan) | Sasahara F. (Japan) |
| 1973§ | Ninomiya K. (Japan) | | Minami Y. (Japan) | Nomura T. (Japan) | Fujii S. (Japan) | Sato N. (Japan) |
| 1975§ | Uemura H. (Japan) | | Minami Y. (Japan) | V. Nevzorov (U.S.S.R.) | Fujii S. (Japan) | J.-L. Rouge (Fr.) |
| 1979 | Endo S. (Japan) | T. Rey (Fr.) | N. Solodukhin (U.S.S.R.) | Katsuki K. (Japan) | Fujii S. (Japan) | D. Ultsch (E.Ger.) |
| 1981 | Yamashita Y. (Japan) | Moriwaki Y. (Japan) | Kashiwazaki K. (Japan) | Park Chong Hak (S.Kor.) | N. Adams (U.K.) | B. Tchoulilouyan (Fr.) |
| 1983 | Saito H. (Japan) | K. Tietseri (U.S.S.R.) | N. Solodukhin (U.S.S.R.) | Nakanishi H. (Japan) | Hikage N. (Japan) | D. Ultsch (E.Ger.) |
| 1985 | Masaki Y. (Japan) | Hosokawa S. (Japan) | Y. Sololov (U.S.S.R.) | Ahn Byung Keun (S.Kor.) | Hikage N. (Japan) | P. Seisenbacher (Austria) |
| 1987 | Ogawa N. (Japan) | Kim Jae Yup (S.Kor.) | Yamamoto Y. (Japan) | M. Swain (U.S.) | Okada H. (Japan) | F. Canu (Fr.) |
| 1989 | Ogawa N. (Japan) | A. Totikashvili (U.S.S.R.) | D. Becanovic (Yugos.) | Koga T. (Japan) | Kim Bying Ju (S.Kor.) | F. Canu (Fr.) |
| 1991 | Ogawa N. (Japan) | Koshino T. (Japan) | G. Quellmalz (Ger.) | Koga T. (Japan) | D. Lascau (Ger.) | Okada H. (Japan) |
| 1993 | R. Kubacki (Pol.) | Sonada R. (Japan) | Nakamura Y. (Japan) | Yung Chung Hoon (S.Kor.) | Chun Ki Young (S.Kor.) | Nakamura Y. (Japan) |
| 1995 | D. Douillet (Fr.) | N. Ojeguine (Russia) | U. Quellmalz (Ger.) | Hideshima D. (Japan) | Koga T. (Japan) | Chun Ki Young (S.Kor.) |
| 1997 | R. Kubacki (Pol.) | Nomura T. (Japan) | Kim Hyuk (S.Kor.) | Nakamura K. (Japan) | Cho In Chul (S.Kor.) | Chun Ki Young (S.Kor.) |
| 1999 | Shinohara S. (Japan) | M. Poulot (Cuba) | L. Benboudaoud (Fr.) | J. Pedro (U.S.) | G. Randall (U.K.) | Yoshida H. (Japan) |
| 2001 | A. Mikhaylin (Russia) | Anis Lounifi (Tun.) | A. Miresmaeili (Iran) | V. Marakov (Russia) | Cho In Chul (S.Kor.) | F. Demonttaucon (Fr.) |

| year | 95 kg (100 kg) | year | 95 kg (100 kg) | year | +95 kg (+100 kg) | year | +95 kg (+100 kg) |
|---|---|---|---|---|---|---|---|
| 1965‡ | A. Geesink (Neth.) | 1985 | Sugai H. (Japan) | 1965‡ | | 1985 | Cho Yong Chul (S.Kor.) |
| 1967§ | W. Ruska (Neth.) | 1987 | Sugai H. (Japan) | 1967§ | | 1987 | G. Verichev (U.S.S.R.) |
| 1969§ | Suma S. (Japan) | 1989 | K. Kurtanidze (U.S.S.R.) | 1969§ | | 1989 | Ogawa N. (Japan) |
| 1971§ | W. Ruska (Neth.) | 1991 | S. Traineau (Fr.) | 1971§ | | 1991 | S. Kosorotov (U.S.S.R.) |
| 1973§ | Takagi C. (Japan) | 1993 | A. Kovacs (Hung.) | 1973§ | | 1993 | D. Douillet (Fr.) |
| 1975§ | Endo S. (Japan) | 1995 | P. Nastula (Pol.) | 1975§ | | 1995 | D. Douillet (Fr.) |
| 1979 | T. Khubuluri (U.S.S.R.) | 1997 | P. Nastula (Pol.) | 1979 | Yamashita Y. (Japan) | 1997 | D. Douillet (Fr.) |
| 1981 | T. Khubuluri (U.S.S.R.) | 1999 | Inoue K. (Japan) | 1981 | Yamashita Y. (Japan) | 1999 | Shinohara S. (Japan) |
| 1983 | A. Preschel (E.Ger.) | 2001 | Inoue K. (Japan) | 1983 | Yamashita Y. (Japan) | 2001 | A. Mikhaylin (Russia) |

*Figures in parentheses represent new weight classes established in 1999. †Weight classes not held—open weight division only. ‡Divisions called lightweight, middleweight, heavyweight. §Divisions called lightweight, light-middleweight, middleweight, light-heavyweight, and heavyweight.

**World Judo Championships—women***

| year | open weights | 48 kg | 52 kg | 56 kg (57 kg) | 61 kg (63 kg) | 66 kg (70 kg) |
|---|---|---|---|---|---|---|
| 1980 | I. Berghmans (Belg.) | J. Bridge (U.K.) | E. Hrovat (Austria) | G. Winklbauer (Austria) | A. Staps (Neth.) | E. Simon (Austria) |
| 1982 | I. Berghmans (Belg.) | K. Briggs (U.K.) | L. Doyle (U.K.) | B. Rodriguez (Fr.) | M. Rothier (Fr.) | B. Deydier (Fr.) |
| 1984 | I. Berghmans (Belg.) | K. Briggs (U.K.) | Yamaguchi K. (Japan) | A.-M. Burns (U.S.) | N. Hernandez (Venez.) | B. Deydier (Fr.) |
| 1986 | I. Berghmans (Belg.) | K. Briggs (U.K.) | D. Brun (Fr.) | A. Hughes (U.K.) | D. Bell (U.K.) | B. Deydier (Fr.) |
| 1987 | Gao Fengliang (China) | Li Zhang Yun (China) | S. Rendle (U.K.) | C. Arnaud (Fr.) | D. Bell (U.K.) | A. Schreiber (W.Ger.) |
| 1989 | E. Rodriguez (Cuba) | K. Briggs (U.K.) | S. Rendle (U.K.) | C. Arnaud (Fr.) | C. Fleury (Fr.) | E. Pierantozzi (Italy) |
| 1991 | Zhuang Xiaoyan (China) | C. Nowak (Fr.) | A. Giungi (Italy) | M. Blasco (Spain) | F. Eckoff (Ger.) | E. Pierantozzi (Italy) |
| 1993 | B. Maksymow (Pol.) | Tamura R. (Japan) | R. Verdecia (Cuba) | N. Fairbrother (U.K.) | G. Vandecavaye (Belg.) | Cho Min Sun (S.Kor.) |
| 1995 | M. van der Lee (Neth.) | Tamura R. (Japan) | M.-C. Restoux (Fr.) | D. González (Cuba) | Jung Sung Sook (S.Kor.) | Cho Min Sun (S.Kor.) |
| 1997 | D. Beltran (Cuba) | Tamura R. (Japan) | M.-C. Restoux (Fr.) | I. Fernández (Spain) | S. Vandenhende (Fr.) | K. Howey (U.K.) |
| 1999 | D. Beltran (Cuba) | Tamura R. (Japan) | Narasaki N. (Japan) | D. González (Cuba) | Maeda K. (Japan) | S. Veranes (Cuba) |
| 2001 | C. Lebrun (Fr.) | Tamura R. (Japan) | Kye S.H. (N.Kor.) | Y. Lupetey (Cuba) | G. Vandecavaye (Belg.) | Ueno M. (Japan) |

| year | 72 kg (78 kg) | year | 72 kg (78 kg) | year | +72 kg (+78 kg) | year | +72 kg (+78 kg) |
|---|---|---|---|---|---|---|---|
| 1980 | J. Triadou (Fr.) | 1991 | Kim Mi Jong (S.Kor.) | 1980 | M. de Cal (Italy) | 1991 | Moon Ji Yoon (S.Kor.) |
| 1982 | B. Classen (W.Ger.) | 1993 | Leng Chin Hui (China) | 1982 | N. Lupino (Fr.) | 1993 | J. Hagn (Ger.) |
| 1984 | I. Berghmans (Belg.) | 1995 | C. Luna (Cuba) | 1984 | M.-T. Motta (Italy) | 1995 | A. Seriese (Neth.) |
| 1986 | I. de Kok (Neth.) | 1997 | Anno N. (Japan) | 1986 | Gao Fengliang (China) | 1997 | C. Cicot (Fr.) |
| 1987 | I. de Kok (Neth.) | 1999 | Anno N. (Japan) | 1987 | Gao Fengliang (China) | 1999 | B. Maksymow (Pol.) |
| 1989 | I. Berghmans (Belg.) | 2001 | Anno N. (Japan) | 1989 | Gao Fengliang (China) | 2001 | Yuan Hua (China) |

*Figures in parentheses represent new weight classes established in 1999.

## ROWING

World championship rowing was established in 1962 by the Fédération Internationale des Sociétés d'Aviron (FISA; founded 1892). Events are contested over a 2,000-metre course and include single, double, and quadruple sculls; pairs (with and without coxswain); fours (with and without coxswain); and eights (with coxswain). Women's world championships, held since 1974, include single, double, and coxed quadruple sculls; coxless pairs; fours; and eights, raced over a 1,000-metre course until 1985 (2,000-metre course thereafter).

The most famous and historic of rowing courses is the 2,112-metre course at Henley-on-Thames, Oxfordshire, England. Two events of the Henley Regatta are open to the world, the Diamond Challenge Sculls for single sculls and the Grand Challenge Cup for eights. Unless otherwise mentioned, the clubs listed in the Henley Regatta events are English.

Another historic event is the University Boat Race between Eights from Oxford and Cambridge universities, which was instituted on June 10, 1829. The record time for the course of 4 miles 374 yards (6,755 m) from Putney to Mortlake on the River Thames is 16 min 19 s by Cambridge in 1998. The results including the 147th race in 2001 have been Cambridge 77 wins, Oxford 69 wins, and one dead heat (in 1877).

**World Rowing Championships—men***

| year | single sculls | min:s | double sculls | min:s | coxed pairs | min:s |
|---|---|---|---|---|---|---|
| 1962 | V. Ivanov (U.S.S.R.) | 7:07.9 | R. Duhamel, B. Monnereau (Fr.) | 6:33.9 | Jordan, Neuss (W.Ger.) | 6:29.12 |
| 1964† | V. Ivanov (U.S.S.R.) | 8:22.51 | C. Tyurin, B. Dubrovsky (U.S.S.R.) | 7:10.66 | E. Ferry, C. Findlay (U.S.) | 8:21.33 |
| 1966 | D.M. Spero (U.S.) | 7:05.92 | M. Buergin, M. Studach (Switz.) | 6:34.98 | H. van Nes, J. van de Graaf (Neth.) | 7:12.83 |
| 1968† | J. Wienese (Neth.) | 7:47.80 | A. Sass, A. Timoshinin (U.S.S.R.) | 6:51.82 | P. Baran, R. Sambo (Italy) | 8:04.81 |
| 1970 | A. Demiddi (Arg.) | 7:16.54 | J. Engelbrecht, N. Secher (Den.) | 6:28.68 | Tudor, Ciapura (Rom.) | 7:25.30 |
| 1972† | Y. Malyshev (U.S.S.R.) | 7:10.12 | A. Timoshinin, G. Korshikov (U.S.S.R.) | 7:01.77 | W. Gunkel, J. Lucke (E.Ger.) | 7:17.25 |
| 1974 | W. Hönig (E.Ger.) | 7:20.11 | H.-U. Schmied, C. Kreuziger (E.Ger.) | 6:35.95 | V. Yeshinov, N. Ivanov (U.S.S.R.) | 7:21.90 |
| 1975 | P.-M. Kolbe (W.Ger.) | 7:10.08 | F. Hansen, A. Hansen (Nor.) | 6:34.49 | J. Lucke, W. Gunkel (E.Ger.) | 7:16.24 |
| 1976† | P. Karppinen (Fin.) | 7:23.03 | F. Hansen, A. Hansen (Nor.) | 7:13.20 | H. Jahrling, F. Ulrich (E.Ger.) | 7:58.99 |
| 1979 | P. Karppinen (Fin.) | 6:58.27 | F. Hansen, A. Hansen (Nor.) | 6:26.98 | J. Pfeiffer, G. Uebeler (E.Ger.) | 7:06.35 |
| 1980† | P. Karppinen (Fin.) | 7:09.61 | J. Dreifke, K. Kroppelien (E.Ger.) | 6:24.33 | H. Jahrling, F.-W. Ulrich (E.Ger.) | 7:02.54 |
| 1981 | P.-M. Kolbe (W.Ger.) | 7:45.32 | J. Dreifke, K. Kroppelien (E.Ger.) | 6:41.99 | G. Abbagnale, C. Abbagnale (Italy) | 7:49.73 |
| 1982 | R. Reiche (E.Ger.) | 7:00.67 | R. Thorsen, A. Hansen (Nor.) | 6:23.66 | G. Abbagnale, C. Abbagnale (Italy) | 6:59.63 |
| 1983 | P.-M. Kolbe (W.Ger.) | 6:49.88 | T. Lange, U. Heppner (E.Ger.) | 6:20.17 | T. Greiner, U. Diessner (E.Ger.) | 6:49.75 |
| 1984† | P. Karppinen (Fin.) | 7:00.24 | B. Lewis, P. Enquist (U.S.) | 6:36.87 | G. Abbagnale, C. Abbagnale (Italy) | 7:05.99 |
| 1985 | P. Karppinen (Fin.) | 6:48.08 | U. Heppner, T. Lange (E.Ger.) | 6:15.49 | G. Abbagnale, C. Abbagnale (Italy) | 6:53.40 |
| 1986 | P.-M. Kolbe (W.Ger.) | 6:54.09 | A. Belgeri, I. Pescialli (Italy) | 6:33.64 | A. Holmes, S. Redgrave (U.K.) | 6:51.66 |
| 1987 | T. Lange (E.Ger.) | 7:36.41 | D. Yorddanov, V. Dadev (Bulg.) | 7:03.33 | G. Abbagnale, C. Abbagnale (Italy) | 7:40.81 |
| 1988† | T. Lange (E.Ger.) | 6:49.86 | R. Florijan, N. Rienks (Neth.) | 6:21.13 | G. Abbagnale, C. Abbagnale (Italy) | 6:58.79 |
| 1989 | T. Lange (E.Ger.) | 6:58.14 | R. Thorsen, L. Bjoenness (Nor.) | 6:23.40 | G. Abbagnale, C. Abbagnale (Italy) | 6:54.81 |
| 1990 | Yu. Jensen (U.S.S.R.) | 7:22.15 | C. Zerbst, A. Jonke (Austria) | 6:56.37 | G. Abbagnale, C. Abbagnale (Italy) | 6:48.30 |
| 1991 | T. Lange (Ger.) | 6:41.29 | H.-J. Zwolle, N. Rienks (Neth.) | 6:06.14 | G. Abbagnale, C. Abbagnale (Italy) | 7:34.49 |
| 1992† | T. Lange (Ger.) | 6:51.40 | S. Hawkins, P. Antonie (Aust.) | 6:17.32 | J. Searle, G. Searle (U.K.) | 6:49.83 |
| 1993 | D. Porter (Can.) | 6:59.03 | Y. Lamarque, S. Barathay (Fr.) | 6:24.69 | J. Searle, G. Searle (U.K.) | 7:01.50 |
| 1994 | A. Willims (Ger.) | 6:46.33 | R. Thorsen, L. Bjoenness (Nor.) | 6:08.33 | T. Frankovic, I. Boraska (Croatia) | 6:42.16 |
| 1995 | I. Cop (Slovenia) | 6:52.93 | L. Christensen, M. Haldbo-Hansen (Den.) | 6:17.01 | L. Sartori, G. DeStabile (Italy) | 7:35.11 |
| 1996 | X. Muller (Switz.) | 6:44.85 | D. Tizzano, A. Abbagnale (Italy) | 6:16.90 | Y. Schulte, L. Prevot (Fr.) | 7:18.26 |
| 1997 | J. Koven (U.S.) | 6:44.86 | S. Volkert, A. Hajek (Ger.) | 6:13.35 | S. Fentress, J. Irving (U.S.) | 6:56.30 |
| 1998 | R. Waddell (N.Z.) | 6:39.65 | S. Volkert, A. Hajek (Ger.) | 6:13.20 | N. Green, J. Tomkins (Aust.) | 6:45.01 |
| 1999 | R. Waddell (N.Z.) | 6:36.66 | L. Spik, I. Cop (Slovenia) | 6:04.37 | J. Neil, P. Henry (U.S.) | 6:48.56 |
| 2000 | R. Waddell (N.Z.) | 6:48.90 | L. Spik, I. Cop (Slovenia) | 6:16.63 | K. Borcherding, M. Guerrieri (U.S.) | 7:07.15 |
| 2001 | O. Tufte (Nor.) | 6:43:04 | A. Haller, T. Peto (Hung.) | 6:14:16 | J. Cracknell, M. Pinsent (U.K.) | 6:49:33 |
| 2002 | M. Hacker (Ger.) | 6:36:33 | A. Haller, T. Peto (Hung.) | 6:05:74 | L. Krisch, A. Werner (Ger.) | 6:47:93 |

| year | coxless pairs | min:s | coxed fours | min:s | coxless fours | min:s | eights | min:s |
|---|---|---|---|---|---|---|---|---|
| 1962 | Bender, Z. Keller (Ger.‡) | 6:54.62 | West Germany | 6:29.12 | West Germany | 6:19.24 | West Germany | 5:50.83 |
| 1964† | G. Hungerford, R.C. Jackson (Can.) | 7:32.94 | Germany‡ | 7:00.44 | Denmark | 6:59.30 | United States | 5:18.23 |
| 1966 | R. Kremtz, A. Goehler (E.Ger.) | 6:53.86 | East Germany | 6:29.54 | East Germany | 6:18.41 | West Germany | 5:56.28 |
| 1968† | J. Lucke, H.J. Bothe (E.Ger.) | 7:26.56 | New Zealand | 6:45.62 | East Germany | 6:39.18 | West Germany | 6:07.00 |
| 1970 | W. Klatt, P. Gorniv (E.Ger.) | 6:57.81 | West Germany | 6:28.55 | East Germany | 6:23.15 | East Germany | 5:36.10 |
| 1972† | S. Brietzke, W. Mager (E.Ger.) | 6:53.16 | West Germany | 6:31.85 | East Germany | 6:24.27 | New Zealand | 6:08.94 |
| 1974 | J. Landvoigt, B. Landvoigt (E.Ger.) | 6:59.09 | East Germany | 6:25.38 | East Germany | 6:19.20 | United States | 5:46.37 |
| 1975 | J. Landvoigt, B. Landvoigt (E.Ger.) | 7:06.40 | U.S.S.R. | 6:31.46 | East Germany | 6:13.81 | East Germany | 5:39.01 |
| 1976† | J. Landvoigt, B. Landvoigt (E.Ger.) | 7:23.31 | U.S.S.R. | 6:40.22 | East Germany | 6:37.42 | East Germany | 5:58.29 |
| 1979 | J. Landvoigt, B. Landvoigt (E.Ger.) | 6:42.63 | East Germany | 6:27.24 | East Germany | 6:00.64 | East Germany | 5:36.41 |
| 1980† | J. Landvoigt, B. Landvoigt (E.Ger.) | 6:48.01 | East Germany | 6:14.51 | East Germany | 6:08.17 | East Germany | 5:49.05 |
| 1981 | J. Pimenov, N. Pimenov (U.S.S.R.) | 7:15.06 | East Germany | 6:36.88 | U.S.S.R. | 6:35.85 | U.S.S.R. | 6:02.30 |
| 1982 | M. Grepperud, S. Loken (Nor.) | 6:41.98 | East Germany | 6:19.04 | Switzerland | 6:10.41 | New Zealand | 5:36.99 |
| 1983 | C. Ertel, U. Sauerbrey (E.Ger.) | 6:35.85 | New Zealand | 6:13.89 | West Germany | 5:57.02 | New Zealand | 5:34.39 |
| 1984† | P. Iosub, V. Toma (Rom.) | 6:45.39 | Great Britain | 6:18.64 | New Zealand | 6:03.48 | Canada | 5:41.32 |
| 1985 | N. Pimenov, Yu. Pimenov (U.S.S.R.) | 6:38.39 | U.S.S.R. | 6:07.23 | West Germany | 6:00.19 | U.S.S.R. | 5:33.71 |
| 1986 | Yu. Pimenov, N. Pimenov (U.S.S.R.) | 6:42.37 | East Germany | 6:03.81 | United States | 6:03.53 | Australia | 5:33.54 |
| 1987 | S. Redgrave, A. Holmes (U.K.) | 7:11.20 | East Germany | 6:41.74 | East Germany | 6:39.70 | United States | 5:58.83 |
| 1988† | S. Redgrave, A. Holmes (U.K.) | 6:36.84 | East Germany | 6:10.74 | East Germany | 6:03.11 | West Germany | 5:46.05 |
| 1989 | T. Jung, U. Kellner (E.Ger.) | 6:39.95 | Romania | 6:14.90 | East Germany | 6:06.94 | West Germany | 5:43.88 |
| 1990 | T. Jung, U. Kellner (E.Ger.) | 7:07.91 | East Germany | 6:46.73 | Australia | 5:52.20 | West Germany | 5:26.62 |
| 1991 | S. Redgrave, M. Pinsent (U.K.) | 6:21.35 | Germany | 5:58.96 | Australia | 6:29.69 | Germany | 5:50.98 |
| 1992† | S. Redgrave, M. Pinsent (U.K.) | 6:27.72 | Romania | 5:59.37 | Australia | 5:55.04 | Canada | 5:29.53 |
| 1993 | S. Redgrave, M. Pinsent (U.K.) | 6:37.11 | Romania | 6:14.64 | France | 6:04.54 | Germany | 5:37.08 |
| 1994 | S. Redgrave, M. Pinsent (U.K.) | 6:18.65 | Romania | 6:06.69 | Italy | 5:48.44 | United States | 5:24.50 |
| 1995 | S. Redgrave, M. Pinsent (U.K.) | 6:28.11 | United States | 6:37.50 | Italy | 5:58.28 | Germany | 5:53.40 |
| 1996 | S. Redgrave, M. Pinsent (U.K.) | 6:20.09 | Romania | 6:25.74 | Australia | 6:06.37 | Netherlands | 5:42.74 |
| 1997 | M. Andrieux, J.-C. Rolland (Fr.) | 6:27.69 | France | 6:04.17 | Great Britain | 5:52.40 | United States | 5:27.20 |
| 1998 | R. Sens, D. Kirchhoff (Ger.) | 6:22.32 | Australia | 6:09.43 | Great Britain | 5:48.06 | United States | 5:38.78 |
| 1999 | D. Ginn, J. Tomkins (Aust.) | 6:19.00 | United States | 6:38.31 | Great Britain | 5:48.57 | United States | 6:01.58 |
| 2000 | M. Andrieux, J.-C. Rolland (Fr.) | 6:32.97 | Great Britain | 6:16.82 | Great Britain | 5:56.24 | Great Britain | 5:33.08 |
| 2001 | J. Cracknell, M. Pinsent (U.K.) | 6:27:57 | France | 6:08:25 | Great Britain | 5:48:98 | Romania | 5:27:48 |
| 2002 | J. Cracknell, M. Pinsent (U.K.) | 6:14:27 | Great Britain | 6:06:70 | Germany | 5:41:35 | Canada | 5:26:92 |

*Results are for heavyweight events only. †Olympic champions, recognized as world champions. ‡Joint East-West German team.

## World Rowing Championships—women*

| year | single sculls | min:s | double sculls | min:s | quadruple sculls | min:s |
|---|---|---|---|---|---|---|
| 1974 | C. Scheiblich (E.Ger.) | 3:46.52 | G. Yermolayeva, E. Antonova (U.S.S.R.) | 3:24.00 | East Germany | 3:19.81 |
| 1975 | C. Scheiblich (E.Ger.) | 3:55.75 | G. Yermolayeva, E. Antonova (U.S.S.R.) | 3:33.70 | East Germany | 3:21.61 |
| 1976† | C. Scheiblich (E.Ger.) | 4:05.56 | S. Otzetova, Z. Yordanova (Bulg.) | 3:44.36 | East Germany | 3:29.99 |
| 1977 | C. Scheiblich (E.Ger.) | 3:34.31 | R. Zobelt, A. Borchmann (E.Ger.) | 3:16.83 | East Germany | 3:10.11 |
| 1978 | C. Hahn-Scheiblich (E.Ger.) | 4:12.49 | S. Otzetova, Z. Yordanova (Bulg.) | 4:01.94 | Bulgaria | 3:31.16 |
| 1979 | S. Toma (Rom.) | 3:35.44 | H. Westphal, C. Linse (E.Ger.) | 3:15.95 | East Germany | 3:06.75 |
| 1980† | S. Toma (Rom.) | 3:40.69 | Y. Khloptseva, L. Popova (U.S.S.R.) | 3:16.27 | East Germany | 3:15.32 |
| 1981 | S. Toma (Rom.) | 3:54.46 | M. Kokoreviche, M. Antonina (U.S.S.R.) | 3:27.06 | U.S.S.R. | 3:19.83 |
| 1982 | I. Felisova (U.S.S.R.) | 3:42.63 | A. Makhina, E. Bratishko (U.S.S.R.) | 3:19.47 | U.S.S.R. | 3:07.58 |
| 1983 | J. Hampe (E.Ger.) | 3:36.51 | J. Schenk, M. Schröter (E.Ger.) | 3:13.44 | U.S.S.R. | 3:02.48 |
| 1984† | V. Racila (Rom.) | 3:40.68 | M. Popescu, E. Oleniuc (Rom.) | 3:26.75 | Romania | 3:14.11 |
| 1985 | C. Linse (E.Ger.) | 7:40.37 | S. Schwabe, M. Schröter (E.Ger.) | 6:58.80 | East Germany | 6:22.47 |
| 1986 | J. Hampe (E.Ger.) | 7:29.60 | S. Schwabe, B. Schramm (E.Ger.) | 6:57.71 | East Germany | 6:13.91 |
| 1987 | M. Georgieva (Bulg.) | 8:59.26 | S. Madina, V. Ninova (Bulg.) | 7:47.89 | East Germany | 6:58.42 |
| 1988† | J. Behrendt (E.Ger.) | 7:47.19 | B. Peter, M. Schröter (E.Ger.) | 7:00.48 | East Germany | 6:21.06 |
| 1989 | E. Lipa (Rom.) | 7:27.96 | J. Sorges, B. Schramm (E.Ger.) | 7:01.71 | East Germany | 6:16.62 |
| 1990 | B. Peter (E.Ger.) | 7:24.10 | K. Boron, B. Schramm (E.Ger.) | 6:18.63 | East Germany | 6:14.08 |
| 1991 | S. Laumann (Can.) | 8:17.58 | K. Boron, B. Schramm (Ger.) | 6:44.71 | Germany | 6:55.85 |
| 1992† | E. Lipa (Rom.) | 7:25.54 | K. Boron, K. Köppen (Ger.) | 6:49.00 | Germany | 6:20.18 |
| 1993 | J. Thieme (Ger.) | 7:26.00 | P. Baker, B. Lawson (N.Z.) | 7:03.42 | China | 6:21.07 |
| 1994 | T. Hansen (Den.) | 7:23.96 | P. Baker, B. Lawson (N.Z.) | 6:45.30 | Germany | 6:11.78 |
| 1995 | M. Brandin (Swed.) | 7:26.00 | M. McBean, K. Heddle (Can.) | 6:55.76 | Germany | 6:40.80 |
| 1996 | Ye. Khodotovich (Belarus) | 7:32.21 | M. McBean, K. Heddle (Can.) | 6:56.84 | Germany | 6:27.44 |
| 1997 | Ye. Khodotovich (Belarus) | 7:29.30 | E. Meike, K. Boron (Ger.) | 6:51.07 | Germany | 6:16.15 |
| 1998 | I. Fedotova (Russia) | 7:25.09 | M. Batten, G. Lindsay (Gt.Brit.) | 6:48.85 | Germany | 6:24.38 |
| 1999 | Ye. Karsten (Belarus) | 7:11.68 | J. Thieme, K. Boron (Ger.) | 6:41.98 | Germany | 7:06.53 |
| 2000 | Ye. Karsten (Belarus) | 7:28.14 | J. Thieme, K. Boron (Ger.) | 6:55.44 | Germany | 6:19.58 |
| 2001 | K. Rutschow-Stomporowski (Ger.) | 7:19.25 | K. Boron, K. Kowalski (Ger.) | 6:50.20 | Germany | 6:12.95 |
| 2002 | R. Nieykova (Bulg.) | 7:07.71 | G. Evers-Swindell, C. Evers-Swindell (N.Z.) | 6:38.78 | Germany | 6:15.66 |

| year | coxless pairs | min:s | fours‡ | min:s | eights | min:s |
|---|---|---|---|---|---|---|
| 1974 | C. Neacsu, M. Ghita (Rom.) | 3:43.12 | East Germany | 3:28.99 | East Germany | 3:04.82 |
| 1975 | A. Noack, S. Dahne (E.Ger.) | 3:49.83 | East Germany | 3:24.18 | East Germany | 3:14.53 |
| 1976† | S. Kelbetcheva, S. Groultcheva (Bulg.) | 4:01.22 | East Germany | 3:45.08 | East Germany | 3:33.32 |
| 1977 | A. Noack, S. Dahne (E.Ger.) | 3:27.89 | East Germany | 3:20.59 | East Germany | 3:00.23 |
| 1978 | C. Bugel, U. Steindorf (E.Ger.) | 4:02.65 | East Germany | 3:48.47 | U.S.S.R. | 3:22.00 |
| 1979 | U. Steindorf, K. Bugel (E.Ger.) | 3:27.74 | U.S.S.R. | 3:17.03 | U.S.S.R. | 2:58.09 |
| 1980† | U. Steindorf, C. Klier (E.Ger.) | 3:30.49 | East Germany | 3:19.27 | East Germany | 3:03.32 |
| 1981 | I. Rudolph, S. Anders (E.Ger.) | 3:45.50 | U.S.S.R. | 3:18.75 | U.S.S.R. | 3:07.58 |
| 1982 | M. Sandig, S. Fruhlich (E.Ger.) | 3:32.44 | U.S.S.R. | 3:17.16 | U.S.S.R. | 2:57.57 |
| 1983 | M. Gasch, S. Fruhlich (E.Ger.) | 3:26.68 | East Germany | 3:11.18 | U.S.S.R. | 2:56.22 |
| 1984† | R. Arba, E. Horvat (Rom.) | 3:32.60 | Romania | 3:19.30 | United States | 2:59.80 |
| 1985 | R. Arba, E. Florea (Rom.) | 7:25.08 | East Germany | 6:50.08 | U.S.S.R. | 6:14.00 |
| 1986 | R. Arba, O. Homeghi (Rom.) | 7:12.20 | Romania | 6:43.86 | U.S.S.R. | 6:06.76 |
| 1987 | R. Arba, O. Homeghi (Rom.) | 8:00.73 | Romania | 7:30.12 | Romania | 6:55.61 |
| 1988† | R. Arba, O. Homeghi (Rom.) | 7:28.13 | East Germany | 6:56.00 | East Germany | 6:15.17 |
| 1989 | K. Haaker, J. Zeidler (E.Ger.) | 7:26.97 | East Germany | 6:45.81 | Romania | 6:07.92 |
| 1990 | S. Werremeier, I. Althoff (W.Ger.) | 9:28.37 | Romania | 7:51.68 | Romania | 6:59.18 |
| 1991 | M. McBean, K. Heddle (Can.) | 6:57.42 | Canada | 6:25.43 | Canada | 6:28.20 |
| 1992† | M. McBean, K. Heddle (Can.) | 7:06.22 | Canada | 6:30.85 | Canada | 6:02.62 |
| 1993 | C. Gosse, H. Cortin (Fr.) | 7:24.74 | China | 6:42.06 | Romania | 6:18.88 |
| 1994 | C. Gosse, H. Cortin (Fr.) | 7:01.77 | Netherlands | 6:30.76 | Germany | 6:07.42 |
| 1995 | M. Still, K. Slatter (Austl.) | 7:12.70 | United States | 7:03.53 | United States | 6:50.73 |
| 1996 | M. Still, K. Slatter (Austl.) | 7:01.39 | United States | 6:49.48 | Romania | 6:19.73 |
| 1997 | E. Robinson, A. Korn (Can.) | 7:08.09 | Great Britain | 6:40.30 | Romania | 6:02.40 |
| 1998 | E. Robinson, A. Korn (Can.) | 7:05.19 | Ukraine | 6:39.83 | Romania | 6:14.62 |
| 1999 | E. Robinson, T. Luke (Can.) | 7:00.85 | Belarus | 6:26.25 | Romania | 6:47.66 |
| 2000 | G. Damian, D. Ignat (Rom.) | 7:11.00 | Belarus | 6:44.90 | Romania | 6:06.44 |
| 2001 | G. Damian, V. Susanu (Rom.) | 7:01.02 | Australia | 6:27.23 | Australia | 6:03.66 |
| 2002 | G. Andrunache, V. Susanu (Rom.) | 6:53.80 | Australia | 6:26.11 | United States | 6:04.25 |

*Results are for heavyweight events only. †Olympic champions, recognized as world champions. ‡With coxswain until 1989; coxless since then.

## Grand Challenge Cup

| year | winner | min:s | year | winner | min:s | year | winner | min:s |
|---|---|---|---|---|---|---|---|---|
| 1839 | First Trinity Boat Club, Cambridge | 8:30 | 1874 | London R.C. | 7:41 | 1909 | R.C. Naut. de Gand, Belgium | 7:8 |
| 1840 | Leander Club | 9:15 | 1875 | Leander Club | 7:19 | 1910 | Magdalen College, Oxford | 7:19 |
| 1841 | Cambridge Subscription Rooms | —* | 1876 | Thames R.C. | 7:26 | 1911 | Magdalen College, Oxford | 7:2 |
| 1842 | Cambridge Subscription Rooms | 8:30 | 1877 | London R.C. | 8:20½ | 1912 | Sydney R.C., N.S.W. | 7:6 |
| 1843 | Oxford University B.C. (7 oars) | 9:0 | 1878 | Thames R.C. | 7:42 | 1913 | Leander Club | 7:11 |
| 1844 | Etonian Club, Oxford | 8:25 | 1879 | Jesus College, Cambridge | 8:39 | 1914 | Harvard Athletic Association B.C., U.S. | 7:20 |
| 1845 | Cambridge University B.C. | 8:30 | 1880 | Leander Club | 7:3 | 1915–19 | not held | |
| 1846 | Thames Club, London | 8:15 | 1881 | London R.C. | 7:23 | 1920 | Magdalen College, Oxford | 7:24 |
| 1847 | Oxford University B.C. | 8:0 | 1882 | Exeter College, Oxford | 8:11 | 1921 | Magdalen College, Oxford | 6:54 |
| 1848 | Oxford University B.C. | 9:11 | 1883 | London R.C. | 7:51 | 1922 | Leander Club | 7:36 |
| 1849 | Wadham College, Oxford | —* | 1884 | London R.C. | 7:27 | 1923 | Thames R.C. | 6:45 |
| 1850 | Oxford University B.C. | —† | 1885 | Jesus College, Cambridge | 7:22 | 1924 | Leander Club | 8:03 |
| 1851 | Oxford University B.C. | 7:45 | 1886 | Trinity Hall, Cambridge | 6:53½ | 1925 | Leander Club | 6:53 |
| 1852 | Oxford University B.C. | —* | 1887 | Trinity Hall, Cambridge | 6:56 | 1926 | Leander Club | 6:56 |
| 1853 | Oxford University B.C. | 8:3 | 1888 | Thames R.C. | 7:1 | 1927 | Thames R.C. | 7:16 |
| 1854 | First Trinity B.C., Cambridge | 8:15 | 1889 | Thames R.C. | 7:40⅘‡ | 1928 | Thames R.C. | 6:56 |
| 1855 | Cambridge University B.C. | 8:32 | 1890 | London R.C. | 7:4 ‡ | 1929 | Leander Club | 7:00 |
| 1856 | Royal Chester Rowing Club | — | 1891 | Leander Club | 6:51 | 1930 | London R.C. | 6:59 |
| 1857 | London R.C. | 7:55 | 1892 | Leander Club | 7:48‡ | 1931 | London R.C. | 7:33 |
| 1858 | Cambridge University B.C. | 7:26 | 1893 | Leander Club | 7:12 | 1932 | Leander Club | 7:19 |
| 1859 | London R.C. | 7:45 | 1894 | Leander Club | 7:22 | 1933 | London R.C. | 7:36 |
| 1860 | First Trinity B.C., Cambridge | 8:55‡ | 1895 | Trinity Hall, Cambridge | 7:30 | 1934 | Leander Club | 6:45 |
| 1861 | First Trinity B.C., Cambridge | 8:15‡ | 1896 | Leander Club | 7:43 | 1935 | Pembroke College, Cambridge | 8:52 |
| 1862 | London R.C. | 8:2 ‡ | 1897 | New College, Oxford | 6:51 | 1936 | F.C. Zürich R.C., Switz. | 7:25 |
| 1863 | University College, Oxford | 7:45‡ | 1898 | Leander Club | 7:13 | 1937 | R. Wiking, Ger. | 7:33 |
| 1864 | Kingston R.C. | 7:40‡ | 1899 | Leander Club | 7:12 | 1938 | London R.C. | 6:58 |
| 1865 | Kingston R.C. | 7:26‡ | 1900 | Leander Club | 7:6 | 1939 | Harvard University, U.S. | 7:40 |
| 1866 | Etonian Club, Oxford | 8:29 | 1901 | Leander Club | 7:5 ‡ | 1940–45 | not held | |
| 1867 | Etonian Club, Oxford | 7:54 | 1902 | Third Trinity B.C., Cambridge | 7:17 | 1946 | Leander Club | 7:01 |
| 1868 | London R.C. | 7:23‡ | 1903 | Leander Club | 7:9 | 1947 | Jesus College, Cambridge | 7:14 |
| 1869 | Etonian Club, Oxford | 7:28 | 1904 | Leander Club | 7:20 | 1948 | Thames R.C. | 7:02 |
| 1870 | Etonian Club, Oxford | 7:18 | 1905 | Leander Club | 6:58 | 1949 | Leander Club | 6:54 |
| 1871 | Etonian Club, Oxford | 8:5 | 1906 | C. Naut. de Gand, Belgium | 7:9 | 1950 | Harvard University, U.S. | 7:23 |
| 1872 | London R.C. | 8:27 | 1907 | Sport Naut. de Gand, Belgium | 7:31 | | | |
| 1873 | London R.C. | 7:52 | 1908 | Christ Church, Oxford | 7:10 | | | |

(continued on pg. 160)

## Grand Challenge Cup (continued)

| year | winner | min:s |
|---|---|---|
| 1951 | Lady Margaret B.C. | 7:16 |
| 1952 | Leander Club | 6:38 |
| 1953 | Leander Club | 6:49 |
| 1954 | Club Krylya Sovetov, U.S.S.R. | 7:16 |
| 1955 | University of Pennsylvania, U.S. | 6:56 |
| 1956 | Centre Sportif des Forces de l'Armée Française, Fr. | 7:06 |
| 1957 | Cornell University, U.S. | 6:53 |
| 1958 | Trud Club, U.S.S.R. | 6:40 |
| 1959 | Harvard University, U.S. | 6:57 |
| 1960 | Molesey B.C. | 6:35 |
| 1961 | Central Sports Club of U.S.S.R. Navy | 6:43 |
| 1962 | Central Sports Club of U.S.S.R. Navy | 6:40 |
| 1963 | University of London | 6:38 |
| 1964 | Club Zyalghiris Vilnius, U.S.S.R. | 6:25 |
| 1965 | Ratzeburger, W.Ger. | 6:16 |
| 1966 | Turn und Sports Club, W.Ger. | 6:35 |
| 1967 | S.C. Wissenschaft, E.Ger. | 6:46 |
| 1968 | University of London | 7:56 |
| 1969 | S.C. Einheit, E.Ger. | 6:28 |
| 1970 | A.S.K. Vorwarts Rostock, E.Ger. | 6:34 |
| 1971 | Tideway Scullers | 6:46 |
| 1972 | Voenno-Morskogo Flota Club, U.S.S.R. | 6:33 |
| 1973 | Trud Kolomna, U.S.S.R. | 6:23 |
| 1974 | Trud Kolomna, U.S.S.R. | 6:34 |
| 1975 | Leander and Thames Tradesmen | 6:16 |
| 1976 | Thames Tradesmen's R.C. | 6:25 |
| 1977 | University of Washington, U.S. | 6:27 |
| 1978 | Lokomotiv Club, Bulgaria | 6:51 |
| 1979 | Thames Tradesmen and London R.C. | 6:35 |
| 1980 | Charles River Rowing Association, U.S. | 6:24 |
| 1981 | Oxford U. and Thames Tradesmen | 7:15 |
| 1982 | Leander and London R.C. | —§ |
| 1983 | London R.C. and University of London | 6:26 |
| 1984 | Leander Club and London R.C. | 6:22 |
| 1985 | Harvard University, U.S. | 6:27 |
| 1986 | Nautilus R.C. | 6:18 |
| 1987 | Soviet Army | 6:11 |
| 1988 | Leander-University of London | 6:17 |
| 1989 | Hansa Dortmund, W.Ger. | 5:58 |
| 1990 | Hansa Dortmund, W.Ger. | 6:36 |
| 1991 | Leander and Star R.C. | 6:22 |
| 1992 | University of London | 6:04 |
| 1993 | Dortmund, Ger. | 6:11 |
| 1994 | Charles River and San Diego | 6:13 |
| 1995 | San Diego Training Center | 5:59 |
| 1996 | Imperial College and Queens Tower | 6:11 |
| 1997 | Institutes of Sport, Australia | 6:03 |
| 1998 | Hansa Dortmund and Berlin, Ger. | 6:18 |
| 1999 | Hansa Dortmund and Berlin, Ger. | 6:15 |
| 2000 | Institutes of Sport, Australia | 6:19 |
| 2001 | H.A.V.K. Mladost and V.K. Croatia (Cro.) | 6:29 |
| 2002 | Victoria C.R.C. and University of Victoria (Can.) | 6:20 |

B.C.—Boating Club. R.C.—Rowing Club. *Runner-up awarded after foul claimed against winner. †Not rowed out. ‡Times given vary. §Time not recorded.

## The Diamond Challenge Sculls

| year | winner | min:s |
|---|---|---|
| 1844 | T.B. Bumpsted (Scullers Club, London) | 10:32 |
| 1845 | S. Wallace (Leander Club) | 11:30 |
| 1846 | E.G. Moon (Magdalen College, Oxford) | — |
| 1847 | W. Maule (First Trinity Boat Club, Cambridge) | 10:45 |
| 1848 | W.L. Bagshawe (Third Trinity B.C., Cambridge) | — |
| 1849 | T.R. Bone (London) | — |
| 1850 | T.R. Bone (Meteor Club, London) | — |
| 1851 | E.G. Peacock (Thames Club, London) | — |
| 1852 | E. Macnaghten (First Trinity B.C., Cambridge) | — |
| 1853 | S. Rippingall (Peterhouse, Cambridge) | 10:2 |
| 1854 | H.H. Playford (Wandle Club, London) | — |
| 1855 | A.A. Casamajor (Argonaut Club, London) | 9:27 |
| 1856 | A.A. Casamajor (Argonaut Club, London) | — |
| 1857 | A.A. Casamajor (London Rowing Club) | — |
| 1858 | A.A. Casamajor (London R.C.) | — |
| 1859 | E.D. Brickwood (Richmond) | 10:0 |
| 1860 | H.H. Playford (London R.C.) | 12:8 |
| 1861 | A.A. Casamajor (London R.C.) | 10:4 |
| 1862 | E.D. Brickwood (London R.C.) | 10:40 |
| 1863 | C.B. Lawes (Third Trinity B.C., Cambridge) | 9:43 |
| 1864 | W.B. Woodgate (Brasenose College, Oxford) | 10:10* |
| 1865 | E.B. Michell (Magdalen College, Oxford) | 9:11 |
| 1866 | E.B. Michell (Magdalen College, Oxford) | 9:55 |
| 1867 | W.C. Crofts (Brasenose College, Oxford) | 10:2 |
| 1868 | W. Stout (London R.C.) | 9:6 |
| 1869 | W.C. Crofts (Brasenose College, Oxford) | 9:56 |
| 1870 | J.B. Close (First Trinity B.C., Cambridge) | 9:43 |
| 1871 | W. Fawcus (Tynemouth R.C.) | 10:9 |
| 1872 | C.C. Knollys (Magdalen College, Oxford) | 10:48 |
| 1873 | A.C. Dicker (St. John's College, Cambridge) | 9:50 |
| 1874 | A.C. Dicker (St. John's College, Cambridge) | 10:50 |
| 1875 | A.C. Dicker (St. John's College, Cambridge) | 9:15 |
| 1876 | F.L. Playford (London R.C.) | 9:28 |
| 1877 | T.C. Edwards-Moss (Brasenose College, Oxford) | 10:20 |
| 1878 | T.C. Edwards-Moss (Brasenose College, Oxford) | 9:37 |
| 1879 | J. Lowndes (Hertford College, Oxford) | 12:30 |
| 1880 | J. Lowndes (Derby) | 9:10 |
| 1881 | J. Lowndes (Derby) | 9:28 |
| 1882 | J. Lowndes (Derby) | 11:43 |
| 1883 | J. Lowndes (Twickenham R.C.) | 10:2 |
| 1884 | W.S. Unwin (Magdalen College, Oxford) | 9:44 |
| 1885 | W.S. Unwin (Magdalen College, Oxford) | 9:22 |
| 1886 | F.I. Pitman (Third Trinity B.C., Cambridge) | 9:5 |
| 1887 | J.C. Gardner (Emmanuel College, Cambridge) | 8:51 |
| 1888 | G. Nickalls (Magdalen College, Oxford) | 8:36 |
| 1889 | G. Nickalls (Magdalen College, Oxford) | 8:56 |
| 1890 | G. Nickalls (Magdalen College, Oxford) | 8:57½ |
| 1891 | V. Nickalls (Magdalen College, Oxford) | — |
| 1892 | J.J.K. Ooms (Neptunus R.C., Amsterdam) | 10:90½ |
| 1893 | G. Nickalls (Magdalen College, Oxford) | 9:12 |
| 1894 | G. Nickalls (Formosa B.C.) | 9:32 |
| 1895 | R. Guinness (Leander Club) | 9:11 |
| 1896 | R. Guinness (Leander Club) | 9:35 |
| 1897 | E.H. Ten Eyck (Wachusett B.C., Worcester, U.S.) | 8:35 |
| 1898 | B.H. Howell (Trinity Hall, Cambridge) | 8:29 |
| 1899 | B.H. Howell (Thames R.C.) | 8:38 |
| 1900 | E.G. Hemmerde (University College, Oxford) | 8:42 |
| 1901 | C.V. Fox (Guards Brigade R.C.) | 8:46 |
| 1902 | F.S. Kelly (Ballio College, Oxford) | 8:59 |
| 1903 | F.S. Kelly (Leander Club) | 8:41 |
| 1904 | L.E. Scholes (Toronto R.C., Can.) | 8:23 |
| 1905 | F.S. Kelly (Leander Club) | 8:10 |
| 1906 | H.T. Blackstaffe (Vesta R.C.) | 8:35 |
| 1907 | W.H. Darell (Household Brigade B.C.) | 9:24 |
| 1908 | A. McCulloch (Leander Club) | 8:25 |
| 1909 | A.A. Stuart (Kingston R.C.) | 8:30 |
| 1910 | W.D. Kinnear (Kensington R.C.) | 8:51 |
| 1911 | W.D. Kinnear (Kensington R.C.) | 8:14 |
| 1912 | E.W. Powell (Vikings Club) | 8:49 |
| 1913 | C. McVilly (Derwent R.C., Tasmania) | 8:49 |
| 1914 | G. Siniscalchi (Lario Club, Como, Italy) | 9:0 |
| 1915–19 | no standard competition | |
| 1920 | J. Beresford, Jr. (Thames R.C.) | 8:57 |
| 1921 | F.E. Eyken (Delft Univ. B.C., Neth.) | 8:26 |
| 1922 | W.M. Hoover (Duluth B.C., Minnesota, U.S.) | 9:32 |
| 1923 | M.K. Morris (London R.C.) | 8:23 |
| 1924 | J. Beresford, Jr. (Thames R.C.) | 10:32 |
| 1925 | J. Beresford, Jr. (Thames R.C.) | 8:26 |
| 1926 | J. Beresford, Jr. (Thames R.C.) | 8:45 |
| 1927 | R.T. Lee (Worcester College, Oxford) | 9:06 |
| 1928 | J. Wright, Jr. (Argonaut R.C., Can.) | 8:24 |
| 1929 | L.H.F. Guntner (Hoel-Zeitvereening de Amstel, Neth.) | 8:42 |
| 1930 | J.S. Guest (Don R.C., Can.) | 8:29 |
| 1931 | R. Pearce (Leander B.C., Hamilton, Ont.) | 10:03 |
| 1932 | H. Buhtz (Berliner R.C., Ger.) | 9:15 |
| 1933 | T.G. Ashwith (Peterhouse, Cambridge) | 9:07 |
| 1934 | H. Buhtz (Berliner R.C., Ger.) | 8:10 |
| 1935 | E. Ruffi (F.C. Zürich R.C., Switz.) | 8:15 |
| 1936 | E. Ruffi (F.C. Zürich R.C., Switz.) | 9:22 |
| 1937 | J. Hasenohrl (Ruderverein Ellida, Austria) | 9:12 |
| 1938 | J.W. Burk (Penn Athletic Club, U.S.) | 8:02 |
| 1939 | J.W. Burk (Penn Athletic Club, U.S.) | 9:13 |
| 1940–45 | no standard competition | |
| 1946 | J. Sépherlaidès (Société Nautique de la Basse Seine, Fr.) | 8:21 |
| 1947 | J.B. Kelly (Univ. of Pennsylvania, U.S.) | 8:49 |
| 1948 | M.T. Wood (New South Wales Police R.C., Austl.) | 8:24 |
| 1949 | J.B. Kelly (Univ. of Pennsylvania, U.S.) | 8:12 |
| 1950 | A.D. Rowe (Leander Club) | 9:11 |
| 1951 | T.A. Fox (Pembroke College, Cambridge) | 8:59 |
| 1952 | M.T. Wood (Sydney R.C., Austl.) | 8:12 |
| 1953 | T.A. Fox (London R.C.) | 8:12 |
| 1954 | P. Viasic (Mornar Club, Yugos.) | 8:42 |
| 1955 | T. Kocerka (A.Z.S. Bydgoszcz, Pol.) | 8:33 |
| 1956 | T. Kocerka (A.Z.S. Bydgoszcz, Pol.) | 8:37 |
| 1957 | S.A. Mackenzie (Sydney R.C., Austl.) | 8:25 |
| 1958 | S.A. Mackenzie (Sydney R.C., Austl.) | 8:06 |
| 1959 | S.A. Mackenzie (Sydney R.C., Austl.) | 8:29 |
| 1960 | S.A. Mackenzie (Leander Club) | 8:03 |
| 1961 | S.A. Mackenzie (Mosman R.C., Austl.) | 8:34 |
| 1962 | S.A. Mackenzie (Leander Club) | 8:38 |
| 1963 | G. Kottmann (Belvoir R.C., Switz.) | 8:09 |
| 1964 | S. Cromwell (Nonparell R.C., U.S.) | 8:06 |
| 1965 | D.M. Spero (U.S.) | 7:42 |
| 1966 | A. Kille (E.Ger.) | 8:15 |
| 1967 | M. Studach (Switz.) | 8:27 |
| 1968 | H. Wardell-Yerburgh (U.K.) | 10:25 |
| 1969 | H.J. Bohmer (S.C. Dynamo, Berlin) | 8:06 |
| 1970 | J. Meissner (Mannheim R.C., W.Ger.) | 8:18 |
| 1971 | A. Demidi (Arg.) | 8:08 |
| 1972 | A. Timoshinin (U.S.S.R.) | 8:10 |
| 1973 | S. Drea (Neptune R.C., Ire.) | 7:53 |
| 1974 | S. Drea (Neptune R.C., Ire.) | 8:20 |
| 1975 | S. Drea (Neptune R.C., Ire.) | 7:56 |
| 1976 | E.O. Hale (Austl.) | 7:47 |
| 1977 | T.J. Crooks (Leander Club) | 8:11 |
| 1978 | T.J. Crooks (Leander Club) | 8:25 |
| 1979 | R.P. Matheson (Nottingham) | 8:36 |
| 1980 | R. Ibarra (Club Nautico, Arg.) | 8:10 |
| 1981 | C.L. Baillieu (Leander Club) | 9:38 |
| 1982 | C.L. Baillieu (Leander Club) | 8:18 |
| 1983 | S. Redgrave (Marlow R.C.) | 8:23 |
| 1984 | C.L. Baillieu (Leander Club) | 7:57 |
| 1985 | S. Redgrave (Marlow R.C.) | 8:28 |
| 1986 | B. Eltang (Den.) | ‡ |
| 1987 | P.-M. Kolbe (Ruder-Club Hamburg) | 7:52 |
| 1988 | H. McGlashan (Melbourne Univ.) | — |
| 1989 | V. Chalupa (Dukla Praha, Czech.) | 7:23† |
| 1990 | EPM Verdonk (Koru, N.Z.) | 8:21 |
| 1991 | W. Van Belleghem (Belg.) | ‡ |
| 1992 | R. Henderson (Leander R.C.) | 7:44 |
| 1993 | T. Lange (Ger.) | 7:39 |
| 1994 | X. Müller (Grasshopper, Switz.) | 7:35 |
| 1995 | J. Jaanson (Parnu, Est.) | 7:24 |
| 1996 | M.L.O. Vervoorn (Delft, Neth.) | 7:42 |
| 1997 | G.M.P. Searle (Molesey B.C.) | 7:38 |
| 1998 | J. Koven (U.S.) | 7:56 |
| 1999 | M. Hacker (Ger.) | 7:59 |
| 2000 | A.H. Abdullah (U.S.) | 8:12 |
| 2001 | D.S. Free (Austl.) | 8:18 |
| 2002 | P.J.C. Wells (Univ. of London) | 8:30 |

B.C.—Boating Club. R.C.—Rowing Club. *Time is wrong. †Record. ‡Not rowed out.

## SKIING

Although most of the events had been contested at the regional level since the mid-19th century, the first internationally organized skiing championships did not take place until 1924. From 1924 to 1931 only Nordic competition was involved; Alpine championship events were added to world competition in 1931 and to the Olympics in 1936. Except for Olympic years, the Nordic and Alpine championships are held separately and at different locations. Events include cross-country races, ski-jumping, biathlon, and relay races (Nordic) and downhill and slalom skiing (Alpine). Since 1967, an Alpine World Cup has been presented to the competitor with the best combined downhill, slalom, supergiant, and giant slalom performance over a series of major contests. A Nordic World Cup for cross-country events has been awarded since 1979.

**World Nordic Skiing Championships—ski jump**

| year | 70-m jump* | normal hill† | large hill‡ | combined (7.5 km) | combined (15 km) |
|---|---|---|---|---|---|
| 1924§ | J. Tullin Thams (Nor.) | | | | T. Haug (Nor.) |
| 1925 | Dick (Ger.) | | | | Německý (Czech.) |
| 1926 | T. Thams (Nor.) | | | | J. Gröttumsbraaten (Nor.) |
| 1927 | T. Edman (Swed.) | | | | R. Purkert (Czech.) |
| 1928§ | A. Andersen (Nor.) | | | | J. Gröttumsbraaten (Nor.) |
| 1929 | S. Ruud (Nor.) | | | | H. Vinjarengen (Nor.) |
| 1930 | G. Andersen (Nor.) | | | | H. Vinjarengen (Nor.) |
| 1931 | B. Ruud (Nor.) | | | | J. Gröttumsbraaten (Nor.) |
| 1932§ | B. Ruud (Nor.) | | | | J. Gröttumsbraaten (Nor.) |
| 1933 | M. Reynolds (Switz.) | | | | S. Eriksson (Swed.) |
| 1934 | K. Johansen (Nor.) | | | | O. Hagen (Nor.) |
| 1935 | B. Ruud (Nor.) | | | | O. Hagen (Nor.) |
| 1936§ | B. Ruud (Nor.) | | | | O. Hagen (Nor.) |
| 1937 | B. Ruud (Nor.) | | | | S. Roen (Nor.) |
| 1938 | A. Ruud (Nor.) | | | | O. Hoffsbakken (Nor.) |
| 1939 | J. Bradl (Austria) | | | | H. Berauer (Czech.) |
| 1940–47 | not held | | | | |
| 1948§ | P. Hugsted (Nor.) | | | | H. Hasu (Fin.) |
| 1950 | H. Bjornstad (Nor.) | | | | H. Hasu (Fin.) |
| 1952§ | A. Bergmann (Nor.) | | | | S. Slättvik (Nor.) |
| 1954 | M. Pietikainen (Fin.) | | | | S. Stenersen (Nor.) |
| 1956§ | A. Hyvärinen (Fin.) | | | | S. Stenersen (Nor.) |
| 1958 | M. Maatela (Fin.) | J. Karkinen (Fin.) | | | P. Korhonen (Fin.) |
| 1960§ | H. Recknagel (Ger.II) | | | | G. Thoma (Ger.II) |
| 1962 | T. Engan (Nor.)¶ | H. Recknagel (E.Ger.)<br>Rte Y. (Japan)** | | | A. Larsen (Nor.) |
| 1964§ | V. Kankkonen (Fin.) | T. Engan (Nor.) | | | T. Knutsen (Nor.) |
| 1966 | B. Wirkola (Nor.) | B. Wirkola (Nor.) | | | G. Thoma (W.Ger.) |
| 1968§ | J. Raška (Czech.) | V. Belousov (U.S.S.R.) | | | F. Keller (W.Ger.) |
| 1970 | G. Napalkov (U.S.S.R.)¶ | G. Napalkov (U.S.S.R.) | | | L. Rygl (Czech.) |
| 1972§ | Kasaya Y. (Japan) | W. Fortuna (Pol.) | | | U. Wehling (E.Ger.) |
| 1974 | H.-G. Aschenbach (E.Ger.) | H.-G. Aschenbach (E.Ger.) | | | U. Wehling (E.Ger.) |
| 1976§ | H.-G. Aschenbach (E.Ger.) | K. Schnabl (Austria) | | | U. Wehling (E.Ger.) |
| 1978 | M. Buse (E.Ger.) | T. Räisänen (Fin.) | | | K. Winkler (E.Ger.) |
| 1980§ | A. Innauer (Austria) | J. Törmänen (Fin.) | | | U. Wehling (E.Ger.) |
| 1982 | A. Kogler (Austria) | M. Nykänen (Fin.) | | | T. Sandberg (Nor.) |
| 1984§ | J. Weissflog (E.Ger.) | M. Nykänen (Fin.) | | | T. Sandberg (Nor.) |
| 1985 | J. Weissflog (E.Ger.) | P. Bergerud (Nor.) | | | H. Weinbach (W.Ger.) |
| 1987 | J. Parma (Czech.) | A. Felder (Austria) | | | T. Loekken (Nor.) |
| 1988§ | M. Nykänen (Fin.) | M. Nykänen (Fin.) | | | H. Kempf (Switz.) |
| 1989 | J. Weissflog (E.Ger.) | J. Puikkonen (Fin.) | | | T.E. Elden (Nor.) |
| 1991 | H. Kuttin (Austria) | F. Petek (Yugos.) | | | F-B. Lundberg (Nor.) |
| 1992§ | | E. Vettori (Austria) | T. Nieminen (Fin.) | | F. Guy (Fr.) |
| 1993 | | Harada M. (Japan) | E. Bredesen (Nor.) | | Ogiwara K. (Japan) |
| 1994 | | E. Bredesen (Nor.) | J. Weissflog (Ger.) | | F-B. Lundberg (Nor.) |
| 1995 | | T. Okabe (Japan) | T. Ingebrigtsen (Nor.) | | F-B. Lundberg (Nor.) |
| 1996 | | not held | | | |
| 1997 | | J. Ahonen (Fin.) | M. Harada (Japan) | | K. Ogiwara (Japan) |
| 1998 | | J. Soininen (Fin.) | K. Funaki (Japan) | | B.E. Vik (Nor.) |
| 1999 | | K. Funaki (Japan) | M. Schmitt (Ger.) | B.E. Vik (Nor.) | B.E. Vik (Nor.) |
| 2001 | | A. Malysz (Pol.) | M. Schmitt (Ger.) | M. Baacke (Ger.) | B.E. Vik (Nor.) |
| 2002 | | S. Ammann (Switz.) | S. Ammann (Switz.) | S. Lajunen (Fin.) | S. Lajunen (Fin.) |

| | team jump (normal hill) | team jump (large hill) | team combined |
|---|---|---|---|
| 1982 | | Norway | East Germany |
| 1984§ | | not held | |
| 1985 | | Finland | West Germany |
| 1987 | | Finland | West Germany |
| 1988§§ | | Finland | West Germany |
| 1989 | | Finland | Norway |
| 1991 | | Austria | Austria |
| 1992§ | | Finland | Japan |
| 1993 | | Norway | Japan |
| 1994 | | Germany | Japan |
| 1995 | | Finland | Japan |
| 1996 | | not held | |
| 1997 | | Finland | Norway |
| 1998 | | Japan | Norway |
| 1999 | | Germany | Finland |
| 2001 | Austria | Germany | Norway |
| 2002 | not held | Germany§ | Finland§ |

*70-metre hill from 1964. †80-metre hill in 1964; 90-metre hill from 1966. ‡Approximately 120 metres. §Olympic champions, recognized as world champions. ||Combined East-West German team. ¶85-metre hill. **60-metre hill.

**World Nordic Skiing Championships—men**

| year | sprint | 10-km cross-country | 15-km cross-country* | 30-km cross-country | 50-km cross-country | relay† |
|---|---|---|---|---|---|---|
| 1924‡ | | | T. Haug (Nor.) | | T. Haug (Nor.) | Switzerland |
| 1925 | | | Německý (Czech.) | | Donth (Ger.) | |
| 1926 | | | J. Gröttumsbraaten (Nor.) | | Raivio (Fin.) | |
| 1927 | | | S.H. Lindgren (Swed.) | | S.H. Lindgren (Swed.) | |
| 1928‡ | | | J. Gröttumsbraaten (Nor.) | | P. Hedlund (Swed.) | Norway |
| 1929 | | | V. Saarinen (Fin.) | | A. Knuttila (Fin.) | |
| 1930 | | | A. Rustadstuen (Nor.) | | S. Utterström (Swed.) | Norway |
| 1931 | | | J. Gröttumsbraaten (Nor.) | | O. Stenen (Nor.) | |
| 1932‡ | | | S. Utterström (Swed.) | | V. Saarinen (Fin.) | |
| 1933 | | | N. Englund (Fin.) | | V. Saarinen (Fin.) | Sweden |
| 1934 | | | S. Nurmela (Fin.) | | E. Viklund (Swed.) | Finland |
| 1935 | | | K. Karppinen (Fin.) | | N. Englund (Swed.) | Finland |
| 1936‡ | | | E.-A. Larsson (Swed.) | | E. Viklund (Swed.) | Italy§ Finland§ |
| 1937 | | | L. Bergendahl (Nor.) | | P. Niemi (Fin.) | Norway |
| 1938 | | | P. Pitkänen (Fin.) | | K. Jalkanen (Fin.) | Finland |
| 1939 | | | J. Kurikkala (Fin.) | | L. Bergendahl (Nor.) | Finland |
| 1940–47 | | | not held | | | |
| 1948‡ | | | M. Lundström (Swed.) | | N. Karlsson (Swed.) | Sweden |
| 1950 | | | K.E. Aastrom (Swed.) | | G. Ericksson (Swed.) | Sweden |
| 1952‡ | | | H. Brenden (Nor.) | | V. Hakulinen (Fin.) | Finland |
| 1954 | | V. Kuzin (U.S.S.R.) | V. Kuzin (U.S.S.R.) | V. Kuzin (U.S.S.R.) | V. Kuzin (U.S.S.R.) | Finland |
| 1956‡ | | H. Brenden (Nor.) | V. Hakulinen (Fin.) | S. Jernberg (Swed.) | S. Jernberg (Swed.) | U.S.S.R. |
| 1958 | | V. Hakulinen (Fin.) | K. Hamalainen (Fin.) | S. Jernberg (Swed.) | S. Jernberg (Swed.) | Sweden |
| 1960‡ | | S. Brusveen (Nor.) | S. Jernberg (Swed.) | K. Hamalainen (Fin.) | K. Hamalainen (Fin.) | Finland |
| 1962 | | A. Roennlund (Swed.) | E. Mäntyranta (Fin.) | S. Jernberg (Swed.) | S. Jernberg (Swed.) | Sweden |
| 1964‡ | | E. Mäntyranta (Fin.) | E. Mäntyranta (Fin.) | S. Jernberg (Swed.) | S. Jernberg (Swed.) | Sweden |
| 1966 | | G. Eggen (Nor.) | E. Mäntyranta (Fin.) | G. Eggen (Nor.) | G. Eggen (Nor.) | Norway |
| 1968‡ | | H. Groenningen (Nor.) | F. Nones (Italy) | O. Eliefsaeter (Nor.) | O. Eliefsaeter (Nor.) | Norway |
| 1970 | | L. Aslund (Swed.) | V. Vedenin (U.S.S.R.) | K. Oikarainen (Fin.) | K. Oikarainen (Fin.) | U.S.S.R. |
| 1972‡ | | S.Å. Lundbäck (Swed.) | V. Vedenin (U.S.S.R.) | R. Tyldum (Nor.) | R. Tyldum (Nor.) | U.S.S.R. |
| 1974 | | M. Myrmo (Nor.) | T. Magnusson (Swed.) | G. Grimmer (E.Ger.) | G. Grimmer (E.Ger.) | East Germany |
| 1976‡ | | N. Bazhukov (U.S.S.R.) | S. Savelev (U.S.S.R.) | I. Formo (Nor.) | I. Formo (Nor.) | Finland |
| 1978 | | J. Luszczek (Pol.) | S. Savelev (U.S.S.R.) | S.Å. Lundbäck (Swed.) | S.Å. Lundbäck (Swed.) | Sweden |
| 1980‡ | | T. Wassberg (Swed.) | N. Zimyatov (U.S.S.R.) | N. Zimyatov (U.S.S.R.) | N. Zimyatov (U.S.S.R.) | U.S.S.R. |
| 1982 | | O. Braa (Nor.) | T. Eriksson (Swed.) | T. Wassberg (Swed.) | T. Wassberg (Swed.) | Norway; U.S.S.R. (tied) |
| 1984‡ | | G. Svan (Swed.) | N. Zimyatov (U.S.S.R.) | T. Wassberg (Swed.) | T. Wassberg (Swed.) | Sweden |
| 1985 | | K. Haerhoenen (Fin.) | G. Svan (Swed.) | G. Svan (Swed.) | G. Svan (Swed.) | Norway |
| 1987 | | M. Albarello (Italy) | T. Wassberg (Swed.) | M. DeZolt (Italy) | M. DeZolt (Italy) | Sweden |
| 1988‡ | | M. Deviatiarov (U.S.S.R.) | A. Prokurorov (U.S.S.R.) | G. Svan (Swed.) | G. Svan (Swed.) | Sweden |
| 1989 | | G. Svan (Swed.) | V. Smirnov (U.S.S.R.) | G. Svan (Swed.) | G. Svan (Swed.) | Sweden |
| 1991 | | T. Langli (Nor.) | B. Daehlie (Nor.) | G. Svan (Swed.) | T. Mogren (Swed.) | Norway |
| 1992‡ | | V. Ulvang (Nor.) | B. Daehlie (Nor.) | V. Ulvang (Nor.) | B. Daehlie (Nor.) | Norway |
| 1993 | | S. Sivertsen (Nor.) | B. Daehlie (Nor.) | B. Daehlie (Nor.) | T. Mogren (Swed.) | Norway |
| 1994 | | B. Daehlie (Nor.) | B. Daehlie (Nor.) | T. Alsgaard (Nor.) | V. Smirnov (Kazak.) | Italy |
| 1995 | | V. Smirnov (Kazak.) | V. Smirnov (Kazak.) | V. Smirnov (Kazak.) | S. Fauner (Italy) | Norway |
| 1996 | | not held | | | | |
| 1997 | | B. Daehlie (Nor.) | B. Daehlie (Nor.) | A. Prokurorov (Russia) | M. Myllyla (Fin.) | Norway |
| 1998 | | B. Daehlie (Nor.) | T. Alsgaard (Nor.) | M. Myllyla (Fin.) | B. Daehlie (Nor.) | Norway |
| 1999 | | M. Myllyla (Fin.) | T. Alsgaard (Nor.) | M. Myllyla (Fin.) | M. Myllyla (Fin.) | Austria |
| 2001 | T. Hetland (Nor.) | P. Elofsson (Swed.) | P. Elofsson (Swed.) | A. Veerpalu (Est.) | J. Mühlegg (Spain) | Norway |
| 2002 | S. Lajunen (Fin.)‡ | J. Mühlegg (Spain)‡ | A. Veerpalu (Est.)‡ | J. Mühlegg (Spain)‡ | M. Ivanov (Russia)‡ | Norway‡ |

*18-kilometre cross-country until 1952; 15-kilometre in 1954 and thereafter. †Military relay until 1939; 40-kilometre relay in 1948 and thereafter. ‡Olympic champions, recognized as world champions. §Italy won the military relay, Finland the 40-kilometre.

**World Nordic Skiing Championships—women**

| year | sprint | 5-km cross-country | 10-km cross-country | 15-km cross-country | 20-km cross-country | 30-km cross-country | relay* |
|---|---|---|---|---|---|---|---|
| 1952† | | | L. Wideman (Fin.) | | | | |
| 1954 | | | L. Kozyreva (U.S.S.R.) | | | | U.S.S.R. |
| 1956† | | | L. Kozyreva (U.S.S.R.) | | | | Finland |
| 1958 | | | A. Kolchina (U.S.S.R.) | | | | U.S.S.R. |
| 1960† | | | M. Gusakova (U.S.S.R.) | | | | Sweden |
| 1962 | | A. Kolchina (U.S.S.R.) | A. Kolchina (U.S.S.R.) | | | | U.S.S.R. |
| 1964‡ | | K. Boyarskikh (U.S.S.R.) | K. Boyarskikh (U.S.S.R.) | | | | U.S.S.R. |
| 1966 | | A. Kolchina (U.S.S.R.) | K. Boyarskikh (U.S.S.R.) | | | | U.S.S.R. |
| 1968† | | T. Gustafsson (Swed.) | T. Gustafsson (Swed.) | | | | Norway |
| 1970 | | G. Kulakova (U.S.S.R.) | A. Olyunina (U.S.S.R.) | | | | U.S.S.R. |
| 1972‡ | | G. Kulakova (U.S.S.R.) | G. Kulakova (U.S.S.R.) | | | | U.S.S.R. |
| 1974 | | G. Kulakova (U.S.S.R.) | G. Kulakova (U.S.S.R.) | | | | U.S.S.R. |
| 1976† | | H. Takalo (Fin.) | R. Smetanina (U.S.S.R.) | | | | U.S.S.R. |
| 1978 | | H. Takalo (Fin.) | Z. Amosova (U.S.S.R.) | | | | Finland |
| 1980† | | R. Smetanina (U.S.S.R.) | B. Petzold (E.Ger.) | | | | E.Ger. |
| 1982 | | B. Aunli (Nor.) | B. Aunli (Nor.) | | R. Smetanina (U.S.S.R.) | | Norway |
| 1984† | | M.-L. Hämäläinen (Fin.) | M.-L. Hämäläinen (Fin.) | | M.-L. Hämäläinen (Fin.) | | Norway |
| 1985 | | A. Boe (Nor.) | A. Boe (Nor.) | | G. Nykelmo (Nor.) | | U.S.S.R. |
| 1987 | | M. Matikainen (Fin.) | A. Jahren (Nor.) | | M.-H. Westin (Swed.) | | U.S.S.R. |
| 1988† | | M. Matikainen (Fin.) | V. Ventsene (U.S.S.R.) | | T. Tikhonova (U.S.S.R.) | | U.S.S.R. |
| 1989 | | not held | E. Vialbe (U.S.S.R.) | M. Matikainen (Fin.) | | E. Vialbe (U.S.S.R.) | Finland |
| 1991 | | T. Dybendahl (Nor.) | E. Vialbe (U.S.S.R.) | E. Vialbe (U.S.S.R.) | | L. Egorova (U.S.S.R.) | U.S.S.R. |
| 1992† | | M. Lukkarinen (Fin.) | L. Egorova (U.T.‡) | L. Egorova (U.T.‡) | | S. Belmondo (Italy) | U.T.‡ |
| 1993 | | L. Lazutina (Russia) | S. Belmondo (Italy) | E. Vialbe (Russia) | | S. Belmondo (Italy) | Russia |
| 1994 | | L. Yegorova (Russia) | L. Yegorova (Russia) | M. Di Centa (Italy) | | M. Di Centa (Italy) | Russia |
| 1995 | | L. Lazutina (Russia) | L. Lazutina (Russia) | L. Lazutina (Russia) | | Ye. Vyalbe (Russia) | Russia |
| 1996 | | not held | | | | | |
| 1997 | | Ye. Vyalbe (Russia) | Ye. Vyalbe (Russia) | Ye. Vyalbe (Russia) | | Ye. Vyalbe (Russia) | Russia |
| 1998 | | L. Lazutina (Russia) | L. Lazutina (Russia) | O. Danilova (Russia) | | Yu. Chepalova (Russia) | Russia |
| 1999 | | B. Martinsen (Nor.) | S. Belmondo (Italy) | S. Belmondo (Italy) | | L. Lazutina (Russia) | Russia |
| 2001 | P. Manninen (Fin.) | V. Kuitunen (Fin.) | B. Skari Martinsen (Nor.) | B. Skari Martinsen (Nor.) | | canceled | Russia |
| 2002 | Yu. Chepalova (Russia)‡ | O. Danilova (Russia)‡ | B. Skari (Nor.)‡ | S. Belmondo (Italy)‡ | | G. Paruzzi (Italy)‡ | Germany‡ |

*15-kilometre relay until 1974; 20-kilometre in 1976 and thereafter. †Olympic champions, recognized as world champions. ‡Unified Team, consisting of athletes from the Commonwealth of Independent States plus Georgia.




Bjorn Daehlie (Nor.) skiing to victory in the 50-kilometre cross-country race at the 1992 Olympics; he went on to win the 13th Nordic World Cup series

Duomo/William R. Sallaz

**Nordic World Cup**

| year | men | women |
|---|---|---|
| 1979 | O. Braa (Nor.) | G. Kulakova (U.S.S.R.) |
| 1981 | A. Zavyalov (U.S.S.R.) | R. Smetanina (U.S.S.R.) |
| 1982 | B. Koch (U.S.) | B. Aunli (Nor.) |
| 1983 | A. Zavyalov (U.S.S.R.) | M.-L. Hämäläinen (Fin.) |
| 1984 | G. Svan (Swed.) | M.-L. Hämäläinen (Fin.) |
| 1985 | G. Svan (Swed.) | A. Boe (Nor.) |
| 1986 | G. Svan (Swed.) | M. Matikainen (Fin.) |
| 1987 | T. Mogren (Swed.) | M. Matikainen (Fin.) |
| 1988 | G. Svan (Swed.) | M. Matikainen (Fin.) |
| 1989 | G. Svan (Swed.) | E. Vialbe (U.S.S.R.) |
| 1990 | V. Ulvang (Nor.) | L. Lazutina (U.S.S.R.) |
| 1991 | V. Smirnov (U.S.S.R.) | E. Vialbe (U.S.S.R.) |
| 1992 | B. Daehlie (Nor.) | E. Vialbe (Russia) |
| 1993 | B. Daehlie (Nor.) | L. Yegorova (Russia) |
| 1994 | V. Smirnov (Kazak.) | M. Di Centa (Italy) |
| 1995 | B. Daehlie (Nor.) | Ye. Vyalbe (Russia) |
| 1996 | B. Daehlie (Nor.) | M. Di Centa (Italy) |
| 1997 | B. Daehlie (Nor.) | Ye. Vyalbe (Russia) |
| 1998 | T. Alsgaard (Nor.) | L. Lazutina (Russia) |
| 1999 | B. Daehlie (Nor.) | B. Martinsen (Nor.) |
| 2000 | J. Mühlegg (Spain) | B. Martinsen (Nor.) |
| 2001 | P. Elofsson (Swed.) | Yu. Chepalova (Russia) |
| 2002 | P. Elofsson (Swed.) | B. Skari (Nor.) |

**World Alpine Skiing Championships—men**

| year | downhill | combined | slalom | giant slalom | supergiant slalom |
|---|---|---|---|---|---|
| 1931 | W. Prager (Switz.) | | D. Zogg (Switz.) | | |
| 1932 | not held | | not held | | |
| 1933 | W. Prager (Switz.)<br>H. Hauser (Austria)* | A. Seelos (Austria) | A. Seelos (Austria) | | |
| 1934 | D. Zogg (Switz.) | D. Zogg (Switz.) | F. Pfnür (Ger.) | | |
| 1935 | F. Zingerle (Austria) | A. Seelos (Austria) | A. Seelos (Austria) | | |
| 1935† | not held | F. Pfnür (Ger.) | not held | | |
| 1937 | E. Allais (Fr.) | E. Allais (Fr.) | E. Allais (Fr.) | | |
| 1938 | J. Couttet (Fr.) | E. Allais (Fr.) | R. Rominger (Switz.) | | |
| 1939 | H. Lantschner (Ger.) | J. Jennewein (Ger.) | R. Rominger (Switz.) | | |
| 1940–47 | not held | | | | |
| 1948† | H. Oreiller (Fr.) | H. Oreiller (Fr.) | E. Reinalter (Switz.) | | |
| 1950 | Z. Colo (Italy) | not held | G. Schneider (Switz.) | Z. Colo (Italy) | |
| 1952† | Z. Colo (Italy) | not held | O. Schneider (Austria) | S. Eriksen (Nor.) | |
| 1954 | C. Pravda (Austria) | S. Eriksen (Nor.) | S. Eriksen (Nor.) | S. Eriksen (Nor.) | |
| 1956† | A. Sailer (Austria) | not held | A. Sailer (Austria) | A. Sailer (Austria) | |
| 1958 | A. Sailer (Austria) | A. Sailer (Austria) | J. Rieder (Austria) | A. Sailer (Austria) | |
| 1960† | J. Vuarnet (Fr.) | not held | E. Hinterseer (Austria) | R. Staub (Switz.) | |
| 1962 | K. Schranz (Austria) | K. Schranz (Austria) | C. Bozon (Fr.)‡ | E. Zimmermann (Austria) | |
| 1964† | E. Zimmermann (Austria) | not held | J. Stiegler (Austria) | F. Bonlieu (Fr.) | |
| 1966 | J.-C. Killy (Fr.) | J.-C. Killy (Fr.) | C. Senoner (Italy)‡ | G. Perillat (Fr.) | |
| 1968† | J.-C. Killy (Fr.) | not held | J.-C. Killy (Fr.) | J.-C. Killy (Fr.) | |
| 1970 | B. Russi (Switz.) | W. Kidd (U.S.) | J. Augert (Fr.) | K. Schnoll (Austria) | |
| 1972† | B. Russi (Switz.) | G. Thoeni (Italy) | F. Ochoa (Spain) | G. Thoeni (Italy) | |
| 1974 | D. Zwilling (Austria) | F. Klammer (Austria) | G. Thoeni (Italy) | G. Thoeni (Italy) | |
| 1976† | F. Klammer (Austria) | G. Thoeni (Italy) | P. Gros (Italy) | H. Hemmi (Switz.) | |
| 1978 | J. Walcher (Austria) | A. Wenzel (Liech.) | I. Stenmark (Swed.) | I. Stenmark (Swed.) | |
| 1980† | L. Stock (Austria) | not held | I. Stenmark (Swed.) | I. Stenmark (Swed.) | |
| 1982 | H. Weirather (Austria) | M. Vion (Fr.) | I. Stenmark (Swed.) | S. Mahre (U.S.) | |
| 1984† | B. Johnson (U.S.) | not held | P. Mahre (U.S.) | M. Julen (Switz.) | |
| 1985 | P. Zurbriggen (Switz.) | | J. Nilsson (Swed.) | M. Wasmeier (W.Ger.) | |
| 1987 | P. Müller (Switz.) | M. Girardelli (Lux.) | F. Woerndl (W.Ger.) | P. Zurbriggen (Switz.) | P. Zurbriggen (Switz.) |
| 1988† | P. Zurbriggen (Switz.) | H. Strolz (Austria) | A. Tomba (Italy) | A. Tomba (Italy) | F. Piccard (Fr.) |
| 1989 | H. Tauscher (W.Ger.) | M. Girardelli (Lux.) | R. Nierlich (Austria) | R. Nierlich (Austria) | M. Hangl (Switz.) |
| 1991 | F. Heinzer (Switz.) | S. Eberharter (Austria) | M. Girardelli (Lux.) | R. Nierlich (Austria) | S. Eberharter (Austria) |
| 1992† | P. Ortlieb (Austria) | J. Polig (Italy) | F.C. Jagge (Nor.) | A. Tomba (Italy) | K.A. Aamodt (Nor.) |
| 1993 | U. Lehmann (Switz.) | L. Kjus (Nor.) | K.A. Aamodt (Nor.) | K.A. Aamodt (Nor.) | not held |
| 1994 | T. Moe (U.S.) | L. Kjus (Nor.) | T. Stangassinger (Aus.) | M. Wasmeier (Ger.) | M. Wasmeier (Ger.) |
| 1995 | not held | | | | |
| 1996 | P. Ortlieb (Austria) | M. Girardelli (Lux.) | A. Tomba (Italy) | A. Tomba (Italy) | A. Skaardal (Nor.) |
| 1997 | B. Kernen (Switz.) | K.A. Aamodt (Nor.) | T. Stiansen (Nor.) | M. von Grünigen (Switz.) | A. Skaardal (Nor.) |
| 1998 | J.-L. Cretier (Fr.) | M. Reiter (Austria) | H.-P. Buraas (Nor.) | H. Maier (Austria) | H. Maier (Austria) |
| 1999 | H. Maier (Austria) | K.A. Aamodt (Nor.) | K. Palander (Fin.) | L. Kjus (Nor.) | L. Kjus (Nor.),<br>H. Maier (Austria)§ |
| 2000 | not held | | | | |
| 2001 | H. Trinkl (Austria) | K.A. Aamodt (Nor.) | M. Matt (Austria) | M. von Grünigen (Switz.) | D. Rahlves (U.S.) |
| 2002† | F. Strobl (Austria) | K.A. Aamodt (Nor.) | J.-P. Vidal (Fr.) | S. Eberharter (Austria) | K.A. Aamodt (Nor.) |

*Special downhill champion. †Olympic champions, recognized as world champions. ‡Special slalom. §Tie.

**World Alpine Skiing Championships—women**

| year | downhill | combined | slalom | giant slalom | supergiant slalom |
|---|---|---|---|---|---|
| 1931 | E. Mackinnon (U.K.) | | E. Mackinnon (U.K.) | | |
| 1932 | | | not held | | |
| 1933 | I. Wersin-Lantschner (Austria) | I. Wersin-Lantschner (Austria) | I. Wersin-Lantschner (Austria) | | |
| 1934 | A. Ruegg (Switz.) | C. Cranz (Ger.) | C. Cranz (Ger.) | | |
| 1935 | C. Cranz (Ger.) | C. Cranz (Ger.) | A. Ruegg (Switz.) | | |
| 1936 | not held | C. Cranz (Ger.) | not held | | |
| 1937 | C. Cranz (Ger.) | C. Cranz (Ger.) | C. Cranz (Ger.) | | |
| 1938 | L. Resch (Ger.) | C. Cranz (Ger.) | C. Cranz (Ger.) | | |
| 1939 | C. Cranz (Ger.) | C. Cranz (Ger.) | C. Cranz (Ger.) | | |
| 1940–47 | not held | | | | |
| 1948* | H. Schlunegger (Switz.) | T. Beiser (Austria) | G. Fraser (U.S.) | | |
| 1950 | T. Beiser-Jochum (Austria) | not held | D. Rom (Austria) | D. Rom (Austria) | |
| 1952* | T. Beiser-Jochum (Austria) | not held | A. Lawrence (U.S.) | A. Lawrence (U.S.) | |
| 1954 | I. Schopfer (Switz.) | I. Schopfer (Switz.) | T. Klecker (Austria) | L. Schmith-Couttet (Fr.) | |
| 1956* | M. Berthod (Switz.) | not held | R. Colliard (Switz.) | O. Reichert (W.Ger.) | |
| 1958 | L. Wheeler (Can.) | F. Danzer (Switz.) | I. Bjornbakken (Nor.) | L. Wheeler (Can.) | |
| 1960* | H. Beibl (Ger.†) | not held | A. Heggtvait (Can.) | Y. Ruegg (Switz.) | |
| 1962 | C. Hass (Austria) | M. Goitschel (Fr.) | M. Jahn (Austria)‡ | M. Jahn (Austria) | |
| 1964* | C. Haas (Austria) | not held | C. Goitschel (Fr.) | M. Goitschel (Fr.) | |
| 1966 | E. Schinegger (Austria) | M. Goitschel (Fr.) | A. Famose (Fr.)‡ | M. Goitschel (Fr.) | |
| 1968* | O. Pall (Austria) | not held | M. Goitschel (Fr.) | N. Greene (Can.) | |
| 1970 | A. Zryd (Switz.) | M. Jacot (Fr.) | I. Lafforgue (Fr.) | B. Clifford (Can.) | |
| 1972* | M.-T. Nadig (Switz.) | A. Proell (Austria) | B. Cochran (U.S.) | M.-T. Nadig (Switz.) | |
| 1974 | A. Moser-Proell (Austria) | F. Serrat (Fr.) | H. Wenzel (Liech.) | F. Serrat (Fr.) | |
| 1976* | R. Mittermaier (W.Ger.) | R. Mittermaier (W.Ger.) | R. Mittermaier (W.Ger.) | K. Kreiner (Can.) | |
| 1978 | A. Moser-Proell (Austria) | A. Moser-Proell (Austria) | L. Sölkner (Austria) | M. Epple (W.Ger.) | |
| 1980* | A. Moser-Proell (Austria) | not held | H. Wenzel (Liech.) | H. Wenzel (Liech.) | |
| 1982 | G. Sorensen (Can.) | E. Hess (Switz.) | E. Hess (Switz.) | E. Hess (Switz.) | |
| 1984* | M. Figini (Switz.) | not held | P. Magoni (Italy) | D. Armstrong (U.S.) | |
| 1985 | M. Figini (Switz.) | not held | P. Pelen (Fr.) | D. Roffe (U.S.) | |
| 1987 | M. Wallser (Switz.) | E. Hess (Switz.) | E. Hess (Switz.) | V. Schneider (Switz.) | M. Walliser (Switz.) |
| 1988* | M. Kichl (W.Ger.) | A. Wachter (Austria) | V. Schneider (Switz.) | V. Schneider (Switz.) | S. Wolf (Austria) |
| 1989 | M. Walliser (Switz.) | T. McKinney (U.S.) | M. Svet (Yugos.) | V. Schneider (Switz.) | U. Maier (Austria) |
| 1991 | P. Kronberger (Austria) | C. Bournissen (Switz.) | V. Schneider (Switz.) | P. Wiberg (Swed.) | U. Maier (Austria) |
| 1992* | K. Lee-Gartner (Can.) | P. Kronberger (Austria) | P. Kronberger (Austria) | P. Wiberg (Swed.) | D. Compagnoni (Italy) |
| 1993 | K. Pace (Can.) | M. Vogt (Ger.) | K. Buder (Austria) | C. Merle (Fr.) | K. Seizinger (Ger.) |
| 1994 | K. Seizinger (Ger.) | P. Wiberg (Swed.) | V. Schneider (Switz.) | D. Compagnoni (Italy) | D. Roffe-Steinrotter (U.S.) |
| 1995 | not held | | | | |
| 1996 | P. Street (U.S.) | P. Wiberg (Swed.) | P. Wiberg (Swed.) | D. Compagnoni (Italy) | I. Kostner (Italy) |
| 1997 | H. Lindh (U.S.) | R. Götschl (Austria) | D. Compagnoni (Italy) | D. Compagnoni (Italy) | I. Kostner (Italy) |
| 1998 | K. Seizinger (Ger.) | K. Seizinger (Ger.) | H. Gerg (Ger.) | D. Compagnoni (Italy) | P. Street (U.S.) |
| 1999 | R. Götschl (Austria) | P. Wiberg (Swed.) | Z. Steggall (Austl.) | A. Meissnitzer (Austria) | A. Meissnitzer (Austria) |
| 2000 | not held | | | | |
| 2001 | M. Dorfmeister (Austria) | M. Ertl (Ger.) | A. Paerson (Swed.) | S. Nef (Switz.) | R. Cavagnoud (Fr.) |
| 2002 | C. Montillet (Fr.) | J. Kostelic (Cro.) | J. Kostelic (Cro.) | J. Kostelic (Cro.) | D. Ceccarelli (Italy) |

*Olympic champions, recognized as world champions. †Joint East-West German team. ‡Special slalom.



Petra Kronberger (Austria) on course winning the women's downhill title at the World Alpine Skiing Championships in 1991

Duomo

**Alpine World Cup**

| year | men | women | year | men | women | year | men | women |
|---|---|---|---|---|---|---|---|---|
| 1967 | J.-C. Killy (Fr.) | N. Greene (Can.) | 1979 | P. Luescher (Switz.) | A. Moser-Proell (Austria) | 1991 | M. Girardelli (Lux.) | P. Kronberger (Austria) |
| 1968 | J.-C. Killy (Fr.) | N. Greene (Can.) | 1980 | A. Wenzel (Liecht.) | H. Wenzel (Liecht.) | 1992 | P. Accola (Switz.) | P. Kronberger (Austria) |
| 1969 | K. Schranz (Austria) | G. Gabl (Austria) | 1981 | P. Mahre (U.S.) | M.-T. Nadig (Switz.) | 1993 | M. Girardelli (Lux.) | A. Wachter (Austria) |
| 1970 | K. Schranz (Austria) | M. Jacot (Fr.) | 1982 | P. Mahre (U.S.) | E. Hess (Switz.) | 1994 | K.A. Aamodt (Nor.) | V. Schneider (Switz.) |
| 1971 | G. Thoeni (Italy) | A. Proell (Austria) | 1983 | P. Mahre (U.S.) | T. McKinney (U.S.) | 1995 | A. Tomba (Italy) | V. Schneider (Switz.) |
| 1972 | G. Thoeni (Italy) | A. Proell (Austria) | 1984 | P. Zurbriggen (Switz.) | E. Hess (Switz.) | 1996 | L. Kjus (Nor.) | K. Seizinger (Ger.) |
| 1973 | G. Thoeni (Italy) | A. Proell (Austria) | 1985 | M. Girardelli (Lux.) | M. Figini (Switz.) | 1997 | L. Alphand (Fr.) | P. Wiberg (Swed.) |
| 1974 | P. Gros (Italy) | A. Moser-Proell (Austria) | 1986 | M. Girardelli (Lux.) | M. Walliser (Switz.) | 1998 | H. Maier (Austria) | K. Seizinger (Ger.) |
| 1975 | G. Thoeni (Italy) | A. Moser-Proell (Austria) | 1987 | P. Zurbriggen (Switz.) | M. Walliser (Switz.) | 1999 | L. Kjus (Nor.) | A. Meissnitzer (Austria) |
| 1976 | I. Stenmark (Swed.) | R. Mittermaier (W.Ger.) | 1988 | P. Zurbriggen (Switz.) | M. Figini (Switz.) | 2000 | H. Maier (Austria) | R. Goetschl (Austria) |
| 1977 | I. Stenmark (Swed.) | L.-M. Morerod (Switz.) | 1989 | M. Girardelli (Lux.) | V. Schneider (Switz.) | 2001 | H. Maier (Austria) | J. Kostelic (Croatia) |
| 1978 | I. Stenmark (Swed.) | H. Wenzel (Liecht.) | 1990 | P. Zurbriggen (Switz.) | P. Kronberger (Austria) | 2002 | S. Eberharter (Austria) | M. Dorfmeister (Austria) |

## SWIMMING

The Fédération Internationale de Natation Amateur (FINA; founded 1908) is the world governing body for amateur swimming. It held the first world swimming championships in 1973. After 1975 the FINA championships were held in non-Olympic, even-numbered years. (An exception was the championship held in Australia, which took place during the summer month of January 1991.) Diving, synchronized (or synchro) swimming, and water polo events are included in the competition.

A distinction is made between long-course and short-course pools for purposes of record-setting; world championships and other major contests are held in pools that are 50 m long.

**World Swimming Championships—men**

freestyle

| year | 50 m | 100 m | 200 m | 400 m | 800 m | 1,500 m |
|---|---|---|---|---|---|---|
| 1973 | | J. Montgomery (U.S.) | J. Montgomery (U.S.) | R. DeMont (U.S.) | | S. Holland (Austl.) |
| 1975 | | A. Coan (U.S.) | T. Shaw (U.S.) | T. Shaw (U.S.) | | T. Shaw (U.S.) |
| 1978 | | D. McCagg (U.S.) | B. Forrester (U.S.) | V. Salnikov (U.S.S.R.) | | V. Salnikov (U.S.S.R.) |
| 1982 | | J. Woithe (E.Ger.) | M. Gross (W.Ger.) | V. Salnikov (U.S.S.R.) | | V. Salnikov (U.S.S.R.) |
| 1986 | T. Jager (U.S.) | M. Biondi (U.S.) | M. Gross (W.Ger.) | R. Henkel (W.Ger.) | | R. Henkel (W.Ger.) |
| 1991 | T. Jager (U.S.) | M. Biondi (U.S.) | G. Lamberti (Italy) | J. Hoffmann (Ger.) | | J. Hoffmann (Ger.) |
| 1994 | A. Popov (Russia) | A. Popov (Russia) | A. Kasvio (Fin.) | K. Perkins (Austl.) | | K. Perkins (Austl.) |
| 1998 | B. Pliczuk (U.S.) | A. Popov (Russia) | M. Klim (Austl.) | I. Thorpe (Austl.) | | G. Hackett (Austl.) |
| 2001 | A. Ervin (U.S.) | A. Ervin (U.S.) | I. Thorpe (Austl.) | I. Thorpe (Austl.) | I. Thorpe (Austl.) | G. Hackett (Austl.) |

backstroke / breaststroke

| | 50 m | 100 m | 200 m | 50 m | 100 m | 200 m |
|---|---|---|---|---|---|---|
| 1973 | | R. Matthes (E.Ger.) | R. Matthes (E.Ger.) | | J. Hencken (U.S.) | D. Wilkie (U.K.) |
| 1975 | | R. Matthes (E.Ger.) | Z. Verraszto (Hung.) | | D. Wilkie (U.K.) | D. Wilkie (U.K.) |
| 1978 | | B. Jackson (U.S.) | J. Vassallo (U.S.) | | W. Kusch (W.Ger.) | N. Nevid (U.S.) |
| 1982 | | D. Richter (E.Ger.) | R. Carey (U.S.) | | S. Lundquist (U.S.) | V. Davis (Can.) |
| 1986 | | I. Polyansky (U.S.S.R.) | I. Polyansky (U.S.S.R.) | | V. Davis (Can.) | J. Szabo (Hung.) |
| 1991 | | J. Rouse (U.S.) | M. López Zubero (Spain) | | N. Rozsa (Hung.) | M. Barrowman (U.S.) |
| 1994 | | M. López Zubero (Spain) | V. Selkov (Russia) | | N. Rozsa (Hung.) | N. Rozsa (Hung.) |
| 1998 | | L. Krayzelburg (U.S.) | L. Krayzelburg (U.S.) | | F. De Burghgraeve (Belg.) | K. Grote (U.S.) |
| 2001 | R. Bal (U.S.) | M. Welsh (Austl.) | A. Peirsol (U.S.) | O. Lisogor (Ukr.) | R. Sloudnov (Russia) | B. Hansen (U.S.) |

butterfly / individual medley

| | 50 m | 100 m | 200 m | 200 m | 400 m |
|---|---|---|---|---|---|
| 1973 | | B. Robertson (Can.) | R. Backhaus (U.S.) | G. Larsson (Swed.) | A. Hargitay (Hung.) |
| 1975 | | G. Jagenburg (U.S.) | B. Forrester (U.S.) | A. Hargitay (Hung.) | A. Hargitay (Hung.) |
| 1978 | | J. Bottom (U.S.) | M. Bruner (U.S.) | G. Smith (Can.) | J. Vassallo (U.S.) |
| 1982 | | M. Gribble (U.S.) | M. Gross (W.Ger.) | A. Sidorenko (U.S.S.R.) | R. Pradi (Braz.) |
| 1986 | | P. Morales (U.S.) | M. Gross (W.Ger.) | T. Darnyi (Hung.) | T. Darnyi (Hung.) |
| 1991 | | A. Nesty (Suriname) | M. Stewart (U.S.) | T. Darnyi (Hung.) | T. Darnyi (Hung.) |
| 1994 | | R. Szukala (Pol.) | D. Pankratov (Russia) | J. Sievinen (Fin.) | T. Dolan (U.S.) |
| 1998 | | M. Klim (Austl.) | D. Silantyev (Ukr.) | M. Weuda (Neth.) | T. Dolan (U.S.) |
| 2001 | G. Huegill (Austl.) | L. Frolander (Swed.) | M. Phelps (U.S.) | M. Rosolino (Italy) | A. Bogglatto (Italy) |

team relays / diving

| | 4 × 100-m freestyle | 4 × 200-m freestyle | 4 × 100-m medley | 1-m springboard | 3-m springboard | platform |
|---|---|---|---|---|---|---|
| 1973 | United States | United States | United States | | P. Boggs (U.S.) | K. Dibiasi (Italy) |
| 1975 | United States | West Germany | United States | | P. Boggs (U.S.) | K. Dibiasi (Italy) |
| 1978 | United States | United States | United States | | P. Boggs (U.S.) | G. Louganis (U.S.) |
| 1982 | United States | United States | United States | | G. Louganis (U.S.) | G. Louganis (U.S.) |
| 1986 | United States | East Germany | United States | | G. Louganis (U.S.) | G. Louganis (U.S.) |
| 1991 | United States | Germany | United States | E. Jongejans (Neth.) | K. Ferguson (U.S.) | Sun Shuwei (China) |
| 1994 | United States | Sweden | United States | E. Stewart (Zimb.) | Yu Zhuocheng (China) | D. Sautin (Russia) |
| 1998 | United States | Australia | Australia | Yu Zhuocheng (China) | D. Sautin (Russia) | D. Sautin (Russia) |
| 2001 | Australia | Australia | Australia | Wang Feng (China) | D. Sautin (Russia) | Tian Liang (China) |

diving (continued)

| | synchronized 3-m springboard | synchronized platform |
|---|---|---|
| 2001 | China | China |



Tom Dolan of the United States on the way to winning the 1998 World Swimming Championship in the 400 metres

Al Bello—Allsport

**World Swimming Championships—women**

freestyle

| year | 50 m | 100 m | 200 m | 400 m | 800 m | 1,500 m |
|---|---|---|---|---|---|---|
| 1973 | | K. Ender (E.Ger.) | K. Rothhammer (U.S.) | H. Greenwood (U.S.) | N. Calligaris (Italy) | |
| 1975 | | K. Ender (E.Ger.) | S. Babashoff (U.S.) | S. Babashoff (U.S.) | J. Turrall (Austl.) | |
| 1978 | | B. Krause (E.Ger.) | C. Woodhead (U.S.) | T. Wickham (Austl.) | T. Wickham (Austl.) | |
| 1982 | | B. Meineke (E.Ger.) | A. Verstappen (Neth.) | C. Schmidt (E.Ger.) | K. Linehan (U.S.) | |
| 1986 | T. Costache (Rom.) | K. Otto (E.Ger.) | H. Friedrich (E.Ger.) | H. Friedrich (E.Ger.) | A. Strauss (E.Ger.) | |
| 1991 | Zhuang Yong (China) | N. Haislett (U.S.) | H. Lewis (Austl.) | J. Evans (U.S.) | J. Evans (U.S.) | |
| 1994 | Le Jingyi (China) | Le Jingyi (China) | F. van Almsick (Ger.) | Yang Aihua (China) | J. Evans (U.S.) | |
| 1998 | A. Van Dyken (U.S.) | J. Thompson (U.S.) | C. Poll (C.Rica) | Chen Yan (China) | B. Bennett (U.S.) | |
| 2001 | I. De Bruijn (Neth.) | I. De Bruijn (Neth.) | G. Rooney (Austl.) | Y. Klochkova (Ukr.) | H. Stockbauer (Ger.) | H. Stockbauer (Ger.) |

backstroke

| | 50 m | 100 m | 200 m |
|---|---|---|---|
| 1973 | | U. Richter (E.Ger.) | M. Belote (U.S.) |
| 1975 | | U. Richter (E.Ger.) | B. Treiber (E.Ger.) |
| 1978 | | L. Jezek (U.S.) | L. Jezek (U.S.) |
| 1982 | | K. Otto (E.Ger.) | C. Sirch (E.Ger.) |
| 1986 | | B. Mitchell (U.S.) | C. Sirch (E.Ger.) |
| 1991 | | K. Egerszegi (Hung.) | K. Egerszegi (Hung.) |
| 1994 | | He Cihong (China) | He Cihong (China) |
| 1998 | | L. Maurer (U.S.) | R. Maracineanu (Fr.) |
| 2001 | H. Cope (U.S.) | N. Coughlin (U.S.) | D. Mocanu (Rom.) |

breaststroke

| 50 m | 100 m | 200 m |
|---|---|---|
| | R. Vogel (E.Ger.) | R. Vogel (E.Ger.) |
| | H. Anke (E.Ger.) | H. Anke (E.Ger.) |
| | J. Bogdanova (U.S.S.R.) | L. Kachushite (U.S.S.R.) |
| | U. Geweniger (E.Ger.) | S. Varganova (U.S.S.R.) |
| | S. Gerasch (E.Ger.) | S. Hörner (E.Ger.) |
| | L. Frame (Austl.) | E. Volkova (U.S.S.R.) |
| | S. Riley (Austl.) | S. Riley (Austl.) |
| | K. Kowal (U.S.) | A. Kovacs (Hung.) |
| Luo Xuejuan (China) | Luo Xuejuan (China) | A. Kovacs (Hung.) |

butterfly

| | 50 m | 100 m | 200 m |
|---|---|---|---|
| 1973 | | K. Ender (E.Ger.) | R. Kother (E.Ger.) |
| 1975 | | K. Ender (E.Ger.) | R. Kother (E.Ger.) |
| 1978 | | J. Pennington (U.S.) | T. Caulkins (U.S.) |
| 1982 | | M.T. Meagher (U.S.) | I. Geissler (E.Ger.) |
| 1986 | | K. Gressler (E.Ger.) | M. Meagher (U.S.) |
| 1991 | | Qian Hong (China) | S. Sanders (U.S.) |
| 1994 | | Liu Limin (China) | Liu Limin (China) |
| 1998 | | J. Thompson (U.S.) | S. O'Neill (Austl.) |
| 2001 | I. De Bruijn (Neth.) | P. Thomas (Austl.) | P. Thomas (Austl.) |

individual medley

| 200 m | 400 m |
|---|---|
| A. Hubner (E.Ger.) | G. Wegner (E.Ger.) |
| K. Heddy (U.S.) | U. Tauber (E.Ger.) |
| T. Caulkins (U.S.) | T. Caulkins (U.S.) |
| P. Schneider (E.Ger.) | P. Schneider (E.Ger.) |
| K. Otto (E.Ger.) | K. Nord (E.Ger.) |
| Lin Li (China) | Lin Li (China) |
| Lu Bin (China) | Dai Guohong (China) |
| Wu Yanyan (China) | Chen Yan (China) |
| M. Bowen (U.S.) | Y. Klochkova (Ukr.) |

team relays

| | 4 × 100-m freestyle | 4 × 200-m freestyle | 4 × 100-m medley |
|---|---|---|---|
| 1973 | East Germany | | East Germany |
| 1975 | East Germany | | East Germany |
| 1978 | United States | | United States |
| 1982 | East Germany | | East Germany |
| 1986 | East Germany | East Germany | East Germany |
| 1991 | United States | Germany | United States |
| 1994 | China | China | China |
| 1998 | United States | Germany | United States |
| 2001 | Germany | Great Britain | Australia |

diving

| 1-m springboard | 3-m springboard | platform |
|---|---|---|
| | K. Kohler (E.Ger.) | U. Knape (Swed.) |
| | I. Kalinina (U.S.S.R.) | J. Ely (U.S.) |
| | I. Kalinina (U.S.S.R.) | I. Kalinina (U.S.S.R.) |
| | M. Neyer (U.S.) | W. Wyland (U.S.) |
| | Gao Min (China) | Chen Lin (China) |
| Gao Min (China) | Gao Min (China) | Fu Mingxia (China) |
| Chen Lixia (China) | Tan Shuping (China) | Fu Mingxia (China) |
| I. Lashko (Russia) | Y. Pakhalina (Russia) | O. Zhupina (Ukr.) |
| B. Hartley (Can.) | Guo Jingling (China) | Xu Mian (China) |

diving (continued)

| year | synchronized 3-m springboard | synchronized platform |
|---|---|---|
| 2001 | China | China |

## TABLE TENNIS

Official world table tennis championships were first held in 1926 under the auspices of the International Table Tennis Federation (ITTF; founded 1926). Women's doubles competition was added in 1929 and women's team competition in 1934. In 1980 the ITTF first sponsored a men's World Cup competition for the top 16 ranking players; it has been held annually since then.

At world championships, held biennially since 1957, players compete for: the Swaythling Cup (men's team event; best of nine singles matches); the Marcel Corbillon Cup (women's team event; best of four singles and one doubles matches); the St. Bride's Vase (men's singles); the G. Geist Prize (women's singles); the Iran Cup (men's doubles championships); the W.J. Pope Trophy (women's doubles championships); and the Heydusek Prize (mixed doubles championships).

**Table Tennis World Cup—men**

| year | winner |
|---|---|
| 1980 | Guo Yuehua (China) |
| 1981 | T. Klampar (Hung.) |
| 1982 | Guo Yuehua (China) |
| 1983 | M. Appelgren (Swed.) |
| 1984 | Jiang Jialiang (China) |
| 1985 | Chen Xinhua (China) |
| 1986 | Chen Longcan (China) |
| 1987 | Teng Yi (China) |
| 1988 | A. Grubba (Pol.) |
| 1989 | Ma Wenge (China) |
| 1990 | J.-O. Waldner (Swed.) |
| 1991 | J. Persson (Swed.) |
| 1992 | Ma Wenge (China) |
| 1993 | Z. Primorac (Croatia) |
| 1994 | J.-P. Gatien (Fr.) |
| 1995 | Kong Linghui (China) |
| 1996 | Liu Guoliang (China) |
| 1997 | Z. Primorac (Croatia) |
| 1998 | J. Rosskopf (Ger.) |
| 1999 | V. Samsonov (Bela.) |
| 2000 | Ma Ling (China) |
| 2001 | V. Samsonov (Bela.) |

**Table Tennis World Cup—women**

| year | winner |
|---|---|
| 1996 | Deng Yaping (China) |
| 1997 | Wang Nan (China) |
| 1998 | Wang Nan (China) |
| 1999 | Wang Nan (China) |
| 2000 | Li Ju (China) |
| 2001 | Zhang Yining (China) |
| 2002 | Zhang Yining (China) |



Jorgen Persson (Swed.) winning the St. Bride's Vase, 1991

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**World Table Tennis Championships—mixed**

| year | Heydusek Prize |
|---|---|
| 1927–28 | Z. Mechlovits, M. Mednyanszky (Hung.) |
| 1929 | I. Kelén, A. Sipós (Hung.) |
| 1930–31 | M. Szabados, M. Mednyanszky (Hung.) |
| 1932 | G.V. Barna, A. Sipós (Hung.) |
| 1933 | I. Kelén, M. Mednyanszky (Hung.) |
| 1934 | M. Szabados, M. Mednyanszky (Hung.) |
| 1935 | G.V. Barna, A. Sipós (Hung.) |
| 1936 | M. Hamr, G. Kleinova (Czech.) |
| 1937 | B. Váňa, V. Votrubcová (Czech.) |
| 1938 | L. Bellak (Hung.), W. Woodhead (U.K.) |
| 1939 | B. Váňa, V. Votrubcová (Czech.) |
| 1940–46 | no competition |
| 1947 | F. Soos, G. Farkas (Hung.) |
| 1948 | R. Miles, T. Thall (U.S.) |
| 1949–50 | F. Sidó, G. Farkas (Hung.) |
| 1951 | B. Váňa (Czech.), A. Roseanu (Rom.) |
| 1952–53 | F. Sidó (Hung.), A. Roseanu (Rom.) |
| 1954 | I. Andreadis (Czech.), G. Farkas (Hung.) |
| 1955 | K. Szepesi, E. Koczian (Hung.) |
| 1956 | E. Klein, L.T. Neuberger (U.S.) |
| 1957 | Ogimura I., Eguchi F. (Japan) |
| 1959 | Ogimura I., Eguchi F. (Japan) |
| 1961 | Ogimura I., Matsuzaki K. (Japan) |
| 1963 | Kimura K., Ito K. (Japan) |
| 1965 | Kimura K., Seki M. (Japan) |
| 1967 | Hasegawa N., Yamanaka N. (Japan) |
| 1969 | Hasegawa N., Konno Y. (Japan) |
| 1971 | Zhang Shilin, Liu Huijing (China) |
| 1973 | Liang Geliang, Li Li (China) |
| 1975 | S. Gomozkov, T. Ferdman (U.S.S.R.) |
| 1977 | J. Secretin, C. Bergeret (Fr.) |
| 1979 | Liang Geliang, Ge Xinai (China) |
| 1981 | Xie Saike, Huang Junqun (China) |
| 1983 | Guo Yuehua, Ni Xialian (China) |
| 1985 | Cai Zhenhua, Cao Yanhua (China) |
| 1987 | Hui Jun, Geng Lijuan (China) |
| 1989 | Yoo Nam Kyu, Hyung Jung Hwa (S.Kor.) |
| 1991 | Wang Tao, Liu Wei (China) |
| 1993 | Wang Tao, Liu Wei (China) |
| 1995 | Wang Tao, Liu Wei (China) |
| 1997 | Liu Guoliang, Wu Na (China) |
| 1999 | Ma Lin, Zhang Yingying (China) |
| 2001 | Qin Zhijian, Yang Ying (China) |

**World Table Tennis Championships—men**

| year | St. Bride's Vase | Iran Cup | Swaythling Cup |
|---|---|---|---|
| 1927 | R. Jacobi (Hung.) | R. Jacobi, R. Pecsi (Hung.) | Hungary |
| 1928 | Z. Mechlovits (Hung.) | A. Liebster, R. Thum (Australia) | Hungary |
| 1929 | F.J. Perry (U.K.) | G.V. Barna, M. Szabados (Hung.) | Hungary |
| 1930 | V. Barna (Hung.) | G.V. Barna, M. Szabados (Hung.) | Hungary |
| 1931 | M. Szabados (Hung.) | G.V. Barna, M. Szabados (Hung.) | Hungary |
| 1932 | V. Barna (Hung.) | G.V. Barna, M. Szabados (Hung.) | Czechoslovakia |
| 1933 | V. Barna (Hung.) | G.V. Barna, S. Glancz (Hung.) | Hungary |
| 1934–35 | V. Barna (Hung.) | G.V. Barna, M. Szabados (Hung.) | Hungary |
| 1936 | S. Kolář (Czech.) | R.G. Blattner, J.H. McClure (U.S.) | Austria |
| 1937 | R. Bergmann (Austria) | R.G. Blattner, J.H. McClure (U.S.) | United States |
| 1938 | B. Váňa (Czech.) | J.H. McClure, S. Schiff (U.S.) | Hungary |
| 1939 | R. Bergmann (Austria) | R. Bergmann (Austria), G.V. Barna (Hung.) | Czechoslovakia |
| 1940–46 | no competition | | |
| 1947 | B. Váňa (Czech.) | B. Váňa, A. Slár (Czech.) | Czechoslovakia |
| 1948 | R. Bergmann (U.K.) | B. Váňa, L. Stipek (Czech.) | Czechoslovakia |
| 1949 | J. Leach (U.K.) | F. Tokár, I. Andreadis (Czech.) | Hungary |
| 1950 | R. Bergmann (U.K.) | F. Sidó, F. Soos (Hung.) | Czechoslovakia |
| 1951 | J. Leach (U.K.) | B. Váňa, I. Andreadis (Czech.) | Czechoslovakia |
| 1952 | Satō H. (Japan) | Fujii N., Hayashi T. (Japan) | Hungary |
| 1953 | F. Sidó (Hung.) | F. Sidó, J. Koczian (Hung.) | United Kingdom |
| 1954 | Ogimura I. (Japan) | V. Harangozo, Z. Dolimar (Yugos.) | Japan |
| 1955 | Tanaka T. (Japan) | I. Andreadis, L. Stipek (Czech.) | Japan |
| 1956 | Ogimura I. (Japan) | Ogimura I., Tomita Y. (Japan) | Japan |
| 1957 | Tanaka T. (Japan) | I. Andreadis, L. Stipek (Czech.) | Japan |
| 1959 | Rong Guoduan (China) | Ogimura I., Murakami T. (Japan) | Japan |
| 1961 | Zhuang Zedong (China) | Hoshino N., Kimura K. (Japan) | China |
| 1963 | Zhuang Zedong (China) | Jiang Shilin, Wang Zhiliang (China) | China |
| 1965 | Zhuang Zedong (China) | Zhuan Zedong, Xu Yinsheng (China) | China |
| 1967 | Hasegawa N. (Japan) | K. Johansson, H. Asler (Swed.) | Japan |
| 1969 | Ito S. (Japan) | K. Johansson, H. Asler (Swed.) | Japan |
| 1971 | S. Bengtsson (Swed.) | T. Klampar, I. Jonyer (Hung.) | China |
| 1973 | Xi Ending (China) | K. Johansson, S. Bengtsson (Swed.) | Sweden |
| 1975 | I. Jonyer (Hung.) | I. Jonyer, G. Gergely (Hung.) | China |
| 1977 | Kono M. (Japan) | Li Zhenshi, Liang Geliang (China) | China |
| 1979 | Ono S. (Japan) | A. Stipancic, D. Surbek (Yugos.) | Hungary |
| 1981 | Guo Yuehua (China) | Cai Zhenhua, Li Zhenshi (China) | China |
| 1983 | Guo Yuehua (China) | D. Surbek, Z. Kalinic (Yugos.) | China |
| 1985 | Jiang Jialiang (China) | M. Appelgren, U. Carlsson (Swed.) | China |
| 1987 | Jiang Jialiang (China) | Chen Longcan, Wei Qingguang (China) | China |
| 1989 | J.-O. Waldner (Swed.) | J. Rosskopf, S. Fetzner (W.Ger.) | Sweden |
| 1991 | J. Persson (Swed.) | P. Karlsson, T. Von Scheele (Swed.) | Sweden |
| 1993 | J.-P. Gatien (Fr.) | Wang Tao, Lu Lin (China) | Sweden |
| 1995 | Kong Linghui (China) | Wang Tao, Lu Lin (China) | China |
| 1997 | J.-O. Waldner (Swed.) | Kong Linghui, Liu Guoliang (China) | China |
| 1999 | Liu Guoliang (China) | Kong Linghui, Liu Guoliang (China) | not held |
| 2000 | not held | not held | Sweden |
| 2001 | Wang Liqin (China) | Wang Liqin, Yan Sen (China) | China |

**World Table Tennis Championships—women**

| year | G. Geist Prize | W.J. Pope Trophy | Corbillon Cup |
|---|---|---|---|
| 1927 | M. Mednyanszky (Hung.) | | |
| 1928 | M. Mednyanszky (Hung.) | E. Metzger, E. Ruester (Ger.) | |
| 1929–31 | M. Mednyanszky (Hung.) | M. Mednyanszky, A. Sipós (Hung.) | |
| 1932–33 | A. Sipós (Hung.) | M. Mednyanszky, A. Sipós (Hung.) | |
| 1934 | M. Kettnerová (Czech.) | M. Mednyanszky, A. Sipós (Hung.) | Germany |
| 1935 | M. Kettnerová (Czech.) | M. Kettnerová, M. Smídová (Czech.) | Czechoslovakia |
| 1936 | R.H. Aarons (U.S.) | V. Depetrisová, V. Votrubcová (Czech.) | Czechoslovakia |
| 1937 | title vacant | V. Depetrisová, V. Votrubcová (Czech.) | United States |
| 1938 | T. Pritzi (Austria) | T. Pritzi, D. Busemann (Austria) | Czechoslovakia |
| 1939 | V. Depetrisová (Czech.) | no competition | Germany |
| 1940–46 | no competition | | |
| 1947 | G. Farkas (Hung.) | T. Pritzi (Austria), G. Farkas (Hung.) | United Kingdom |
| 1948 | G. Farkas (Hung.) | V. Thomas, P. Franks (U.K.) | United Kingdom |
| 1949 | G. Farkas (Hung.) | H. Elliot (U.K.), G. Farkas (Hung.) | United States |
| 1950 | A. Roseanu (Rom.) | D. Bereg, H. Elliot (U.K.) | Romania |
| 1951 | A. Roseanu (Rom.) | D. Rowe, R. Rowe (U.K.) | Romania |
| 1952 | A. Roseanu (Rom.) | Nashimura T., Narahara S. (Japan) | Japan |
| 1953 | A. Roseanu (Rom.) | A. Roseanu (Rom.), G. Farkas (Hung.) | Romania |
| 1954 | A. Roseanu (Rom.) | D. Rowe, R. Rowe (U.K.) | Japan |
| 1955 | A. Roseanu (Rom.) | A. Roseanu, E. Zeller (Rom.) | Romania |
| 1956 | Okawa T. (Japan) | A. Roseanu, E. Zeller (Rom.) | Romania |
| 1957 | Eguchi F. (Japan) | L. Mosoczy, A. Simon (Hung.) | Japan |
| 1959 | Matsuzaki K. (Japan) | Namba T., Yamaizumi K. (Japan) | Japan |
| 1961 | Jiu Zhonghui (China) | M. Alexandru, G. Pitica (Rom.) | Japan |
| 1963 | Matsuzaki K. (Japan) | Matsuzaki K., Seki M. (Japan) | Japan |
| 1965 | Fukazu N. (Japan) | Liu Huijing, Zheng Minjin (China) | China |
| 1967 | Morisawa S. (Japan) | Morisawa S., Hirota S. (Japan) | Japan |
| 1969 | Kowada T. (Japan) | Z. Rudnova, S. Grinberg (U.S.S.R.) | U.S.S.R. |
| 1971 | Liu Huijing (China) | Liu Huijing, Zheng Minjin (China) | Japan |
| 1973 | Hu Youlan (China) | M. Alexandru (Rom.), Hamada M. (Japan) | South Korea |
| 1975 | Pak Yung Sun (N.Kor.) | M. Alexandru (Rom.), Takahashi S. (Japan) | China |
| 1977 | Pak Yung Sun (N.Kor.) | Pak Yong Ok (N.Kor.), Yang Ying (China) | China |
| 1979 | Ge Xinai (China) | Zhang Deying, Zhang Li (China) | China |
| 1981 | Tong Ling (China) | Cao Yanhua, Zhang Deying (China) | China |
| 1983 | Cao Yanhua (China) | Shen Jianping, Dai Lili (China) | China |
| 1985 | Cao Yanhua (China) | Dai Lili, Geng Lijuan (China) | China |
| 1987 | He Zhili (China) | Hyun Jung Hwa, Yang Young Ja (S.Kor.) | China |
| 1989 | Qiao Hong (China) | Qiao Hong, Deng Yaping (China) | China |
| 1991 | Deng Yaping (China) | Gao Jun, Chen Zihe (China) | Korea |
| 1993 | Hyun Jung Hwa (S.Kor.) | Liu Wei, Qiao Yunping (China) | China |
| 1995 | Deng Yaping (China) | Deng Yaping, Qiao Hong (China) | China |
| 1997 | Deng Yaping (China) | Deng Yaping, Yang Ying (China) | China |
| 1999 | Wang Nan (China) | Wang Nan, Li Ju (China) | not held |
| 2000 | not held | not held | China |
| 2001 | Wang Nan (China) | Wang Nan, Li Ju (China) | China |

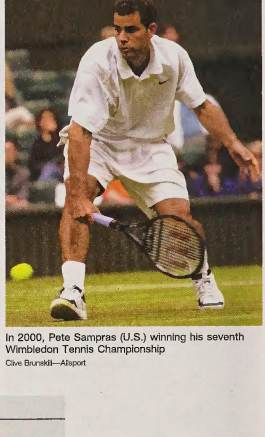
## TENNIS

Four events dominate world championship tennis. The first of the traditional "Big Four," or "grand slam," events was the All-England Lawn Tennis Championships (better known as the Wimbledon Championships), founded in 1877. Its only event the first year was the men's singles championships; women first competed in 1884. Major tennis tournaments also sprang up in the United States (1881 for men; women's singles competition first contested 1887, added officially 1889), France (1891 for men; women's singles competition added 1897), and Australia (1905 for men; women's singles competition added 1922). Open tennis (open, that is, both to professionals and to amateurs) became the rule in the Big Four tournaments in 1968.

International team tennis was organized in 1900 with the institution of the Davis Cup. Competing men's teams play four singles matches and one doubles match for the trophy. The Wightman Cup was contested yearly between British and American women's teams from 1923 to 1989. The International Tennis Federation (ITF, formerly the International Lawn Tennis Federation; founded 1913) established the Federation Cup in 1963 for international women's team competition. It is decided by elimination rounds of two singles and one doubles contest.



Serena and Venus Williams (U.S.) winning the women's doubles in the 2001 Australian Open Tennis Championship
Sean Garnsworthy—Allsport

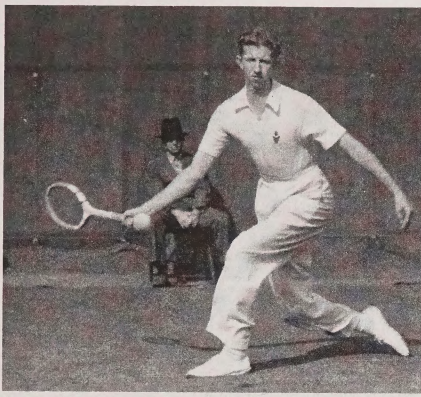


In 2000, Pete Sampras (U.S.) winning his seventh Wimbledon Tennis Championship
Clive Brunskill—Allsport

**All-England (Wimbledon) Tennis Championships—singles**

| year | men | women | year | men | women |
|---|---|---|---|---|---|
| 1877 | S.W. Gore (U.K.) | | 1940–45 | no competition | |
| 1878 | P.F. Hadow (U.K.) | | 1946 | Y. Petra (Fr.) | P. Betz (U.S.) |
| 1879 | J.T. Hartley (U.K.) | | 1947 | J. Kramer (U.S.) | M. Osborne (U.S.) |
| 1880 | J.T. Hartley (U.K.) | | 1948 | B. Falkenburg (U.S.) | L. Brough (U.S.) |
| 1881 | W. Renshaw (U.K.) | | 1949 | T. Schroeder (U.S.) | L. Brough (U.S.) |
| 1882 | W. Renshaw (U.K.) | | 1950 | B. Patty (U.S.) | L. Brough (U.S.) |
| 1883 | W. Renshaw (U.K.) | | 1951 | D. Savitt (U.S.) | D. Hart (U.S.) |
| 1884 | W. Renshaw (U.K.) | M. Watson (U.K.) | 1952 | F. Sedgman (Austl.) | M. Connolly (U.S.) |
| 1885 | W. Renshaw (U.K.) | M. Watson (U.K.) | 1953 | V. Seixas (U.S.) | M. Connolly (U.S.) |
| 1886 | W. Renshaw (U.K.) | B. Bingley (U.K.) | 1954 | J. Drobny (Czech.) | M. Connolly (U.S.) |
| 1887 | H.F. Lawford (U.K.) | L. Dod (U.K.) | 1955 | T. Trabert (U.S.) | L. Brough (U.S.) |
| 1888 | E. Renshaw (U.K.) | L. Dod (U.K.) | 1956 | L. Hoad (Austl.) | S. Fry (U.S.) |
| 1889 | E. Renshaw (U.K.) | B. Bingley Hillyard (U.K.) | 1957 | L. Hoad (Austl.) | A. Gibson (U.S.) |
| 1890 | W.J. Hamilton (U.K.) | L. Rice (U.K.) | 1958 | A. Cooper (Austl.) | A. Gibson (U.S.) |
| 1891 | W. Baddeley (U.K.) | L. Dod (U.K.) | 1959 | A. Olmedo (Peru) | M. Bueno (Braz.) |
| 1892 | W. Baddeley (U.K.) | L. Dod (U.K.) | 1960 | N. Fraser (Austl.) | M. Bueno (Braz.) |
| 1893 | J. Pim (U.K.) | L. Dod (U.K.) | 1961 | R. Laver (Austl.) | A. Mortimer (U.K.) |
| 1894 | J. Pim (U.K.) | B. Hillyard (U.K.) | 1962 | R. Laver (Austl.) | K. Susman (U.S.) |
| 1895 | W. Baddeley (U.K.) | C. Cooper (U.K.) | 1963 | C. McKinley (U.S.) | M. Smith (Austl.) |
| 1896 | H. Mahony (U.K.) | C. Cooper (U.K.) | 1964 | R. Emerson (Austl.) | M. Bueno (Braz.) |
| 1897 | R. Doherty (U.K.) | B. Hillyard (U.K.) | 1965 | R. Emerson (Austl.) | M. Smith (Austl.) |
| 1898 | R. Doherty (U.K.) | C. Cooper (U.K.) | 1966 | M. Santana (Spain) | B.J. King (U.S.) |
| 1899 | R. Doherty (U.K.) | B. Hillyard (U.K.) | 1967 | J. Newcombe (Austl.) | B.J. King (U.S.) |
| 1900 | R. Doherty (U.K.) | C. Sterry (U.K.) | 1968* | R. Laver (Austl.) | B.J. King (U.S.) |
| 1901 | A.W. Gore (U.K.) | C. Cooper Sterry (U.K.) | 1969 | R. Laver (Austl.) | A. Jones (U.K.) |
| 1902 | L. Doherty (U.K.) | M.E. Robb (U.K.) | 1970 | J. Newcombe (Austl.) | M. Smith Court (Austl.) |
| 1903 | L. Doherty (U.K.) | D. Douglass (U.K.) | 1971 | J. Newcombe (Austl.) | E. Goolagong (Austl.) |
| 1904 | L. Doherty (U.K.) | D. Douglass (U.K.) | 1972 | S. Smith (U.S.) | B.J. King (U.S.) |
| 1905 | L. Doherty (U.K.) | M. Sutton (U.S.) | 1973 | J. Kodeš (Czech.) | B.J. King (U.S.) |
| 1906 | L. Doherty (U.K.) | D. Douglass (U.K.) | 1974 | J. Connors (U.S.) | C. Evert (U.S.) |
| 1907 | N. Brookes (Austl.) | M. Sutton (U.S.) | 1975 | A. Ashe (U.S.) | B.J. King (U.S.) |
| 1908 | A.W. Gore (U.K.) | C. Sterry (U.K.) | 1976 | B. Borg (Swed.) | C. Evert (U.S.) |
| 1909 | A.W. Gore (U.K.) | D. Boothby (U.K.) | 1977 | B. Borg (Swed.) | V. Wade (U.K.) |
| 1910 | T. Wilding (N.Z.) | D. Douglass Lambert Chambers (U.K.) | 1978 | B. Borg (Swed.) | M. Navratilova (Czech.) |
| | | | 1979 | B. Borg (Swed.) | M. Navratilova (U.S.) |
| 1911 | T. Wilding (N.Z.) | D. Lambert Chambers (U.K.) | 1980 | B. Borg (Swed.) | E. Goolagong Cawley (Austl.) |
| 1912 | T. Wilding (N.Z.) | E.W. Larcombe (U.K.) | 1981 | J. McEnroe (U.S.) | C. Evert Lloyd (U.S.) |
| 1913 | T. Wilding (N.Z.) | D. Lambert Chambers (U.K.) | 1982 | J. Connors (U.S.) | M. Navratilova (U.S.) |
| 1914 | N. Brookes (Austl.) | D. Lambert Chambers (U.K.) | 1983 | J. McEnroe (U.S.) | M. Navratilova (U.S.) |
| 1915–18 | no competition | | 1984 | J. McEnroe (U.S.) | M. Navratilova (U.S.) |
| 1919 | G. Patterson (Austl.) | S. Lenglen (Fr.) | 1985 | B. Becker (W.Ger.) | M. Navratilova (U.S.) |
| 1920 | B. Tilden (U.S.) | S. Lenglen (Fr.) | 1986 | B. Becker (W.Ger.) | M. Navratilova (U.S.) |
| 1921 | B. Tilden (U.S.) | S. Lenglen (Fr.) | 1987 | P. Cash (Austl.) | M. Navratilova (U.S.) |
| 1922 | G. Patterson (Austl.) | S. Lenglen (Fr.) | 1988 | S. Edberg (Swed.) | S. Graf (W.Ger.) |
| 1923 | B. Johnston (U.S.) | S. Lenglen (Fr.) | 1989 | B. Becker (W.Ger.) | S. Graf (W.Ger.) |
| 1924 | J. Borotra (Fr.) | K. McKane (U.K.) | 1990 | S. Edberg (Swed.) | M. Navratilova (U.S.) |
| 1925 | R. Lacoste (Fr.) | S. Lenglen (Fr.) | 1991 | M. Stich (Ger.) | S. Graf (Ger.) |
| 1926 | J. Borotra (Fr.) | K. McKane Godfree (U.K.) | 1992 | A. Agassi (U.S.) | S. Graf (Ger.) |
| 1927 | H. Cochet (Fr.) | H. Wills (U.S.) | 1993 | P. Sampras (U.S.) | S. Graf (Ger.) |
| 1928 | R. Lacoste (Fr.) | H. Wills (U.S.) | 1994 | P. Sampras (U.S.) | C. Martinez (Spain) |
| 1929 | H. Cochet (Fr.) | H. Wills (U.S.) | 1995 | P. Sampras (U.S.) | S. Graf (Ger.) |
| 1930 | B. Tilden (U.S.) | H. Wills Moody (U.S.) | 1996 | R. Krajicek (Neth.) | S. Graf (Ger.) |
| 1931 | S. Wood (U.S.) | C. Aussem (Ger.) | 1997 | P. Sampras (U.S.) | M. Hingis (Switz.) |
| 1932 | E. Vines (U.S.) | H. Wills Moody (U.S.) | 1998 | P. Sampras (U.S.) | J. Novotna (Cz. Rep.) |
| 1933 | J. Crawford (Austl.) | H. Wills Moody (U.S.) | 1999 | P. Sampras (U.S.) | L. Davenport (U.S.) |
| 1934 | F. Perry (U.K.) | D. Round (U.K.) | 2000 | P. Sampras (U.S.) | V. Williams (U.S.) |
| 1935 | F. Perry (U.K.) | H. Wills Moody (U.S.) | 2001 | G. Ivanisevic (Cro.) | V. Williams (U.S.) |
| 1936 | F. Perry (U.K.) | H. Jacobs (U.S.) | 2002 | L. Hewitt (Austl.) | S. Williams (U.S.) |
| 1937 | D. Budge (U.S.) | D. Round (U.K.) | 2003 | R. Federer (Switz.) | S. Williams (U.S.) |
| 1938 | D. Budge (U.S.) | H. Wills Moody (U.S.) | 2004 | R. Federer (Switz.) | M. Sharapova (Russia) |
| 1939 | B. Riggs (U.S.) | A. Marble (U.S.) | | | |

*Open since 1968.



Don Budge (U.S.) winning the U.S. Open in 1938; that same year, he won the singles championships in Australia, France, and Great Britain, becoming the first amateur tennis player to win the grand slam

UPI/Bettmann

**Wightman Cup**

| year | winner | year | winner |
|---|---|---|---|
| 1923 | United States | 1959 | United States |
| 1924 | Great Britain | 1960 | Great Britain |
| 1925 | Great Britain | 1961 | United States |
| 1926 | United States | 1962 | United States |
| 1927 | United States | 1963 | United States |
| 1928 | Great Britain | 1964 | United States |
| 1929 | United States | 1965 | United States |
| 1930 | Great Britain | 1966 | United States |
| 1931 | United States | 1967 | United States |
| 1932 | United States | 1968 | Great Britain |
| 1933 | United States | 1969 | United States |
| 1934 | United States | 1970 | United States |
| 1935 | United States | 1971 | United States |
| 1936 | United States | 1972 | United States |
| 1937 | United States | 1973 | United States |
| 1938 | United States | 1974 | Great Britain |
| 1939 | United States | 1975 | Great Britain |
| 1940–45 | no competition | 1976 | United States |
| 1946 | United States | 1977 | United States |
| 1947 | United States | 1978 | Great Britain |
| 1948 | United States | 1979 | United States |
| 1949 | United States | 1980 | United States |
| 1950 | United States | 1981 | United States |
| 1951 | United States | 1982 | United States |
| 1952 | United States | 1983 | United States |
| 1953 | United States | 1984 | United States |
| 1954 | United States | 1985 | United States |
| 1955 | United States | 1986 | United States |
| 1956 | United States | 1987 | United States |
| 1957 | United States | 1988 | United States |
| 1958 | Great Britain | 1989 | United States |

**All-England (Wimbledon) Tennis Championships—doubles**

| year | men | women | year | men | women |
|---|---|---|---|---|---|
| 1879 | L.R. Erskine, H. Lawford | | 1946 | T. Brown, J. Kramer | L. Brough, M. Osborne |
| 1880 | W. Renshaw, E. Renshaw | | 1947 | B. Falkenburg, J. Kramer | P. Todd, D. Hart |
| 1881 | W. Renshaw, E. Renshaw | | 1948 | J. Bromwich, F. Sedgman | L. Brough, M. Osborne du Pont |
| 1882 | J.T. Hartley, R.T. Richardson | | 1949 | P. Gonzales, F. Parker | L. Brough, M. du Pont |
| 1883 | C.W. Grinstead, C.E. Welldon | | 1950 | J. Bromwich, A. Quist | L. Brough, M. du Pont |
| 1884 | W. Renshaw, E. Renshaw | | 1951 | K. McGregor, F. Sedgman | D. Hart, S. Fry |
| 1885 | W. Renshaw, E. Renshaw | | 1952 | K. McGregor, F. Sedgman | D. Hart, S. Fry |
| 1886 | W. Renshaw, E. Renshaw | | 1953 | L. Hoad, K. Rosewall | D. Hart, S. Fry |
| 1887 | H.W. Wilberforce, P.B. Lyon | | 1954 | R. Hartwig, M. Rose | L. Brough, M. du Pont |
| 1888 | W. Renshaw, E. Renshaw | | 1955 | R. Hartwig, L. Hoad | A. Mortimer, A. Shilcock |
| 1889 | W. Renshaw, E. Renshaw | | 1956 | L. Hoad, K. Rosewall | A. Buxton, A. Gibson |
| 1890 | J. Pim, F.O. Stoker | | 1957 | S. Patty, G. Mulloy | A. Gibson, D. Hard |
| 1891 | W. Baddeley, H. Baddeley | | 1958 | S. Davidson, U. Schmidt | M. Bueno, A. Gibson |
| 1892 | E.W. Lewis, H.S. Barlow | | 1959 | R. Emerson, N. Fraser | J. Arth, D. Hard |
| 1893 | J. Pim, F.O. Stoker | | 1960 | R. Osuna, D. Ralston | M. Bueno, D. Hard |
| 1894 | W. Baddeley, H. Baddeley | | 1961 | R. Emerson, N. Fraser | K. Hantze, B.J. Moffitt |
| 1895 | W. Baddeley, H. Baddeley | | 1962 | B. Hewitt, F. Stolle | B.J. Moffitt, K. Hantze Susman |
| 1896 | W. Baddeley, H. Baddeley | | 1963 | R. Osuna, A. Palafox | M. Bueno, D. Hard |
| 1897 | R. Doherty, L. Doherty | | 1964 | B. Hewitt, F. Stolle | M. Smith, L. Turner |
| 1898 | R. Doherty, L. Doherty | | 1965 | J. Newcombe, T. Roche | M. Bueno, B.J. Moffitt |
| 1899 | R. Doherty, L. Doherty | | 1966 | K. Fletcher, J. Newcombe | M. Bueno, N. Richey |
| 1900 | R. Doherty, L. Doherty | | 1967 | B. Hewitt, F. McMillan | R. Casals, B.J. Moffitt King |
| 1901 | R. Doherty, L. Doherty | | 1968 | J. Newcombe, T. Roche | R. Casals, B.J. King |
| 1902 | S. Smith, F. Riseley | | 1969 | J. Newcombe, T. Roche | M. Smith Court, J. Tegart |
| 1903 | R. Doherty, L. Doherty | | 1970 | J. Newcombe, T. Roche | R. Casals, B.J. King |
| 1904 | R. Doherty, L. Doherty | | 1971 | R. Emerson, R. Laver | R. Casals, B.J. King |
| 1905 | R. Doherty, L. Doherty | | 1972 | B. Hewitt, F. McMillan | B.J. King, B. Stove |
| 1906 | S. Smith, F. Riseley | | 1973 | J. Connors, I. Nastase | R. Casals, B.J. King |
| 1907 | N. Brookes, T. Wilding | | 1974 | J. Newcombe, T. Roche | E. Goolagong, P. Michel |
| 1908 | T. Wilding, J. Ritchie | | 1975 | V. Gerulaitis, S. Mayer | Kiyomura A., Sawamatsu K. |
| 1909 | A.W. Gore, R. Barrett | | 1976 | B. Gottfried, R. Ramirez | C. Evert, M. Navratilova |
| 1910 | T. Wilding, J. Ritchie | | 1977 | R. Case, G. Masters | H. Gourlay Cawley, J. Russell |
| 1911 | A. Gobert, M. Decugis | | 1978 | B. Hewitt, F. McMillan | K. Reid, W. Turnbull |
| 1912 | R. Barrett, C. Dixon | | 1979 | J. McEnroe, P. Fleming | B.J. King, M. Navratilova |
| 1913 | R. Barrett, C. Dixon | Mrs. R. McNair, D. Boothby | 1980 | P. McNamara, P. McNamee | K. Jordan, A. Smith |
| 1914 | N. Brookes, T. Wilding | E. Ryan, A. Morton | 1981 | J. McEnroe, P. Fleming | M. Navratilova, P. Shriver |
| 1915–18 | no competition | | 1982 | P. McNamara, P. McNamee | M. Navratilova, P. Shriver |
| 1919 | R.V. Thomas, P. O'Hara Wood | S. Lenglen, E. Ryan | 1983 | J. McEnroe, P. Fleming | M. Navratilova, P. Shriver |
| 1920 | D. Williams, S. Garland | S. Lenglen, E. Ryan | 1984 | J. McEnroe, P. Fleming | M. Navratilova, P. Shriver |
| 1921 | R. Lycett, M. Woosnam | S. Lenglen, E. Ryan | 1985 | H. Gunthardt, B. Taroczy | K. Jordan, E. Smylie |
| 1922 | J. Anderson, R. Lycett | S. Lenglen, E. Ryan | 1986 | J. Nystrom, M. Wilander | M. Navratilova, P. Shriver |
| 1923 | L. Godfree, R. Lycett | S. Lenglen, E. Ryan | 1987 | R. Seguso, K. Flach | C. Kohde-Kilsche, H. Sukova |
| 1924 | F. Hunter, V. Richards | H. Wightman, H. Wills | 1988 | R. Seguso, K. Flach | S. Graf, G. Sabatini |
| 1925 | J. Borotra, R. Lacoste | S. Lenglen, E. Ryan | 1989 | J. Fitzgerald, A. Jarryd | J. Novotna, H. Sukova |
| 1926 | J. Brugnon, H. Cochet | M. Browne, E. Ryan | 1990 | R. Leach, J. Pugh | J. Novotna, H. Sukova |
| 1927 | F. Hunter, B. Tilden | H. Wills, E. Ryan | 1991 | J. Fitzgerald, A. Jarryd | L. Savchenko, N. Zvereva |
| 1928 | J. Brugnon, H. Cochet | P. Saunders, P. Watson | 1992 | J. McEnroe, M. Stich | G. Fernandez, N. Zvereva |
| 1929 | W. Allison, J. Van Ryn | P. Saunders Michell, P. Watson | 1993 | T. Woodbridge, M. Woodforde | G. Fernandez, N. Zvereva |
| 1930 | W. Allison, J. Van Ryn | H. Wills Moody, E. Ryan | 1994 | T. Woodbridge, M. Woodforde | G. Fernandez, N. Zvereva |
| 1931 | G. Lott, J. Van Ryn | P. Mudford, D. Barron | 1995 | T. Woodbridge, M. Woodforde | A. Sánchez Vicario, J. Novotna |
| 1932 | J. Borotra, J. Brugnon | D. Metaxa, J. Sigart | 1996 | T. Woodbridge, M. Woodforde | H. Sukova, M. Hingis |
| 1933 | J. Borotra, J. Brugnon | E. Ryan, S. Mathieu | 1997 | T. Woodbridge, M. Woodforde | G. Fernandez, N. Zvereva |
| 1934 | G. Lott, L. Stoefen | E. Ryan, S. Mathieu | 1998 | J. Eltingh, P. Haarhuis | M. Hingis, J. Novotna |
| 1935 | J. Crawford, A. Quist | F. James, K. Stammers | 1999 | M. Bhupathi, L. Paes | L. Davenport, C. Morariu |
| 1936 | P. Hughes, R. Tuckey | F. James, K. Stammers | 2000 | T. Woodbridge, M. Woodforde | S. Williams, V. Williams |
| 1937 | D. Budge, G. Mako | S. Mathieu, B. Yorke | 2001 | D. Johnson, J. Palmer | L. Raymond, R. Stubbs |
| 1938 | D. Budge, G. Mako | S. Palfrey Fabyan, A. Marble | 2002 | T. Woodbridge, J. Bjorkman | S. Williams, V. Williams |
| 1939 | E. Cooke, B. Riggs | S. Palfrey Fabyan, A. Marble | 2003 | J. Bjorkman, T. Woodbridge | K. Clijsters, A. Sugiyama |
| 1940–45 | no competition | | 2004 | J. Bjorkman, T. Woodbridge | C. Black, R. Stubbs |

**Australian Open Tennis Championships—singles**

| year | men | women |
|---|---|---|
| 1905 | R. Heath (Austl.) | |
| 1906 | T. Wilding (N.Z.) | |
| 1907 | H. Rice (Austl.) | |
| 1908 | F. Alexander (U.S.) | |
| 1909 | T. Wilding (N.Z.) | |
| 1910 | R. Heath (Austl.) | |
| 1911 | N. Brookes (Austl.) | |
| 1912 | J.C. Parke (U.K.) | |
| 1913 | E.F. Parker (Austl.) | |
| 1914 | P. O'Hara Wood (Austl.) | |
| 1915 | F.G. Lowe (U.K.) | |
| 1916–18 | no competition | |
| 1919 | A.R.F. Kingscote (U.K.) | |
| 1920 | P. O'Hara Wood | |
| 1921 | R. Gemmell (Austl.) | |
| 1922 | J. Anderson (Austl.) | M. Molesworth (Austl.) |
| 1923 | P. O'Hara Wood (Austl.) | M. Molesworth (Austl.) |
| 1924 | J. Anderson (Austl.) | S. Lance (Austl.) |
| 1925 | J. Anderson (Austl.) | D. Akhurst (Austl.) |
| 1926 | J. Hawkes (Austl.) | D. Akhurst (Austl.) |
| 1927 | G. Patterson (Austl.) | E. Boyd (Austl.) |
| 1928 | J. Borotra (Fr.) | D. Akhurst (Austl.) |
| 1929 | J.C. Gregory (U.K.) | D. Akhurst (Austl.) |
| 1930 | E.F. Moon (Austl.) | D. Akhurst (Austl.) |
| 1931 | J. Crawford (Austl.) | C. Buttsworth (Austl.) |
| 1932 | J. Crawford (Austl.) | C. Buttsworth (Austl.) |
| 1933 | J. Crawford (Austl.) | J. Hartigan (Austl.) |
| 1934 | F. Perry (U.K.) | J. Hartigan (Austl.) |
| 1935 | J. Crawford (Austl.) | D. Round (U.K.) |
| 1936 | A. Quist (Austl.) | J. Hartigan (Austl.) |
| 1937 | V. McGrath (Austl.) | N. Wynne (Austl.) |
| 1938 | D. Budge (U.S.) | D. Bundy (U.S.) |
| 1939 | J. Bromwich (Austl.) | E. Westacott (Austl.) |
| 1940 | A. Quist (Austl.) | N. Wynne (Austl.) |
| 1941–45 | no competition | |
| 1946 | J. Bromwich (Austl.) | N. Wynne Bolton (Austl.) |
| 1947 | D. Pails (Austl.) | N. Bolton (Austl.) |
| 1948 | A. Quist (Austl.) | N. Bolton (Austl.) |
| 1949 | F. Sedgman (Austl.) | D. Hart (U.S.) |
| 1950 | F. Sedgman (Austl.) | L. Brough (U.S.) |
| 1951 | D. Savitt (U.S.) | N. Bolton (Austl.) |
| 1952 | K. McGregor (Austl.) | T. Long (Austl.) |
| 1953 | K. Rosewall (Austl.) | M.C. Connolly (U.S.) |
| 1954 | M. Rose (Austl.) | T. Long (Austl.) |
| 1955 | K. Rosewall (Austl.) | B. Penrose (Austl.) |
| 1956 | L. Hoad (Austl.) | M. Carter (Austl.) |
| 1957 | A. Cooper (Austl.) | S. Fry (U.S.) |
| 1958 | A. Cooper (Austl.) | A. Mortimer (U.K.) |
| 1959 | A. Olmedo (Peru) | M. Carter Reitano (Austl.) |
| 1960 | R. Laver (Austl.) | M. Smith (Austl.) |
| 1961 | R. Emerson (Austl.) | M. Smith (Austl.) |
| 1962 | R. Laver (Austl.) | M. Smith (Austl.) |
| 1963 | R. Emerson (Austl.) | M. Smith (Austl.) |
| 1964 | R. Emerson (Austl.) | M. Smith (Austl.) |
| 1965 | R. Emerson (Austl.) | M. Smith (Austl.) |
| 1966 | R. Emerson (Austl.) | M. Smith (Austl.) |
| 1967 | R. Emerson (Austl.) | N. Richey (U.S.) |
| 1968 | B. Bowrey (Austl.) | B.J. King (U.S.) |
| 1969 | R. Laver (Austl.) | M. Smith Court (Austl.) |
| 1970 | A. Ashe (U.S.) | M. Court (Austl.) |
| 1971 | K. Rosewall (Austl.) | M. Court (Austl.) |
| 1972 | K. Rosewall (Austl.) | V. Wade (U.K.) |
| 1973 | J. Newcombe (Austl.) | M. Court (Austl.) |
| 1974 | J. Connors (U.S.) | E. Goolagong (Austl.) |
| 1975 | J. Newcombe (Austl.) | E. Goolagong (Austl.) |
| 1976 | M. Edmondson (Austl.) | E. Goolagong Cawley (Austl.) |
| 1977 | R. Tanner (U.S.) | K. Reid (Austl.) |
| 1978* | V. Gerulaitis (U.S.) | E. Cawley (Austl.) |
| 1979 | G. Vilas (Arg.) | C. O'Neill (Austl.) |
| 1980 | G. Vilas (Arg.) | B. Jordan (U.S.) |
| 1981 | B. Teacher (U.S.) | H. Mandlikova (Czech.) |
| 1982 | J. Kriek (S.Af.) | M. Navratilova (U.S.) |
| 1983 | J. Kriek (S.Af.) | C. Evert Lloyd (U.S.) |
| 1984 | M. Wilander (Swed.) | M. Navratilova (U.S.) |
| 1985 | M. Wilander (Swed.) | C. Evert Lloyd (U.S.) |
| 1986 | S. Edberg (Swed.) | M. Navratilova (U.S.) |
| 1987 | S. Edberg (Swed.) | H. Mandlikova (Czech.) |
| 1988 | M. Wilander (Swed.) | S. Graf (W.Ger.) |
| 1989 | I. Lendl (Czech.) | S. Graf (W.Ger.) |
| 1990 | I. Lendl (Czech.) | S. Graf (W.Ger.) |
| 1991 | B. Becker (Ger.) | M. Seles (Yugos.) |
| 1992 | J. Courier (U.S.) | M. Seles (Yugos.) |
| 1993 | J. Courier (U.S.) | M. Seles (Yugos.) |
| 1994 | P. Sampras (U.S.) | S. Graf (Ger.) |
| 1995 | A. Agassi (U.S.) | M. Pierce (Fr.) |
| 1996 | B. Becker (Ger.) | M. Seles (U.S.) |
| 1997 | P. Sampras (U.S.) | M. Hingis (Switz.) |
| 1998 | P. Korda (Cz.Rep.) | M. Hingis (Switz.) |
| 1999 | Ye. Kafelnikov (Russia) | M. Hingis (Switz.) |
| 2000 | A. Agassi (U.S.) | L. Davenport (U.S.) |
| 2001 | A. Agassi (U.S.) | J. Capriati (U.S.) |
| 2002 | T. Johansson (Swed.) | J. Capriati (U.S.) |
| 2003 | A. Agassi (U.S.) | S. Williams (U.S.) |
| 2004 | R. Federer (Switz.) | J. Henin-Hardenne (Belg.) |

*Tournaments (since December 1977) held in December rather than January.

**French Open Tennis Championships—singles**

| year | men | women |
|---|---|---|
| 1891 | J. Briggs | |
| 1892 | J. Schopfer | |
| 1893 | J. Riboulet | |
| 1894 | A. Vacherot | |
| 1895 | A. Vacherot | |
| 1896 | A. Vacherot | |
| 1897 | P. Aymé | C. Masson |
| 1898 | P. Aymé | C. Masson |
| 1899 | P. Aymé | C. Masson |
| 1900 | P. Aymé | C. Prévost |
| 1901 | A. Vacherot | P. Girod |
| 1902 | A. Vacherot | C. Masson |
| 1903 | M. Decugis | C. Masson |
| 1904 | M. Decugis | K. Gillou |
| 1905 | M. Germot | K. Gillou |
| 1906 | M. Germot | K. Fenwick |
| 1907 | M. Decugis | M. de Kermel |
| 1908 | M. Decugis | K. Fenwick |
| 1909 | M. Decugis | J. Mattey |
| 1910 | M. Germot | J. Mattey |
| 1911 | A. Gobert | J. Mattey |
| 1912 | M. Decugis | J. Mattey |
| 1913 | M. Decugis | M. Broquedis |
| 1914 | M. Decugis | M. Broquedis |
| 1915–19 | no competition | |
| 1920 | A. Gobert | S. Lenglen |
| 1921 | J. Samazeuilh | S. Lenglen |
| 1922 | H. Cochet | S. Lenglen |
| 1923 | P. Blanchy | S. Lenglen |
| 1924 | J. Borotra | S. Lenglen |
| 1925* | R. Lacoste (Fr.) | S. Lenglen (Fr.) |
| 1926 | H. Cochet (Fr.) | S. Lenglen (Fr.) |
| 1927 | R. Lacoste (Fr.) | K. Bouman (Neth.) |
| 1928 | H. Cochet (Fr.) | H. Wills (U.S.) |
| 1929 | R. Lacoste (Fr.) | H. Wills (U.S.) |
| 1930 | H. Cochet (Fr.) | H. Wills Moody (U.S.) |
| 1931 | J. Borotra (Fr.) | C. Aussem (Ger.) |
| 1932 | H. Cochet (Fr.) | H. Wills Moody (U.S.) |
| 1933 | J. Crawford (Austl.) | M. Scriven (U.K.) |
| 1934 | G. von Cramm (Ger.) | M. Scriven (U.K.) |
| 1935 | F. Perry (U.K.) | H. Sperling (Den.) |
| 1936 | G. von Cramm (Ger.) | H. Sperling (Den.) |
| 1937 | H. Henkel (Ger.) | H. Sperling (Den.) |
| 1938 | D. Budge (U.S.) | S. Mathieu (Fr.) |
| 1939 | D. McNeill (U.S.) | S. Mathieu (Fr.) |
| 1940–45 | no competition | |
| 1946 | M. Bernard (Fr.) | M. Osborne (U.S.) |
| 1947 | J. Asboth (Hung.) | P. Todd (U.S.) |
| 1948 | F. Parker (U.S.) | N. Landry (Belg.) |
| 1949 | F. Parker (U.S.) | M. Osborne du Pont (U.S.) |
| 1950 | B. Patty (U.S.) | D. Hart (U.S.) |
| 1951 | J. Drobny (Czech.) | S. Fry (U.S.) |
| 1952 | J. Drobny (Czech.) | D. Hart (U.S.) |
| 1953 | K. Rosewall (Austl.) | M. Connolly (U.S.) |
| 1954 | T. Trabert (U.S.) | M. Connolly (U.S.) |
| 1955 | T. Trabert (U.S.) | A. Mortimer (U.K.) |
| 1956 | L. Hoad (Austl.) | A. Gibson (U.S.) |
| 1957 | S. Davidson (Swed.) | S. Bloomer (U.K.) |
| 1958 | M. Rose (Austl.) | S. Kormoczi (Hung.) |
| 1959 | N. Pietrangeli (Italy) | C. Truman (U.K.) |
| 1960 | N. Pietrangeli (Italy) | D. Hard (U.S.) |
| 1961 | M. Santana (Spain) | A. Haydon (U.K.) |
| 1962 | R. Laver (Austl.) | M. Smith (Austl.) |
| 1963 | R. Emerson (Austl.) | L. Turner (Austl.) |
| 1964 | M. Santana (Spain) | M. Smith (Austl.) |
| 1965 | F. Stolle (Austl.) | L. Turner (Austl.) |
| 1966 | T. Roche (Austl.) | A. Haydon Jones (U.K.) |
| 1967 | R. Emerson (Austl.) | F. Durr (Fr.) |
| 1968 | K. Rosewall (Austl.) | N. Richey (U.S.) |
| 1969 | R. Laver (Austl.) | M. Smith Court (Austl.) |
| 1970 | J. Kodeš (Czech.) | M. Court (Austl.) |
| 1971 | J. Kodeš (Czech.) | E. Goolagong (Austl.) |
| 1972 | A. Gimeno (Spain) | B.J. King (U.S.) |
| 1973 | I. Nastase (Rom.) | M. Court (Austl.) |
| 1974 | B. Borg (Swed.) | C. Evert (U.S.) |
| 1975 | B. Borg (Swed.) | C. Evert (U.S.) |
| 1976 | A. Panatta (Italy) | S. Barker (U.K.) |
| 1977 | G. Vilas (Arg.) | M. Jausovec (Yugos.) |
| 1978 | B. Borg (Swed.) | V. Ruzici (Rom.) |
| 1979 | B. Borg (Swed.) | C. Evert Lloyd (U.S.) |
| 1980 | B. Borg (Swed.) | C. Evert Lloyd (U.S.) |
| 1981 | B. Borg (Swed.) | H. Mandlikova (Czech.) |
| 1982 | M. Wilander (Swed.) | M. Navratilova (U.S.) |
| 1983 | Y. Noah (Fr.) | C. Evert Lloyd (U.S.) |
| 1984 | I. Lendl (Czech.) | M. Navratilova (U.S.) |
| 1985 | M. Wilander (Swed.) | C. Evert Lloyd (U.S.) |
| 1986 | I. Lendl (Czech.) | C. Evert Lloyd (U.S.) |
| 1987 | I. Lendl (Czech.) | S. Graf (W.Ger.) |
| 1988 | M. Wilander (Swed.) | S. Graf (W.Ger.) |
| 1989 | M. Chang (U.S.) | A. Sánchez Vicario (Spain) |
| 1990 | A. Gomez (Ecua.) | M. Seles (Yugos.) |
| 1991 | J. Courier (U.S.) | M. Seles (Yugos.) |
| 1992 | J. Courier (U.S.) | M. Seles (Yugos.) |
| 1993 | S. Bruguera (Spain) | S. Graf (Ger.) |
| 1994 | S. Bruguera (Spain) | A. Sánchez Vicario (Spain) |
| 1995 | T. Muster (Austria) | S. Graf (Ger.) |
| 1996 | Ye. Kafelnikov (Russia) | S. Graf (Ger.) |
| 1997 | G. Kuerten (Braz.) | I. Majoli (Croatia) |
| 1998 | C. Moya (Spain) | A. Sánchez Vicario (Spain) |
| 1999 | A. Agassi (U.S.) | S. Graf (Ger.) |
| 2000 | G. Kuerten (Braz.) | M. Pierce (Fr.) |
| 2001 | G. Kuerten (Braz.) | J. Capriati (U.S.) |
| 2002 | A. Costa (Spain) | S. Williams (U.S.) |
| 2003 | J.C. Ferrero (Spain) | J. Henin-Hardenne (Belg.) |
| 2004 | G. Gaudio (Arg.) | A. Myskina (Russia) |

*In 1925 opened to non-French participants.

## Australian Open Tennis Championships—doubles

| year | men | women |
|---|---|---|
| 1905 | T. Tachell, R. Lycett | |
| 1906 | T. Wilding, R. Heath | |
| 1907 | H. Parker, W. Gregg | |
| 1908 | F. Alexander, A. Dunlop | |
| 1909 | E.F. Parker, J. Keane | |
| 1910 | H. Rice, A. Campbell | |
| 1911 | R. Heath, R. Lycett | |
| 1912 | J.C. Parke, C. Dixon | |
| 1913 | E.F. Parker, A. Hedemann | |
| 1914 | A. Campbell, G. Patterson | |
| 1915 | H. Rice, C. Todd | |
| 1916–18 | no competition | |
| 1919 | P. O'Hara Wood, R.V. Thomas | |
| 1920 | P. O'Hara Wood, R.V. Thomas | |
| 1921 | R. Gemmell, R.V. Thomas | |
| 1922 | G. Patterson, J. Hawkes | E. Boyd, M. Mountain |
| 1923 | P. O'Hara Wood, C. St. John | E. Boyd, S. Lance |
| 1924 | N. Brookes, J. Anderson | D. Akhurst, S. Lance |
| 1925 | G. Patterson, P. O'Hara Wood | D. Akhurst, S. Lance Harper |
| 1926 | G. Patterson, J. Hawkes | Mrs. P. O'Hara Wood, E. Boyd |
| 1927 | G. Patterson, J. Hawkes | Mrs. P. O'Hara Wood, L. Bickerton |
| 1928 | J. Borotra, J. Brugnon | D. Akhurst, E. Boyd |
| 1929 | J. Crawford, H. Hopman | D. Akhurst, L. Bickerton |
| 1930 | J. Crawford, H. Hopman | M. Molesworth, E. Hood |
| 1931 | C. Donohoe, R. Dunlop | D. Akhurst Cozens, L. Bickerton |
| 1932 | J. Crawford, E.F. Moon | C. Buttsworth, M. Crawford |
| 1933 | E. Vines, K. Gledhill | M. Molesworth, E. Westacott |
| 1934 | F. Perry, G. Hughes | M. Molesworth, E. Westacott |
| 1935 | J. Crawford, V. McGrath | E. Dearman, N. Lyle |
| 1936 | A. Quist, J. Turnbull | T. Coyne, N. Wynne |
| 1937 | A. Quist, D. Turnbull | T. Coyne, N. Wynne |
| 1938 | A. Quist, J. Bromwich | T. Coyne, N. Wynne |
| 1939 | A. Quist, J. Bromwich | T. Coyne, N. Wynne |
| 1940 | A. Quist, J. Bromwich | T. Coyne, N. Wynne |
| 1941–45 | no competition | |
| 1946 | A. Quist, J. Bromwich | J. Fitch, M. Bevis |
| 1947 | A. Quist, J. Bromwich | T. Coyne Long, N. Wynne Bolton |
| 1948 | A. Quist, J. Bromwich | T. Long, N. Bolton |
| 1949 | A. Quist, J. Bromwich | T. Long, N. Bolton |
| 1950 | A. Quist, J. Bromwich | L. Brough, D. Hart |
| 1951 | F. Sedgman, K. McGregor | T. Long, N. Bolton |
| 1952 | F. Sedgman, K. McGregor | T. Long, N. Bolton |
| 1953 | L. Hoad, K. Rosewall | M. Connolly, J. Sampson |
| 1954 | R. Hartwig, M. Rose | M. Bevis Hawton, B. Penrose |
| 1955 | V. Seixas, T. Trabert | M. Hawton, B. Penrose |
| 1956 | L. Hoad, K. Rosewall | M. Hawton, T. Long |
| 1957 | L. Hoad, N. Fraser | A. Gibson, S. Fry |
| 1958 | A. Cooper, N. Fraser | M. Hawton, T. Long |
| 1959 | R. Laver, B. Mark | R. Schuurman, S. Reynolds |
| 1960 | R. Laver, B. Mark | M. Bueno, C. Truman |
| 1961 | R. Laver, B. Mark | M. Reitano, M. Smith |
| 1962 | R. Emerson, N. Fraser | M. Smith, R. Ebbern |
| 1963 | B. Hewitt, F. Stolle | M. Smith, R. Ebbern |
| 1964 | B. Hewitt, F. Stolle | J. Tegart, L. Turner |
| 1965 | J. Newcombe, T. Roche | M. Smith, L. Turner |
| 1966 | R. Emerson, F. Stolle | C. Graebner, N. Richey |
| 1967 | J. Newcombe, T. Roche | L. Turner, J. Tegart |
| 1968 | D. Crealy, A. Stone | K. Krantzcke, K. Melville |
| 1969 | R. Emerson, R. Laver | M. Smith Court, J. Tegart |
| 1970 | B. Lutz, S. Smith | M. Court, J. Tegart Dalton |
| 1971 | J. Newcombe, T. Roche | M. Court, E. Goolagong |
| 1972 | O. Davidson, K. Rosewall | K. Harris, H. Gourlay |
| 1973 | M. Anderson, J. Newcombe | M. Court, V. Wade |
| 1974 | R. Case, G. Masters | E. Goolagong, P. Michel |
| 1975 | J. Alexander, P. Dent | E. Goolagong, P. Michel |
| 1976 | J. Newcombe, T. Roche | E. Goolagong Cawley, H. Gourlay |
| 1977 | A. Ashe, T. Roche | D. Fromholtz, H. Gourlay |
| 1978* | A. Stone, R. Ruffels | E. Cawley, H. Gourlay Cawley† C. Matison, P. Whytcross† |
| 1979 | W. Fibak, K. Warwick | R. Tomanova, B. Nagelsen |
| 1980 | P. McNamara, P. McNamee | J. Chaloner, D. Evers |
| 1981 | K. Warwick, M. Edmondson | M. Navratilova, B. Nagelsen |
| 1982 | K. Warwick, M. Edmondson | K. Jordan, A. Smith |
| 1983 | J. Alexander, J. Fitzgerald | M. Navratilova, P. Shriver |
| 1984 | M. Edmondson, P. McNamee | M. Navratilova, P. Shriver |
| 1985 | M. Edmondson, S. Stewart | M. Navratilova, P. Shriver |
| 1986 | P. Annacone, C. van Rensburg | M. Navratilova, P. Shriver |
| 1987 | S. Edberg, A. Jarryd | M. Navratilova, P. Shriver |
| 1988 | R. Leach, J. Pugh | M. Navratilova, P. Shriver |
| 1989 | R. Leach, J. Pugh | M. Navratilova, P. Shriver |
| 1990 | P. Aldrich, D. Visser | J. Novotna, H. Sukova |
| 1991 | S. Davis, D. Pate | P. Fendick, M.J. Fernandez |
| 1992 | T. Woodbridge, M. Woodforde | A. Sánchez Vicario, H. Sukova |
| 1993 | D. Visser, L. Warder | G. Fernandez, N. Zvereva |
| 1994 | P. Haarhuis, J. Eltingh | G. Fernandez, N. Zvereva |
| 1995 | J. Palmer, R. Reneberg | A. Sánchez Vicario, J. Novotna |
| 1996 | S. Edberg, P. Korda | A. Sánchez Vicario, C. Rubin |
| 1997 | T. Woodbridge, M. Woodforde | M. Hingis, N. Zvereva |
| 1998 | J. Bjorkman, J. Eltingh | M. Hingis, M. Lucic |
| 1999 | J. Bjorkman, P. Rafter | M. Hingis, A. Kournikova |
| 2000 | E. Ferreira, R. Leach | L. Raymond, R. Stubbs |
| 2001 | J. Bjorkman, T. Woodbridge | S. Williams, V. Williams |
| 2002 | M. Knowles, D. Nestor | M. Hingis, A. Kournikova |
| 2003 | M. Llodra, F. Santoro | S. Williams, V. Williams |
| 2004 | M. Llodra, F. Santoro | V. Ruano Pascual, P. Suárez |

*Tournaments (since December 1977) held in December rather than January. †Finals rained out.

## French Open Tennis Championships—doubles

| year | men | women |
|---|---|---|
| 1891 | B. Desjoyau, T. Legrand | |
| 1892 | D. Albertini, J. Havet | |
| 1893 | J. Schopfer, F. Goldsmith | |
| 1894 | L. Brosselin, J. Lesage | |
| 1895 | A. Vacherot, C. Winzer | |
| 1896 | F. Warden, J. Wynn | |
| 1897 | P. Aymé, T. Lebreton | |
| 1898 | A. Vacherot, X. Casdagli | |
| 1899 | P. Aymé, T. Lebreton | |
| 1900 | P. Aymé, T. Lebreton | |
| 1901 | A. Vacherot, M. Vacherot | |
| 1902 | M. Decugis, J. Worth | |
| 1903 | M. Decugis, J. Worth | |
| 1904 | M. Decugis, M. Germot | |
| 1905 | M. Decugis, J. Worth | |
| 1906 | M. Decugis, M. Germot | |
| 1907 | M. Decugis, M. Germot | |
| 1908 | M. Decugis, M. Germot | |
| 1909 | M. Decugis, M. Germot | |
| 1910 | M. Decugis, M. Dupont | |
| 1911 | M. Decugis, M. Germot | |
| 1912 | M. Decugis, M. Germot | |
| 1913 | M. Decugis, M. Germot | |
| 1914 | M. Decugis, M. Germot | |
| 1915–19 | no competition | |
| 1920 | M. Decugis, M. Germot | |
| 1921 | A. Gobert, W. Laurentz | |
| 1922 | J. Brugnon, M. Dupont | |
| 1923 | P. Blanchy, J. Samazeuilh | |
| 1924 | J. Borotra, R. Lacoste | |
| 1925 | J. Borotra, R. Lacoste | S. Lenglen, D. Vlasto |
| 1926 | V. Richards, H. Kinsey | S. Lenglen, D. Vlasto |
| 1927 | H. Cochet, J. Brugnon | I. Peacock, E. Heine |
| 1928 | J. Borotra, J. Brugnon | P. Watson, E. Bennett |
| 1929 | J. Borotra, R. Lacoste | L. de Alvarez, K. Bouman |
| 1930 | H. Cochet, J. Brugnon | H. Wills Moody, E. Ryan |
| 1931 | G. Lott, J. Van Ryn | E. Whittingstall, B. Nuthall |
| 1932 | H. Cochet, J. Brugnon | H. Wills Moody, E. Ryan |
| 1933 | G. Hughes, F. Perry | S. Mathieu, E. Ryan |
| 1934 | J. Borotra, J. Brugnon | S. Mathieu, E. Ryan |
| 1935 | J. Crawford, A. Quist | M. Scriven, K. Stammers |
| 1936 | J. Borotra, M. Bernard | S. Mathieu, A. Yorke |
| 1937 | G. von Cramm, H. Henkel | S. Mathieu, A. Yorke |
| 1938 | B. Destremau, Y. Petra | S. Mathieu, A. Yorke |
| 1939 | D. McNeill, C. Harris | S. Mathieu, J. Jedrzejowska |
| 1940–45 | no competition | |
| 1946 | M. Bernard, Y. Petra | L. Brough, M. Osborne |
| 1947 | E. Fannin, E. Sturgess | L. Brough, M. Osborne |
| 1948 | L. Bergelin, J. Drobny | D. Hart, P. Todd |
| 1949 | F. Parker, P. Gonzales | L. Brough, M. Osborne du Pont |
| 1950 | B. Talbert, T. Trabert | D. Hart, S. Fry |
| 1951 | K. McGregor, F. Sedgman | D. Hart, S. Fry |
| 1952 | K. McGregor, F. Sedgman | D. Hart, S. Fry |
| 1953 | L. Hoad, K. Rosewall | D. Hart, S. Fry |
| 1954 | V. Seixas, T. Trabert | M. Connolly, N. Hopman |
| 1955 | V. Seixas, T. Trabert | B. Fleitz, D. Hard |
| 1956 | D. Candy, R. Perry | A. Buxton, A. Gibson |
| 1957 | M. Anderson, A. Cooper | S. Bloomer, D. Hard |
| 1958 | A. Cooper, N. Fraser | N. Reyes, Y. Ramirez |
| 1959 | N. Pietrangeli, O. Sirola | S. Reynolds, R. Schuurman |
| 1960 | R. Emerson, N. Fraser | M. Bueno, D. Hard |
| 1961 | R. Emerson, R. Laver | S. Reynolds, R. Schuurman |
| 1962 | R. Emerson, N. Fraser | S. Reynolds Price, R. Schuurman |
| 1963 | R. Emerson, M. Santana | A. Jones, R. Schuurman |
| 1964 | R. Emerson, K. Fletcher | M. Smith, L. Turner |
| 1965 | R. Emerson, F. Stolle | M. Smith, L. Turner |
| 1966 | C. Graebner, D. Ralston | M. Smith, J. Tegart |
| 1967 | J. Newcombe, T. Roche | F. Durr, G. Sheriff |
| 1968 | K. Rosewall, F. Stolle | F. Durr, A. Jones |
| 1969 | J. Newcombe, T. Roche | F. Durr, A. Jones |
| 1970 | I. Nastase, I. Tiriac | F. Durr, G. Chanfreau |
| 1971 | A. Ashe, M. Riessen | F. Durr, G. Chanfreau |
| 1972 | B. Hewitt, F. McMillan | B.J. King, B. Stove |
| 1973 | J. Newcombe, T. Okker | M. Smith Court, V. Wade |
| 1974 | D. Crealy, O. Parun | C. Evert, O. Morozova |
| 1975 | B. Gottfried, R. Ramirez | C. Evert, M. Navratilova |
| 1976 | F. McNair, S. Stewart | F. Bonicelli, G. Chanfreau Lovera |
| 1977 | B. Gottfried, R. Ramirez | R. Marsikova, P. Teeguarden |
| 1978 | H. Pfister, G. Mayer | M. Jausovec, V. Ruzici |
| 1979 | S. Mayer, G. Mayer | B. Stove, W. Turnbull |
| 1980 | V. Amaya, H. Pfister | K. Jordan, A. Smith |
| 1981 | H. Gunthardt, B. Taroczy | R. Fairbank, T. Harford |
| 1982 | S. Stewart, F. Taygan | M. Navratilova, A. Smith |
| 1983 | A. Jarryd, H. Simonsson | R. Fairbank, C. Reynolds |
| 1984 | H. Leconte, Y. Noah | M. Navratilova, P. Shriver |
| 1985 | M. Edmondson, K. Warwick | M. Navratilova, P. Shriver |
| 1986 | J. Fitzgerald, T. Smid | M. Navratilova, A. Temesvari |
| 1987 | R. Seguso, A. Jarryd | M. Navratilova, P. Shriver |
| 1988 | E. Sánchez, A. Gomez | M. Navratilova, P. Shriver |
| 1989 | J. Grabb, P. McEnroe | L. Savchenko, N. Zvereva |
| 1990 | S. Casal, E. Sánchez | J. Novotna, H. Sukova |
| 1991 | J. Fitzgerald, A. Jarryd | G. Fernandez, J. Novotna |
| 1992 | J. Hlasek, M. Rosset | G. Fernandez, N. Zvereva |
| 1993 | L. Jensen, M. Jensen | G. Fernandez, N. Zvereva |
| 1994 | B. Black, J. Stark | G. Fernandez, N. Zvereva |
| 1995 | J. Eltingh, P. Haarhuis | G. Fernandez, N. Zvereva |
| 1996 | Ye. Kafelnikov, D. Vacek | L. Davenport, M.J. Fernandez |
| 1997 | Ye. Kafelnikov, D. Vacek | G. Fernandez, N. Zvereva |
| 1998 | J. Eltingh, P. Haarhuis | M. Hingis, J. Novotna |
| 1999 | M. Bhupathi, L. Paes | S. Williams, V. Williams |
| 2000 | T. Woodbridge, M. Woodforde | M. Hingis, M. Pierce |
| 2001 | M. Bhupathi, L. Paes | V. Ruano Pascual, P. Suárez |
| 2002 | Ye. Kafelnikov, P. Haarhuis | V. Ruano Pascual, P. Suárez |
| 2003 | B. Bryan, M. Bryan | K. Clijsters, A. Sugiyama |
| 2004 | X. Malisse, O. Rochus | V. Ruano Pascual, P. Suárez |

## United States Open Tennis Championships—singles

| year | men | women |
|---|---|---|
| 1881 | D. Sears (U.S.) | |
| 1882 | D. Sears (U.S.) | |
| 1883 | D. Sears (U.S.) | |
| 1884 | D. Sears (U.S.) | |
| 1885 | D. Sears (U.S.) | |
| 1886 | D. Sears (U.S.) | |
| 1887 | D. Sears (U.S.) | E. Hansell (U.S.) |
| 1888 | H. Slocum (U.S.) | B. Townsend (U.S.) |
| 1889 | H. Slocum (U.S.) | B. Townsend (U.S.) |
| 1890 | O. Campbell (U.S.) | E. Roosevelt (U.S.) |
| 1891 | O. Campbell (U.S.) | M. Cahill (U.S.) |
| 1892 | O. Campbell (U.S.) | M. Cahill (U.S.) |
| 1893 | R. Wrenn (U.S.) | A. Terry (U.S.) |
| 1894 | R. Wrenn (U.S.) | H. Helwig (U.S.) |
| 1895 | F. Hovey (U.S.) | J. Atkinson (U.S.) |
| 1896 | R. Wrenn (U.S.) | E. Moore (U.S.) |
| 1897 | R. Wrenn (U.S.) | J. Atkinson (U.S.) |
| 1898 | M.D. Whitman (U.S.) | J. Atkinson (U.S.) |
| 1899 | M.D. Whitman (U.S.) | M. Jones (U.S.) |
| 1900 | M.D. Whitman (U.S.) | M. McAteer (U.S.) |
| 1901 | W.A. Larned (U.S.) | E. Moore (U.S.) |
| 1902 | W.A. Larned (U.S.) | M. Jones (U.S.) |
| 1903 | L. Doherty (U.K.) | E. Moore (U.S.) |
| 1904 | H. Ward (U.S.) | M. Sutton (U.S.) |
| 1905 | B. Wright (U.S.) | E. Moore (U.S.) |
| 1906 | W.J. Clothier (U.S.) | H. Homans (U.S.) |
| 1907 | W.A. Larned (U.S.) | E. Sears (U.S.) |
| 1908 | W.A. Larned (U.S.) | M. Bargar-Wallach (U.S.) |
| 1909 | W.A. Larned (U.S.) | H. Hotchkiss (U.S.) |
| 1910 | W.A. Larned (U.S.) | H. Hotchkiss (U.S.) |
| 1911 | W.A. Larned (U.S.) | H. Hotchkiss (U.S.) |
| 1912 | M. Mcloughlin (U.S.) | M.K. Browne (U.S.) |
| 1913 | M. McLoughlin (U.S.) | M.K. Browne (U.S.) |
| 1914 | D. Williams (U.S.) | M.K. Browne (U.S.) |
| 1915 | B. Johnston (U.S.) | M. Bjurstedt (Nor.) |
| 1916 | R. Williams (U.S.) | M. Bjurstedt (Nor.) |
| 1917 | R.L. Murray (U.S.) | M. Bjurstedt (Nor.) |
| 1918 | R.L. Murray (U.S.) | M. Bjurstedt (Nor.) |
| 1919 | B. Johnston (U.S.) | H. Hotchkiss Wightman (U.S.) |
| 1920 | B. Tilden (U.S.) | M. Bjurstedt Mallory (U.S.) |
| 1921 | B. Tilden (U.S.) | M. Mallory (U.S.) |
| 1922 | B. Tilden (U.S.) | M. Mallory (U.S.) |
| 1923 | B. Tilden (U.S.) | H. Wills (U.S.) |
| 1924 | B. Tilden (U.S.) | H. Wills (U.S.) |
| 1925 | B. Tilden (U.S.) | H. Wills (U.S.) |
| 1926 | R. Lacoste (Fr.) | M. Mallory (U.S.) |
| 1927 | R. Lacoste (Fr.) | H. Wills (U.S.) |
| 1928 | H. Cochet (Fr.) | H. Wills (U.S.) |
| 1929 | B. Tilden (U.S.) | H. Wills (U.S.) |
| 1930 | J. Doeg (U.S.) | B. Nuthall (U.K.) |
| 1931 | E. Vines (U.S.) | H. Wills Moody (U.S.) |
| 1932 | E. Vines (U.S.) | H. Jacobs (U.S.) |
| 1933 | F. Perry (U.K.) | H. Jacobs (U.S.) |
| 1934 | F. Perry (U.K.) | H. Jacobs (U.S.) |
| 1935 | W. Allison (U.S.) | H. Jacobs (U.S.) |
| 1936 | F. Parker (U.K.) | A. Marble (U.S.) |
| 1937 | D. Budge (U.S.) | A. Lizana (Chile) |
| 1938 | D. Budge (U.S.) | A. Marble (U.S.) |
| 1939 | B. Riggs (U.S.) | A. Marble (U.S.) |
| 1940 | D. McNeill (U.S.) | A. Marble (U.S.) |
| 1941 | B. Riggs (U.S.) | S. Palfrey Cooke (U.S.) |
| 1942 | T. Schroeder (U.S.) | P. Betz (U.S.) |
| 1943 | J.R. Hunt (U.S.) | P. Betz (U.S.) |
| 1944 | F. Parker (U.S.) | P. Betz (U.S.) |
| 1945 | F. Parker (U.S.) | S. Palfrey Cooke (U.S.) |
| 1946 | J. Kramer (U.S.) | P. Betz (U.S.) |
| 1947 | J. Kramer (U.S.) | L. Brough (U.S.) |
| 1948 | G. Gonzales (U.S.) | M. du Pont (U.S.) |
| 1949 | P. Gonzales (U.S.) | M. du Pont (U.S.) |
| 1950 | A. Larsen (U.S.) | M. du Pont (U.S.) |
| 1951 | F. Sedgman (Austl.) | M. Connolly (U.S.) |
| 1952 | F. Sedgman (Austl.) | M. Connolly (U.S.) |
| 1953 | T. Trabert (U.S.) | M. Connolly (U.S.) |
| 1954 | V. Seixas (U.S.) | D. Hart (U.S.) |
| 1955 | T. Trabert (U.S.) | D. Hart (U.S.) |
| 1956 | K. Rosewall (Austl.) | S. Fry (U.S.) |
| 1957 | M. Anderson (Austl.) | A. Gibson (U.S.) |
| 1958 | A. Cooper (Austl.) | A. Gibson (U.S.) |
| 1959 | N. Fraser (Austl.) | M. Bueno (Braz.) |
| 1960 | N. Fraser (Austl.) | D. Hard (U.S.) |
| 1961 | R. Emerson (Austl.) | D. Hard (U.S.) |
| 1962 | R. Laver (Austl.) | M. Smith (Austl.) |
| 1963 | R. Osuna (Mex.) | M. Bueno (Braz.) |
| 1964 | R. Emerson (Austl.) | M. Bueno (Braz.) |
| 1965 | M. Santana (Spain) | M. Smith (Austl.) |
| 1966 | F. Stolle (Austl.) | M. Bueno (Braz.) |
| 1967 | J. Newcombe (Austl.) | B.J. King (U.S.) |
| 1968* | A. Ashe (U.S.) | V. Wade (U.K.) |
| | | M. Court (Austl.) |
| 1969* | R. Laver (Austl.) | M. Court (Austl.) |
| | S. Smith (U.S.) | |
| 1970 | K. Rosewall (Austl.) | M. Court (Austl.) |
| 1971 | S. Smith (U.S.) | B.J. King (U.S.) |
| 1972 | I. Nastase (Rom.) | B.J. King (U.S.) |
| 1973 | J. Newcombe (Austl.) | M. Court (Austl.) |
| 1974 | J. Connors (U.S.) | B.J. King (U.S.) |
| 1975 | M. Orantes (Spain) | C. Evert (U.S.) |
| 1976 | J. Connors (U.S.) | C. Evert (U.S.) |
| 1977 | G. Vilas (Arg.) | C. Evert (U.S.) |
| 1978 | J. Connors (U.S.) | C. Evert (U.S.) |
| 1979 | J. McEnroe (U.S.) | T. Austin (U.S.) |
| 1980 | J. McEnroe (U.S.) | C. Evert Lloyd (U.S.) |
| 1981 | J. McEnroe (U.S.) | T. Austin (U.S.) |
| 1982 | J. Connors (U.S.) | C. Evert Lloyd (U.S.) |
| 1983 | J. Connors (U.S.) | M. Navratilova (U.S.) |
| 1984 | J. McEnroe (U.S.) | M. Navratilova (U.S.) |
| 1985 | I. Lendl (Czech.) | H. Mandlikova (Czech.) |
| 1986 | I. Lendl (Czech.) | M. Navratilova (U.S.) |
| 1987 | I. Lendl (Czech.) | M. Navratilova (U.S.) |
| 1988 | M. Wilander (Swed.) | S. Graf (W.Ger.) |
| 1989 | B. Becker (W.Ger.) | S. Graf (W.Ger.) |
| 1990 | P. Sampras (U.S.) | G. Sabatini (Arg.) |
| 1991 | S. Edberg (Swed.) | M. Seles (Yugos.) |
| 1992 | S. Edberg (Swed.) | M. Seles (Yugos.) |
| 1993 | P. Sampras (U.S.) | S. Graf (Ger.) |
| 1994 | A. Agassi (U.S.) | A. Sánchez Vicario (Spain) |
| 1995 | P. Sampras (U.S.) | S. Graf (Ger.) |
| 1996 | P. Sampras (U.S.) | S. Graf (Ger.) |
| 1997 | P. Rafter (Austl.) | M. Hingis (Switz.) |
| 1998 | P. Rafter (Austl.) | L. Davenport (U.S.) |
| 1999 | A. Agassi (U.S.) | S. Williams (U.S.) |
| 2000 | M. Safin (Russia) | V. Williams (U.S.) |
| 2001 | L. Hewitt (Austl.) | V. Williams (U.S.) |
| 2002 | P. Sampras (U.S.) | S. Williams (U.S.) |
| 2003 | A. Roddick (U.S.) | J. Henin-Hardenne (Belg.) |
| 2004 | R. Federer (Switz.) | S. Kuznetsova (Russia) |

*In 1968 and 1969 both amateur and open championships were held. Ashe won both men's competitions in 1968; Smith won the amateur championship in 1969. Court won the women's amateur competition in 1968 and both championships in 1969. Thereafter the championships were open.

## Davis Cup

| year | winner | runner-up | results |
|---|---|---|---|
| 1900 | United States | British Isles* | 3–0 |
| 1901 | no competition | | |
| 1902 | United States | British Isles | 3–2 |
| 1903 | British Isles | United States | 4–1 |
| 1904 | British Isles | Belgium | 5–0 |
| 1905 | British Isles | United States | 5–0 |
| 1906 | British Isles | United States | 5–0 |
| 1907 | Australasia† | British Isles | 3–2 |
| 1908 | Australasia | United States | 3–2 |
| 1909 | Australasia | United States | 5–0 |
| 1910 | no competition | | |
| 1911 | Australasia | United States | 5–0 |
| 1912 | British Isles | Australasia | 3–2 |
| 1913 | United States | British Isles | 3–2 |
| 1914 | Australia | United States | 3–2 |
| 1915–18 | no competition | | |
| 1919 | Australia | British Isles | 4–1 |
| 1920 | United States | Australia | 5–0 |
| 1921 | United States | Japan | 5–0 |
| 1922 | United States | Australia | 4–1 |
| 1923 | United States | Australia | 4–1 |
| 1924 | United States | Australia | 5–0 |
| 1925 | United States | France | 5–0 |
| 1926 | United States | France | 4–1 |
| 1927 | France | United States | 3–2 |
| 1928 | France | United States | 4–1 |
| 1929 | France | United States | 3–2 |
| 1930 | France | United States | 4–1 |
| 1931 | France | United Kingdom | 3–2 |
| 1932 | France | United States | 3–2 |
| 1933 | United Kingdom | France | 3–2 |
| 1934 | United Kingdom | United States | 4–1 |
| 1935 | United Kingdom | United States | 5–0 |
| 1936 | United Kingdom | Australia | 3–2 |
| 1937 | United States | United Kingdom | 4–1 |
| 1938 | United States | Australia | 3–2 |
| 1939 | Australia | United States | 3–2 |
| 1940–45 | no competition | | |
| 1946 | United States | Australia | 5–0 |
| 1947 | United States | Australia | 4–1 |
| 1948 | United States | Australia | 5–0 |
| 1949 | United States | Australia | 4–1 |
| 1950 | Australia | United States | 4–1 |
| 1951 | Australia | United States | 3–2 |
| 1952 | Australia | United States | 4–1 |
| 1953 | Australia | United States | 3–2 |
| 1954 | United States | Australia | 3–2 |
| 1955 | Australia | United States | 5–0 |
| 1956 | Australia | United States | 5–0 |
| 1957 | Australia | United States | 5–0 |
| 1958 | Australia | United States | 3–2 |
| 1959 | Australia | United States | 3–2 |
| 1960 | Australia | Italy | 4–1 |
| 1961 | Australia | Italy | 5–0 |
| 1962 | Australia | Mexico | 5–0 |
| 1963 | United States | Australia | 3–2 |
| 1964 | Australia | United States | 3–2 |
| 1965 | Australia | Spain | 4–1 |
| 1966 | Australia | India | 4–1 |
| 1967 | Australia | Spain | 4–1 |
| 1968 | United States | Australia | 4–1 |
| 1969 | United States | Romania | 5–0 |
| 1970 | United States | West Germany | 5–0 |
| 1971 | United States | Romania | 3–2 |
| 1972 | United States | Romania | 3–2 |
| 1973 | Australia | United States | 5–0 |
| 1974 | South Africa‡ | India | |
| 1975 | Sweden | Czechoslovakia | 3–2 |
| 1976 | Italy | Chile | 4–1 |
| 1977 | Australia | Italy | 3–1 |
| 1978 | United States | United Kingdom | 4–1 |
| 1979 | United States | Italy | 5–0 |
| 1980 | Czechoslovakia | Italy | 4–1 |
| 1981 | United States | Argentina | 3–1 |
| 1982 | United States | France | 4–1 |
| 1983 | Australia | Sweden | 3–2 |
| 1984 | Sweden | United States | 4–1 |
| 1985 | Sweden | West Germany | 3–2 |
| 1986 | Australia | Sweden | 3–2 |
| 1987 | Sweden | India | 5–0 |
| 1988 | West Germany | Sweden | 4–1 |
| 1989 | West Germany | Sweden | 3–2 |
| 1990 | United States | Australia | 3–2 |
| 1991 | France | United States | 3–1 |
| 1992 | United States | Switzerland | 3–1 |
| 1993 | Germany | Australia | 4–1 |
| 1994 | Sweden | Russia | 4–1 |
| 1995 | United States | Russia | 3–2 |
| 1996 | France | Sweden | 3–2 |
| 1997 | Sweden | United States | 5–0 |
| 1998 | Sweden | Italy | 4–1 |
| 1999 | Australia | France | 3–2 |
| 2000 | Spain | Australia | 3–1 |
| 2001 | France | Australia | 3–2 |
| 2002 | Russia | France | 3–2 |
| 2003 | Australia | Spain | 3–1 |

*Included Ireland up to 1922. †Included New Zealand up to 1923. ‡Forfeit; India withdrew from final.

## Federation Cup

| year | winner | runner-up | results |
|---|---|---|---|
| 1963 | United States | Australia | 2–1 |
| 1964 | Australia | United States | 2–1 |
| 1965 | Australia | United States | 2–1 |
| 1966 | United States | West Germany | 3–0 |
| 1967 | United States | United Kingdom | 2–0 |
| 1968 | Australia | The Netherlands | 3–0 |
| 1969 | United States | Australia | 2–1 |
| 1970 | Australia | West Germany | 3–0 |
| 1971 | Australia | United Kingdom | 3–0 |
| 1972 | South Africa | United Kingdom | 2–1 |
| 1973 | Australia | South Africa | 3–0 |
| 1974 | Australia | United States | 2–1 |
| 1975 | Czechoslovakia | Australia | 3–0 |
| 1976 | United States | Australia | 2–1 |
| 1977 | United States | Australia | 2–1 |
| 1978 | United States | Australia | 2–1 |
| 1979 | United States | Australia | 3–0 |
| 1980 | United States | Australia | 3–0 |
| 1981 | United States | United Kingdom | 3–0 |
| 1982 | United States | West Germany | 3–0 |
| 1983 | Czechoslovakia | West Germany | 2–1 |
| 1984 | Czechoslovakia | Australia | 2–1 |
| 1985 | Czechoslovakia | United States | 2–1 |
| 1986 | United States | Czechoslovakia | 3–0 |
| 1987 | West Germany | United States | 2–1 |
| 1988 | Czechoslovakia | U.S.S.R. | 2–1 |
| 1989 | United States | Spain | 3–0 |
| 1990 | United States | U.S.S.R. | 2–1 |
| 1991 | Spain | United States | 2–1 |
| 1992 | Germany | Spain | 2–1 |
| 1993 | Spain | Australia | 3–0 |
| 1994 | Spain | United States | 3–0 |
| 1995 | Spain | United States | 3–2 |
| 1996 | United States | Spain | 5–0 |
| 1997 | France | The Netherlands | 4–1 |
| 1998 | Spain | Switzerland | 3–2 |
| 1999 | United States | Russia | 4–1 |
| 2000 | United States | Spain | 5–0 |
| 2001 | Belgium | Russia | 2–1 |
| 2002 | Slovakia | Spain | 3–1 |
| 2003 | France | United States | 4–1 |

**United States Open Tennis Championships—doubles**

| year | men | women | year | men | women |
|---|---|---|---|---|---|
| 1881 | C. Clark, F. Taylor | | 1944 | D. McNeill, B. Falkenburg | L. Brough, M. Osborne |
| 1882 | D. Sears, J. Dwight | | 1945 | G. Mulloy, B. Talbert | L. Brough, M. Osborne |
| 1883 | D. Sears, J. Dwight | | 1946 | G. Mulloy, B. Talbert | L. Brough, M. Osborne |
| 1884 | D. Sears, J. Dwight | | 1947 | J. Kramer, T. Schroeder | L. Brough, M. Osborne |
| 1885 | D. Sears, J. Clark | | 1948 | G. Mulloy, B. Talbert | L. Brough, M. Osborne du Pont |
| 1886 | D. Sears, J. Dwight | | 1949 | J. Bromwich, B. Sidwell | L. Brough, M. du Pont |
| 1887 | D. Sears, J. Dwight | | 1950 | J. Bromwich, F. Sedgman | L. Brough, M. du Pont |
| 1888 | O. Campbell, V. Hall | | 1951 | K. McGregor, F. Sedgman | S. Fry, D. Hart |
| 1889 | H. Slocum, H. Taylor | | 1952 | M. Rose, V. Seixas | S. Fry, D. Hart |
| 1890 | V. Hall, C. Hobart | E. Roosevelt, G. Roosevelt | 1953 | R. Hartwig, M. Rose | S. Fry, D. Hart |
| 1891 | O. Campbell, B. Huntington | M. Cahill, Mrs. W.F. Morgan | 1954 | V. Seixas, T. Trabert | S. Fry, D. Hart |
| 1892 | O. Campbell, B. Huntington | M. Cahill, A. McKinley | 1955 | Kamo K., Miyagi A. | L. Brough, M. du Pont |
| 1893 | C. Hobart, F. Hovey | A. Terry, H. Butler | 1956 | L. Hoad, K. Rosewall | L. Brough, M. du Pont |
| 1894 | C. Hobart, F. Hovey | H. Helwig, J. Atkinson | 1957 | A. Cooper, N. Fraser | L. Brough, M. du Pont |
| 1895 | M. Chace, R. Wrenn | H. Helwig, J. Atkinson | 1958 | A. Olmedo, H. Richardson | J. Arth, D. Hard |
| 1896 | C. Neel, S. Neel | E. Moore, J. Atkinson | 1959 | N. Fraser, R. Emerson | J. Arth, D. Hard |
| 1897 | L. Ware, G. Sheldon | J. Atkinson, K. Atkinson | 1960 | N. Fraser, R. Emerson | M. Bueno, D. Hard |
| 1898 | L. Ware, G. Sheldon | J. Atkinson, K. Atkinson | 1961 | C. McKinley, D. Ralston | D. Hard, L. Turner |
| 1899 | H. Ward, D. Davis | J. Craven, M. McAteer | 1962 | R. Osuna, A. Palafox | D. Hard, M. Bueno |
| 1900 | H. Ward, D. Davis | E. Parker, H. Champlin | 1963 | C. McKinley, D. Ralston | R. Ebsern, M. Smith |
| 1901 | H. Ward, D. Davis | J. Atkinson, M. McAteer | 1964 | C. McKinley, D. Ralston | B.J. Moffitt, K. Susman |
| 1902 | R. Doherty, L. Doherty | J. Atkinson, M. Jones | 1965 | R. Emerson, F. Stolle | C. Graebner, N. Richey |
| 1903 | R. Doherty, L. Doherty | E. Moore, C. Neely | 1966 | R. Emerson, F. Stolle | M. Bueno, N. Richey |
| 1904 | H. Ward, B. Wright | M. Sutton, M. Hall | 1967 | J. Newcombe, T. Roche | B.J. Moffitt King, R. Casals |
| 1905 | H. Ward, B. Wright | H. Homans, C. Neely | 1968* | B. Lutz, S. Smith | M. Bueno, M. Court |
| 1906 | H. Ward, B. Wright | Mrs. L. Coe, Mrs. D. Platt | 1969* | K. Rosewall, F. Stolle | F. Durr, D. Hard |
| 1907 | F. Alexander, H. Hackett | M. Weimer, C. Neely | | D. Crealy, A. Stone | M. Court, V. Wade |
| 1908 | F. Alexander, H. Hackett | E. Sears, M. Curtis | 1970 | P. Barthes, N. Pilic | M. Court, J. Dalton |
| 1909 | F. Alexander, H. Hackett | H. Hotchkiss, E. Rotch | 1971 | J. Newcombe, R. Taylor | R. Casals, J. Dalton |
| 1910 | F. Alexander, H. Hackett | H. Hotchkiss, E. Rotch | 1972 | C. Drysdale, R. Taylor | F. Durr, B. Stove |
| 1911 | R. Little, G. Touchard | H. Hotchkiss, E. Sears | 1973 | O. Davidson, J. Newcombe | M. Court, V. Wade |
| 1912 | M. McLoughlin, T. Bundy | D. Green, M. Browne | 1974 | B. Lutz, S. Smith | B.J. King, R. Casals |
| 1913 | M. McLoughlin, T. Bundy | M. Browne, L. Williams | 1975 | J. Connors, I. Nastase | M. Court, V. Wade |
| 1914 | M. McLoughlin, T. Bundy | M. Browne, L. Williams | 1976 | T. Okker, M. Riessen | L. Boshoff, I. Kloss |
| 1915 | B. Johnston, C. Griffin | H. Hotchkiss Wightman, E. Sears | 1977 | B. Hewitt, F. McMillan | M. Navratilova, B. Stove |
| 1916 | B. Johnston, C. Griffin | M. Bjurstedt, E. Sears | 1978 | B. Lutz, S. Smith | M. Navratilova, B.J. King |
| 1917 | F. Alexander, H. Throckmorton | M. Bjurstedt, E. Sears | 1979 | J. McEnroe, P. Fleming | W. Turnbull, B. Stove |
| 1918 | B. Tilden, V. Richards | M. Zinderstein, E. Goss | 1980 | R. Lutz, S. Smith | B.J. King, M. Navratilova |
| 1919 | N. Brookes, G. Patterson | M. Zinderstein, E. Goss | 1981 | J. McEnroe, P. Fleming | K. Jordan, A. Smith |
| 1920 | B. Johnston, C. Griffin | M. Zinderstein, E. Goss | 1982 | K. Curren, S. Denton | R. Casals, W. Turnbull |
| 1921 | B. Tilden, V. Richards | M. Browne, L. Williams | 1983 | J. McEnroe, P. Fleming | M. Navratilova, P. Shriver |
| 1922 | B. Tilden, V. Richards | M. Zinderstein Jessup, H. Wills | 1984 | J. Fitzgerald, T. Smid | M. Navratilova, P. Shriver |
| 1923 | B. Tilden, B. Norton | K. McKane, Mrs. B.C. Covell | 1985 | K. Flach, R. Seguso | C. Kohde-Kilsch, H. Sukova |
| 1924 | H. Kinsey, H. Kinsey | H. Wightman, H. Wills | 1986 | A. Gómez, S. Zivojinovic | M. Navratilova, P. Shriver |
| 1925 | D. Williams, V. Richards | M. Browne, H. Wills | 1987 | S. Edberg, A. Jarryd | M. Navratilova, P. Shriver |
| 1926 | D. Williams, V. Richards | E. Ryan, E. Goss | 1988 | S. Casal, E. Sánchez | G. Fernandez, R. White |
| 1927 | B. Tilden, F. Hunter | K. McKane Godfree, E. Harvey | 1989 | J. McEroe, M. Woodforde | M. Navratilova, H. Mandlikova |
| 1928 | G. Lott, J. Hennessey | H. Wightman, H. Wills | 1990 | P. Aldrich, D. Visser | M. Navratilova, G. Fernadez |
| 1929 | G. Lott, J. Doeg | P. Watson, P. Michell | 1991 | J. Fitzgerald, A. Jarryd | P. Shriver, N. Zvereva |
| 1930 | G. Lott, J. Doeg | B. Nuthall, S. Palfrey | 1992 | J. Grabb, R. Reneberg | G. Fernandez, N. Zvereva |
| 1931 | W. Allison, J. Van Ryn | B. Nuthall, E. Whittingstall | 1993 | K. Flach, R. Leach | A. Sánchez Vicario, H. Sukova |
| 1932 | E. Vines, K. Gledhill | H. Jacobs, S. Palfrey | 1994 | P. Haarhuis, J. Eltingh | A. Sánchez Vicario, J. Novotna |
| 1933 | G. Lott, L. Stoefen | B. Nuthall, F. James | 1995 | T. Woodbridge, M. Woodforde | G. Fernandez, N. Zvereva |
| 1934 | G. Lott, L. Stoefen | H. Jacobs, S. Palfrey | 1996 | T. Woodbridge, M. Woodforde | G. Fernandez, N. Zvereva |
| 1935 | W. Allison, J. Van Ryn | H. Jacobs, S. Palfrey Fabyan | 1997 | Ye. Kafelnikov, D. Vacek | L. Davenport, J. Novotna |
| 1936 | D. Budge, G. Mako | M. Van Ryn, C. Babcock | 1998 | S. Stolle, C. Suk | M. Hingis, J. Novotna |
| 1937 | G. von Cramm, H. Henkel | S. Palfrey Fabyan, A. Marble | 1999 | S. Lareau, A. O'Brien | S. Williams, V. Williams |
| 1938 | D. Budge, G. Mako | S. Palfrey Fabyan, A. Marble | 2000 | L. Hewitt, M. Mirnyi | J. Halard Decugis, A. Sugiyama |
| 1939 | A. Quist, J. Bromwich | S. Palfrey Fabyan, A. Marble | 2001 | W. Black, K. Ullyet | L. Raymond, R. Stubbs |
| 1940 | J. Kramer, T. Schroeder | S. Palfrey Fabyan, A. Marble | 2002 | M. Bhupathi, M. Mirnyi | V. Ruano Pascual, P. Suárez |
| 1941 | J. Kramer, T. Schroeder | S. Palfrey Cooke, M. Osborne | 2003 | J. Bjorkman, T. Woodbridge | V. Ruano Pascual, P. Suárez |
| 1942 | G. Mulloy, B. Talbert | L. Brough, M. Osborne | 2004 | M. Knowles, D. Nestor | V. Ruano Pascual, P. Suárez |
| 1943 | J. Kramer, F. Parker | L. Brough, M. Osborne | | | |

*In 1968 and 1969 both amateur and open championships were held. Lutz and Smith won both men's competitions in 1968; Crealy and Stone took the men's amateur championships in 1969. Bueno and Court won both women's competitions in 1968; Court and Wade took the women's amateur championships in 1969. Thereafter the championships were open.

## VOLLEYBALL

World volleyball championships for men were inaugurated in 1949. Women's competition began in 1952. These biennial championships are organized by the Fédération Internationale de Volley-Ball (FIVB; founded 1947).

**World Volleyball Championships**

| year | men | women | year | men | women | year | men | women |
|---|---|---|---|---|---|---|---|---|
| 1949 | U.S.S.R. | | 1970 | East Germany | U.S.S.R. | 1988* | United States | U.S.S.R. |
| 1952 | U.S.S.R. | U.S.S.R. | 1972* | Japan | U.S.S.R. | 1990 | Italy | U.S.S.R. |
| 1956 | Czechoslovakia | U.S.S.R. | 1974 | Poland | Japan | 1992* | Brazil | Cuba |
| 1960 | U.S.S.R. | U.S.S.R. | 1976* | Poland | Japan | 1994 | Italy | Cuba |
| 1962 | U.S.S.R. | Japan | 1978 | U.S.S.R. | Cuba | 1996 | The Netherlands | Cuba |
| 1964* | U.S.S.R. | Japan | 1980* | U.S.S.R. | U.S.S.R. | 1998 | Italy | Cuba |
| 1966 | Czechoslovakia | Japan | 1982 | U.S.S.R. | China | 2000 | Yugoslavia | Cuba |
| 1967 | not held | Japan | 1984* | United States | China | 2002 | Brazil | Italy |
| 1968* | U.S.S.R. | U.S.S.R. | 1986 | United States | China | | | |

*Olympic champions, considered world champions.

## WRESTLING

The first official amateur wrestling world championship was organized by the Fédération Internationale des Lutte Amateur (FILA; founded 1913, reconstituted 1921). Although Greco-Roman style wrestling championships were held in 1910 and 1920–22, they were in effect (like the championships of 1923–49 in fact) open European championships, and the first actual world Greco-Roman wrestling championships were not held until 1950. World amateur freestyle wrestling championships were first held in 1951.

(Wrestling tables follow on pages 174 and 175.)

## World Wrestling Championships—freestyle*

| year | 48 kg | 52 kg (54 kg, 55 kg) | 57 kg (58 kg, 60 kg) | 62 kg (63 kg, 66 kg) | 68 kg (69 kg) |
|---|---|---|---|---|---|
| 1951 | | A. Yucel (Tur.) | Akar (Tur.) | H. Zafer (Tur.) | O. Anderberg (Swed.) |
| 1952† | | H. Gemici (Tur.) | Ishii S. (Japan) | B. Sit (Tur.) | O. Anderberg (Swed.) |
| 1954 | | H. Akbas (Tur.) | M. Dagistanli (Tur.) | Sasahara S. (Japan) | J. Tofigh (Iran) |
| 1956† | | M. Tsalkalamanidze (U.S.S.R.) | M. Dagistanli (Tur.) | Sasahara S. (Japan) | I. Habibi (Iran) |
| 1957 | | M. Kartal (Tur.) | H. Akbas (Tur.) | M. Dagistanli (Tur.) | A. Bestayev (U.S.S.R.) |
| 1959 | | A. Aliyev (U.S.S.R.) | H. Akbas (Tur.) | M. Dagistanli (Tur.) | V. Sinyavsky (U.S.S.R.) |
| 1960† | | A. Bilek (Tur.) | T. McCann (U.S.) | M. Dagistanli (Tur.) | S. Wilson (U.S.) |
| 1961 | | A. Aliyev (U.S.S.R.) | M.E. Saifpour Saidabadi (Iran) | V. Rubashvili (U.S.S.R.) | M. Sanatkaran (Iran) |
| 1962 | | A. Aliyev (U.S.S.R.) | H. Akbas (Tur.) | Watanabe O. (Japan) | E. Valtchev (Bulg.) |
| 1963 | | Y. Kemal (Tur.) | A. Ibragimov (U.S.S.R.) | Watanabe O. (Japan) | Horiuchi I. (Japan) |
| 1964† | | Yoshida Y. (Japan) | Uetake Y. (Japan) | Watanabe O. (Japan) | E. Dimov (Bulg.) |
| 1963 | | Yoshida Y. (Japan) | Fukuda T. (Japan) | M.E. Saifpour Saidabadi (Iran) | A. Mohaved Ardabili (Iran) |
| 1966 | | Chang Sun Chang (S.Kor.) | A. Aliyev (U.S.S.R.) | Kaneko M. (Japan) | A. Mohaved Ardabili (Iran) |
| 1967 | | Nakata S. (Japan) | A. Aliyev (U.S.S.R.) | Kaneko M. (Japan) | A. Mohaved Ardabili (Iran) |
| 1968† | | Nakata S. (Japan) | Uetake Y. (Japan) | Kaneko M. (Japan) | A. Mohaved Ardabili (Iran) |
| 1969 | I. Jayadi (Iran) | R. Sanders (U.S.) | Tanaka T. (Japan) | Morita T. (Japan) | A. Mohaved Ardabili (Iran) |
| 1970 | I. Jayadi (Iran) | A.A. Riza (Tur.) | Yamagida H. (Japan) | S. Seyed-Abbassi (Iran) | A. Mohaved Ardabili (Iran) |
| 1971 | I. Jayadi (Iran) | M. Ghorbanli (Iran) | Yamagida H. (Japan) | Z. Abdulbekov (U.S.S.R.) | D. Gable (U.S.) |
| 1972† | R. Dmitriyev (U.S.S.R.) | Kato K. (Japan) | Yamagida H. (Japan) | Z. Abdulbekov (U.S.S.R.) | D. Gable (U.S.) |
| 1973 | R. Dmitriyev (U.S.S.R.) | E. Javadi (Iran) | M. Faravachi (Iran) | Z. Abdulbekov (U.S.S.R.) | L. Keaser (U.S.) |
| 1974 | H. Murselov (Bulg.) | Takada Y. (Japan) | V. Yumin (U.S.S.R.) | I. Zeveg (Mong.) | N. Nasrullayev (U.S.S.R.) |
| 1975 | K. Issaev (Bulg.) | Takada Y. (Japan) | Aral M. (Japan) | Z. Oydov (Mong.) | P. Pinigin (U.S.S.R.) |
| 1976† | K. Issaev (Bulg.) | Takada Y. (Japan) | V. Yumin (U.S.S.R.) | Yang J.M. (S.Kor.) | P. Pinigin (U.S.S.R.) |
| 1977 | A. Beloglazov (U.S.S.R.) | Takada Y. (Japan) | Sasaki T. (Japan) | V. Yumin (U.S.S.R.) | P. Pinigin (U.S.S.R.) |
| 1978 | S. Kornilayev (U.S.S.R.) | A. Beloglazov (U.S.S.R.) | Tomiyama H. (Japan) | V. Yumin (U.S.S.R.) | P. Pinigin (U.S.S.R.) |
| 1979 | S. Kornilayev (U.S.S.R.) | Takada Y. (Japan) | Tomiyama H. (Japan) | V. Yumin (U.S.S.R.) | M. Kharaturua (U.S.S.R.) |
| 1980† | C. Pollio (Italy) | A. Beloglazov (U.S.S.R.) | S. Beloglazov (U.S.S.R.) | M. Abushev (U.S.S.R.) | S. Absaidov (U.S.S.R.) |
| 1981 | S. Kornilayev (U.S.S.R.) | Asakura T. (Japan) | S. Beloglazov (U.S.S.R.) | S. Sterev (Bulg.) | S. Absaidov (U.S.S.R.) |
| 1982 | S. Kornilayev (U.S.S.R.) | H. Reigeluth (Ger.) | A. Beloglazov (U.S.S.R.) | S. Beloglazov (U.S.S.R.) | M. Kharaturua (U.S.S.R.) |
| 1983 | Kim Hwan Cher (N.Kor.) | V. Jordanov (Bulg.) | S. Beloglazov (U.S.S.R.) | V. Aleksseev (U.S.S.R.) | A. Fadzaev (U.S.S.R.) |
| 1984† | R. Weaver (U.S.) | S. Trstena (Yugos.) | Tomiyama H. (Japan) | R. Lewis (U.S.) | You I.T. (S.Kor.) |
| 1985 | Kim Chol Hwan (N.Kor.) | V. Jordanov (Bulg.) | S. Beloglazov (U.S.S.R.) | V. Aleksseev (U.S.S.R.) | A. Fadzaev (U.S.S.R.) |
| 1986 | Li Yae-sik (N.Kor.) | Kim Yong-sik (N.Kor.) | S. Beloglazov (U.S.S.R.) | K. Isaev (U.S.S.R.) | A. Fadzaev (U.S.S.R.) |
| 1987 | Li Yae-sik (N.Kor.) | V. Jordanov (Bulg.) | S. Beloglazov (U.S.S.R.) | J. Smith (U.S.) | A. Fadzaev (U.S.S.R.) |
| 1988† | Kobayashi T. (Japan) | Sato M. (Japan) | S. Beloglazov (U.S.S.R.) | J. Smith (U.S.) | A. Fadzaev (U.S.S.R.) |
| 1989 | Kim Jong-shin (S.Kor.) | V. Jordanov (Bulg.) | Kim Sik-seung (N.Kor.) | J. Smith (U.S.) | B. Bovdayev (U.S.S.R.) |
| 1990 | A. Martinez (Cuba) | M. Tortoi (Cuba) | A. Puerto (Cuba) | J. Smith (U.S.) | A. Fadzaev (U.S.S.R.) |
| 1991 | V. Orudzhev (U.S.S.R.) | Z. Jones (U.S.) | S. Smal (U.S.S.R.) | J. Smith (U.S.) | A. Fadzaev (U.S.S.R.) |
| 1992† | Park II (N.Kor.) | Li Hak (N.Kor.) | A. Puerto (Cuba) | J. Smith (U.S.) | A. Fadzaev (U.T.‡) |
| 1993 | A. Vila (Cuba) | V. Jordanov (Bulg.) | Terry Brands (U.S.) | Tom Brands (U.S.) | A.A. Fallah (Iran) |
| 1994 | A. Vila (Cuba) | V. Jordanov (Bulg.) | A. Puerto (Cuba) | M. Azizov (Russia) | A. Leipold (Ger.) |
| 1995 | V. Orudzhev (Russia) | V. Jordanov (Bulg.) | Terry Brands (U.S.) | E. Tedeev (Ukr.) | A. Gevorkian (Arm.) |
| 1996 | Kim Il (N.Kor.) | V. Jordanov (Bulg.) | K. Cross (U.S.) | Tom Brands (U.S.) | V. Bogiyev (Russia) |
| 1997 | discontinued | W. Garcia (Cuba) | M. Talaee (Iran) | A. Kenari (Iran) | A. Gevorkian (Arm.) |
| 1998 | | S. Henson (U.S.) | A.R. Dabier (Iran) | S. Barzakov (Bulg.) | A. Gevorkian (Arm.) |
| 1999 | | Kim Woo Yong (S.Kor.) | H. Dogan (Tur.) | E. Tedeyev (Ukr.) | D. Igali (Can.) |
| 2000 | | N. Abdullayev (Azer.) | A.R. Dabier (Iran) | M. Umakhanov (Russia) | D. Igali (Can.) |
| 2001 | | H. Kantoyev (Belu.) | G. Sissaouri (Can.) | S. Barzakov (Bulg.) | N. Pestari (Bulg.) |
| 2002 | | R. Montero Rosales (Cuba) | H. Dogan (Tur.) | E. Tedeyev (Ukr.) | discontinued |

| | 74 kg (76 kg, 74 kg) | 82 kg (85 kg, 84 kg) | 90 kg | 100 kg (97 kg, 96 kg) | 130 kg (130 kg, 120 kg) |
|---|---|---|---|---|---|
| 1951 | C. Atik (Tur.) | Zafer (Tur.) | Y. Dogu (Tur.) | B. Antonsson (Swed.) | |
| 1952† | W. Smith (U.S.) | D. Tsimakurdze (U.S.S.R.) | W. Palm (Swed.) | A. Mekokishvili (U.S.S.R.) | |
| 1954 | V. Balavadze (U.S.S.R.) | A. Zandi (Iran) | A. Englas (U.S.S.R.) | A. Mekokishvili (U.S.S.R.) | |
| 1956† | Ikeda M. (Japan) | N. Nemati (Bulg.) | G.R. Nikpati (Iran) | H. Kaplan (Tur.) | |
| 1957 | V. Balavadze (U.S.S.R.) | N. Sorurl (Iran) | N. Stanshev (Bulg.) | H. Kaplan (Tur.) | |
| 1959 | I. Habibi (Iran) | G. Skhirtladze (U.S.S.R.) | G.R. Takhti (Iran) | L. Akhmedov (Bulg.) | |
| 1960† | D. Blubaugh (U.S.) | H. Güngör (Tur.) | I. Ali (Tur.) | W. Dietrich (W.Ger.) | |
| 1961 | I. Habibi (Iran) | M. Savarabadi (Iran) | G.R. Takhti (Iran) | W. Dietrich (W.Ger.) | |
| 1962 | I. Habibi (Iran) | M. Mehdizadeh (Iran) | A. Medved (U.S.S.R.) | A. Ivanitsky (U.S.S.R.) | |
| 1963 | G. Sagaradze (U.S.S.R.) | P. Gardchev (Bulg.) | A. Medved (U.S.S.R.) | A. Ivanitsky (U.S.S.R.) | |
| 1964† | I. Ogan (Tur.) | P. Gardchev (Bulg.) | A. Medved (U.S.S.R.) | A. Ivanitsky (U.S.S.R.) | A. Medved (U.S.S.R.) |
| 1965 | G. Sagaradze (U.S.S.R.) | M. Mehdizadeh (Iran) | A. Ayik (Tur.) | A. Ivanitsky (U.S.S.R.) | |
| 1966 | M. Atalay (Tur.) | P. Gardchev (Bulg.) | A. Medved (U.S.S.R.) | A. Ivanitsky (U.S.S.R.) | |
| 1967 | D. Sauton-Robin (Fr.) | B. Gurevich (U.S.S.R.) | A. Ayik (Tur.) | A. Medved (U.S.S.R.) | |
| 1968† | M. Atalay (Tur.) | B. Gurevich (U.S.S.R.) | A. Ayik (Tur.) | A. Medved (U.S.S.R.) | |
| 1969 | Z. Beriashvili (U.S.S.R.) | F. Fozzard (U.S.) | B. Gurevich (U.S.S.R.) | C. Lomidze (U.S.S.R.) | A. Medved (U.S.S.R.) |
| 1970 | W. Wells (U.S.) | Y. Shakhmuradov (U.S.S.R.) | G. Strachov (U.S.S.R.) | V. Gulyutkin (U.S.S.R.) | A. Medved (U.S.S.R.) |
| 1971 | G. Gusov (U.S.S.R.) | L. Tediashvili (U.S.S.R.) | B. Petrov (Bulg.) | C. Lomidze (U.S.S.R.) | A. Medved (U.S.S.R.) |
| 1972† | W. Wells (U.S.) | L. Tediashvili (U.S.S.R.) | B. Peterson (U.S.) | I. Yaygin (U.S.S.R.) | A. Medved (U.S.S.R.) |
| 1973 | M. Barzegar (Iran) | V. Syulzhin (U.S.S.R.) | L. Tediashvili (U.S.S.R.) | I. Yaygin (U.S.S.R.) | S. Andiyev (U.S.S.R.) |
| 1974 | R. Ashurallyev (U.S.S.R.) | V. Novozhilov (U.S.S.R.) | L. Tediashvili (U.S.S.R.) | V. Gulyutkin (U.S.S.R.) | S. Ladislav (Rom.) |
| 1975 | A. Ashurallyev (U.S.S.R.) | A. Seger (W.Ger.) | L. Tediashvili (U.S.S.R.) | K. Bayanmunkh (Mong.) | S. Andiyev (U.S.S.R.) |
| 1976† | Date J. (Japan) | J. Peterson (U.S.) | L. Tediashvili (U.S.S.R.) | I. Yaygin (U.S.S.R.) | S. Andiyev (U.S.S.R.) |
| 1977 | S. Dziedzic (U.S.) | A. Seger (W.Ger.) | A. Prokopchuk (U.S.S.R.) | A. Bisultanov (U.S.S.R.) | S. Andiyev (U.S.S.R.) |
| 1978 | L. Kemp (U.S.) | M. Aratsliov (U.S.S.R.) | U. Neupert (E.Ger.) | H. Buttner (E.Ger.) | S. Andiyev (U.S.S.R.) |
| 1979 | L. Kemp (U.S.) | I. Kovacs (Hung.) | K. Ortsuev (U.S.S.R.) | I. Mate (U.S.S.R.) | S. Khasimikov (U.S.S.R.) |
| 1980† | V. Raitchev (Bulg.) | I. Abilov (Bulg.) | S. Oganisyan (U.S.S.R.) | I. Mate (U.S.S.R.) | S. Andiyev (U.S.S.R.) |
| 1981 | M. Knosp (W.Ger.) | C. Campbell (U.S.) | S. Oganisyan (U.S.S.R.) | R. Gehrke (E.Ger.) | S. Khasimikov (U.S.S.R.) |
| 1982 | L. Kemp (U.S.) | T. Dzgoev (U.S.S.R.) | U. Neupert (E.Ger.) | I. Mate (U.S.S.R.) | S. Khasimikov (U.S.S.R.) |
| 1983 | D. Schultz (U.S.) | T. Dzgoev (U.S.S.R.) | P. Naniev (U.S.S.R.) | A. Khadartzev (U.S.S.R.) | S. Khasimikov (U.S.S.R.) |
| 1984† | D. Schultz (U.S.) | M. Schultz (U.S.) | E. Banach (U.S.) | L. Banach (U.S.) | B. Baumgartner (U.S.) |
| 1985 | R. Cascaret (Cuba) | M. Schultz (U.S.) | B. Scherr (U.S.) | L. Khabelov (U.S.S.R.) | D. Gobedzhishvili (U.S.S.R.) |
| 1986 | R. Cascaret (Cuba) | V. Modozian (U.S.S.R.) | M. Khadartzev (U.S.S.R.) | A. Khadartzev (U.S.S.R.) | B. Baumgartner (U.S.) |
| 1987 | A. Varaev (U.S.S.R.) | M. Schultz (U.S.) | M. Khadartzev (U.S.S.R.) | L. Khabelov (U.S.S.R.) | A. Khadartzev (U.S.S.R.) |
| 1988† | K. Monday (U.S.) | Han Myang Woo (S.Kor.) | M. Khadartzev (U.S.S.R.) | V. Puscasu (Rom.) | D. Gobedzhishvili (U.S.S.R.) |
| 1989 | K. Monday (U.S.) | E. Jabraylov (U.S.S.R.) | M. Khadartzev (U.S.S.R.) | A. Atavov (U.S.S.R.) | A.R. Soleimani (Iran) |
| 1990 | R. Sofiyadi (Bulg.) | J. Lohyna (Czech.) | M. Khadartzev (U.S.S.R.) | L. Khabelov (U.S.S.R.) | D. Gobedzhishvili (U.S.S.R.) |
| 1991 | A. Khadem (Iran) | K. Jackson (U.S.) | M. Khadartzev (U.S.S.R.) | L. Khabelov (U.S.S.R.) | A. Schroder (Ger.) |
| 1992† | Park Yang (S.Kor.) | K. Jackson (U.S.) | M. Khadartzev (U.T.‡) | L. Khabelov (U.T.‡) | B. Baumgartner (U.S.) |
| 1993 | Park Jang-Soon (S.Kor.) | S. Ozturk (Tur.) | A. Jadidi (Iran) | L. Khabelov (Russia) | B. Baumgartner (U.S.) |
| 1994 | T. Ceylan (Tur.) | L. Jabrailov (Moldova) | A. Jadidi (Iran) | A. Sabejev (Ger.) | M. Demir (Tur.) |
| 1995 | B. Saytyev (Russia) | K. Jackson (U.S.) | R. Kadeem (Iran) | K. Angle (U.S.) | B. Baumgartner (U.S.) |
| 1996 | B. Saytyev (Russia) | Kh. Magomedov (Russia) | R. Kadeem (Iran) | K. Angle (U.S.) | M. Demir (Tur.) |
| 1997 | B. Saytyev (Russia) | L. Gutches (U.S.) | discontinued | K. Kuramagomedov (Russia) | Z. Guclu (Tur.) |
| 1998 | B. Saytyev (Russia) | A.R. Heydari (Iran) | | A. Jadidi (Iran) | A. Rodriguez (Cuba) |
| 1999 | A. Saytyev (Russia) | Y. Romero Rosales (Cuba) | | S. Murtasaliyev (Russia) | S. Neal (U.S.) |
| 2000 | B. Stey (U.S.) | A. Saytyev (Russia) | | S. Murtasaliyev (Russia) | D. Musulbes (Russia) |
| 2001 | B. Saytyev (Russia) | K. Magomedov (Russia) | | G. Gogchelidze (Russia) | D. Musulbes (Russia) |
| 2002 | M. Hajizadeh Jouibari (Iran) | A. Saytyev (Russia) | | E. Kurtanidze (Geo.) | D. Musulbes (Russia) |

*Figures in parentheses represent new weight classes established in 1997; second figures represent weight classes adopted in 2002. †Olympic champions, recognized as world champions (for earlier Olympic champions, *see* Olympic Games). ‡Unified Team, consisting of athletes from the Commonwealth of Independent States plus Georgia.

**World Wrestling Championships—Greco-Roman style***

| year | 48 kg | 52 kg (54 kg, 55 kg) | 57 kg (58 kg, 60 kg) | 62 kg (63 kg, 66 kg) | 68 kg (69 kg) |
|---|---|---|---|---|---|
| 1950 | | B. Johansson (Swed.) | M. Hassan (Egypt) | O. Anderberg (Swed.) | J. Gal (Hung.) |
| 1952† | | B. Gurevich (U.S.S.R.) | I. Hodos (Hung.) | Y. Punkin (U.S.S.R.) | C. Safin (U.S.S.R.) |
| 1953 | | B. Gurevich (U.S.S.R.) | A. Teryan (U.S.S.R.) | O. Anderberg (Swed.) | K. Freii (Swed.) |
| 1955 | | I. Fabra (Italy) | V. Stashkevich (U.S.S.R.) | I. Polyak (Hung.) | G. Gamarnik (U.S.S.R.) |
| 1956† | | N. Solovyev (U.S.S.R.) | K. Vyrupayev (U.S.S.R.) | R. Mäkinen (Fin.) | K. Lehtonen (Fin.) |
| 1958 | | B. Gurevich (U.S.S.R.) | O. Karavayev (U.S.S.R.) | I. Polyak (Hung.) | R. Dogan (Tur.) |
| 1960† | | D. Pirvulescu (Rom.) | O. Karavayev (U.S.S.R.) | M. Sille (Tur.) | A. Koridze (U.S.S.R.) |
| 1961 | | A. Sayadov (U.S.S.R.) | O. Karavayev (U.S.S.R.) | H. Mostafia (U.A.R.) | A. Koridze (U.S.S.R.) |
| 1962 | | S. Rybalko (U.S.S.R.) | Ichiguchi M. (Japan) | I. Polyak (Hung.) | K. Ayvaz (Tur.) |
| 1963 | | B. Vukov (Yugos.) | J. Varga (Hung.) | G. Sapunov (U.S.S.R.) | S. Horvat (Yugos.) |
| 1964† | | Hanahara T. (Japan) | Ichiguchi M. (Japan) | I. Polyak (Hung.) | K. Ayvaz (Tur.) |
| 1965 | | S. Rybalko (U.S.S.R.) | I. Chernya (Rom.) | Y. Grigorev (U.S.S.R.) | G. Sapunov (U.S.S.R.) |
| 1966 | | A. Keresov (Bulg.) | F. Stange (W.Ger.) | R. Rurua (U.S.S.R.) | S. Horvat (Yugos.) |
| 1967 | | V. Bakulin (U.S.S.R.) | I. Baciu (Rom.) | R. Rurua (U.S.S.R.) | F. Tapio (Fin.) |
| 1968† | | P. Kirov (Bulg.) | J. Varga (Hung.) | R. Rurua (U.S.S.R.) | Mumemura M. (Japan) |
| 1969 | G. Berceanu (Rom.) | F. Aluzadeh (Iran) | R. Kazakov (U.S.S.R.) | R. Rurua (U.S.S.R.) | S. Popescu (Rom.) |
| 1970 | G. Berceanu (Rom.) | P. Kirov (Bulg.) | J. Varga (Hung.) | Fujimoto H. (Japan) | R. Rurua (U.S.S.R.) |
| 1971 | S. Zubkov (U.S.S.R.) | P. Kirov (Bulg.) | R. Kazakov (U.S.S.R.) | G. Markov (Bulg.) | S. Damyanovic (Yugos.) |
| 1972† | G. Berceanu (Rom.) | P. Kirov (Bulg.) | R. Kazakov (U.S.S.R.) | G. Markov (Bulg.) | S. Khisamutdinov (U.S.S.R.) |
| 1973 | V. Zubkov (U.S.S.R.) | G. Guergue (Rom.) | J. Lipien (Pol.) | K. Lipien (Pol.) | S. Khisamutdinov (U.S.S.R.) |
| 1974 | V. Zubkov (U.S.S.R.) | P. Kirov (Bulg.) | F. Mustafin (U.S.S.R.) | K. Lipien (Pol.) | N. Davidyan (U.S.S.R.) |
| 1975 | V. Zubkov (U.S.S.R.) | V. Konstantinov (U.S.S.R.) | F. Mustafin (U.S.S.R.) | N. Davidyan (U.S.S.R.) | S. Khisamutdinov (U.S.S.R.) |
| 1976† | A. Shumakov (U.S.S.R.) | V. Konstantinov (U.S.S.R.) | P. Ukkola (Fin.) | K. Lipien (Pol.) | S. Naibandyan (U.S.S.R.) |
| 1977 | A. Shumakov (U.S.S.R.) | N. Ginga (Rom.) | P. Ukkola (Fin.) | L. Reczi (Hung.) | H. Wehling (E.Ger.) |
| 1978 | C. Alexandru (Rom.) | V. Blagidze (U.S.S.R.) | S. Serikov (U.S.S.R.) | B. Kramarenko (U.S.S.R.) | S. Rusu (Rom.) |
| 1979 | C. Alexandru (Rom.) | L. Racz (Hung.) | S. Serikov (U.S.S.R.) | I. Toth (Hung.) | A. Supron (Pol.) |
| 1980† | Z. Ushkempirov (U.S.S.R.) | V. Blagidze (U.S.S.R.) | S. Serikov (U.S.S.R.) | S. Migiakis (Greece) | S. Rusu (Rom.) |
| 1981 | Z. Ushkempirov (U.S.S.R.) | V. Blagidze (U.S.S.R.) | P. Passarelli (W.Ger.) | I. Toth (Hung.) | G. Yermilov (U.S.S.R.) |
| 1982 | T. Kazarashvili (U.S.S.R.) | B. Pashayan (U.S.S.R.) | P. Mikhalik (Pol.) | R. Swierad (Pol.) | G. Yermilov (U.S.S.R.) |
| 1983 | B. Tsenov (Bulg.) | B. Pashayan (U.S.S.R.) | Ito M. (Japan) | H. Lahtinen (Fin.) | T. Sirjä (Fin.) |
| 1984† | V. Maenza (Italy) | Miyahara A. (Japan) | P. Passarelli (W.Ger.) | Kim W.K. (S.Kor.) | V. Lisjak (Yugos.) |
| 1985 | M. Allakhverdiev (U.S.S.R.) | J. Ronningen (Nor.) | S. Balov (Bulg.) | J. Vangelov (Bulg.) | S. Negrisan (Rom.) |
| 1986 | M. Allakhverdiev (U.S.S.R.) | S. Dudiaev (U.S.S.R.) | E. Ivanov (Bulg.) | K. Madszidov (U.S.S.R.) | L. Dzulfalakian (U.S.S.R.) |
| 1987 | M. Allakhverdiev (U.S.S.R.) | P. Roque (Cuba) | P. Mourier (Fr.) | J. Vangelov (Bulg.) | A. Abayev (U.S.S.R.) |
| 1988† | V. Maenza (Italy) | J. Ronningen (Nor.) | A. Sike (Hung.) | K. Madszidov (U.S.S.R.) | L. Dzulfalakian (U.S.S.R.) |
| 1989 | O. Kucherenko (U.S.S.R.) | A. Ignatenko (U.S.S.R.) | E. Ivanov (Bulg.) | K. Madszidov (U.S.S.R.) | C. Passarelli (W.Ger.) |
| 1990 | O. Kucherenko (U.S.S.R.) | A. Ignatenko (U.S.S.R.) | R. Yildiz (Ger.) | M. Oliveras (Cuba) | I. Doguchiev (U.S.S.R.) |
| 1991 | Duk Yong Gooun (S.Kor.) | R. Martinez (Cuba) | R. Yildiz (Ger.) | S. Martinov (U.S.S.R.) | I. Doguchiev (U.S.S.R.) |
| 1992† | O. Kucherenko (U.T.‡) | J. Ronningen (Nor.) | An Han Bong (S.Kor.) | A. Pirim (Tur.) | A. Repka (Hung.) |
| 1993 | W. Sánchez (Cuba) | R. Martinez (Cuba) | A. Manukjan (Arm.) | S. Martinov (Russia) | I. Doguchiev (Russia) |
| 1994 | W. Sánchez (Cuba) | A. Mkrtchyan (Ger.) | J. Melnichenko (Kazak.) | S. Martinov (Russia) | I. Doguchiev (Russia) |
| 1995 | Sim Kwon Ho (S.Kor.) | S. Danielaev (Russia) | D. Hall (U.S.) | S. Martinov (Russia) | A. Adzhy (Ukr.) |
| 1996 | Sim Kwon Ho (S.Kor.) | A. Nazaryan (Arm.) | Y. Melnichenko (Kazak.) | W. Zawadzki (Pol.) | R. Adzhy (Ukr.) |
| 1997 | discontinued | E. Yildiz (Tur.) | Y. Melnichenko (Kazak.) | S. Eroglu (Tur.) | Son Sang Pil (S.Kor.) |
| 1998 | | Sim Kwon Ho (S.Kor.) | Kim In Sub (S.Kor.) | M. Manukyan (Kazak.) | A. Tretyakov (Russia) |
| 1999 | | L. Rivas (Cuba) | Kim In Sub (S.Kor.) | M. Manukyan (Kazak.) | Son Sang Pil (S.Kor.) |
| 2000 | | Sim Kwon Ho (S.Kor.) | A. Nazaryan (Bulg.) | V. Samurgashev (Russia) | F. Azcuy (Cuba) |
| 2001 | | H. Rangraz (Iran) | D. Aripov (Uzbek.) | V. Galustyan (Arm.) | F. Azcuy (Cuba) |
| 2002 | | G. Mamedaliyev (Russia) | A. Nazaryan (Bulg.) | J. Samuelsson (Swed.) | discontinued |

| year | 74 kg (76 kg, 74 kg) | 82 kg (85 kg, 84 kg) | 90 kg | 100 kg (97 kg, 96 kg) | 130 kg (120 kg) |
|---|---|---|---|---|---|
| 1950 | M. Siimanainen (Fin.) | A. Gronberg (Swed.) | M. Candas (Tur.) | B. Antonsson (Swed.) | |
| 1952† | M. Szilvási (Hung.) | A. Gronberg (Swed.) | K. Gröndahl (Fin.) | J. Kotkas (U.S.S.R.) | |
| 1953 | G. Chatvorgyan (U.S.S.R.) | G. Kartozyia (U.S.S.R.) | A. Erginas (U.S.S.R.) | B. Antonsson (Swed.) | |
| 1955 | V. Maneyev (U.S.S.R.) | G. Kartoziya (U.S.S.R.) | V. Nikolayev (U.S.S.R.) | A. Mazur (U.S.S.R.) | |
| 1956† | M. Bayrak (Tur.) | G. Kartoziya (U.S.S.R.) | V. Nikolayev (U.S.S.R.) | A. Parfenov (U.S.S.R.) | |
| 1958 | K. Ayvaz (Tur.) | G. Kartoziya (U.S.S.R.) | R. Abashidze (U.S.S.R.) | I. Bogdan (U.S.S.R.) | |
| 1960† | M. Bayrak (Tur.) | D. Dobrev (Bulg.) | T. Kis (Tur.) | I. Bogdan (U.S.S.R.) | |
| 1961 | V. Bularca (Rom.) | V. Zenin (U.S.S.R.) | I. Gooris (Hung.) | I. Bogdan (U.S.S.R.) | |
| 1962 | A. Kolesov (U.S.S.R.) | T. Kis (Tur.) | R. Abashidze (U.S.S.R.) | I. Kozma (Hung.) | |
| 1963 | A. Kolesov (U.S.S.R.) | T. Kis (Tur.) | R. Abashidze (U.S.S.R.) | A. Roshchin (U.S.S.R.) | |
| 1964† | A. Kolesov (U.S.S.R.) | B. Simic (Yugos.) | B. Rantchev (Bulg.) | I. Kozma (Hung.) | |
| 1965 | A. Kolesov (U.S.S.R.) | R. Bogdanas (U.S.S.R.) | J. Anisimov (U.S.S.R.) | N. Shmakov (U.S.S.R.) | |
| 1966 | V. Igumenov (U.S.S.R.) | V. Olenik (U.S.S.R.) | B. Radev (Bulg.) | I. Kozma (Hung.) | |
| 1967 | V. Igumenov (U.S.S.R.) | L. Siltsi (Hung.) | N. Yakovenko (U.S.S.R.) | I. Kozma (Hung.) | |
| 1968† | R. Vesper (E.Ger.) | I. Metz (E.Ger.) | B. Radev (Bulg.) | I. Kozma (Hung.) | |
| 1969 | V. Igumenov (U.S.S.R.) | P. Kroumov (Bulg.) | A. Yurkevich (U.S.S.R.) | N. Yakovenko (U.S.S.R.) | A. Roshchin (U.S.S.R.) |
| 1970 | V. Igumenov (U.S.S.R.) | A. Nazarenko (U.S.S.R.) | V. Rezantsev (U.S.S.R.) | P. Svensson (Swed.) | A. Roshchin (U.S.S.R.) |
| 1971 | V. Igumenov (U.S.S.R.) | C. Hegedus (Hung.) | V. Rezantsev (U.S.S.R.) | N. Martinescu (Rom.) | P. Svensson (Swed.) |
| 1972† | V. Macha (Czech.) | C. Hegedus (Hung.) | V. Rezantsev (U.S.S.R.) | N. Martinescu (Rom.) | A. Roshchin (U.S.S.R.) |
| 1973 | I. Kolev (Bulg.) | L. Liberman (U.S.S.R.) | V. Rezantsev (U.S.S.R.) | N. Balboshin (U.S.S.R.) | A. Tomov (Bulg.) |
| 1974 | V. Macha (Czech.) | A. Nazarenko (U.S.S.R.) | V. Rezantsev (U.S.S.R.) | N. Balboshin (U.S.S.R.) | A. Tomov (Bulg.) |
| 1975 | A. Bykov (U.S.S.R.) | A. Nazarenko (U.S.S.R.) | V. Rezantsev (U.S.S.R.) | K. Losano (Bulg.) | A. Tomov (Bulg.) |
| 1976† | A. Bykov (U.S.S.R.) | M. Petrović (Yugos.) | V. Rezantsev (U.S.S.R.) | N. Balboshin (U.S.S.R.) | A. Kolchinsky (U.S.S.R.) |
| 1977 | V. Macha (Czech.) | V. Cheboksarov (U.S.S.R.) | F. Andersson (Swed.) | N. Balboshin (U.S.S.R.) | N. Dinev (Bulg.) |
| 1978 | A. Nitulayev (U.S.S.R.) | I. Draica (Rom.) | S. Nikolov (Bulg.) | N. Balboshin (U.S.S.R.) | A. Kolchinsky (U.S.S.R.) |
| 1979 | F. Kocsis (Hung.)§<br>I. Chopov (Bulg.)§ | G. Korban (U.S.S.R.) | F. Andersson (Swed.) | N. Balboshin (U.S.S.R.) | A. Tomov (U.S.S.R.) |
| 1980† | F. Kocsis (Hung.) | G. Korban (U.S.S.R.) | N. Nottny (Hung.) | G. Raikov (Bulg.) | A. Kolchinsky (U.S.S.R.) |
| 1981 | A. Kudryavtsev (U.S.S.R.) | G. Korban (U.S.S.R.) | I. Kanygin (U.S.S.R.) | M. Saladze (U.S.S.R.) | R. Memisevic (Yugos.) |
| 1982 | S. Rusu (Rom.) | T. Abkhasava (U.S.S.R.) | R. Anderson (Swed.) | R. Wroclawski (Pol.) | N. Dinev (Bulg.) |
| 1983 | M. Mamiachvili (U.S.S.R.) | T. Abkhasava (U.S.S.R.) | I. Kanygin (U.S.S.R.) | A. Dimitrov (Bulg.) | E. Arthuine (U.S.S.R.) |
| 1984† | J. Salomaki (Fin.) | I. Draica (Rom.) | S. Fraser (U.S.) | V. Andrei (Rom.) | J. Blatnick (U.S.) |
| 1985 | M. Mamiachvili (U.S.S.R.) | B. Daras (Pol.) | M. Houck (U.S.) | A. Dimitrov (Bulg.) | I. Rostorotsky (U.S.S.R.) |
| 1986 | M. Mamiachvili (U.S.S.R.) | no award | A. Malina (Pol.) | T. Gaspar (Hung.) | T. Johansson (Swed.) |
| 1987 | J. Salomaki (Fin.) | T. Komaromi (Hung.) | V. Popov (U.S.S.R.) | G. Guedekhaorui (U.S.S.R.) | I. Rostorotsky (U.S.S.R.) |
| 1988† | Kim Young Nam (S.Kor.) | M. Mamiachvili (U.S.S.R.) | A. Komchev (Bulg.) | A. Wronski (Pol.) | A. Karelin (U.S.S.R.) |
| 1989 | D. Turlykhanov (U.S.S.R.) | T. Komaromi (Hung.) | M. Bullmann (E.Ger.) | G. Himmel (W.Ger.) | A. Karelin (U.S.S.R.) |
| 1990 | M. Iskandarian (U.S.S.R.) | P. Farcas (Hung.) | M. Bullmann (Ger.) | S. Demiaschkievish (U.S.S.R.) | A. Karelin (U.S.S.R.) |
| 1991 | M. Iskandarian (U.S.S.R.) | P. Farcas (Hung.) | M. Bullmann (Ger.) | H. Milian (Cuba) | A. Karelin (U.S.S.R.) |
| 1992† | M. Iskandarian (U.T.‡) | P. Farcas (Hung.) | M. Bullmann (Ger.) | H. Milian (Cuba) | A. Karelin (U.T.‡) |
| 1993 | N. Alamanza (Cuba) | M. Yerlikaya (Tur.) | G. Koguchavilli (Russia) | M. Ljungberg (Swed.) | A. Karelin (Russia) |
| 1994 | M. Iskandarian (Russia) | T. Zander (Ger.) | G. Koguchavilli (Russia) | A. Wronski (Pol.) | A. Karelin (Russia) |
| 1995 | Y. Riemer (Fr.) | H. Yerlikaya (Tur.) | H. Baser (Tur.) | M. Ljungberg (Swed.) | A. Karelin (Russia) |
| 1996 | F. Ascuy (Cuba) | H. Yerlikaya (Tur.) | V. Oleynyk (Ukr.) | A. Wronski (Pol.) | A. Karelin (Russia) |
| 1997 | M. Yli-Hannuksela (Fin.) | S. Tsuir (Russia) | discontinued | G. Koguchavilli (Russia) | A. Karelin (Russia) |
| 1998 | B. Bayseytov (Kazak.) | A. Menshikov (Russia) | | G. Koguchavilli (Russia) | A. Karelin (Russia) |
| 1999 | N. Avluca (Tur.) | L. Mendez (Cuba) | | G. Koguchavilli (Russia) | A. Karelin (Russia) |
| 2000 | M. Kardanov (Russia) | H. Yerlikaya (Tur.) | | M. Ljungberg (Swed.) | R. Gardner (U.S.) |
| 2001 | A. Abrahamian (Swed.) | M. Vakhtangadze (Georgia) | | A. Bezruchkin (Russia) | R. Gardner (U.S.) |
| 2002 | V. Samurgashev (Russia) | A. Abrahamian (Swed.) | | M. Ozal (Tur.) | D. Byers (U.S.) |

*Figures in parentheses represent new weight classes established in 1997, second figures represent weight classes adopted in 2002. †Olympic champions, recognized as world champions (for earlier Olympic champions, *see* Olympic Games). ‡Unified Team, consisting of athletes from the Commonwealth of Independent States plus Georgia. §Tied.

## YACHTING

One of the classic yachting events is the race that was first proposed by the Royal Yacht Squadron (RYS), best known as the America's Cup. This cup, open to challenge since 1870, was originally the Hundred-Guinea Cup, presented by the RYS for a race around the Isle of Wight, U.K., and won handily by the U.S. yacht *America*. The most graceful of the yachts entered for the America's Cup are generally considered to have been the J-class yachts raced between 1930 and 1937. The cost of maintenance, however, was prohibitive, and since 1958, both winning and challenging vessels have been 12-metres.

The Transpacific Race was inaugurated in 1906 and usually was raced over 2,225 miles between San Pedro, Calif., and Diamond Head Light, Oahu, Hawaii. It was made biennial in 1939, alternating with the Bermuda Race.

The Bermuda Race, from 1906 to 1910, was an annual race between Gravesend Bay, N.Y. (in 1908 the starting point was Marblehead, Mass.), and Bermuda. Six races from New London, Conn., and one from Montauk Point, N.Y. (1932), were held in 1923–34. Since 1936 it has been raced biennially from Newport, R.I., over a 635-mile course. In 1982 it was divided into two classes—one for cruiser/racers and one for grand prix racers—with the craft winning its race by the greatest margin as overall winner. Since 1986 two equal awards have been offered.

The Admiral's Cup is awarded biennially to the national team accumulating the most total points in a series of six races (five until 1987) held off the southern coast of England.

**America's Cup**

| year | winning yacht | owner | skipper | losing yacht | owner |
|---|---|---|---|---|---|
| 1851 | *America* (U.S.) | J.C. Stevens | R. Brown | *Aurora* (U.K.) | LeMarchant-Thomas |
| 1870 | *Magic* (U.S.) | F. Osgood | A. Comstock | *Cambria* (U.K.) | J. Ashbury |
| 1871 | *Columbia* (U.S.) | F. Osgood | N. Comstock | *Livonia* (U.K.) | J. Ashbury |
| | *Sappho* (U.S.) | W.P. Douglas | S. Greenwood | | |
| 1876 | *Madeleine* (U.S.) | J.S. Dickerson | J. Williams | *Countess of Dufferin* (Can.) | C. Gifford and syndicate |
| 1881 | *Mischief* (U.S.) | J.R. Busk | N. Clock | *Atalanta* (Can.) | A. Cuthbert |
| 1885 | *Puritan* (U.S.) | J.M. Forbes, C.J. Paine and syndicate | A. Crocker | *Genesta* (U.K.) | Sir R. Sutton |
| 1886 | *Mayflower* (U.S.) | C.J. Paine | M.V.B. Stone | *Galatea* (U.K.) | W. Henn |
| 1887 | *Volunteer* (U.S.) | C.J. Paine | H.C. Haff | *Thistle* (U.K.) | J. Bell and syndicate |
| 1893 | *Vigilant* (U.S.) | C.O. Iselin and syndicate | W. Hansen | *Valkyrie II* (U.K.) | Lord Dunraven |
| 1895 | *Defender* (U.S.) | W.K. Vanderbilt, C.O. Iselin, E.D. Morgan | H.C. Haff | *Valkyrie III* (U.K.) | Lord Dunraven, Lord Lonsdale, Lord Wolverton, H. McCalmont |
| 1899 | *Columbia* (U.S.) | J.P. Morgan, C.O. Iselin, E.D. Morgan | C. Barr | *Shamrock* (U.K.) | Sir T. Lipton |
| 1901 | *Columbia* (U.S.) | J.P. Morgan, E.D. Morgan | C. Barr | *Shamrock II* (U.K.) | Sir T. Lipton |
| 1903 | *Reliance* (U.S.) | C.O. Iselin and syndicate | C. Barr | *Shamrock III* (U.K.) | Sir T. Lipton |
| 1920 | *Resolute* (U.S.) | H. Walters and syndicate | C.F. Adams II | *Shamrock IV* (U.K.) | Sir T. Lipton |
| 1930 | *Enterprise* (U.S.) | W. Aldrich and syndicate | H.S. Vanderbilt | *Shamrock V* (U.K.) | Sir T. Lipton |
| 1934 | *Rainbow* (U.S.) | H.S. Vanderbilt and syndicate | H.S. Vanderbilt | *Endeavour* (U.K.) | T.O.M. Sopwith |
| 1937 | *Ranger* (U.S.) | H.S. Vanderbilt | H.S. Vanderbilt | *Endeavour II* (U.K.) | T.O.M. Sopwith |
| 1958 | *Columbia* (U.S.) | H. Sears and syndicate | B.S. Cunningham | *Sceptre* (U.K.) | H.L. Goodson and syndicate |
| 1962 | *Weatherly* (U.S.) | H.D. Mercer, A.D. Frese, C.S. Walsh | E. Mosbacher, Jr. | *Gretel* (Austl.) | Sir F. Packer and syndicate |
| 1964 | *Constellation* (U.S.) | W.S. Dubsmann, E. Ridder and syndicate | R.N. Bavier, Jr., E. Riddler | *Sovereign* (U.K.) | J.A.J. Boyden |
| 1967 | *Intrepid* (U.S.) | Intrepid syndicate | E. Mosbacher, Jr. | *Dame Pattie* (U.K.) | E. Christensen and 15 commercial firms |
| 1970 | *Intrepid* (U.S.) | Intrepid syndicate | W. Ficker | *Gretel II* (Austl.) | Sir F. Packer and syndicate |
| 1974 | *Courageous* (U.S.) | Courageous syndicate | T. Hood | *Southern Cross* (Austl.) | A. Bond |
| 1977 | *Courageous* (U.S.) | Courageous syndicate | T. Turner | *Australia* (Austl.) | A. Bond and syndicate |
| 1980 | *Freedom* (U.S.) | Maritime College at Ft. Schuyler Foundation, Inc. | D. Conner | *Australia* (Austl.) | A. Bond and syndicate |
| 1983 | *Australia II* (Austl.) | A. Bond and syndicate | J. Bertrand | *Liberty* (U.S.) | Maritime Col. at Ft. Schuyler Foundation, Inc. |
| 1987 | *Stars & Stripes* (U.S.) | Sail America syndicate | D. Conner | *Kookaburra III* (Austl.) | K. Parry and syndicate |
| 1988 | *Stars & Stripes* (U.S.) | Sail America syndicate | D. Conner | *New Zealand* (N.Z.) | M. Fay |
| 1992 | *America*[3] (U.S.) | America[3] Foundation | B. Koch | *Il Moro di Venezia* (Italy) | Compagnia della Vela di Venezia |
| 1995 | *Black Magic* (N.Z.) | P. Blake and Team New Zealand | R. Coutts | *Young America* | Pact 95 syndicate |
| 2000 | *Black Magic* (N.Z.) | Team New Zealand | R. Coutts | *Luna Rossa* (Italy) | Prada Challenge |
| 2003 | *Alinghi* (Switz.) | Alinghi Swiss Challenge | R. Coutts | *New Zealand* (N.Z.) | Team New Zealand |

**Transpacific Race**

| year | winning yacht | owner | year | winning yacht | owner |
|---|---|---|---|---|---|
| 1906 | *Lurline* | H.H. Sinclair | 1943–45 | no competition | |
| 1908 | *Lurline* | H.H. Sinclair | 1947 | *Dolphin* | F. Morgan |
| 1910 | *Hawaii* | Honolulu Yachting Club | 1949 | *Kitten* | F.W. Lyon |
| | | | 1951 | *Sea Witch* | A.L. McCormick |
| 1912 | *Lurline* | A.E. Davis | 1953 | *Staghound* | I.P. Fulmor |
| 1923 | *Diablo* | A.R. Pedder | 1955 | *Staghound* | I.P. Fulmor |
| 1925 | *Mariner* | L.A. Norris | 1957 | *Legend* | C. Ullman |
| 1926 | *Invader* | D.M. Lee | 1959 | *Nalu II* | P. Grant |
| 1928 | *Teva* | C.W. Stose | 1961 | *Nam Sang* | A.B. Robbs, Jr. |
| 1930 | *Enchantress* | M. Adams | 1963 | *Islander* | T. Corkett |
| 1932 | *Fayth* | W.S. McNutt | 1965 | *Peyche* | D. Salisbury |
| 1934 | *Manulwa* | H. Dillingham | 1967 | *Holiday Too* | R. Allan |
| 1936 | *Dorade* | J. Flood | 1969 | *Argonaut* | J. Andron |
| 1939 | *Blitzen* | T.J. Reynolds | 1971 | *Windward Passage* | R. Johnson |
| 1941 | *Escapade* | D.W. Elliott | 1973 | *Chutzpah* | S. Cowan |
| | | | 1975 | *Chutzpah* | S. Cowan |
| | | | 1977 | *Merlin* | B. Lee |
| | | | 1979 | *Arriba* | D. Choate |
| | | | 1981 | *Sweet Okole* | D. Treadway |
| | | | 1983 | *Bravura* | I. Loube |
| | | | 1985 | *Montgomery Street* | D. Denning |
| | | | 1987 | *Merlin* | D. Campion |
| | | | 1989 | *Silver Bullet* | J. DeLaura |
| | | | 1991 | *Chance* | R. McNulty |
| | | | 1993 | *Silver Bullet* | J. DeLaura |
| | | | 1995 | *Merlin* | D. Sinclair |
| | | | 1997 | *Ralphie* | J. Montgomery |
| | | | 1999 | *Grand Illusion* | J. McDowell |
| | | | 2001 | *Bull* | S. Radow |
| | | | 2003 | *Alta Vita* | B. Turpin |

**Admiral's Cup**

| year | winning team |
|---|---|
| 1957 | United Kingdom |
| 1959 | United Kingdom |
| 1961 | United States |
| 1963 | United Kingdom |
| 1965 | United Kingdom |
| 1967 | Australia |
| 1969 | United States |
| 1971 | United Kingdom |
| 1973 | West Germany |
| 1975 | United Kingdom |
| 1977 | United Kingdom |
| 1979 | Australia |
| 1981 | United Kingdom |
| 1983 | West Germany |
| 1985 | West Germany |
| 1987 | New Zealand |
| 1989 | United Kingdom |
| 1991 | France |
| 1993 | Germany |
| 1995 | Italy |
| 1997 | United States |
| 1999 | The Netherlands |
| 2001 | cancelled |
| 2003 | Australia |

**Bermuda Race***

| year | winning yacht | owner | year | winning yacht | owner | year | winning yacht | owner |
|---|---|---|---|---|---|---|---|---|
| 1906 | *Tamerlane* | F. Maier | 1948 | *Baruna* | H.C. Taylor | 1978 | *Babe* | A. Gay |
| 1907 | *Dervish* | H.A. Morss | 1950 | *Argyll* | W.T. Moore | 1980 | *Hoger Danske* | R. Wilson |
| 1908 | *Venona* | E.J. Bliss | 1952 | *Carina* | R.S. Nye | 1982‡ | *Brigadoon III* | B. Morton |
| 1909 | *Margaret* | G.S. Runk | 1954 | *Malay* | D.D. Strohmeier | 1984 | *Pamir* | F. Curren, Jr. |
| 1910 | *Vagrant* | H.S. Vanderbilt | 1956 | *Finisterre* | C. Mitchell | 1986§ | *Silver Star* | D. Clarke |
| 1923† | *Malabar IV* | J.G. Alden | 1958 | *Finisterre* | C. Mitchell | | *Puritan* | D. Robinson |
| 1924 | *Memory* | R.N. Bavier | 1960 | *Finisterre* | C. Mitchell | 1988 | *Congere* | B. Koeppel |
| 1926 | *Malabar VII* | J.G. Alden | 1962 | *Nina* | D.C. Fales | 1990 | *Denali* | L. Huntington |
| 1928 | *Rugosa II* | R. Grinnell | 1964 | *Burgoo* | M. Ernstof | 1992 | *Constellation* | U.S. Naval Academy |
| 1930 | *Malay* | R.W. Ferris | 1966 | *Thunderbird* | T.V. Learson | 1994 | *Gaylark* | K. Smith |
| 1932 | *Malabar X* | Alden and Gale | 1968 | *Robin* | T. Hood | 1996 | *Boomerang* | G. Coumantaros |
| 1934 | *Edlu* | R.J. Schaefer | 1970 | *Carina* | R.S. Nye | 1998 | *Kodiak* | L. Ecclestone |
| 1936 | *Kirawan* | R.P. Baruch | 1972 | *Noryema* | R. Amey | 2000 | *Restless* | E. Crawford |
| 1938 | *Baruna* | H.C. Taylor | 1974 | *Scaramouche* | C.E. Kirsch | 2002 | *Zaraffa* | H. Sheldon |
| 1946† | *Gesture* | A.H. Fuller | 1976 | *Running Tide* | A. Van Metre | 2004 | *Alliance* | D. Porco |

*St. David's Lighthouse Trophy winner from 2002. †No competition 1911–22; 1940–44. ‡Overall winner under new measurement rules. §First listed is IOR (International Offshore Rule) winner; second is IMS (International Measurement System) winner.

**sports medicine,** medical and paramedical supervision of athletes in training and in competition and the treatment of their injuries. As participation in athletic sports and games increased in the 20th century, the need for special attention to sports medicine became apparent. With its development came increased attention to and understanding of exercise physiology.

There are four aspects to sports medicine: preparation of the athlete, prevention of illness or injury, diagnosis and treatment of illness or injury, and rehabilitation and return of the injured athlete to sports activity. Preparation, or conditioning, improves specific aspects of performance, such as speed, strength, and endurance. The diet of the athlete, specific exercise programs for specific sports, and monitoring the duration and conditions of practice sessions are all-important.

Prevention of injury begins with a physical examination to identify any preexisting conditions that might cause injury or illness to the athlete. Stretching exercises before practice or performance prevent injury from sudden strain. Practitioners of sports medicine also advise the design of equipment, *e.g.,* protective padding or headgear, so as to reduce the chance of injury.

Sports medicine has developed many surgical techniques, particularly for knee injuries, that have come to be applied in general surgical and medical practice.

In Europe, sports medicine has long been a recognized medical specialty, but it was recognized more slowly in the United States. The International Federation of Sportive Medicine was founded in 1928 and by the 1980s had about 50 national affiliates.

**spotlight,** device used to produce intense illumination in a well-defined area in stage, film, television, ballet, and opera production. It resembles a small searchlight but usually has shutters, an iris diaphragm, and adjustable lenses to shape the projected light. Coloured light is produced by a mechanism for sliding or rotating coloured gelatin filters, called gels even though later made of acetate, into the beam. The first theatrical spotlight was the limelight (*q.v.*), which gave way to such light sources as the arc, electric discharge, and incandescent lamp. The practical lensed spotlight was developed in 1879 by Louis Hartmann of the United States.

Follow spotlights project spots that can readily be changed to cover a large area or one as small as a human face. They turn easily on mounts to follow performers.

**Spotswood, Alexander** (b. 1676, Tangier, Morocco—d. June 7, 1740, Annapolis, Md.), one of the first British colonial governors of North America to appreciate the economic value of the Western frontier.

After service under the 1st duke of Marlborough in the War of the Spanish Succession (1701–14), he was appointed lieutenant governor of Virginia (1710). In this post he recommended the establishment of a Virginia company to carry on trade with the Indians, urged the construction of forts along the frontier, and personally organized and conducted in 1716 an exploring expedition into the Shenandoah Valley. After his term as governor ended (September 1722), he remained in Virginia, living near the ironworks he had established in Germanna, a settlement of Germans in Spotsylvania County (named in his honour). From 1730 to 1739 he served as deputy postmaster general of the colonies.

**Spotsylvania Court House, Battle of** (May 8–19, 1864), Union failure to smash or outflank Confederate forces defending Richmond, Va., during the American Civil War. Following the Battle of the Wilderness (May 5–6), Union Gen. Ulysses S. Grant moved his left flank forward, engaging the Confederate forces of Gen. Robert E. Lee at Spotsylvania Court House, Virginia. The battle raged for about a week and a half, and on May 20 Grant continued his march southeastward in a flanking movement toward the Confederate capital. His casualties were 17,000; Lee's, 8,000.

**spotted deer:** *see* chital.

**Spotted Tail,** also called SINTE-GALESHKA (b. *c.* 1833, Ft. Laramie [Wyoming], U.S.—d. Aug. 5, 1881, Rosebud Reservation, South Dakota), chief of the Brule Teton Indians and, briefly, the Oglala Sioux who sought compromise and accommodation with the invading whites.

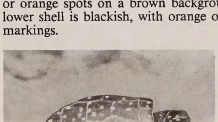
Spotted Tail was not a member of a ruling family, but he won the chieftainship over the hereditary claimant on the basis of his prowess as a warrior. In 1855 he, along with two other warriors, surrendered to white authorities to prevent punishment of the tribe in the wake of an attack on a military detachment. Spotted Tail spent two years in prison and was regarded as a hero among his people upon release.

In 1865 Spotted Tail, in opposition to fellow Sioux chief Red Cloud, favoured allowing white gold-seekers to travel through Indian lands to reach the mines of Montana. In 1868 he signed a treaty confining his people to a reservation in South Dakota and conceding the right of way for a railroad to be built on Indian land. When gold was discovered in the Black Hills, Spotted Tail attempted to negotiate sale of the mineral rights to the U.S. government. But his price ($60,000,000) was too high, and U.S. officials allowed miners to seek gold in the Black Hills without compensation to the Sioux.

Recognizing the futility of resistance, Spotted Tail refused to go on the warpath even when prospectors swarmed over Indian lands. He kept his followers out of the conflicts of 1876—including Little Big Horn—and he helped persuade Crazy Horse to surrender in 1877.

Spotted Tail assumed leadership of the Oglala as well as the Brule Teton Sioux when Red Cloud was deposed in 1881. Shortly thereafter he was assassinated as he left a council meeting by a fellow tribesman named Crow Dog.

**spotted turtle** (*Clemmys guttata*), small freshwater turtle (family Emydidae) found from southern Canada to the southern and central United States. The spotted turtle has a shell about 10 centimetres (4 inches) long. The upper shell is smooth, with round, bright-yellow or orange spots on a brown background; the lower shell is blackish, with orange or yellow markings.



Spotted turtle (*Clemmys guttata*)
By courtesy of the American Museum of Natural History, New York

The spotted turtle is a rather slow-moving reptile. It lives in shallow bodies of water, such as ponds, bogs, and ditches, and it commonly basks in groups in the sun.

**Sprague, Kate Chase,** original name KATHERINE JANE CHASE (b. Aug. 13, 1840, Cincinnati, Ohio, U.S.—d. July 31, 1899, Washington, D.C.), daughter of Abraham Lincoln's secretary of the treasury, Salmon Chase; while continually attempting to advance her father's political fortunes, she became a national fashion and social celebrity.

Educated by her father and in private schools, Kate Chase became the emotional focus of her father's life after the deaths of her mother and stepmother. By the age of 16 she was acting as his official political hostess, and by the age of 20 she was striving earnestly to secure the Republican presidential nomination for him at the Chicago convention in 1860.

Moving to Washington when Salmon Chase was appointed treasury secretary, Kate Chase quickly emerged as the toast of capital society and fashion queen of the nation. On Nov. 12, 1863, she married William Sprague in an elaborate and highly publicized wedding. She used Sprague's wealth to further her father's political ambitions at the expense of Lincoln. And in 1868 she waged another vigorous campaign to win the Republican nomination for him.

The economic crisis of 1873 put the Spragues in financial difficulty, and an already troubled marriage began to fall apart. Their quarrels were detailed in newspapers, as were the eventual divorce proceedings. In 1882 Kate Chase Sprague, newly divorced, sailed for Europe with her three daughters. She returned to Washington in 1886 and lived there the rest of her life in poverty.

*To make the best use of the Britannica, consult the* INDEX *first*

**sprain,** overstretching or tearing of fibres in one or more of the ligaments that support a joint, caused by forced movement beyond their range. Symptoms include sudden severe pain, then swelling around the joint, tenderness, stiffness, and often black-and-blue marks as a result of bleeding into the joint. The common sites for sprains are the ankle, wrist, knee, finger or toe joints, and sacroiliac joint in the lower back. The usual treatment involves support and protection of the joint by adhesive bandaging and the use of graded exercises until healing is complete. If the sprain is severe, surgery to reunite ligaments may be necessary.

**Spranger (van den Schilde), Bartholomaeus,** also spelled BARTHOLOMEUS SPRANGERS, OF SPRANGERSON (b. March 21, 1546, Antwerp, Hapsburg Netherlands—d. August 1611, Prague), Antwerp painter noted for his paintings of nudes executed in the late Mannerist style. In his efforts to develop a Northern artistic canon of the human figure, Spranger employed mannered poses, slender, elongated bodies, and a gleaming, brittle texture in his work. The figures smile invitingly, and the influence of Parmigianino and Correggio is evident in their voluptuous contours.

Spranger went to Italy in 1567 and during a 10-year period spent in Rome and Parma, he assisted in completing an interrupted fresco project. Later, while working in Paris (*c.* 1565), he was influenced by the work of Francesco Primaticcio and Niccolò dell' Abbate. He returned to Rome in 1567 and became an assistant to Taddeo Zuccari, later working in Vienna for the emperor Maximilian II. In 1581 he was appointed court painter in Prague by the emperor Rudolf II, and he remained in that city thereafter. The engraver Hendrik Goltzius made popular copies of Spranger's work, resulting in their becoming widely known.

**Spranger, (Franz Ernst) Eduard** (b. June 27, 1882, Berlin—d. Sept. 17, 1963, Tübingen, W.Ger.), German educator and philosopher. He served as professor of philosophy

in Leipzig (1911–20), Berlin (1920–45), and Tübingen (from 1946), and in 1937–38 he lectured in Japan. He was briefly imprisoned in Berlin late in World War II (1944) but was released at the request of the Japanese ambassador.

Spranger was a student of Wilhelm Dilthey and continued his teacher's research in the *Geisteswissenschaften* (human sciences), emphasizing in his most important works, *Die Lebensformen* (1914; *Types of Men*) and *Psychologie des Jugendalters* (1924; "The Psychology of Youth"), the effects of culture and history on human ethics and actions. His theories on education as both a reflection of and a possible solution to the moral and social problems of the adolescent were influential on German education in the 1920s.

**sprat** (fish): *see* bristling.

**Spratling, William** (b. Sept. 22, 1900, Sonyea, N.Y., U.S.—d. Aug. 8, 1967, near Taxco, Mex.), American designer and architect, who spent more than 30 years in Mexico developing and promoting the silvercraft that made the city of Taxco famous.

A graduate of the New York Fine Arts Institute and Auburn University, in Alabama (where he studied architecture), Spratling taught art and architecture at Tulane University, New Orleans, La., for eight years before going to Mexico in 1927. For two years he taught at the National Autonomous University of Mexico in Mexico City (1927–29) and then settled in Taxco, an old silver town (founded in 1528) that had long been in decay. He befriended silver artisans from all over Mexico and began the design of silver jewelry, artwork, tableware, and tea sets, opening his first *taller,* or workshop, on the Calle Las Delicias in 1933. After World War II his workshop went bankrupt, but he continued his work from a nearby ranch. His example inspired the founding of hundreds of competing workshops.

Over the years Spratling also collected archaeological pieces (housed in the Museo Guillermo Spratling [William Spratling Museum] in Taxco) and founded a silvercraft school. He wrote several books, including *Old Plantation Houses in Louisiana* (1927), *The Frescoes of Diego Rivera* (1929), *A Small Mexican World* (1964), and *File on Spratling: An Autobiography* (1967). He died in an automobile accident.

**Spratly Islands,** group of reefs in the South China Sea, located midway between Vietnam and the Philippines and claimed by several countries. Of the 12 main islets, the largest is the 90-acre (36-hectare) Itu Aba. Another, called Spratly Island or Storm Island, measures 900 feet by 1,500 feet (275 m by 450 m). Turtles and seabirds are the only permanent inhabitants.

Before 1970 the main significance attached to the islands was their strategic location. France held them between 1933 and 1939. During World War II Japan occupied the archipelago and developed it as a submarine base. After the war China established a garrison on Itu Aba, which the Chinese Nationalists maintained after their exile to Taiwan. When Japan renounced its claim to the islands in 1951, Taiwan, mainland China, and Vietnam all declared themselves the rightful owners, and the Philippines added a claim based on proximity in 1955.

In the 1970s South Vietnam occupied three of the Spratly Islands (including Spratly Island itself) to forestall a Chinese occupation. Taiwanese troops remained on Itu Aba. The Philippines then moved forces onto seven of the remaining islets and built an airstrip (1976) on Pagasa Island. By the late 20th century, Vietnam, China, Taiwan, Malaysia (with its occupation of Turumbu Layang-Layang reef [June 1983]), and the Philippines all had conflicting claims to the Spratlys, supported (except in the case of China) by garrisons on various islands.

**spraying and dusting,** in agriculture, the standard methods of applying pest-control chemicals and other compounds. In spraying, the chemicals to be applied are dissolved or suspended in water or, less commonly, in an oil-based carrier. The mixture is then applied as a fine mist to plants, animals, soils, or products to be treated. In dusting, as an alternative method, dry, finely powdered chemicals may be mixed with an inert carrier and applied with some type of blower. Dry granular materials also have been used instead of dusts or sprays where adequate coverage can be obtained. (*See also* crop duster). In fumigation, gases or the vapours of volatile compounds are held in contact with the materials to be treated—grain in a tight bin, for example.

The development of more effective sprays and dusts and their increasingly widespread use in agriculture have prompted concern among biologists and others that humans may disrupt nature and endanger the food and water supply and public health. New chemicals and new precautions have only partially reduced these dangers.

Sprays and dusts are used to control insects, mites, and fungous and bacterial diseases of plants; insects, such as lice and flies, on animals; and weeds, by means of chemical weed killers or herbicides. Sprays and dusts may also be used for such special purposes as applying mineral fertilizers, increasing or decreasing fruit set, delaying the dropping of nearly mature fruits, and defoliating and vine killing to facilitate the harvest of such plants as cotton or potatoes.

Sprays have advantages over dusts in their ability to adhere to and spread over treated surfaces. Spreading-sticking agents or surfactants are commonly added to spray mixtures to increase adhesion and wetting of waxy surfaces. These wetting agents decrease the tendency of water to collect in drops and permit the chemical solution to spread over a leaf in a very thin film, bringing the spray chemical into maximum contact with the fungi, bacteria, insects, or mites to be controlled.



Row-crop sprayer applying pesticides
By courtesy of Ransomes Sims & Jefferies, Ltd., Ipswich, Eng.

There has also been an increase in the use of air sprayers or "wet dusting." The use of a concentrated spray distributed in the airsteam from a powerful fan combines many of the advantages of both spraying and dusting.

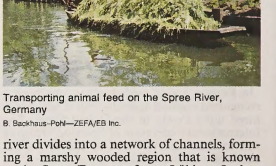
Fumigation may be used to control insects and some diseases in stored products or to control insects such as wireworms and grubs, nematodes, and sometimes fungi and weeds in soil. The chemical may be applied as a gas or as a volatile liquid. Partial fumigation of the soil may be accomplished by applying the chemical in a spray or granular material and immediately working it into the soil. For better pest control on small areas like seedbeds the treated soil is covered with gastight, plastic cover.

**spreading yew** (plant): *see* Japanese yew.

**Sprechstimme** (German: "speech-voice"), in music, a cross between speaking and singing in which the tone quality of speech is heightened and lowered in pitch along melodic contours indicated in the musical notation. *Sprechstimme* is frequently used in 20th-century music.

Its introduction is especially associated with the composer Arnold Schoenberg, who first used it in his *Pierrot Lunaire* (1912). It had been used earlier, however, in the melodrama *Königskinder* (1897; *Children of the King*), by Engelbert Humperdinck.

**Spree River,** river in northeastern Germany, rising in the Lusatian Mountains just above Neugersdorf and flowing north past Bautzen and Spremberg, where it splits temporarily into two arms. After it passes Cottbus, the



Transporting animal feed on the Spree River, Germany
B. Backhaus-Pohl—ZEFA/EB Inc.

river divides into a network of channels, forming a marshy wooded region that is known as the Spree Forest as far as Lübben. It then passes Fürstenwalde and Köpenick and winds through Berlin in several branches to join the Havel River (a tributary of the Elbe) at Spandau after a course of 250 miles (403 km). The Spree drains an area of 3,900 square miles (10,100 square km). A considerable portion of the Spree Forest is now cultivated (market gardening) and also serves as a popular excursion area for Berliners. The Spree River is connected with neighbouring rivers by canals, the most important of which is the Oder-Spree Canal running southeast from Berlin.

**Sprengel, Christian Konrad** (b. Sept. 22, 1750, Spandau, Ger.—d. April 7, 1816, Berlin), German botanist and teacher whose studies of sex in plants led him to a general theory of fertilization which, basically, is accepted today.

Sprengel studied theology and languages, spent several years as a schoolmaster in Spandau and Berlin, and became rector of Spandau. In pursuing botanical studies he neglected his duties, and, after his dismissal in 1794, with a pension, he went to Berlin. As a theologian, he believed that everything in nature was created for a purpose, and in observing plants he attempted to uncover the purpose of each minute part.

Sprengel discovered that the nectaries (nectar-producing organs in flowers) were indicated by special colours, and he reasoned that the colour attracted insects. The insects, he found, were the means of conveying pollen from the stamen (male part) of one flower to the pistil (female part) of another. He also discovered that in many bisexual flowers the stamen and pistil mature at different times, and self-fertilization thus cannot occur; fertilization is accomplished instead by the transfer of pollen from one flower to another. The process of maturation of the male and female parts at different periods he called dichogamy, a term that is still used, and he traced the process in fine detail. He discovered that some flowers rely on the wind to transfer their pollen and studied the differences between these flowers and those fertilized by insects.

Sprengel believed that his principles explained all of the characteristics of flowers, such as position, size, form, colour, odour, and time of flowering. He published his observations and thoughts in *Das entdeckte Geheimnis der Natur im Bau und in der Befruchtung der Blumen* (1793; "The Newly Revealed Mystery of Nature in the Structure and Fertilization of Flowers"). When his book was not well received, Sprengel became depressed and did not publish the results of his other botanical research. He turned to philology but did not distinguish himself in it. His book, after long neglect, was recognized in 1841 by the English naturalist Charles Darwin, who was so impressed by it that much of his own work on flowers arose from Sprengel's researches.

**spring,** in climatology, season of the year between winter and summer during which temperatures gradually rise. It is generally defined in the Northern Hemisphere as extending from the vernal equinox (day and night equal in length), March 20 or 21, to the summer solstice (year's longest day), June 21 or 22, and in the Southern Hemisphere from September 22 or 23 to December 22 or 23. The spring temperature transition from winter cold to summer heat occurs only in middle and high latitudes; near the Equator, temperatures vary little during the year. Spring is very short in the polar regions. For physical causes of the seasons, *see* season.

In many cultures spring has been celebrated with rites and festivals revolving around its importance in food production. In European languages, the concept of spring is associated with the sowing of crops. During this time of the year all plants, including cultivated ones, begin growth anew after the dormancy of winter. Animals are greatly affected, too: they come out of their winter dormancy or hibernation and begin their nesting and reproducing activities; and birds migrate poleward in response to the warmer temperatures.

**spring,** in hydrology, opening at or near the surface of the Earth for the discharge of water from underground sources. A spring is a natural discharge point of subterranean water at the surface of the ground or directly into the bed of a stream, lake, or sea. Water that emerges at the surface without a perceptible current is called a seep. Wells are holes excavated to bring water and other underground fluids to the surface.

A brief treatment of springs and seeps follows. For full treatment, *see* MACROPAEDIA: Hydrosphere.

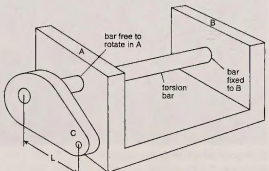
Water in springs, seeps, and wells generally originates as rainfall that has soaked into the soil and percolated into underlying rocks. Permeable rocks (those containing interconnected pore spaces through which water can migrate), such as limestone and sandstone, store and transmit water and are called aquifers. Sometimes the water in an aquifer becomes confined between two impermeable rock layers, such as clay or shale. When these strata are tilted or folded into a structural trap, the water in the lower part of the aquifer is stored under pressure. If the pressure is sufficiently high and a well is sunk through the capping layer, the water will rise to the surface without pumping. This is called an artesian well.

The aquifers that receive and discharge the largest quantities of groundwater are unconsolidated materials such as sand and gravel. These aquifers occur widely and discharge groundwater partly through springs, but mostly through evaporation and seepage. Well water is obtained mostly from such aquifers, particularly those underlying lowland areas. In limestone regions, rainwater sinks through holes or other openings and is drained chiefly through underground passages. Basalt and sandstone aquifers are also sources of water for many springs. Most of the springs whose individual discharges exceed 3 cubic metres per second (100 cubic feet per second) originate from limestone and basalt aquifers.

Springs can be classified by their water temperature. A thermal or hot spring has a water temperature significantly higher than the mean air temperature of the surrounding area. Thermal springs occur in volcanic regions and in areas where rock layers have been broken and folded in geologically recent time. Geysers, a spectacular form of hot spring, eject tall plumes of hot water and steam. Springs containing a noticeable amount of dissolved substances are called mineral springs. Most thermal springs are rich in dissolved minerals while many mineral springs are warm.

The quality of water discharged by a spring depends on the type of aquifer and rock strata through which the water has passed, the temperatures along the route, and the volume of circulating water, past and present. Groundwater is least modified where it travels shallowly over short distances through pervious formations depleted of soluble minerals. Sand and gravel aquifers in humid regions yield good-quality water, whereas water from springs and seeps in arid areas may be contaminated by undesirable mineral deposits. The water quality in sedimentary rocks of marine origin depends on the degree of freshwater flushing. After the brine has been washed away, limestone and sandstone rocks usually yield good-quality, though hard, freshwater.

**spring,** in technology, elastic machine component able to deflect under load in a prescribed manner and to recover its initial shape when unloaded. The combination of force and



Torsion-bar spring

displacement in a deflected spring is energy, which may be stored when moving loads are being arrested or when the spring is wound up for use as a power source. Although most springs are mechanical, hydraulic and air springs are also obtainable.

The helical spring, in which wire is wrapped in a coil that resembles a screw thread, is probably the most commonly used mechanical spring. It can be designed to carry, pull, or push loads. Twisted helical (torsion) springs are used in engine starters and hinges. Helical tension and compression springs have numerous uses, notably automobile suspension systems, gun-recoil mechanisms, and closing valves on engines.

The leaf spring is used mainly for vehicle suspension and in one form consists of a stack of slightly curved narrow plates of equal width and varying length clamped together, with the shorter plates in the centre to form a semi-elliptical shape. The ends of the longest plate are attached to the vehicle by pin connections, and the vehicle axle is clamped to the centre, at which point the stack is thickest.

The spiral spring is made from flat strip or wire coiled up in the manner of the groove on a phonograph record. As a mainspring or hairspring, it provides a compact source of energy in clocks and watches; it is also used on typewriters and parking meters.

The torsion-bar spring shown in the figure is used in the suspension systems of some automobiles. The circular torsion bar is fixed in plate B and supported but free to rotate in plate A. A load applied at point C on the lever twists the bar, and the stiffness of the suspension, which depends on the length and diameter of the bar and the length of the lever, can be easily varied by changing L.

An air spring is basically a column of air confined within a rubber-and-fabric container shaped like a bellows. The spring action results from the compression and expansion of the air. When used on road vehicles, air springs can keep the vehicle at a constant standing height regardless of load.

Hydraulic springs are comparatively small, thick-walled cylinders in which the spring effect is produced by applying a load to the fluid in the cylinder through a small piston entering at the centre of one end of the cylinder. The piston movement, or deflection, is produced by the compression of the fluid and the deformation (bulging) of the cylinder walls. These springs are particularly useful in applications requiring high load capacities and stiffnesses.

**Spring, Howard** (b. Feb. 10, 1889, Cardiff, Wales—d. May 3, 1965, Falmouth, Cornwall, Eng.), Welsh-born British novelist whose chief strength lies in his understanding of provincial life and ambition. Most of his books trace the rise of a character from poverty to affluence, often melodramatically.

The son of a gardener, Spring left school at the age of 11 but continued his education in the evenings, eventually becoming a newspaper reporter and book critic. His first novel, *Shabby Tiger* (1934), had a sequel, the partly autobiographical *Rachel Rosing* (1935). With his best-selling novel *O Absalom!* (1938)—afterward reissued as *My Son, My Son* (filmed 1940)—Spring won worldwide fame. He settled in Cornwall, the setting for books that followed, such as *Fame Is the Spur* (1940), *Hard Facts* (1944), and *The Houses in Between* (1951).

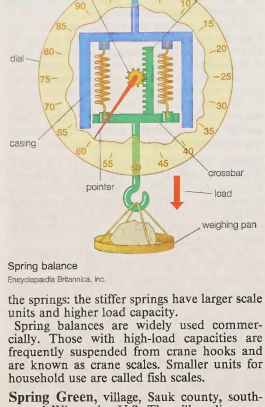
**Spring and Autumn Period,** Chinese (Wade-Giles) CH'UN CH'IU SHIH-TAI, or (Pinyin) CHUN QIU SHIDAI (770–476 BC), in Chinese history, the period during the Chou (or Eastern Chou) dynasty when many vassal states fought and competed for supremacy. It was named after the title of a Confucian book of chronicles, Ch'un Ch'iu (*q.v.*), covering the period 722–479 BC.

During the Spring and Autumn Period the imperial house, with priestly, ritualistic, and diplomatic functions but with diminishing authority, slowly sank out of sight as the local nobles struggled with one another for power. Survival required coalitions, both political and economic, as well as the accumulation of productive wealth. To this end, many drainage operations, canals, dikes, reservoirs, roads, and the like were undertaken, often on an interstate or multistate basis. Long walls too were thrown up as a means of protection not only against one another but also against aboriginal and nomadic tribes. Merchants and artisans began to assume some significance. Education and intellectual life advanced, this being the period of Confucius and other famous thinkers.

**spring balance,** weighing device that utilizes the relation between the applied load and the deformation of a spring. This relationship is usually linear; *i.e.,* if the load is doubled, the deformation is doubled. In the circular balance shown in the figure, the upper ends of the helical springs are attached to the casing and the lower ends to a crossbar that can move relative to the casing and to which the load hook is attached. The pinion to which the indicating pointer is attached is pivoted in the casing and meshes with the rack, which is pivotally connected to the crossbar and is

pressed into contact with the pinion by the rack spring.

When a load is applied, the springs are stretched, and movement of the crossbar with the rack attached rotates the pinion and the load-indicating pointer. The dial is graduated in scale units that depend on the stiffness of




Spring balance
Encyclopædia Britannica, Inc.

the springs: the stiffer springs have larger scale units and higher load capacity.

Spring balances are widely used commercially. Those with high-load capacities are frequently suspended from crane hooks and are known as crane scales. Smaller units for household use are called fish scales.

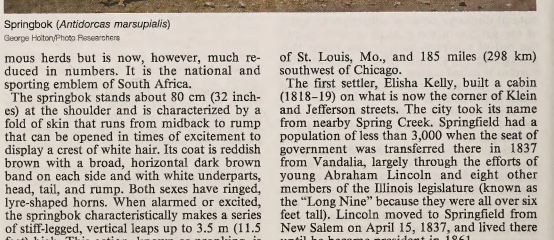
**Spring Green,** village, Sauk county, south-central Wisconsin, U.S. The village lies near the Wisconsin River, 35 miles (56 km) west-northwest of Madison. It originated in the 1860s as a shipping point for livestock and wheat and was incorporated in 1869. The place is, however, best known for its association with the architect Frank Lloyd Wright, who was born in 1867 at Richland Center, 20 miles (32 km) northwest. He chose Spring Green as the site for "Taliesin," his home begun in 1911 and rebuilt after fires of 1914 and 1925. A building that hugs the hills on which it was constructed, it is now known as "Taliesin East" to differentiate it from "Taliesin West," Wright's winter home in Scottsdale, Ariz. At Spring Green in 1933 Wright established the Taliesin Fellowship, his first architectural school for apprentices; the buildings now constitute the summer headquarters of the Frank Lloyd Wright Foundation. A few miles south is another unusual architectural structure—"The House on the Rock," designed by Alexander Jordan (a Wright disciple), 450 feet (140 m) above the Wisconsin River valley; the house winds spirally around the rock, and trees grow through the roof. The site is now surrounded by amusement attractions. Wright was buried in Spring Green until 1985 when, in accordance with the will of his third wife, his remains were exhumed and interred at Taliesin West. Pop. (2000) 1,444.

**Spring of Khosrow Carpet,** also called WINTER OF KHOSROW CARPET, ancient Persian carpet, possibly the most costly and magnificent of all time, made for the Ctesiphon palace of the Sāsānian king Khosrow I (reigned AD 531–579). Described in the historical annals of the Muslim scholar aṭ-Ṭabarī, it became the model for subsequent Garden carpets. The carpet was called the Spring of Khosrow because it represented, in silk, gold, silver, and jewels, the splendour of flowering spring. It was also called the Winter carpet because it was used in bad weather, when real gardens were unavailable. As such, it symbolized the king's power to command the return of the seasons.

Its design was a formalized paradise with streams, paths, rectangular plots of flowers, and flowering trees. Water was represented by crystals, soil by gold, and fruits and flowers by precious stones. When the Arabs captured Ctesiphon (AD 637), the carpet, which measured about 84 square feet (7.8 square m), was cut into fragments and distributed to the troops as booty.

**spring tide,** tide of maximal range, near the time of new and full moon when the Sun and Moon are in syzygy—*i.e.,* aligned with the Earth. Conjunction is the time during new moon when the Sun and Moon lie on the same side of the Earth. The other syzygy condition, opposition, occurs during full moon when the Sun and Moon are positioned on opposite sides of the Earth. In either case of syzygy, the tide-producing forces of the Sun and the Moon reinforce each other, and the tidal amplitudes on Earth are at their greatest. *See* tide.

**springbok,** also called SPRINGBUCK (*Antidorcas marsupialis*), a species of graceful, strikingly marked, gazellelike antelope of the family Bovidae (order Artiodactyla). The springbok is native to the open, treeless plains of southern Africa. It once roamed in enormous herds but is now, however, much reduced in numbers. It is the national and sporting emblem of South Africa.



Springbok (*Antidorcas marsupialis*)
George Holton/Photo Researchers

The springbok stands about 80 cm (32 inches) at the shoulder and is characterized by a fold of skin that runs from midback to rump that can be opened in times of excitement to display a crest of white hair. Its coat is reddish brown with a broad, horizontal dark brown band on each side and with white underparts, head, tail, and rump. Both sexes have ringed, lyre-shaped horns. When alarmed or excited, the springbok characteristically makes a series of stiff-legged, vertical leaps up to 3.5 m (11.5 feet) high. This action, known as pronking, is performed with the head down, the hooves bunched, and the back arched.

**Springbok Flats,** Afrikaans SPRINGBOKVLA, extensive plain in South Africa, extending northeast from Pretoria in Gauteng province for about 100 miles (160 km) to the town of Zebediela in Northern province. The name indicates an abundance of springboks, but now little game remains except in preserves. The whole plain, with an average elevation of about 3,300 feet (1,000 m), is extremely flat and featureless. The climate is hot, with an annual rainfall of about 24 inches (600 mm) and little surface runoff. Vegetation is thornveld and grassland, and the black turf, soil derived from basalt, is fertile. The plain is mainly cattle-raising country; corn (maize), peanuts (groundnuts), and large quantities of oranges are harvested (with irrigation) near Zebediela. The plain is well served by railways and roads.

**Springer, Axel,** in full AXEL CÄSAR SPRINGER (b. May 2, 1912, Altona, near Hamburg, Ger.—d. Sept. 22, 1985, West Berlin), German publisher who founded Axel Springer Verlag AG, one of the largest publishing concerns in Europe.

Springer was the son of a printer and publisher. After limited schooling, he worked as an apprentice in various printing and publishing concerns. He received his journalism training at a news agency and at his father's paper, the *Altonaer Nachrichten.*

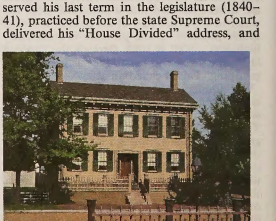
In 1945 Springer started to build his own publishing company. By the time of his death, the Axel Springer Publishing Group was publishing *Die Welt,* a highly regarded conservative daily newspaper; *Bild-Zeitung,* a daily tabloid; the *Hamburger Abendblatt;* the *Berliner Morgenpost;* and other newspapers, as well as radio and television program guides. The company's activities also included two book-publishing concerns (Ullstein and Propyläen) and an audiovisual enterprise.

In 1959–60 Springer moved his operations from Hamburg to West Berlin in what he intended as a symbolic protest over the partition of Germany. He also supported the state of Israel and worked to further German-Jewish reconciliation.

**Springfield,** city, capital of Illinois, U.S., and seat (1825) of Sangamon county. It lies along the Sangamon River in the central part of the state. It is situated 99 miles (160 km) northeast of St. Louis, Mo., and 185 miles (298 km) southwest of Chicago.

The first settler, Elisha Kelly, built a cabin (1818–19) on what is now the corner of Klein and Jefferson streets. The city took its name from nearby Spring Creek. Springfield had a population of less than 3,000 when the seat of government was transferred there in 1837 from Vandalia, largely through the efforts of young Abraham Lincoln and eight other members of the Illinois legislature (known as the "Long Nine" because they were all over six feet tall). Lincoln moved to Springfield from New Salem on April 15, 1837, and lived there until he became president in 1861.

In the Old State Capitol (1837–53, rebuilt in the 1960s as a state historic site), Lincoln served his last term in the legislature (1840–41), practiced before the state Supreme Court, delivered his "House Divided" address, and



Lincoln Home National Historic Site, Springfield, Ill.
© James P. Rowan

maintained an office as president-elect. His body lay in state there (May 4, 1865), and in the historical library is a collection of Lincolniana. The locations of Lincoln's law offices and the Globe Tavern (where his first inaugural speech was written) are marked with bronze plaques. Lincoln's unpretentious house at 8th and Jackson streets has been restored. This home, with the four-block area surrounding it, was designated a national historic site in 1971. In Oak Ridge Cemetery northwest of the city is the Lincoln Tomb, which holds the bodies of Lincoln, his wife, Mary, and their sons Edward, Willie, and Tad. The memorial is 117 feet (36 m) tall and is surmounted by a granite shaft. The First Presbyterian Church contains the Lincoln family pew.

The State House (1868–88) is 361 feet (110 m) high at the top of its dome. The Centennial Building (1918–23) commemorates the 100th anniversary of Illinois statehood. The Governor's Mansion was first occupied by Governor Joel A. Matteson in 1855.

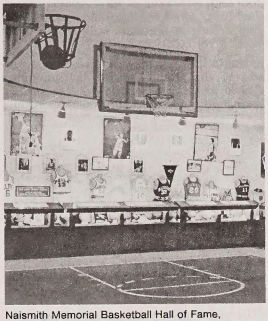
Springfield is a wholesale and retail centre for a rich farming area producing corn (maize), wheat, soybeans, and livestock. It is the site of the Illinois State Fair, held annually since 1893. Principal manufactures include industrial tractors, garage equipment, electric metres and electronic equipment, brick and concrete products, and paints. Tourism is an economic asset. The city is the national headquarters of several insurance companies. It is the seat of Springfield College in Illinois (1925), Diocesan Seminary of the Immaculate Conception (1956), Lincoln Land Community College (1969), and Sangamon State University (1970).

The Lincoln Memorial Garden and Nature Center is near Lake Springfield (a reservoir completed in 1934) at the southeast edge of the city. The home of Vachel Lindsay, the Springfield poet, is maintained as a museum. The Daughters of Union Veterans of the Civil War have their headquarters and a memorial museum in Springfield. Camp Butler National Cemetery, formerly the site of a Civil War prison camp, is 7 miles (11 km) east. Lincoln's New Salem Historic Site is 24 miles (39 km) northwest. Clayville Stagecoach Stop, a restored wayside inn (built in 1824 and named for Henry Clay, the statesman and orator), is 14 miles (22 km) northwest. Inc. village, 1832; city, 1840. Pop. (2000) city, 111,454; Springfield MSA, 201,437.

**Springfield,** city, seat (1812) of Hampden county, southwestern Massachusetts, U.S., on the Connecticut River. It forms a contiguous urban area with Agawam and West Springfield (west), Chicopee and Holyoke (north), Ludlow (northeast), Wilbraham and Hampden (east), and East Longmeadow (south). William Pynchon, one of the original patentees of the Massachusetts Bay Colony, founded a settlement (now Agawam) on the river's west bank in 1635. The colonists' livestock did so much damage to the cornfields of the Indians, however, that the community moved to the present east-bank site in 1636. It was organized as a town in 1641 and named for Pynchon's birthplace in England. Pynchon's autocratic rule ended in 1652 when he returned to England, after being condemned by the Massachusetts General Court for a book attacking the Calvinist doctrine of atonement.

Springfield's transformation from a farming to a manufacturing community was hastened by the building of an arsenal in 1777, which supplied arms during the Revolutionary War and was a target of attack during Shays's Rebellion in 1786. During the American Civil War the Armory (built 1794 and now a national historic site) produced the well-known Springfield muskets; it became a principal manufactory of small arms and later developed the Springfield and Garand rifles. The Organ of Rifles (so-called for the resemblance of stacked arms to organ pipes), made famous by Henry Wadsworth Longfellow's poem "The Arsenal at Springfield," is displayed in the Armory Museum.

Possessing abundant waterpower and connected by railroad to Boston in 1835, Springfield soon became an industrial town. Machinery, electrical equipment, chemicals, rubber goods, plastics, printed matter, and clothing have become important products in its diversified economy. The G. & C. Merriam Company, publishers of Merriam-Webster dictionaries since 1843, has its headquarters there. A group of buildings comprising three museums, a library, a planetarium, and an art gallery, occupies the Quadrangle centre of the city. Eastern States Exposition Park in West Springfield is the site of one of the largest annual (September) industrial-agricultural fairs in the eastern United States; Storrowtown (a reconstructed old New England village) and two theatres are within the park. Springfield College was founded in 1885; other colleges are the American International College (1885), the Western New England College (1919), and the Springfield Technical Community College (1965). The city's Naismith Memorial National Basketball Hall of Fame commemorates James Naismith, who originated basketball there in 1891. Inc. city, 1852. Pop. (2000) city, 152,082; Springfield MSA, 591,932.



Naismith Memorial Basketball Hall of Fame, Springfield, Mass.
Mark Sexton

**Springfield,** city, seat (1833) of Greene county, southwestern Missouri, U.S., near the James River, at the northern edge of the Ozark Highlands, north of the Table Rock Lake area. Settled in 1829, its growth was slow until the period of heavy westward migration, when pioneers were attracted by its location on important land routes. During the American Civil War, the city was held for a few months by Confederate forces after the Battle of Wilson's Creek (Aug. 10, 1861; fought 11 miles [18 km] south) until they were expelled by Federal troops in February 1862. "Wild Bill" Hickok lived in Springfield and scouted for the Federals; he was acquitted there of the murder of Dave Tutt. An extension of the Atlantic and Pacific Railroad (1870) resulted in the development of a rival community, North Springfield, which merged with Springfield in 1887.

The city's agricultural-based economy (dairy products, poultry, stockyards) is augmented by light manufacturing (steel products, television sets, paper containers, refrigeration motors, and V-belts) and educational institutions. The latter include Drury College (1873), Southwest Missouri State University (1905), Evangel College (1955), Central Bible College (1922), and Baptist Bible College. The International Headquarters of the Assemblies of God Church is in the city. Inc. 1838. Pop. (2000) city, 151,580; Springfield MSA, 325,721.

**Springfield,** city, seat (1818) of Clark county, west-central Ohio, U.S., on Buck Creek and Mad River, 25 miles (40 km) northeast of Dayton. The original settlement by James Demint and migrant Kentuckians in 1799 was on the site of the village of Old Piqua (birthplace of Tecumseh, the Shawnee Indian chief). It was laid out in 1801 and named by the wife of Simon Kenton, an Indian scout who had settled there, for the springs in nearby cliffs. The arrival of the National (Cumberland) Road sustained its growth. The manufacture of farm machinery (now a leading industry) began there in 1855 when William Whiteley invented a successful binder. In the 1880s the journal *Farm and Fireside* was published in Springfield as a house organ by P.J. Mast; this formed the basis of the Crowell-Collier publishing ventures (now part of the Macmillan organization). One of the earliest programs of the 4-H Club movement of "learning by doing" for young people was started (1902) there by A.B. Graham. George Harrison Shull (born nearby in 1874) conducted his early hybrid corn experiments in Springfield, which is now the trading centre for a fertile agricultural area. Manufactures are well-diversified and in addition to farm implements include hoisting machinery, funeral supplies, tools, monorails, and a variety of iron and steel products. The city is the seat of Wittenberg University (Lutheran Church in America; 1845) and Clark Technical College (1962). Inc. village, 1827; city, 1850. Pop. (2000) city, 65,358; Dayton-Springfield MSA, 950,558.

**Springfield Race Riot** (August 1908), in U.S. history, brutal two-day assault by several thousand white citizens on the black community of Springfield, Ill. Triggered by the transfer of a black prisoner charged with rape (an accusation later withdrawn), the riot was symptomatic of fears of racial equality in North and South alike. Almost the entire Illinois state militia was required to quell the frenzy of the mob, which shot innocent people, burned homes, looted stores, and mutilated and lynched two elderly blacks.

Afterward, the population seemed to show no remorse, and some persons even advocated the Southern political strategy of disenfranchisement as a means of keeping blacks "in their place." In a moving account of the riot, called "Race War in the North" (Sept. 3, 1908), Southern white journalist William English Walling called for a revival of the abolitionist spirit to stem the tide of such shocking occurrences. Fearing further degeneration in race relations, white liberals were inspired by the article to join with blacks in launching the National Association for the Advancement of Colored People.

*Consult the* INDEX *first*

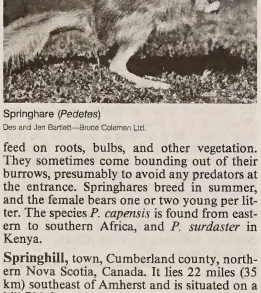
**Springfield rifle,** any of several rifles that were standard infantry weapons of the U.S. Army most of the time from 1873 to 1936, all taking their name from the Springfield Armory, established at Springfield, Mass., by the U.S. Congress in 1794. The armoury had produced smoothbore muskets from its earliest days, and between 1858 and 1865 it turned out more than 840,000 .58-calibre rifled muskets. In 1866, it began adapting the muzzle-loading rifles to breech-loading, single-shot rifles by making a "trapdoor" for the breech with latch, firing pin, and extractor for the cartridge case.

From 1873 to 1892 the armoury turned out breech-loading, single-shot Springfield .45-70s (.45 calibre with 70 grains of black powder). Between 1892 and 1903 the U.S. Army used a Norwegian-designed Krag-Jørgensen bolt-action repeating rifle, but in the meantime the Springfield gunsmiths were studying the German Mauser, a five-shot bolt-action repeating rifle. The United States adapted the Mauser into the Model 1903 Springfield, a rifle that, after some modifications to accommodate Model 1906 ammunition, entered history as the Springfield .30-06, one of the most reliable and accurate military firearms in history. The Springfield served as the principal U.S. infantry weapon until 1936, when it was replaced by the Garand (M1) rifle of World War II—also designed at the Springfield Armory. When the Springfield .30-06 was retired, it was widely modified into a sporting rifle that is still prized for its accuracy.

**springhare,** also called SPRINGHAAS, JUMPING HARE, or CAPE JUMPING HARE, either of two species of hopping African rodents constituting the genus *Pedetes* and the family Pedetidae (order Rodentia). Although they are called hares, springhares are not of the order Lagomorpha.

Springhares have short forelegs and long, powerful hind legs and feet. They are large-eyed animals with relatively long, pointed ears and have long, soft, light reddish brown fur and long, black-tipped tails. They are about 35 to 40 cm (14 to 16 inches) long, excluding a tail of about the same length.

Inhabitants of open, sandy country, springhares live in burrows and emerge at night to



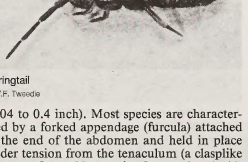
Springhare (*Pedetes*)
Des and Jen Bartlett—Bruce Coleman Ltd.

feed on roots, bulbs, and other vegetation. They sometimes come bounding out of their burrows, presumably to avoid any predators at the entrance. Springhares breed in summer, and the female bears one or two young per litter. The species *P. capensis* is found from eastern to southern Africa, and *P. surdaster* in Kenya.

**Springhill,** town, Cumberland county, northern Nova Scotia, Canada. It lies 22 miles (35 km) southeast of Amherst and is situated on a hill 700 feet (210 m) high, which was once the source of numerous springs—whence its name. Coal, discovered in the vicinity in 1834 and mined commercially since 1872, is the town's economic mainstay. The first Canadian coal-mining trade union was legalized in the Springhill collieries in 1879. One of the mines, with a vertical depth of 4,000 feet (1,220 m), is said to be the deepest in Canada. Springhill has experienced several major mining disasters—in 1891, when 125 miners lost their lives; in 1956, when 39 were killed by an explosion; and in 1958, when 76 were suffocated by a massive earth disturbance. Most of the business district was destroyed by fire in 1957. Coal now is mined only intermittently. Other activities are farming, lumbering, woodworking, and machine-shop practice. Inc. 1889. Pop. (2001) 4,091.

**Springs,** town, Gauteng province, South Africa. It lies in the Witwatersrand, just east of Johannesburg, at an elevation of 5,338 feet (1,627 m). Founded as a coal-mining camp in 1885, it was sustained by the mining of gold beginning in 1908 and was incorporated in 1912. It became the largest single gold-producing area in the world by about the mid-20th century. Manufacturing (including paper, foodstuffs, and cosmetics) has now replaced gold mining as the main economic activity. Pop. (1996) 160,795.

**springtail,** any small, primitive, wingless insect of the group Collembola (sometimes ranked as an order of about 3,500 species). Springtails range in length from 1 to 10 mm



Springtail
M.W.F. Tweedie

(0.04 to 0.4 inch). Most species are characterized by a forked appendage (furcula) attached at the end of the abdomen and held in place under tension from the tenaculum (a clasplike structure formed by a pair of appendages). Although the furcula provides a jumping apparatus for the collembolan, enabling it to catapult itself (hence the common name springtail), the usual method of locomotion is crawling. Springtails also have a ventral abdominal, suckerlike tube (collaphore), which secretes a sticky, adhesive substance and also takes up water. The young hatch from spherical eggs and closely resemble the adult. There can be 3 to 12 molts before maturity and up to about 50 molts during the lifetime of a springtail.

The springtail, found in all types of soil and leaf litter throughout the world from Antarctica to the Arctic, is one of the most widely distributed insects. Certain springtails known as snow fleas are active at near-freezing temperatures and may appear in large numbers on snow surfaces. Springtails live in soil and on water and feed on decaying vegetable matter, sometimes damaging garden crops and mushrooms. The small (2 mm long), green-coloured lucerne flea (*Sminthurus viridis*), one of the most common species, is a serious pest to crops in Australia. Dusting with rotenone or Malathion controls springtails. Fossil springtails are among the oldest insect fossils known.

**sprinkler system,** in fire control, a means of protecting a building against fire by causing an automatic discharge of water, usually from pipes near the ceiling. The prototype, developed in England about 1800, consisted of a pipe with a number of valves held closed by counterweights on strings; when a fire burned the strings, the valves were opened. Many manually operated systems were installed in 19th-century buildings; in these a number of perforated pipes were fed by a main riser that could be turned on in an adjoining area. Because this system resulted in frequent water damage in parts of a room or building untouched by fire, an improvement was sought and found in the Parmelee sprinkler head, introduced in the United States in the 1870s. In this, the normally closed orifice is opened by heat from a fire. Modern versions use a fusible link or a bulb containing chemicals, which breaks at about 160° F (70° C) to open the orifice. Modern sprinkler heads are designed to direct a spray downward. Most sprinkler systems are wet-head—*i.e.,* they use pipes filled with water. Where there is danger of freezing, however, dry-head sprinklers are used in which the pipes are filled with air under moderate pressure; when the system is activated, the air escapes, opening the water-feeder valves. An improved version has air under only atmospheric pressure and is activated by heat-sensing devices. Another special type, used in high-hazard locations, is the deluge system, which delivers a large volume of water quickly.

**sprint,** also called DASH, in track-and-field athletics, a footrace over a short distance with an all-out or nearly all-out burst of speed, the chief distances being 100, 200, and 400 metres and 100, 220, and 440 yards. The course for sprint races is usually marked off in lanes within which each runner must remain for the entire race. Originally sprinters used a standing start, but after 1884 sprinters started from a crouched position using a device called a starting block (legalized in the 1930s) to brace their feet. Races are begun by a pistol shot; at 55 to 65 metres (60 to 70 yards), top sprinters attain maximum speed, more than 40 km per hour (25 miles per hour). After the 65-metre mark the runner begins to lose speed through fatigue.

All important international races at 200 metres and 220 yards, as well as 400 metres and 440 yards, are run on an oval track. The starts are staggered (the lanes farther from the centre begin progressively farther forward on the track) so that each runner will cover an equal distance. As a result, the competitors, particularly in the 400 metres and 440 yards, have no exact knowledge of their respective positions until they have completed the final turn. Great emphasis is therefore placed on an athlete's




Marion Jones (U.S.) running the 200-metre event at the 2000 Olympics, Sydney
© AFP/Corbis

ability to judge his own pace, as well as upon his speed and endurance. For World Cup and world championship winners, *see* Sporting Record: *Athletics. See also* Olympic Games.

**sprint,** in bicycle racing, a competition over a 1,000-metre (1,094-yard) course (500-metre for women) with time taken only over the last 200 metres (219 yards). Racers compete in groups of two (sometimes called a match sprint) or three, and they frequently spend the early laps of the race moving relatively slowly and trying to maneuver their opponents into the lead, while at the same time following



Sprint bicyclists at the Vodafone Arena in Melbourne, Australia
Mark Dadswell—Getty Images

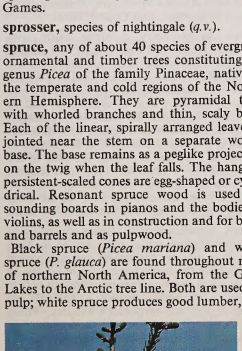
close behind and conserving energy for the final high-speed dash to the finish line.

Tandem races, an amateur event, are similar to sprint competition, with teams of two racers each competing on tandem bicycles. Speeds are slightly higher, and the racers generally maintain a more steady pace than in the individual sprints. For world champions, *see* Sporting Record: *Cycling*. *See also* Olympic Games.

**sprosser,** species of nightingale (*q.v.*).

**spruce,** any of about 40 species of evergreen ornamental and timber trees constituting the genus *Picea* of the family Pinaceae, native to the temperate and cold regions of the Northern Hemisphere. They are pyramidal trees with whorled branches and thin, scaly bark. Each of the linear, spirally arranged leaves is jointed near the stem on a separate woody base. The base remains as a peglike projection on the twig when the leaf falls. The hanging, persistent-scaled cones are egg-shaped or cylindrical. Resonant spruce wood is used for sounding boards in pianos and the bodies of violins, as well as in construction and for boats and barrels and as pulpwood.

Black spruce (*Picea mariana*) and white spruce (*P. glauca*) are found throughout most of northern North America, from the Great Lakes to the Arctic tree line. Both are used for pulp; white spruce produces good lumber, and



Black spruce (*Picea mariana*)
Grant Heilman—EB Inc.

black spruce is the source of spruce gum. White spruce usually is 18 to 21 metres (about 60 to 70 feet) tall. A drought-tolerant variety, *Picea glauca* "Black Hills," is useful in landscaping and in windbreaks. The cones of black spruce are purple, those of white spruce brown. Engelmann spruce (*P. engelmanni*) of western North America is an important timber source. The blue spruce, or Colorado spruce (*P. pungens*), has a similar range and is used as an ornamental because of its bluish leaves and symmetrical growth habit.

The Norway spruce (*P. abies*), an important timber and ornamental tree native to northern Europe, is used in reforestation both there and in North America.

**Spruce Knob,** highest point in West Virginia, U.S., located in the Allegheny Mountains in the eastern part of the state, about 25 miles (40 km) southeast of Elkins. Spruce Knob lies at an elevation of 4,863 feet (1,482 metres) at the southern end of Spruce Mountain, a ridge extending northeast-southwest along the western edge of Pendleton county. The peak, accessible by road from nearby Judy Gap, is within Monongahela National Forest and is one of the focal points of Spruce Knob–Seneca Rocks National Recreation Area. The recreation area, established in 1965, has an area of about 156 square miles (404 square km) and is a noted destination for rock climbing.

**sprung rhythm,** an irregular system of prosody developed by the 19th-century English poet Gerard Manley Hopkins. It is based on the number of stressed syllables in a line and permits an indeterminate number of unstressed syllables. In sprung rhythm, a foot may be composed of from one to four syllables. (In regular English metres, a foot consists of two or three syllables.) Because stressed syllables often occur sequentially in this patterning rather than in alternation with unstressed syllables, the rhythm is said to be "sprung." Hopkins claimed to be only the theoretician, not the inventor, of sprung rhythm. He saw it as the rhythm of common English speech and the basis of such early English poems as Langland's *Piers Plowman* and nursery rhymes such as

Ding, dong, bell;
Pussy's in the well.

Sprung rhythm is a bridge between regular metre and free verse. An example of Hopkins' use of it is:

Margaret are you grieving
Over Goldengrove unleaving?

"Spring and Fall to a Young Child"

**spun glass:** *see* fibreglass.

**spurge** (*Euphorbia*), one of the largest flowering-plant genera, with more than 1,600 species, many of which are important to man as ornamentals, sources of drugs, or as weeds. The genus takes its common name from a group of annual herbs used as purgatives, or spurges, mainly the 1-metre- (3-foot-) tall European *E. lathyris,* seeds of which were once used for their laxative effect. The diverse, worldwide genus includes many species in arid parts of Africa and India that resemble cactus plants. Unlike cacti, euphorbias have a milky sap. Euphorbia plants vary from flat, creeping herbs—such as the weedy North American prostrate spurge (*E. supine*), which grows out of sidewalk cracks—to shrubs and trees. They have one female flower consisting of a single female reproductive structure, the pistil, surrounded by numerous male flowers of one stamen each. All these reduced flowers are enclosed in a cup-shaped, leaflike structure with five lobes and a gland on each, called a cyathium. Fruits are explosive, three-seeded capsules.

The cactus-like kinds include spined, succulent (fleshy), and angled 15-metre-tall trees such as *E. candelabrum* and *E. nyikae* from



Spurge (*Euphorbia venata*)
Valerie Finnis

East Africa; spined and angled succulent shrubs, 6 metres tall, such as *E. grandicornis* from southern Africa and *E. lactea* from the East Indies, both of which are grown as hedges in areas with a mild climate.

Succulent but unthorned and with upright, 6-metre, fingerlike, much-branched stems is milkbush (*E. tirucalli*) from India, used in Africa and many tropical places as a hedge for huts or cattle enclosures. Wax plant (*E. antisyphilitica*), from Mexico, has similar but unbranched, rodlike, gray-green, mostly naked, 1-metre stems from the surface of which comes an important wax used for polishes, candles, lubricants, and paper waterproofing.

The somewhat climbing, thorned, leafy, woody-stemmed crown of thorns (*E. milii* or *E. splendens*) from Madagascar is a popular houseplant in temperate areas and a good source of colour in tropical gardens.

What is probably the most appreciated of the tropical euphorbias is the poinsettia from southern Mexico and Guatemala, which has scarlet bracts (leaflike structures attached just below flowers) and is associated with Christmas. Another species associated with Christmas in southern Mexico and Central America, where it is native, is the shrub pascuita (*E. leucocephala*), 1.5 to 4 metres tall, which is covered much of the winter with a mist of small, white bracts. In some varieties the leaves are dark red. The scarlet plume (*E. fulgens*), from Mexico, a 90-centimetre- (3-foot-) tall shrub with slender stems and scarlet bract clusters, is sometimes grown as a pot plant and in mild-winter areas as a garden shrub.

Perennial ornamentals of temperate climes include: cypress spurge (*E. cyparissias*), from Europe, a globe-shaped plant with needlelike foliage that is covered with golden bracts in spring; *E. venata* or *E. wulfenii,* from Europe, a plant, 0.9 to 1.2 metres tall, with greenish yellow heads on bluish foliage; cushion spurge (*E. epithymoides*), from Europe, a 30.5-cm globe of gold to chartreuse that blooms in spring; *E. characias,* a 0.9- to 1.2-metre-tall European plant with sulfur-yellow bracts in summer; and *E. griffithii,* from the Himalayas, the fireglow variety of which has fire-orange heads in early summer.

Annual ornamentals include snow-on-the-mountain (*E. marginata*), native in the North American west; and many varieties of fire-on-the-mountain (*E. heterophylla*), from

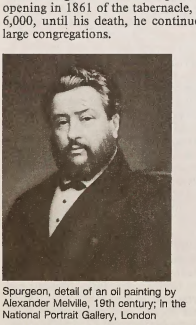
the eastern and central United States to Peru, with red-marked, poinsettia-like green bracts and leaves of varied shape on 90-centimetre- (35-inch-) tall plants.

Important as weeds are flowering spurge (*E. corollata*), of the middle and eastern United States; the leafy spurge (*E. escula*), naturalized from Europe in the northern United States and adjacent Canada; spotted spurge (*E. maculata*); prostrate spurge and the related European petty spurge (*E. peplus*); and sun spurge (*E. helioscopia*).

Some botanists have divided the euphorbias into various genera, including *Poinsettia, Tithymalus, Tithymalopsis*, and *Dichrophyllum.*

**Spurgeon, C.H.,** in full CHARLES HADDON SPURGEON (b. June 19, 1834, Kelvedon, Essex, Eng.—d. Jan. 31, 1892, Menton, France), English fundamentalist Baptist minister and celebrated preacher whose sermons, which were often spiced with humour, were widely translated and extremely successful in sales.

Reared a Congregationalist, Spurgeon became a Baptist in 1850 and, the same year, at 16, preached his first sermon. In 1852 he became minister at Waterbeach, Cambridgeshire, and in 1854 minister of New Park Street Chapel in Southwark, London. Within a year a new structure had to be built to accommodate his following, and almost immediately an even larger church was required. From the opening in 1861 of the tabernacle, which held 6,000, until his death, he continued to draw large congregations.



Spurgeon, detail of an oil painting by Alexander Melville, 19th century; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

The editor of a monthly magazine, Spurgeon also founded a ministerial college (in 1856) and an orphanage (1867). His sermons, which he published weekly, ultimately filled more than 50 volumes in the collected edition. An ardent fundamentalist, he distrusted the scientific methods and philological approach of modern biblical criticism and in 1887 left the increasingly liberal Baptist Union.

**Spurius** (ancient Roman personal name, or praenomen): *see under* gens or family name or honorific (*e.g.,* under Cassius for Spurius Cassius Vecellinus).

**spurred snapdragon:** *see* toadflax.

**Spurs, Battle of the** (1302): *see* Golden Spurs, Battle of the.

**Sputnik,** any of a series of artificial Earth satellites whose launching by the Soviet Union beginning on Oct. 4, 1957, inaugurated the Space Age. Sputnik 1, the first satellite launched by man, was a 184-pound (83.6-kilogram) capsule. It achieved an Earth orbit with an apogee (farthest point from Earth) of 584 miles (942 km) and a perigee (nearest point) of 143 miles (230 km), circling the Earth every 96 minutes and remaining in orbit until early 1958 when it fell back and burned in the Earth's atmosphere. Sputnik 2 carried the dog Laika, the first living creature to be shot into space and orbit the Earth. Eight more Sputnik missions with similar satellites carried out experiments on a variety of animals to test spacecraft life-support systems; they also tested reentry procedures and furnished data on space temperatures, pressures, particles, radiation, and magnetic fields.

**Spyri, Johanna,** *née* HEUSSER (b. June 12, 1829, Hirzel, Switz.—d. July 7, 1901, Zürich), Swiss writer whose story for children, *Heidi,* is known all over the world. Her psychological insight into the child mind, her humour, and her ability to enter into childish joys and sorrows give her books attraction and lasting value.

After her marriage in 1852 to Bernhard Spyri, a lawyer engaged in editorial work, she moved to Zürich. Her love of homeland, feeling for nature, unobtrusive piety, and cheerful wisdom gave both her work and her life their unique quality. Her books include *Ein Blatt*



Johanna Spyri

By courtesy of the Bibliotheque Nationale Suisse, Bern

*auf Vronys Grab* (1870; "A Leaf from Vrony's Grave"), *Heidi,* 2 vol. (1880–81), *Heimatlos* (1881), and *Gritli* (1882).

**squab,** variety of domestic pigeon (*q.v.*) raised for its meat.

**squall,** sudden wind-speed increase of 8 metres per second (18 miles per hour) or more, to a peak speed of 11 metres per second (25 miles per hour) or more, for one minute or longer. It includes several briefer wind-speed changes, or gusts. A squall is often named after the weather phenomenon that accompanies it, such as rain, hail, or thunder; a line squall is one associated with a squall line of thunderstorms that is often hundreds of kilometres long. Cold air descending from slopes produces some squalls, such as the bora on the Adriatic coast of Italy and the Balkans; moving cold fronts cause others, such as the norther in North America.

**Squanto,** also called TISQUANTUM (d. November 1622, Chatham Harbor, Plymouth Colony [now Chatham, Mass., U.S.]), native American Indian interpreter and guide.

Squanto was born into the Pawtuxet tribe that occupied lands in present-day Massachusetts and Rhode Island. Little is known about his early life. Some authorities believe that he was taken from home to England in 1605 by George Weymouth and returned with explorer John Smith in 1614–15. He was, in any event, seized with other Indians by one of Smith's men, Thomas Hunt, who took them to the Mediterranean port of Málaga, Spain, to be sold into slavery. Squanto somehow escaped to England and joined the Newfoundland Company. He returned home in 1619 on his second trip back to North America only to find that his tribe had been wiped out by disease.

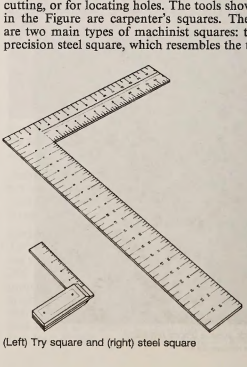
During the spring of 1621, Squanto was brought to the newly founded Pilgrim settlement of Plymouth by Samoset, an Indian who had been befriended by the English settlers. Squanto, who had been living with the Wampanoag tribe since his return from England, soon became a member of the Plymouth colony. Because Squanto was fluent in English, Governor William Bradford made him his Indian emissary, and he then served as interpreter for Edward Winslow, the Pilgrim representative, during his negotiations with Massasoit, chief of the Wampanoags. Squanto died while guiding Bradford on Cape Cod.

**Squarcione, Francesco** (b. 1397, Padua, Carrara [now in Italy]—d. *c.* 1468, Padua), early Renaissance painter who founded the Paduan school.

Squarcione was associated in 1434 with the influential Tuscan painter Fra Filippo Lippi during the latter's stay in Padua. His two extant panel paintings, a Madonna in a museum of the Prussian Cultural Property Foundation in Berlin and a polyptych of 1449–52 in the Civic Museum of Padua, show the influence of the Florentine early Renaissance style, especially that of the sculptor Donatello, who worked in Padua from 1443 to 1453. The only record of his mature style is contained in a cycle of frescoes of scenes from the life of St. Francis on the exterior of San Francesco at Padua (*c.* 1452–66). Such compositions as can be reconstructed confirm the traditional view of Squarcione as one of the channels through which the early Renaissance style of Florence diffused in Padua. According to Scardeone (the prime source for knowledge of the painter's work), Squarcione had 137 pupils. Among the artists he taught or influenced were Andrea Mantegna, Marco Zoppo, Giorgio Schiavone, and Cosmè Tura.

**square,** in geometry, a plane figure with four equal sides and four right (90°) angles. A square is a special kind of rectangle (an equilateral one) and a special kind of parallelogram (an equilateral and equiangular one). A square has four axes of symmetry, and its two finite diagonals (as with any rectangle) are equal. Bisection of a square by a diagonal results in two right triangles. If the length of the side of a square is $s$, then the area of the square is $s^2$, or "$s$ squared." From this relation is derived the algebraic use of the term *square,* which denotes the product that results from multiplying any algebraic expression by itself.

**square,** in measurement, device consisting of two straightedges set at right angles to each other. It is used by carpenters and machinists for checking the correctness of right angles, as a guide when drawing lines on materials before cutting, or for locating holes. The tools shown in the Figure are carpenter's squares. There are two main types of machinist squares: the precision steel square, which resembles the try



(Left) Try square and (right) steel square

square in the Figure but is not graduated, and the combination square set. The latter consists of a steel ruler and three attachments that can slide and be clamped on it—namely, the centre head, the protractor, and the square head. The centre head has two legs situated at right angles to each other that straddle the ruler in such a way that one edge of the ruler bisects the right angle; when the legs are in contact with a circular cylinder near one end, the edge of the ruler can be used as a guide for drawing a diametral line on the end of the cylinder.

The protractor has a blade that can be set at any angle relative to the axis of the ruler. The square has two main surfaces, one at right angles to the ruler axis and one at 45 degrees.

In drafting, a T-shaped instrument known as a T square is used for establishing a horizontal reference on the drafting board.

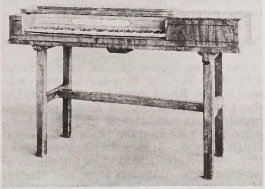
**square dance,** dance for four couples (or groups of four couples) standing in square formation, the most popular and widely known type of folk dance in the United States. It was called the square dance to distinguish it from comparable dances called the contra, or longways dance, for a double file of couples, and from the round dance for a circle of couples. Historians trace the origin of the square dance to both the Kentucky running set of English derivation and to the cotillon, a stately French dance in square formation, popular at the court of Louis XV but supplanted later by the quadrille (also a "square" dance).

The Americanized quadrille, or square dance, begins and progresses rapidly in well-ordered patterns within the framework of a relatively compact square, sets of four couples forming its four sides. To the traditional accompaniment of accordion, banjo, fiddle, and guitar and to prompting, patter, and singing calls made by a "caller," couples perform a variety of movements, all based on a smooth, "shuffling" walk. (Stepwork is less important than the cooperative movement.) Formerly danced in five main figures, the contemporary square dance is composed of three.

**Square Deal,** description by U.S. President Theodore Roosevelt (served 1901–09) of his personal approach to current social problems and the individual. It embraced Roosevelt's idealistic view of labour, citizenship, parenthood, and Christian ethics. Roosevelt first used the term following the settlement of a mining strike in 1902 to describe the ideal of peaceful coexistence between big business and labour unions. The Square Deal concept was later largely incorporated into the platform of the Progressive Party, when Roosevelt was its presidential candidate in 1912.

**square piano,** musical instrument that was popular for domestic music-making from the time of its invention in the mid-18th century (possibly by the Saxon organ-builder Ernst Christian Friderici) to about 1860 in Europe and to about 1880 in the United States. This type of piano was introduced in France by the instrument-builder Sébastien Érard (*c.* 1777) and was already popular in England after about 1760, thanks largely to the efforts of Johann Christoph Zumpe and other immigrant German builders, who concentrated on building square pianos with a simple, so-called single action (mechanism) that was adequate for the demands of most salon music.

The strings of the square (actually rectangular) piano run horizontally across the instrument from side to side, like those of a clavichord, which probably was the source of the design. The earliest square pianos were difficult to keep in tune, but engineering improvements and the introduction of metal frames stabilized the case. The compass gradually grew from the original five octaves but seldom reached the 88-key range of modern pianos. The soundboard likewise grew in size, and late square pianos were often longer than



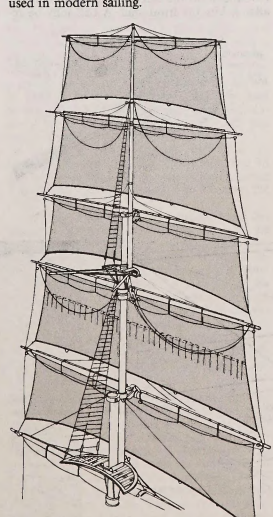
Square piano by Johann Christoph Zumpe, 1767; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London

6 feet (1.8 m) and heavier than comparable grand pianos. Near the end of the 19th century, square pianos were supplanted by upright pianos, which allowed larger soundboards, extended range, and reduced weight and floor space.

**square root,** in mathematics, a factor of a number that when multiplied by itself gives the number. *See* root.

**square sail,** simplest form of rigging and the most ancient. The sails are attached to yards (crossbars) that are hung at their centres from the mast, and there are as many as five yards, one above the other. The characteristic of the square sail, apart from its shape, is that it always presents the same face to the wind, though the yard may pivot considerably about the mast. The square sail was the only rigging used in northern European waters until late in the Middle Ages, but by the 11th century it could be turned to catch the wind on the beam. Ultimately, it was combined with the more versatile fore-and-aft lateen sail of the Mediterranean to produce the full-rigged ship of the age of exploration. Square sails are little used in modern sailing.



Square sail

From Bjorn Landstrom, *The Ship*, illustration copyright 1961 by Bjorn Landstrom, reproduced by permission of Doubleday & Company, Inc.

**squaretail** (trout): *see* brook trout.

**squaring,** in painting, simple technique for transferring an image from one surface to another (and sometimes converting the image from one scale to another) by nonmechanical means. The original work to be transferred is divided into a given number of squares; the same number of squares is then marked off—with charcoal or some other easily removable medium—on the surface of the receiving area. The contents of each square of the original are then drawn in the corresponding square of the reproduction. The use of the grid ensures the accurate placement of images onto the reproduction.



"The Holy Family," black chalk drawing with squaring by Giovanni Battista Salvi, called Sassoferrato; in the E.B. Crocker Art Gallery, Sacramento, Calif.

By courtesy of the E.B. Crocker Art Gallery, Sacramento, California

The Egyptians used squaring at least 5,000 years ago. It has been used to transfer cartoons onto murals, to transfer preparatory drawings onto canvas paintings, and to alter the scale of any work in the same media.

**squash,** any of various fruits of plants (genus *Cucurbita*) of the gourd family (Cucurbitaceae), widely cultivated as vegetables and for livestock feed. The principal species are *C. maxima* and certain varieties of *C. pepo.*

Summer squash is a quick-growing, small-fruited, nontrailing or bush type of *C. pepo.* Plants are upright and spreading, 45 to 75 cm (18 to 30 inches) high, and produce a great diversity of fruit forms, from flattened, through oblong, to elongate and crooked fruits, coloured from white through cream to yellow, green, and variegated. Fruit surfaces or contours may be scalloped, smooth, ridged, or warty. The fruits develop very rapidly and must be harvested a few days after they form (before the seeds and rinds harden) and used soon after harvest.

Winter varieties of squash, *C. maxima,* are long-vining, generally large-fruited, long-season kinds. The fruits after harvest can be stored many months (into wintertime) if kept dry and well above freezing. The fruit stems are greatly enlarged next to the fruits; the fruits show a wide range of sizes, shapes, and colours; and the rinds are relatively harder than those for summer squash and usually inedible to human tastes. *See also* pumpkin.

Some squash may be indigenous to Asia, but most evidence suggests that squash is native to the New World, where it was widely cultivated by the Indians before European settlement.

The fruit is usually served as a cooked vegetable, and the blossoms may also be cooked and eaten.

**squash bug** (insect): *see* coreid bug.

**squash rackets,** also called SQUASH, rackets also spelled RACQUETS, singles or doubles game played in a four-walled court with a long-handled strung racket and a small rubber ball. The game is played on exactly the same principle as rackets but in a smaller court.

Squash is usually played by two people, but it can be played by four (doubles).

Two different varieties of game are played: softball (the so-called "British," or "international," version) and hardball (the "American" version). In softball, which is the standard game internationally, the game is played with a softer, slower ball on the kind of wide, tall court shown in the accompanying diagram. The ball stays in play far longer, and there is more court to cover, making it a physically demanding game that requires fitness, patience, and deliberation. Hardball squash, which is popular in the United States, is played on a narrower court with a harder, faster ball. The hardball game emphasizes quick reactions and creative shot making.

*History.* Squash rackets is a descendant of rackets, having probably originated around the middle of the 19th century at Harrow School in England. Students there who were unable to get into the rackets court took their exercise hitting an India-rubber ball, which squashed when hit against a wall. The new game soon became popular in other English boarding schools. In the 1890s private courts were built, and, after the turn of the century, club courts appeared at Bath, Queen's, and the Marylebone Cricket Club.

Not until after World War I did squash rackets catch on, and in the 1920s the game spread rapidly, becoming more popular than its parent game, rackets. Many courts were built in clubs, schools, and colleges. Rules were formulated; the English national association was organized; and dimensions of the court were established, along with regulations in regard to the ball and racket. Many competitions began: the Professional Championship in 1920, the Amateur Championship for men and women in 1922, and the Open Championship in 1930. International competition with the United States began with the sending of a British team to the United States in 1924, though such competition was later hampered by differences in British and American courts, balls, and methods of scoring.

In the United States the game played in the early years was actually squash tennis, using a lawn tennis ball and tennis racket. Squash tennis has been supplanted by squash rackets in most American cities but continues to have a following.

From England the game spread throughout the British Empire—to Canada, India, Australia, and South Africa. Today squash is played throughout the world. The World Squash Federation (WSF) promotes the game and coordinates tours and championships between nations. The WSF membership has grown to some 115 nations, each of which also belongs to one of five regional squash federations.

Outstanding squash players have included F.D. Amr Bey, an Egyptian amateur who won several British open titles in the 1930s; the Khans of Pakistan, a family of professional players and teachers who often dominated open play from the 1950s to the 1990s; Janet Morgan, British women's champion from 1949–50 to 1958–59 and the winner of American and Australian titles; and Heather McKay (*née* Blundell), the Australian who won the British women's championship from 1961–62 to 1976–77, as well as other championships.

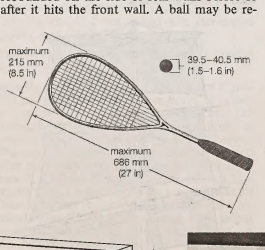
*The game.* The international version of squash is played on an enclosed rectangular court that is 32 feet (9.75 m) long and about 21 feet (6.4 m) wide. The main features of the court are, on the front wall, a service line above which a ball must bounce on a serve. Below this service line on the front wall is a board or metal liner, which extends to a height of 18.9 inches (48 cm) from the floor and which, if hit by a ball, results in a lost play or point for the striker. Another line delimits the height of play along the front and side walls. The "short line" on the floor marks the point beyond which a served ball must bounce on the floor, and the rear area enclosed by this line is divided into two smaller rectangles that function as service boxes, within one of which the server must stand while serving and within the other of which the ball that he has served must bounce on the floor.

The object of the game is to bounce, or rebound, the ball off the front wall in such a way that the opponent is unable to reach it and rebound it off the front wall in his turn. In serving and at any other time, the ball may be bounced directly off the front wall or it may be rebounded off the side or rear walls before or after it hits the front wall. A ball may be returned before it has bounced once on the floor (after rebounding off the front wall), but, after it has bounced on the floor more than once, the ball is dead. A player must give his opponent a fair chance at reaching the ball, which often means getting out of the other's way after having made one's shot. Under British rules, a point is scored only if the winner of a rally (exchange, or succession, of shots) was the one who served the ball; if he was not, the winner of the rally becomes the server, and if he wins consecutive rallies he serves consecutively. In American play, a point is scored by the winner of a rally irrespective of who served.

A game can consist of 9 or 15 points, with a tie at the 8-, 13-, or 14-point mark being decided by a tie-breaking system of play. The small, highly responsive squash ball is propelled at high speeds both to and from the front wall, and the pace of play is accordingly swift. The players try to put one another out of reach of a shot by skilled placement and by varying the speed of their shots. The game demands good eye-hand coordination and, above all, quick reflexes.

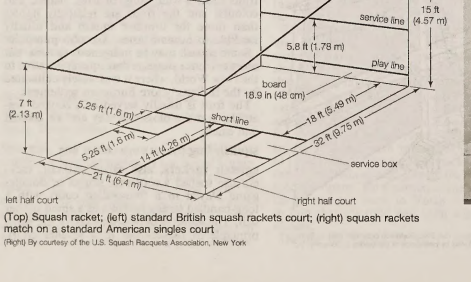
The squash racket itself is similar to that used in the game of rackets, but the handle is shorter; the American racket is heavier than the British. The ball is made of rubber or of a rubber and butyl composition.

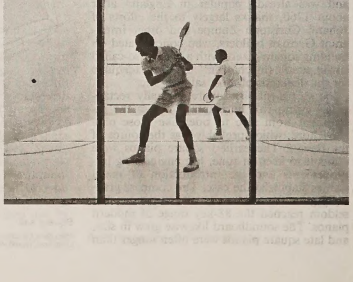
The standard British court has four walls, usually of wood. The dimensions and markings of the British court are shown in the accompanying diagram. The board, or telltale, is a strip of sheet metal or other resonant material that produces a clearly different sound when the part of the front wall "out-of-play" is hit. The standard court for the American version is considerably narrower than the English court, being 5.6 m (18 feet 6 inches) wide, and some other dimensions are also slightly different. Doubles courts are 13.7 m (45 feet) by 7.6 m (25 feet).




**squash tennis,** racket game resembling squash rackets (*q.v.*) played by two people only in a four-walled court using a lively inflated ball that bounces very fast and is the size of a tennis ball. The game requires great speed in anticipation and turning.

Squash tennis is played in the same court as squash rackets. There are minor differences in the line markings, such as the "out" line on the back wall being two feet lower than for squash rackets. Players use a lawn tennis racket, an inch shorter in the handle, and a green, pressurized ball, similar to but slightly smaller than the tennis ball. Scoring is the same as in American squash rackets. Points were scored only by the server until a change



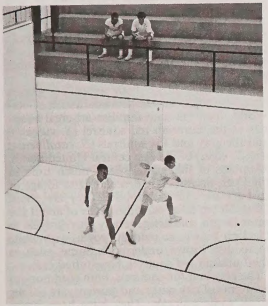



(Top) Squash racket; (left) standard British squash rackets court; (right) squash rackets match on a standard American singles court

(Right) By courtesy of the U.S. Squash Racquets Association, New York

made in 1954 allowed hand-out to score as well.

Squash tennis makes fewer demands than squash rackets on the legs in pursuing the ball, but puts a greater premium on agility and quickness of foot and reflexes in turning and spinning. The ball caroms off the front, side, and back walls in dizzying action. It is so volatile that it may rebound from the front wall to the back wall and again to the front wall. Squash rackets is largely a game of



Squash tennis
By courtesy of the University of Pennsylvania, Philadelphia; photograph, Lawrence S. Williams, Inc.

wrist and touch, as well as of the arm. The squash tennis stroke is more comparable to the free-swinging lawn-tennis drive. The volley—returning the ball before it touches the floor—is important in both squash games.

**squatter,** in 19th-century Australian history, an illegal occupier of crown grazing land beyond the prescribed limits of settlement. The inroad of squatters contributed to the growth of the country's wool industry and to the development of a powerful social class in Australian life. By the late 1840s the authorities recognized the economic good derived from the squatters' activity and issued them leases for their sheep runs and tenure extending as long as 14 years. By this time the squatters had a hold on the land; many had become wealthy grandees.

The 1850s saw a large influx of immigrants, as well as thousands of miners drawn to Australia by the gold strikes. A cry for land was raised from this quarter, which challenged the squatters' position. The cry was strong enough to prompt the Legislative Assemblies of the various colonies to pass "selection" acts in subsequent years. Generally, these provided for the sale of land at auction, forcing squatters to bid against prospective farmers for the land that they already controlled by leasehold. The wealthy squatters were able to purchase the choicest land, but much grazing area fell into the hands of small farmers, who found the agricultural yield disappointing. Their hostility against the selectors and their rugged pioneer ethos led the squatters often to resist social and political change.

**squatter sovereignty** (U.S. history): *see* popular sovereignty.

**squatters' rights:** *see* preemption.

**Squaw Valley,** world-famous winter sports area in Placer County, eastern California, U.S., just northwest of Lake Tahoe. The focus of a state recreation area, it was the site of the 1960 Winter Olympics and has ice-skating facilities, ski lifts, trails and slopes to Squaw Peak (8,960 ft [2,731 m]). Alpine Meadows ski resort is immediately to the south.

**squawfish,** any of several edible fishes of the genus *Ptychocheilus* found in the rivers



Squawfish (*Ptychocheilus grandis*)
Painting by Gilbert Emerson

of western North America. They are the largest members of the carp family (Cyprinidae) in North America. Squawfishes are long, large-mouthed, pike-like fishes. Voracious carnivores, they make lively sport fishes. The largest species, the Colorado River squawfish, or white salmon (*P. lucius*), may grow to about 1.5 metres (5 feet) with a reported weight of about 36 kilograms (79 pounds); because of changes in its habitat, this species has declined significantly and is considered endangered.

**Squibb, E(dward) R(obinson)** (b. July 4, 1819, Wilmington, Del., U.S.—d. Oct. 25, 1900, Brooklyn, N.Y.), U.S. chemist and pharmaceutical manufacturer who developed methods of making pure and reliable drugs and founded a company to manufacture them.

During the four years when Squibb served on various ships as a U.S. Navy medical officer, he observed the poor quality of medicines supplied to the Navy. He persuaded the Navy to manufacture their own drugs instead of contracting for them from the lowest bidder. In 1851, he was appointed to Brooklyn Naval Hospital. He set up a laboratory there and built the first still for making anesthetic ether. The ether was heated by steam passing through a coil rather than by open flame, which had been dangerous. Squibb did not patent this process or any of his later discoveries. Instead, he published his design in 1856 in *The American Journal of Pharmacy*. Between 1852 and 1857, he discovered processes for making chloroform, fluid extracts, bismuth salts, and other preparations.

After Squibb had resigned from the Navy, Dr. Richard S. Satterlee, surgeon general of the U.S. Army, suggested that Squibb start a laboratory of his own to supply the Army with reliable drugs. After borrowing $1,300 from a friend, he set up a laboratory in Brooklyn in 1858. Less than a month later, it burned to the ground in an ether explosion. Squibb saved the records of his experiments but was badly burned in the process.

A year later, his laboratory had been rebuilt and he sent out a circular advertising 38 preparations. By 1883, he was manufacturing 324 products and selling them all over the world.

His drugs and medicines were in great demand in the Civil War. After the war, he campaigned for better enforcement of the laws regulating the import of drugs. He helped revise the *Pharmacopoeia,* the basic code book of American pharmacy. From 1882 until his death, he also wrote and published *Ephemeris,* a journal of practical advice and new discoveries, to update the *Pharmacopoeia.*

His inventions include the automatic zero burette and a specific gravity apparatus. In 1892, his two sons joined the firm, which became E.R. Squibb & Sons.

**squid,** any of numerous 10-armed cephalopods (order Teuthoidea) found in both coastal and oceanic waters. Squids may be swift swimmers or part of the drifting sea life. They range in size from about 1.5 centimetres (less than ¾ inch) to more than 20 metres (more than 65 feet), including the tentacles.

Squids have elongated tubular bodies and short compact heads. Two of the 10 arms have developed into long slender tentacles with expanded ends and four rows of suckers with toothed, horny rings. The body of most squids is strengthened by a feathery-shaped, internal shell composed of a horny material. Squid eyes, almost as complex as human eyes, are usually set into the sides of the head.

Little is known of the life history of squids. Some attach their eggs to floating weeds and others to the ocean bottom. In some species the young resemble the adults at hatching; in others there is a planktonic larval stage.

The luminescent squids bear numerous light organs, which may be for recognition and for attracting prey.



Squid (*Illex coindeti*) swimming forward
Douglas P. Wilson

Squids are numerous in the sea and serve as food for many animals, including the sperm whale, bony fishes, and man.

**Squier, E(phraim) G(eorge)** (b. June 17, 1821, Bethlehem, N.Y., U.S.—d. April 17, 1888, Brooklyn, N.Y.), U.S. newspaper editor, diplomat, and archaeologist who, with the physician and archaeologist Edwin H. Davis, conducted the first major study of the remains of the pre-Columbian North American Mound Builders. He also carried out explorations in Central America, Peru, and Bolivia in an effort to find the origins of the Mound Builder civilization.

As a young man, Squier went to the heartland of the Ohio mound country to edit a newspaper at Chillicothe and began to explore the prehistoric earthworks. Between 1845 and 1847 he and Davis probed some 200 mounds, studied about 100 earthwork enclosures, and collected a large number of artifacts. Their findings appeared in the beautifully illustrated *Ancient Monuments of the Mississippi Valley* (1848), the first publication of the Smithsonian Institution. Immediately recognized as a major work of American archaeology, it remains significant to the present time. In addition to summarizing contemporary knowledge of the mounds, it also served as a model for later research. Squier's subsequent study of the mounds in New York was described in another valuable work, *Aboriginal Monuments of the State of New York* (1851).

In 1849 Squier went to Nicaragua as U.S. chargé d'affaires to Central America and secured an agreement, never ratified, permitting U.S. construction of an interoceanic canal across Nicaragua. The mission allowed him to travel widely and explore antiquities around Granada and on the islands in Lake Nicaragua. His findings appeared in *Nicaragua: Its People, Scenery, Monuments, and the Proposed Interoceanic Canal,* 2 vol. (1852). For the next 20 years, while occupied with developing a railway across Honduras, he wrote several books and a number of papers on the archaeology, ethnology, and linguistics of Honduras, Nicaragua, and El Salvador. As U.S. commissioner to Peru (1863–65), he settled financial claims and was able to visit a number of ancient sites, including the remains of the pre-Inca Chimú civilization, then scarcely known. His observations were published in *Peru: Incidents of Travel and Exploration in the Land of the Incas* (1877).

**squill,** any of the bulbous plants of the genus *Scilla* of the family Liliaceae, consisting of

about 100 species, native to temperate Eurasia. The narrow, sometimes grasslike leaves arise from the base of the plant.



Cuban lily or Peruvian jacinth (*Scilla peruviana*)
A to Z Botanical Collection

The squill's small white, blue, or purple flowers are borne in a cluster at the tip of a leafless flower stalk. Some spring-flowering species are cultivated as garden ornamentals.

**squinch,** in architecture, any of several devices by which a square or polygonal room has its upper corners filled in to form a support for a dome: by corbelling out the courses of masonry, each course projecting slightly beyond the one below; by building one or more arches diagonally across the corner; by building in the corner a niche with a half dome at its head; or by filling the corner with a little conical vault that has an arch on its outer diagonal face and its apex in the corner.

The arched squinch that is often used in Byzantine architecture originally seems to have been developed, almost simultaneously, by the Roman builders of the late imperial period and the Sāsānians in Persia. In Italy the Romanesque squinch form is either the conical type as in the church of S. Ambrogio at Milan or a succession of arched rings as in the 13th-century central tower of the abbey church at Chiaravalle. More complex forms with niches and colonnettes are characteristic of the French Romanesque of Auvergny, as in the cathedral of Le Puy-en Velay (late 11th and early 12th centuries); churches of southwestern France, such as Saint-Hilaire at Poitiers, use conical squinches of the Italian type.

Islāmic architecture, borrowing from the Sāsānian precedent, makes great use of squinch forms (*see* pendentive). The stalactite work (*q.v.*), which is so marked a feature of later Islāmic architecture, is, in essence, merely a decorative development of a combination of niche squinch forms. In Gothic architecture squinch arches are frequently used on the insides of square towers to support octagonal spires.

**squint** (eye disorder): *see* strabismus.

**squint** (architecture): *see* hagioscope.

**Squire, Sir J(ohn) C(ollings)** (b. April 2, 1882, Plymouth, Devon, Eng.—d. Dec. 20, 1958, Rushlake Green, Sussex), English journalist, playwright, a leading poet of the Georgian school, and an influential critic and editor.

Squire was educated at Blundell's School and at St. John's College, Cambridge University. He was appointed literary editor of the *New Statesman* in 1913, and acting editor in 1917. From 1919 to 1934 he was editor of the *London Mercury,* which was to become the unofficial organ of the Georgian poets. His poetry appeared in *Collected Parodies* (1921), *Poems in One Volume* (1926), *Selected Poems* (1948), and *Collected Poems* (1959), volumes that show technical competence as well as a delightful sense of parody. Squire also collaborated with J.L. Balderston on the hit play *Berkeley Square* (performed 1926), an adaptation of Henry James's *The Sense of the Past.* He was knighted in 1933.

**Squires, Sir Richard Anderson** (b. Jan. 18, 1880, Harbour Grace, Nfd.—d. March 26, 1940, St. John's), controversial prime minister of Newfoundland (1919–23; 1928–32) who gained a reputation for being opportunistic, extravagant, and corrupt but whose promotion of education and industrial development laid the foundation for the Newfoundland Liberal Party's emergence as the dominant political force in the province after its union with Canada in 1949.

Squires was elected to the Newfoundland House of Assembly in 1909 as a member of the People's Party, at that time led by his law partner Edward Patrick Morris, 1st Baron Morris. In 1917, during World War I, the party joined with the Liberals to form a war coalition government. In 1914–19 Squires served on the Legislative Council; he was minister of justice and attorney general in 1914–17 and colonial secretary in 1917–18. When a Liberal, William Lloyd, became prime minister in 1918, Squires left the coalition, denouncing, in particular, the participation in the government of the Liberal backer William Coaker, president of the Fisherman's Protective Union. When, however, Sir Michael Patrick Cashin reorganized the government in a more conservative direction the following year, dropping Coaker, Squires joined the Liberals and formed an alliance with Coaker that later proved advantageous to Squires' career. As prime minister, Squires helped develop education and industry, but the Great Depression of the 1930s finished his career. He was knighted in 1921.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**squirrel,** generally, any rodent of the family Sciuridae (order Rodentia); the name is sometimes restricted to the familiar, bushy-tailed, arboreal species. Squirrels are found almost worldwide, in a variety of habitats, including forests, deserts, plains, and tundra. There are about 50 genera and 260 species, among them the ground squirrels, marmots, and chipmunks.

Many squirrels are arboreal. Some (as marmots) are terrestrial; others (flying squirrels) glide from tree to tree by means of furry flaps of skin connecting their forelegs and hind legs. All squirrels have strong hindlegs and well-developed, hairy tails. They differ widely in colour and markings and vary in form from slender (flying squirrels) to stout (marmots). Total length ranges from about 10 centimetres (4 inches) in the African pygmy squirrel (*Myosciurus pumilio*) to about 90 cm in the giant squirrels (*Ratufa*) of Asia.



Eurasian red squirrel (*Sciurus vulgaris*)
Schunemann—Annan Photo Features

All squirrels except the gliders are diurnal. Tree dwellers are agile, live in tree hollows or nests built of leaves and twigs, and are usually active throughout the year. Ground dwellers live in burrows, and many become dormant in winter (hibernate) or summer (estivate). Squirrels are primarily vegetarian and are noted for their fondness for seeds and nuts. Some species eat insects or supplement their diets with animal protein. Females bear one or more litters a year, of 1 to 15 young; gestation is 22 to 45 days.

The genus *Sciurus,* with about 55 species found through most of Eurasia and the New World, includes such familiar arboreal squirrels as the Eurasian red squirrel (*S. vulgaris*) and the gray and fox squirrels (*S. carolinensis* and *S. niger*) of the east central United States. Members of this genus spend much time in the trees, occasionally descending to forage or to bury nuts in the ground. They are about 20 to 30 cm long, excluding tails of about the same length, and are generally gray, grayish to blackish brown, or reddish brown, with white to reddish brown underparts. Some, such as the Eurasian red squirrel, have tufted ears.

The gray and fox squirrels, both common inhabitants of city parks and gardens, are edible, small game animals. They have been introduced into western North America and (gray squirrel) into Britain and South Africa. The Eurasian red squirrel, which in colder climates sometimes is hunted for its thick winter fur, is a native of forests from Britain to Japan. In parts of Britain, it has been replaced by the gray squirrel.

The North American red squirrels (*Tamiasciurus*) are highly vocal, reddish brown animals that live primarily in coniferous forests and habitually collect large stores of pinecones for winter use. There are two species: the red, or spruce, squirrel (*T. hudsonicus*), found from Alaska to New Mexico and South Carolina; and the Douglas squirrel, or chickaree (*T. douglasii*), found from British Columbia to California. The former is about 20 cm long, without the 10- to 15-cm tail, and has white underparts; the Douglas squirrel is slightly smaller and has reddish brown underparts.

There are a number of arboreal squirrels native to Africa. Notable species include: the giant forest squirrel (*Protoxerus stangeri*), a speckled brownish or blackish animal; about a dozen species of African striped squirrels (*Funisciurus*), with one or more longitudinal stripes on their backs; about 12 species of African bush squirrels (*Paraxerus*), which are speckled grayish yellow to bright reddish brown, with or without stripes; and sun squirrels (*Heliosciurus*), which are solid-coloured, sometimes greenish squirrels.

There are also a number of tree-dwelling squirrels in Asia. Among them are: Asiatic striped palm squirrels (*Funambulus*), chipmunk-like, gray brown to blackish animals; four species of giant, or rock, squirrels (*Ratufa*), agile, variably coloured squirrels whose coats may be white, black, yellowish to reddish brown, or gray; and Oriental tree squirrels (*Callosciurus,* about 20 species), which are thick-furred, often brightly coloured inhabitants of eastern Asia.

For terrestrial squirrels, *see* chipmunk; ground squirrel; marmot; prairie dog. For gliding squirrels, *see* flying squirrel.

**squirrel corn** (*Dicentra canadensis*), wild flower of eastern and midwestern North American woodlands belonging to the fumitory family (Fumariaceae). It takes its name from the nodule-like, yellow tubers that cluster



Squirrel corn (*Dicentra canadensis*)
G. Tomsich—Shostal

along the rootstock. The fernlike leaves and flower stalks spring from these tubers. The tremulous, two-lobed flowers resemble those of the bleeding heart (*D. spectabilis*), to which it is related. The plant is approximately 30 cm (1 foot) tall.

**squirrel monkey,** either of two (and possibly more) species of arboreal monkeys constituting the genus *Saimiri* of the family Cebidae. The squirrel monkeys are the most common primates in riverside forests of Central America, the Guianas, and the Amazon River basin. These monkeys associate in groups, sometimes of several hundred. They are attractive animals measuring 25–40 cm (10–16 inches) long, with a heavy, nonprehensile, 37–47-centimetre tail.

They have small, expressive faces; large eyes; large, generally tufted ears; and short, soft fur. Their muzzles are dark, their faces white, and their tail tips black. Their colour is gray- to olive-green with whitish underparts and yellow or orange arms, hands, and feet. Common squirrel monkeys (*S. sciureus*) generally have olive or grayish crowns, while red-backed squirrel monkeys (*S. oerstedii*) have black crowns and reddish backs.

Squirrel monkeys are active during the day and troop single file after a leader along constantly used pathways in the trees. They sleep huddled together on branches, tails wrapped around their bodies. They are omnivorous and eat fruit, insects, and small animals. They bear a single young after gestation of about 5½ to 6 months. The young cling to the back of either the male or the female. Squirrel monkeys



Common squirrel monkey (*Saimiri sciureus*)
© GERRY ELLIS NATURE PHOTOGRAPHY

are delicate and susceptible to cold but are good laboratory animals and also make clean, affectionate, and gentle pets with a penchant for playing with hair. They may live 10 years or more in captivity and seem to do best when kept with others of their kind.

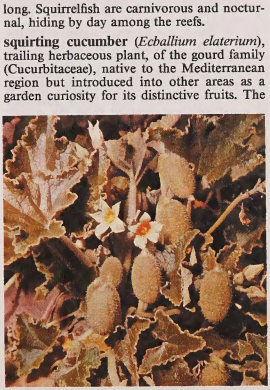
**squirrelfish,** also called SOLDIERFISH, any of about 70 species of large-eyed, colourful, tropical reef fish of the family Holocentridae (order Beryciformes). Squirrelfish are edible fish found throughout the tropics. They have spiny fins and rough, prickly scales; some also have a sharp spine on each cheek. Most squirrelfish are red in colour, and many are marked with yellow, white, or black. The largest species is probably *Holocentrus spinifer,* a Pacific squirrelfish growing about 60 cm (24 inches)



Squirrelfish (*Myripristis jacobus*)
Carl Roessler

long. Squirrelfish are carnivorous and nocturnal, hiding by day among the reefs.

**squirting cucumber** (*Ecballium elaterium*), trailing herbaceous plant, of the gourd family (Cucurbitaceae), native to the Mediterranean region but introduced into other areas as a garden curiosity for its distinctive fruits. The



Squirting cucumber (*Ecballium elaterium*)
G. Tomsich—Shostal

hairy, rough, thick-stemmed plant may spread out to about 60 cm (about 24 inches). It has yellow, bell-shaped flowers. The long-stalked, bluish green fruits, about 4 to 5 cm long, explosively eject their brown seeds as they detach from the stem upon reaching maturity. The seeds may travel 3 to 6 m (about 10 to 20 feet) from the plant.

**sraddha,** Sanskrit ŚRĀDDHA, also spelled SHRADDHA, in Hinduism, a ceremony performed in honour of a dead ancestor. The rite is both a social and a religious responsibility enjoined on all male Hindus (with the exception of some sannyasis, or ascetics). The importance given in India to the birth of sons is to ensure that there will be a male descendant to perform the sraddha ceremony after one's death.

The rite is performed for the deceased father, grandfather, and great-grandfather and also for the mother, grandmother, and great-grandmother. It is intended to nourish, protect, and support the spirits of the dead in their pilgrimage from the lower to higher realms, preceding their reincarnation and reappearance on Earth. The rites are performed between the 11th and 31st days after death, depending on caste traditions, and at regular intervals thereafter. The first annual death anniversary is observed by a sraddha ceremony that enables the deceased (*preta*) to be admitted into the assembly of forefathers (*pitr*).

**Sranantonga,** also called SRANAN TONGO, TAKI-TAKI, or NINGRE-TONGO, a creole language spoken in Suriname (formerly Dutch Guiana) in northeastern South America. Sranantonga originated as a pidgin based on English, spoken by slaves of African descent who worked on the plantations of Suriname. The pidgin was strongly influenced by the African languages native to the slaves, as well as by Portuguese, the language of the original Guianan plantation owners, who were Portuguese Jews. These latter were displaced by the English, whose language formed the basis for Sranantonga.

In the 17th century the part of Guiana in which Sranantonga was spoken was taken over by the Dutch, and since then Sranantonga has added a strong Dutch overlay. The language as spoken currently bears very little clear resemblance to Dutch, Portuguese, or English.

Examples of typical sentences in Sranantonga are *Mek konu gi-em moni en bai sani, dan eng sa go kir eng,* "Let the king give him money to buy things, then he will go (and) kill it"; *Mi sa gi(bi) yu tin sensi,* "I'll give you ten cents"; and *Mi doifi frei gowe, ma mi xoluk, dati tan,* "My dove flew away, but my luck, that stays."

Saramacca, another pidgin spoken by Guianan Bush Negroes, is also English-based, with Portuguese influences. However, it shows much greater evidence of African influence and less Dutch influence than does Sranantonga. Saramacca preserves an African system of pitches, a high pitch (marked by an acute accent) distinguished from a low pitch: *Mi tâ tyá deêsî dâ dí ómi,* "I am taking medicine to the man."

**Sraosha,** in Zoroastrianism, divine being who is the messenger of Ahura Mazdā and the embodiment of the divine word. His name, related to the Avestan word for "hearing," signifies man's obedient hearkening to Ahura Mazdā's word and also signifies Ahura Mazdā's omnipresent listening. Sraosha is the medium between man and God. Zoroastrians believe that no ritual is valid without his presence, and he is very prominent in Zoroastrian liturgy. Depicted as a strong and holy youth whose heavenly abode is a thousand-pillared house, he has, in addition, a protective role. It is Sraosha that Ahura Mazdā sends to chastise the demons that harass men. Thrice nightly he descends to earth to combat them, crushing their skulls. His strongest weapon is prayer. In the end of time, he will be the agent of the final extermination of evil. Sraosha also leads the righteous soul through the ordeal of judgment three days after its body's death.

**Śrauta-sūtra,** any of a number of Hindu ritual manuals used by priests engaged in the performance of the grander Vedic sacrifices, those requiring three fires and the services of many specialized priests. The manuals are called *śrauta* (from Sanskrit *śruti,* "revelation") because they are based directly on the older Vedic literature considered as a class to be *Śruti,* or revealed. The *Śrauta-sūtras,* together with the *Gṛhya-sūtras* (dealing with domestic ceremonies) and the *Dharma-sūtras* (dealing with rules of conduct), make up the *Kalpa-sūtras,* collections of brief aphoristic texts that emerged within the different schools of the Veda. Each *Śrauta-sūtra* guides the priests of its own particular Vedic school in the performance of specialized functions. The texts deal with such subjects as the laying of the three fires, the full and new moon ceremonies, and the various animal and soma sacrifices.

**Śrāvastī,** Pāli SĀVATTHI, city of ancient India, located near the Rāpti River in northeastern Uttar Pradesh.

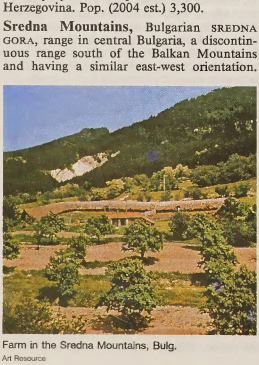
In Buddhist times (6th century BC–6th century AD), Śrāvastī was capital of the kingdom of Kosala and was important both as a prosperous trading centre and for its religious associations. It stood at the junction of three great roads connecting it with the great cities of eastern, northern, and western India. It was closely associated with the life of the Buddha and with figures significant in later Buddhist history. Its most important religious place was the Jetavana Monastery, erected in a garden outside the city walls and presented to the Buddha by a wealthy banker, Anāthapiṇḍaka. Other Buddhist monasteries were the Rājakārāma and the Pūrvārāma. Śrāvastī was also an important centre for the Jainas.

The city has been identified with the twin villages of Saheth and Maheth northwest of Balrāmpur. Today it is surrounded by a great rampart of earth and brick. Excavation has revealed three main periods, ranging from the earliest, characterized by pre-Buddhist painted grayware, to the early wares of the final occupation.

**Srebrenica,** town, eastern Bosnia and Herzegovina. The town's name is derived from the Serbo-Croatian word *srebro,* meaning "silver." Rich deposits of silver and lead discovered in the surrounding mountains led to the town's founding in 1387 as a mining centre. Lead and zinc mining remain important.

Srebrenica was a centre of commerce and trade in the 15th century. It was populated by Ragusan merchants and German miners and was the site of a Franciscan monastery when it was seized by the Turks in 1440. Srebrenica was converted to Islām in the mid-16th century despite strong local resistance. In the 20th century its population was largely Muslim, with a significant Serbian minority. During the conflict between Muslims and Bosnian Serbs in the 1990s, the town was declared a "safe area" for Bosniacs (Muslims) by the United Nations. Bosnian Serbs laid siege to the town in 1995, massacring some 7,000 Bosniacs. Several Bosnian Serbs were later convicted of war crimes by a UN tribunal at The Hague, Neth., for their role in the massacre. A report issued in 2002 criticized both the UN and Dutch peacekeepers, prompting the resignation of the entire Dutch government; a memorial cemetery to the victims of the massacre was dedicated in 2003. Srebrenica was included in Serb-held territory by the 1995 partition of Bosnia and Herzegovina. Pop. (2004 est.) 3,300.

**Sredna Mountains,** Bulgarian SREDNA GORA, range in central Bulgaria, a discontinuous range south of the Balkan Mountains and having a similar east-west orientation.



Farm in the Sredna Mountains, Bulg.
Art Resource

Structurally, the Sredna range is a part of the Rhodope Mountains, from which it is separated by the Thracian Plain. Between the Sredna and Balkan mountains lie several basins: from west to east, the basins are marked by the towns of Sofia, Srednogorie, Karlovo, Kazanlŭk, and Sliven.

The Sredna range has three parts. Westernmost is the Ikhtimanska (Ikhtiman) Sredna, 20 miles (32 km) southeast of Sofia. It is an irregular, forested, hilly region with a sparse population. Its eastern limit is the Topolnitsa River. From the Topolnitsa to the Struma River, a distance of 42 miles (68 km), lie the Sŭshtinska, or Syshtinska ("True"), Sredna Mountains, which have a sharper spine of resistant, intrusive rocks. The maximum elevation in this section, 5,262 feet (1,604 m), is that of Bogdan, a peak 17 miles (27 km) west of the town of Karlovo. The Topolnitsa and Struma rivers are important north-south transportation routes.

East of the Struma River valley is the Sŭrnena ("Deer") Range, which rises to its highest point of 4,054 feet (1,236 m) at the summit of Bratan (formerly Morozov), then dwindles eastward to the confluence of the Tundzha and Mochuritsa rivers. This section extends 85 miles (137 km) east-west.

To the north, the Sŭrnena Range faces the valley of the Tundzha River, which is impounded near Kazanlŭk by the Georgi Dimitrov Dam (completed in 1955); to the south, it slopes sharply to the Thracian Plain, which is drained by the Maritsa River. Small quantities of metal ores are obtained from the ranges; near Srednogorie, on the Topolnitsa River, is a large electrolytic copper works. The intermontane basins of Karlovo and Kazanlŭk are known collectively as the Valley of Roses owing to their production of attar of roses.

**Srednyaya Tunguska River** (Russia): *see* Podkamennaya Tunguska River.

**Sremski Karlovci,** German KARLOWITZ, Hungarian KARLOCA, also spelled CARLOWITZ, town in the autonomous *pokrajina* (province) of Vojvodina, Serbia, Serbia and Montenegro. It lies along the Danube River and on the road and rail routes from Belgrade to Subotica (in Vojvodina) and Hungary. In 1698–99 the village was the site of a 72-day congress that ended hostilities between the Ottoman Empire and various European states in the Treaty of Carlowitz. The town also was host in 1848 to an assembly of Vojvodina Serbs who declared the region's independence from Hungarian rule. The surrounding area is noted for its cereals and fodder crops and the fruit farms and vineyards of the Fruška Mountains. Pop. (2004 est.) 8,900.

**Śrī** (Hindu goddess): *see* Lakṣmī.

**Sri Gangānagar** (India): *see* Gangānagar.

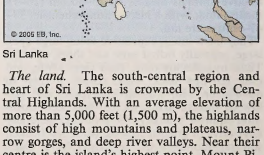
**Sri Indraditya,** also called SRI INDRAPATINDRADITYA, original name BANG KLANG HAO, Hao also spelled THAO (fl. *c.* 1240–60), founder and ruler of the kingdom of Sukhothai, the first independent Tai (Thai) state. Bang Klang Hao headed a petty Tai principality near Sukhothai when, about 1245, he joined with another Tai leader, Pha Muang, to rebel against the governor of Sukhothai, who was a deputy of the Khmer kings of Angkor. The two seized nearby Sawankhalok, and Bang Klang Hao defeated the Khmer governor in personal combat before Sukhothai. Pha Muang then conferred his own royal Khmer title on Bang Klang Hao, who as Śrī Indraditya now ruled independently. Over the ensuing century, Sukhothai grew and flourished as the preeminent Tai state of the region, particularly under Indraditya's second son, Ramkhamhaeng.

**Sri Jayewardenepura Kotte,** also called JAYAVARDHANAPURA KOTTE, legislative and judicial capital of Sri Lanka. It is located about 5 miles (8 km) southeast of Colombo, the country's administrative capital, in the suburb of Kotte. The new parliamentary complex of buildings, which are situated on an island in a lake and in a region of reclaimed swamps, opened in 1982. The name Sri Jayewardenepura is derived from the name of the 15th-century Sinhalese capital at Kotte *(q.v.).*

**Sri Lanka,** officially DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA, Sinhalese SRI LANKĀ PRAJATHANTHRIKA SAMAJAVADI JANARAJAYA, formerly CEYLON, island country in the Indian Ocean, separated from the southeastern coast of peninsular India by Palk Strait. This pear-shaped island extends about 268 miles (432 km) from north to south and about 139 miles (224 km) from east to west. Its capital is Colombo. Area 25,332 square miles (65,610 square km). Pop. (2003 est.) 19,065,000.

A brief treatment of Sri Lanka follows. For full treatment, *see* MACROPAEDIA: Sri Lanka.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.




Sri Lanka

*The land.* The south-central region and heart of Sri Lanka is crowned by the Central Highlands. With an average elevation of more than 5,000 feet (1,500 m), the highlands consist of high mountains and plateaus, narrow gorges, and deep river valleys. Near their centre is the island's highest point, Mount Pidurutalagala (8,281 feet [2,524 m]). Encircling this elevated region to the north and east are various lowlands. The eastern plains are undulating and dotted with isolated hills, while the northern lowlands region has flat, broad, and fertile plains drained by several small rivers and marked by occasional ridges. The coastal fringe to the north and east is speckled with marshes, lagoons, spits, and sand bars; on the southwest coast, however, steep hills descend toward the sea. The Mahaweli River, flowing from the Central Highlands to the northeastern coast, is the country's largest river.

Sri Lanka has an equatorial climate, with little seasonal temperature variation. Average temperatures range from 72° to 92° F (22° to 33° C) in the lowlands to as low as 44° F (7° C) in the mountains. The relative humidity is high in most places year-round. The island's position in relation to the Indian subcontinent and to the neighbouring seas has resulted in modification of the equatorial climate by the seasonal occurrence of monsoons, whose rainfall is not uniform; average annual rainfall varies from less than 40 inches (1,000 mm) in the Dry Zone of the north and east to more than 150 inches (3,750 mm) in the Wet Zone of the southwestern highlands. The natural vegetation, which covers one-third of the island, varies from dry mixed evergreen forests (ebony and satinwood) and thorn scrub in the Dry Zone to tropical wet evergreens and montane forests in the Wet Zone. Wildlife includes deer, leopard, bear, wild pig, elephant, and a variety of monkeys.

Mineral resources of Sri Lanka include graphite, iron ore, ilmenite (titanium ore), kaolin, and gemstones. Significant quantities

of sapphires, rubies, topazes, garnets, moonstones, and zircons are found in gravel-sized alluvium near the city of Ratnapura, in the southwest.

*The people.* The Sinhalese are the predominant ethnic group, constituting about three-fourths of the population. Other ethnic groups include the Tamils and the Muslims (partly descended from Arab seafarers and sometimes miscalled Moors). Sinhalese and Tamil are the official languages; English is also widely spoken. More than two-thirds of the populace (mostly the Sinhalese) adhere to Buddhism, while approximately one-sixth (the Tamils) are Hindus. Other religious groups include Muslims and Christians.

The population growth rate is one of the lowest in southern Asia, largely because of the country's comparatively low birth rate. Sri Lanka's population density, however, is extremely high. In an effort to alleviate social and economic problems related to high population density, the government has implemented measures designed to decrease fertility levels while maintaining a balance in immigration and emigration levels.

The infant mortality rate and the overall death rate are both low for a developing country, and the average life expectancy (69 years for men and 73 years for women) is the highest in southern Asia. The government, moreover, is working to improve the health-care system with an emphasis on further lowering maternal and infant mortality.

Approximately one-fifth of Sri Lanka's population is urban, a figure that is expected to increase rapidly into the next century. Government reports indicate that, while metropolitan areas are developing rapidly, rural development is progressing at a less than satisfactory pace.

*The economy.* Sri Lanka has a developing mixed (public and private) economy, largely based on agriculture, services, and light industries. Numerous industries have been nationalized since 1971, and economic development has been heavily subsidized by the International Monetary Fund, the Asian Development Bank, the United States, and Japan. The Netherlands, Germany, and the People's Republic of China have also provided extensive foreign aid. The creation of new jobs has not kept pace with the growth of the population, and unemployment is widespread. The gross national product (GNP) is growing faster than the population; the GNP per capita, however, is very low by world standards.

Agriculture accounts for approximately one-fourth of the gross domestic product (GDP) and employs two-fifths of the workforce. Agricultural output is divided between cash crops, largely grown on plantations, and staples, which are grown on small peasant holdings. Land reform has fragmented many estates, and smallholders now produce significant quantities of rubber and tea. One-third of the island's land is arable, and government efforts to increase its productivity have centred on irrigation in the Mahaweli River valley. Despite the island's 2,000-year-long tradition of constructing irrigation tanks and canals, much of the island's irrigation potential remains undeveloped.

Harvests of rice, the chief staple, do not meet domestic demand. Increased use of fertilizer has helped to improve the productivity of paddies. Subsistence farming dominates rice production, and few paddies are larger than 5 acres (2 hectares). Tea, which is grown in the Central Highlands, is a major export; rubber and coconuts are produced at lower elevations and are also important sources of foreign exchange.

A wide variety of gemstones, for which Sri Lanka is world famous, is exported. Significant quantities of high-grade graphite, in the production of which the island leads the world, are also exported. Graphite production is a state monopoly controlled through the State Graphite Corporation since 1971.

Manufacturing industries account for approximately one-seventh of the GDP and employ one-eighth of the workforce. Chief manufactures include textiles, ceramics, petroleum products, vegetable oils, fertilizers, and cement. Most large-scale industries are now owned by the government, and the private sector produces mainly consumer goods and some capital goods such as machine tools and building materials. An Investment Promotion Zone was established north of Colombo in the late 1970s to attract foreign investment through various tax exemptions.

Electricity is produced almost totally from hydroelectric sources. The island's electrical-generating capacity was greatly increased in the 1980s as several new hydroelectric projects were completed.

Services are the largest sector of the GDP and employ one-third of the workforce. Foreign banks were allowed to open "offshore" branches in Sri Lanka in 1979 as part of a government effort to promote the country as an international financial centre for South Asia.

Sri Lanka's balance of trade has been chronically unfavourable since the mid-1970s. Remittances from citizens working abroad are a major source of foreign exchange. Public corporations control imports; private firms handle most exports. Sri Lanka's chief suppliers include Japan, Iran, the United States, Taiwan, and the United Kingdom. The United States, Germany, the United Kingdom, and Japan are likewise important markets for Sri Lanka's exports.

*Government and social conditions.* Sri Lanka is a socialist republic. Its constitution, promulgated in 1978, vests greater executive authority than previously in the president, who is directly elected to a six-year term. He functions as head of state and government and as commander in chief of the armed forces. The president governs with the assistance of an appointed cabinet. Legislative power resides in a unicameral Parliament, composed of 225 members directly elected to six-year terms. The president may summon or dissolve the Parliament at any time. The Parliament has the power to enact retroactive law and amend the constitution. The major political parties are the United National Party, the Tamil United Liberation Front, and the Sri Lanka Freedom Party. The judicial system is composed of the Supreme Court, appointed by the president; the Court of Appeal; the High Court; and the various lower courts.

Sri Lanka's social-welfare program provides a limited segment of the population with cash benefits for temporary work disability and unemployment, old age, disability, permanent work disability, and survivor grants. Hospital care is free in government facilities. The effectiveness of this service is limited, however, by a shortage of both facilities and personnel. Malnutrition and various gastrointestinal diseases persist as serious problems, but malaria, smallpox, cholera, and plague have been eliminated from the country. The housing shortage is most acute in and around Colombo. The government's housing policy is primarily concerned with the construction of low-income housing, the extension of sanitation facilities, and slum clearance.

Sri Lanka's adult literacy rate of nearly 90 percent for males and more than 80 percent for females compares favourably to that of most South Asian countries. Education is free at all levels and is compulsory between the ages of 5 and 15. Secondary, technical and vocational, and higher education are also available.

Although freedom of the press is constitutionally guaranteed, the government may exercise direct censorship as authorized by the Anti-Terrorism Law. Newspapers are published in Sinhalese, Tamil, and English. The Sri Lanka Broadcasting Corporation (radio) provides national, commercial, and educational services. Television was introduced on an experimental basis in 1979, and in 1982 broadcasts began on a regular basis throughout the country.

*Cultural life.* Sri Lanka possesses a rich cultural heritage that dates back to the 3rd century BC. The country's artistic tradition centres largely on Buddhist and Hindu religious art and dance-drama. There are three main forms of the national dance-drama: the *kōlam* (Tamil: "costume"), a masked dance-drama; the devil dance, a dance to the spirits asking relief from illness or misfortune; and the Kandyan dance, a national dance of great importance, dealing with mythological, historical, and naturalistic themes. Examples of traditional sculpture, painting, and architecture are seen in the remains of ancient works. These include colossal Buddha images, temples (especially around Kandy), and temple paintings. Other surviving art traditions include ivory carving, metal-working, lacquered woodwork, and basketry.

*History.* The island's first human settlers probably included immigrant aborigines of southern Asia, peoples of the proto-Australoid ethnic group. These peoples were absorbed by Indo-Europeans who arrived from north India about the 5th century BC and developed into the Sinhalese. The Tamils were probably later immigrants from Dravidian India, migrating over a period from the early centuries AD to about 1200.

Buddhism was introduced during the 3rd century BC, and the city of Anurādhapura was established as a major political and religious centre. As Buddhism spread, the Anurādhapura kingdom extended its political control over Ceylon (*c.* 200 BC–*c.* AD 1000). The Sinhalese lost control of Ceylon to the Cōla (invaders from southern India) from 993 to 1070, but Sinhalese rule was firmly reestablished during the Polonnaruwa period (*c.* 1070–1200). Between 1200 and 1505 Sinhalese power gravitated to the southwest part of the island, while a south Indian dynasty seized power in the north and established the Tamil kingdom in the 14th century. Foreign invasions from India, China, and Malaya occurred in the 13th, 14th, and 15th centuries.

In 1505 a Portuguese fleet landed on Ceylon. The Portuguese were permitted to build a fort and received trade concessions in 1518. They engaged in various alliances with local kings, taking advantage of any disharmony existing between the kingdoms and enthroning their own protégés whenever possible. By 1619, through a combination of active occupation and royal deeds, the Portuguese controlled most of the island.

The Kandyan kingdom enlisted the Dutch to oust the Portuguese, and Ceylon eventually came under the control of the Dutch East India Company until 1796, when control passed to the British; in 1802 Ceylon became a crown colony. From 1830 the phenomenal growth of coffee dominated Ceylon's economic development until a leaf disease destroyed the plantations. Experiments with tea were successful in the 1880s, and soon that became the plantation crop.

Ceylonese nationalism expanded on religious, social, and educational fronts in the early 20th century. In 1919 the Ceylon National Congress united Sinhalese and Tamil groups. A succession of constitutions were promulgated by the British in 1920 to satisfy nationalistic demands, and in 1948 dominion status was conferred on the colony. The United National Party (UNP) controlled the government until it was unseated in 1956 by the Sri Lanka Freedom Party (SLFP), a group dedicated to maintaining Sinhalese identity. The Tamils

objected bitterly to this period of Sinhala nationalism, and by 1965 the UNP had regained control of the government. However, in 1970 the SLFP formed a coalition with various Marxist parties and won a landslide victory in the elections. The SLFP government initiated many economic and social reforms during the early and mid-1970s, and its constitution of 1972 proclaimed Ceylon the Republic of Sri Lanka.

In 1977 the UNP was returned to power and radically revised the constitution to construct a presidential system of government. The country was renamed the Democratic Socialist Republic of Sri Lanka. Subsequent political and governmental changes occurred relatively smoothly despite recurring racial tension between Sri Lanka's Sinhala and Tamil communities. Violence erupted in 1981, and Tamil leaders began demanding a separate Tamil homeland. Sections of the Tamil community resorted to guerrilla warfare in their campaign for an autonomous Tamil state in the north and east of the country, and the violence continued into the 1990s. In 1993 Sri Lanka's president was assassinated, allegedly by radical Tamil forces.

**Śrī-Nāthajī,** unique representation of the Hindu god Krishna. It is the main cult image of the Vallabhācārya sect, an important devotional sect of India. The image is enshrined in the main temple of the cult at Nāthdwārā (Rājasthān state), where it is accorded an elaborate service of worship daily.

According to sect tradition, the image of Śrī-Nāthajī revealed itself to the sect's founder, Vallabha, while he was visiting Mount Govardhana, near Mathura (the image has one hand raised, suggestive of Krishna's lifting of Mount Govardhana to shelter the cowherds from a storm sent by the jealous god Indra). The image was first worshiped in Mathura, and, while in flight from the Mughals, the chariot carrying the image broke down at Nāthdwārā, where it was given protection by the local Rājput chief. Representations of Śrī-Nāthajī, covered with the ornaments and garlands of worship, are commonly seen in the homes and shops of devotees throughout North and West India.



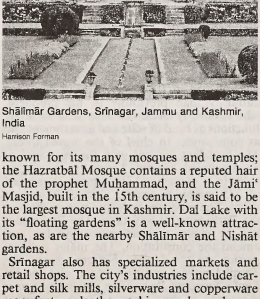
Śrī-Nāthajī, detail of a painting, Rajasthani style, mid-19th century; in a private collection
P. Chandra

**Srihatta** (Bangladesh): *see* Sylhet.

**Srikākulam,** also called CHICACOLE, city, northeastern Andhra Pradesh state, southern India. The city lies along the Nāgāvali River. Srikākulam once served as the capital of a Muslim region that was known as the Northern Circārs (Northern Sarkārs). Of historical interest is the mosque, which was constructed in 1641. The city has several government colleges that are affiliated with Andhra University. Pop. (1991 prelim.) 88,684.

**Srinagar,** city, summer capital of the Indian-held sector of Jammu and Kashmir state, northwestern India. The city lies along the banks of the Jhelum River, at an elevation of 5,200 feet (1,600 m) in the Vale of Kashmir.

Situated amid clear lakes and lofty mountains, Srinagar has long had a considerable tourist economy. Along its course through the city the Jhelum River is spanned by seven wooden bridges, and numerous adjacent canals and waterways abound with shikaras, the gondolas of Kashmir. Srinagar is well



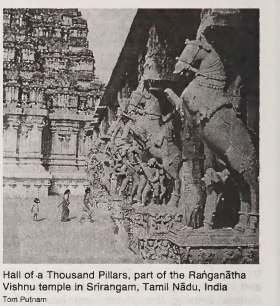
Shālīmār Gardens, Srinagar, Jammu and Kashmir, India
Harrison Forman

known for its many mosques and temples; the Hazratbāl Mosque contains a reputed hair of the prophet Muḥammad, and the Jāmi' Masjid, built in the 15th century, is said to be the largest mosque in Kashmir. Dal Lake with its "floating gardens" is a well-known attraction, as are the nearby Shālīmār and Nishāt gardens.

Srinagar also has specialized markets and retail shops. The city's industries include carpet and silk mills, silverware and copperware manufacture, leatherworking, and wood carving. The University of Kashmir (1969) is in the city. Regular flights connect Srinagar with Delhi and Amritsar. Not far from the city is Gulmarg, the Meadow of Flowers, at an elevation of 8,500 feet (2,590 m). It affords magnificent views of the Vale of Kashmir and also of Nanga Parbat, at 26,660 feet (8,126 m) one of the loftiest peaks in the Himalayas. The Vale of Kashmir contains the surrounding area's most fertile agricultural land, and the valley is one of the most densely populated areas of Jammu and Kashmir. The mountains among which Srinagar is situated are heavily forested with pine, fir, and deodar. Pop. (2001 prelim.) city, 894,940; metropolitan area, 971,357.

**Srirangam,** city, east-central Tamil Nādu state, southeastern India. It lies on an island at the division of the Cauvery and Coleroon rivers near the city of Tiruchchirāppali.

Srirangam is one of the most frequently visited pilgrimage centres in southern India. Its main Raṅganātha temple, though primarily Vaishnavite, is also holy to Śaivites. The temple is composed of seven rectangular enclosures, one within the other, the outermost having a perimeter more than 2 miles (3 km) in length. A remarkable feature of the temple is the Hall of a Thousand Pillars with its colonnade of rearing horses. The temple and 1,000-pillared hall were constructed in the Vijayanagar period (1336–1565). Pop. (2001 prelim.) Tiruchchirāppali metro. corp., 746,062.



Hall of a Thousand Pillars, part of the Raṅganātha Vishnu temple in Srirangam, Tamil Nādu, India
Tom Putnam

**Srirangapatnam** (India): *see* Seringapatam.

**Srisaket** (Thailand): *see* Sisaket.

**Śrīvaiṣṇava,** member of a sect of Hindus, most numerous in South India, who pay allegiance to Lord Vishnu and follow the teachings of the philosopher Rāmānuja. "Śrī" refers to Vishnu's consort, also called Lakṣmī, to whom Vishnu first taught the doctrine.

The sect reached its peak in the late 10th or 11th century, when the passionate devotional hymns of the Āḻvārs (a group of mystics) were introduced into the temple service by Nāthamuni. He is called the first *ācārya* ("teacher") of the sect and founded a Sanskrit-Tamil school at Srirangam (Tamil Nadu state), which was then and continues to be a great Vaishnavite centre in South India. Rāmānuja (11th/12th century), in an exposition of the *Vedānta-sūtras* called *Śrībhāṣya* ("Beautiful Commentary"), gave the sect a philosophical doctrine to fit its views and early literature. *Śrībhasya* was the first sectarian commentary ever written on a Hindu sacred text and the model for the many others that followed.

Toward the end of the late 14th century, a controversy arose that split the Śrīvaiṣṇavas into their present two subsects, the Vaḍakalai (or school of northern learning), which relied more on the Sanskrit scriptures, and the Teṉkalai (or school of southern learning), which stressed the Tamil hymns of the Āḻvārs.

The Śrīvaiṣṇava is among the most exclusive of the Hindu sects. They worship only Vishnu and his consorts and attendants and do not acknowledge Krishna's youthful companion, his mistress Rādhā. Brahman members take the lead in the strict observance of caste regulations in such matters as diet and interdining. Śrīvaiṣṇava Brahmans are much given to scholarly pursuits and have earned for themselves the honorary title of *ācārya,* or, in Tamil, *ayyangar,* often spelled *iyengar. See also* Teṉkalai; Vaḍakalai.

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**Srivastava, Dhanpat Rai** (Indian author): *see* Prem Chand.

**Śrivijaya empire,** maritime and commercial kingdom that flourished between the 7th and the 13th century in the Malay Archipelago. The kingdom, which originated in Palembang on Sumatra, soon extended its influence and controlled the Strait of Malacca. The kingdom's power was based on its control of international sea trade. It established trade relations not only with the states in the archipelago but also with China and India.

Śrivijaya was also a religious centre in the region. It adhered to Mahāyāna Buddhism and

soon became the stopping point for Chinese Buddhist pilgrims on their way to India. The kings of Śrivijaya even founded monasteries at Negapatam in India.

Śrivijaya continued to grow; by the year 1000 it controlled most of Java but soon lost it to Cōla, an Indian maritime and commercial kingdom, which found Śrivijaya an obstacle on the sea route between South and East Asia. In 1025 Cōla seized Palembang, captured the King, and carried off his treasures and also attacked other parts of the kingdom. By the end of the 12th century, Śrivijaya had been reduced to a small kingdom and its dominant role in Sumatra was taken by Malayu (based in Jambi), a vassal of Java. A Javanese kingdom, Majapahit, soon began to dominate the Indonesian political scene.

**Srong-brtsan-sgam-po** (b. *c.* 608—d. 650), Tibetan king (crowned 629) who extended his dominion to include Nepal and parts of India and China and whose reign marked the beginning of recorded history in Tibet. He commissioned a court scholar to create the Tibetan written language using an Indo-European model for the script. Because two of his wives, a Nepalese and a Chinese princess, were Buddhists, he is credited by lama historians with introducing Buddhism into Tibet. To house the famous image of the Gautama Buddha brought to Tibet by his Nepalese bride, he built in Lhasa, the capital, the Gtsug-lag-khang temple, which remains Tibetan Buddhism's most sacred place.

**Śruti** (Sanskrit: "Learning by Hearing"), that class of Hindu sacred literature based on revelation, the most revered body of sacred literature in Hinduism. *Śruti* works are considered divine revelation, heard and transmitted by earthly sages, as contrasted to *Smṛti*, or that which is remembered. Though *Śruti* is considered to be the more authoritative, in practice the *Smṛti* texts are more influential in modern Hinduism. The revealed texts encompass the four Vedas—Rg, Yajur, Sāma, and Atharvaveda (the earliest Hindu sacred literature)—and the *Brāhmaṇas* (ritual treatises), the *Āraṇyakas* ("Books of the Forest"), and the *Upaniṣads* (philosophic elaborations on the Vedas that form the basis of much of later Indian philosophy).

**śruti** (Sanskrit: "heard"), in the music of India and Pakistan, the smallest tonal interval that can be perceived. The octave, in Indian theory, is divided into 22 *śrutis*. The division is not precisely equal, but these microtonal units may be compared to Western quarter tones, of which there are 24 to an octave.

The word *śruti* is used both to indicate a specific note and as a unit of measurement to describe the size of an interval encompassed by two given notes.

**SS:** *see under* Saints, or Saintes.

**SS,** abbreviation of SCHUTZSTAFFEL (German: "Protective Echelon"), the black-uniformed elite corps of the Nazi Party. Founded by Adolf Hitler in April 1925 as a small personal bodyguard, the SS grew with the success of the Nazi movement and, gathering immense police and military powers, became virtually a state within a state.

From 1929 until its dissolution in 1945, the SS was headed by Heinrich Himmler (*q.v.*), who built up the SS from fewer than 300 members to more than 50,000 by the time the Nazis came to power in 1933. Himmler, a racist fanatic, screened applicants for their supposed physical perfection and racial purity but recruited members from all ranks of German society. With their sleek black uniforms and special insignia (lightning-like runic S's, death's-head badges, and silver daggers), the men of the SS felt superior to the brawling brown-shirted Storm Troopers of the SA (*q.v.*), to which initially they were nominally subordinate.

When Hitler, with SS help, purged the SA in 1934 and reduced it to political impotence, the SS became an independent group responsible, via Himmler, to Hitler alone. Between 1934 and 1936 Himmler and his chief adjutant, Reinhard Heydrich, consolidated SS strength by gaining control of all of Germany's police forces and expanding their organization's responsibilities and activities. At the same time, special military SS units were trained and equipped along the lines of the regular army. By 1939 the SS, now numbering about 250,000 men, had become a massive and labyrinthian bureaucracy, divided mainly into two groups: the Allgemeine-SS (General SS) and the Waffen-SS (Armed SS).

The Allgemeine-SS dealt mainly with police and "racial" matters. Its most important division was the Reichssicherheitshauptamt (RSHA; Reich Security Central Office), which was made up of the Ordnungspolizei (Orpo; Order Police) and the Sicherheitspolizei (Sipo; Security Police), which, in turn, was divided into the Kriminalpolizei (Kripo; Criminal Police) and the dreaded Gestapo (*q.v.*) under Heinrich Müller. The RSHA also included the Sicherheitsdienst (SD; Security Service), a security department in charge of foreign and domestic intelligence and espionage.

The Waffen (Armed) SS was made up of three subgroups: the Leibstandarte, Hitler's personal bodyguard; the Totenkopfverbände (Death's-Head Battalions), which administered the concentration camps; and the Verfügungstruppen (Disposition Troops), which swelled to 39 divisions in World War II and which, serving as elite combat troops alongside the regular army, gained a reputation as fanatical fighters.

SS men were schooled in racial hatred and admonished to harden their hearts to human suffering. Their chief "virtue" was their absolute obedience and loyalty to the Führer, who gave them their motto: "Thy Honour is Thy Loyalty." During World War II the SS carried out massive executions of political opponents, Gypsies, Jews, Polish leaders, Communist authorities, partisan resisters, and Russian prisoners of war. Following the defeat of Nazi Germany by the Allies, the SS was declared a criminal organization by the Allied Tribunal in Nürnberg in 1946.

**SS-Angehörigen, Organisation der** (German: Organization of SS Members): *see* Odessa.

**Ssu-ma Ch'ien,** Pinyin SIMA QIAN (b. *c.* 145 BC, Lung-men, China—d. *c.* 85 BC), astronomer, calendar expert, and the first great Chinese historian, noted for his authorship of the *Shih-chi* ("Historical Records"), which is considered to be the most important history of China down to the end of the 2nd century.

*Life.* Ssu-ma Ch'ien was the son of Ssu-ma T'an, the grand historian (sometimes translated as "astronomer royal") at the Han court during the period 140–110 BC. The office of grand historian combined responsibility for astronomical observations and for the regulation of the calendar with the duties of keeping a daily record of state events and court ceremonies. After traveling extensively in his youth, Ssu-ma Ch'ien entered court service. In 111 BC he accompanied a military expedition into the southwest of China, and in 110 BC he was a member of the Emperor's entourage when the latter visited Mt. T'ai to conduct the sacrifices symbolizing the dynasty's authority. In the same year, his father died, and after the mandatory period of mourning he was appointed in 108 BC to succeed him in the post of grand historian.

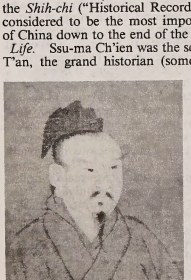
In 105 he was among those responsible for a complete reform of the Chinese calendar, a reform prompted by the Han emperor Wu Ti's inauguration of what was to be a "new beginning" to the Han dynasty. At about the same time, Ssu-ma Ch'ien began to undertake the unfulfilled ambition of his father to write a definitive history of the Chinese past, an ambition strengthened by his belief that under Wu Ti the Han had reached a peak of achievement that deserved to be recorded for posterity. Before his history was completed, however, Ssu-ma Ch'ien deeply offended the Emperor by coming to the defense of a disgraced general. Ssu-ma Ch'ien was arraigned for "defaming the Emperor," a capital crime. Either because the Emperor felt him too valuable a man to lose or because Ssu-ma Ch'ien himself requested a reprieve so that he could complete his history, he was castrated instead of executed.

Wu Ti later relented, and Ssu-ma Ch'ien again rose in the Imperial favour, becoming palace secretary (*chung-shu-ling*). But he remained bitterly conscious of the shame he had suffered and lived a retiring life, devoting himself to the completion of his great masterpiece.

*Structure and content of Shih-chi.* The *Shih-chi* is his great claim to fame. There had, of course, been many histories before Ssu-ma Ch'ien's time. The keeping of court chronicles was already an established practice under the earlier dynasties. One such work, the *Ch'un-ch'iu* ("Spring and Autumn [Annals]") of the petty state of Lu, was said to have been the work of Confucius. It had achieved status as a canonical book largely because of its ethical judgments on the events that it recounts.

Ssu-ma Ch'ien denied that his work was in any way comparable to this great Classic. He termed himself not a "maker," like Confucius, but merely a "transmitter" of past events. His great successor as historian of the Han, Pan Ku (AD 32?–92), took him to task for his haphazard use of ideas from the various schools of philosophy and for his devotion to Taoism. But the ethical standards of Han Confucianism that Pan Ku and his contemporaries could take for granted had not in Ssu-ma Ch'ien's lifetime achieved the authority they had by the 1st century AD. Like most of his contemporaries, Ssu-ma Ch'ien was an eclectic, employed at a court at which magic and the supernatural were still potent forces and where the state religious cult and accepted moral and political standards were still in a fluid state. Ssu-ma Ch'ien's moral judgments are, thus, not in accordance with any consistent theories.

His main achievement was that he reduced to an orderly narrative the complex events of the past, recorded in often contradictory sources deriving from the many independent states, each of which employed its own chronology. He organized these facts not, as in previous histories, simply as a chronologically ordered record but according to a new five-part plan.



Ssu-ma Ch'ien, detail, ink and colour on silk; in the National Palace Museum, Taipei

By courtesy of the National Palace Museum, Taipei, Taiwan, Republic of China

The "Basic Annals" gave a dated chronological outline centred on events at the court considered to have been the paramount power at the time. The following section consisted of chronological tables in which he attempted to clarify the confusion of the history of the various independent feudal kingdoms and to enable his reader to see at a glance what was happening in each of the states at any given time. The detailed accounts of each state were given in chapters entitled "The Hereditary Houses." A number of monographs dealt with various crucial aspects of government. These sections show Ssu-ma Ch'ien to have favoured the practical reformist statesmen who, in his own time, were formulating new policies for the increasingly centralized state, rather than the proponents of Confucian moral theories. The work ends with a collection of "Biographies" that deal with a variety of famous individuals, who are selected as exemplars of various types of conduct, and also with the affairs of the various foreign peoples, relations with whom were beginning to become increasingly important during the reign of Wu-ti.

*The Shih-chi* provided a model for the later dynastic histories but differs from them in many ways. Its time span is far longer: such attempts to encompass the whole of human history were rare among later Chinese historians. Its source material, too, was far more varied. It incorporated not only the court annals of the Ch'in and the Han dynasties but also various earlier histories, parts of court chronicles of various feudal states, and material from the canonical books and the philosophical writings of all the schools, even historical romances. Neither is his subject matter exclusively court-centred and "political," as were the later histories: it includes a far wider range of society, including businessmen and merchants, condottieri and bandits, actors and court favourites, good officials and bad.

Ssu-ma Ch'ien did not attempt to compose "objective" history but rather belonged unmistakably to the didactic Chinese tradition of history. He makes moral judgments on his characters. He also attempts to characterize them in types, recording an individual's exemplary deeds in one chapter and his misdeeds elsewhere. But the lessons he derives from history are varied and often mutually incompatible. He is much more notable for the critical attention he devotes to his sources. His acute critical comments are appended at the end of each chapter.

*Influence.* Ssu-ma Ch'ien is important not only as a historian but also as a master of racy, flexible Chinese prose. He exerted a potent influence on later writers, particularly upon the early writers of narrative prose and fiction. Since Ssu-ma Ch'ien's time, his history has been acknowledged as the great historical masterpiece in Chinese, a standard against which all later histories would be measured and a model for large-scale historical composition, not only in China but in all East Asian countries influenced by the Chinese literary tradition. (D.C.T.)

BIBLIOGRAPHY. The standard study of Ssu-ma Ch'ien is the extremely perceptive work of Burton Watson, *Ssu-ma Ch'ien, Grand Historian of China* (1958), which gives a full critical analysis of Ssu-ma Ch'ien's works and also translates all the relevant biographical material from early sources. Édouard Chavannes, *Les Mémoires historiques de Sema-Ts'ien*, 5 vol. (1895–1905), translated the first 47 chapters of the *Shih-chi* with copious scholarly annotation. A sixth volume (1969) includes further translations by Chavannes and a bibliography of Western-language translations. Much of the remaining portion is translated in Burton Watson, *The Records of the Grand Historian of China*, 2 vol. (1961), which deals entirely with sections on the Han period.

**Ssu-ma Hsiang-ju,** Pinyin SIMA XIANGRU (b. 179 BC, Ch'eng-tu, China—d. 117 BC, Mao-ling, Nan Yüeh), famous Chinese writer of *fu*, a form of descriptive poetry.

Self-trained in literature and fencing, Ssu-ma Hsiang-ju was appointed as bodyguard to the Han emperor Ching I, but soon he took a new position at the court of Prince Hsiao of Liang and began to compose his famous *fu* "Tzu Hsü fu" ("Master Nil"), in which three imaginary characters describe the delights of the hunt.

After the death of Prince Hsiao, Ssu-ma Hsiang-ju returned to Ch'eng-tu, where he met, seduced, and eloped with Cho Wen-chün, the recently widowed daughter of a wealthy man. Although her father at first opposed the marriage, he later relented and gave the penniless couple money and slaves as the result of Ssu-ma's appointment at the emperor's court. This appointment came about because the poet had entrusted his "Tzu Hsü fu" to a friend, who had shown it to the emperor. Immediately charmed by the poem, the emperor asked him to write a *fu* on the imperial hunt. Ssu-ma extended his original work into a highly imaginative and successful *fu* entitled "Shang-lin fu" ("Supreme Park") and was rewarded with the court post. Endowed with his wife's share of the immense family fortune, the poet lived in comfort while he continued to write his *fu*. Only 29 *fu* and 4 prose selections survive.

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**Ssu-ma Kuang,** Pinyin SIMA GUANG (b. 1019, Hsia, Hunan, China—d. 1086, Pien Lian, Hunan), scholar, statesman, and poet who compiled the monumental *Tzu-chih t'ung-chien* ("Comprehensive Mirror for Aid in Government"), a general chronicle of Chinese history from 403 BC to AD 959, considered one of the finest single historical works in Chinese. Known for his moral uprightness, he was learned in several disciplines and prominent in government.

Ssu-ma Kuang studied the Confucian Classics and, after passing his civil-service examinations, rose rapidly to high office. Between 1069 and 1085 he led the faction opposing the radical reforms of the innovator Wang An-shih. Conservative in his interpretation of the Confucian Classics, Ssu-ma argued for the cause of good government through moral leadership rather than by assertive measures and through the improved functioning of tested institutions rather than by drastic changes. Shortly before his death he finally succeeded in dislodging Wang's faction from the government and became the leading minister in a government that attempted to repeal most of Wang's reforms. Until recent times most historians tended to view Ssu-ma favourably and Wang from an opposite viewpoint, but recent historical work has shown that Ssu-ma's program of antireform measures was not greatly successful.

With chosen associates, Ssu-ma compiled the *Tzu-chih t'ung-chien* in emulation of the *Ch'un-ch'iu* ("Spring and Autumn [Annals]," a chronicle believed to have been edited by Confucius). Ssu-ma criticized men and institutions from the standpoint of Confucian moral principles. He devoted most of his attention to political events, but the work also covered such diverse subjects as rites, music, astronomy, geography, and economy. In spite of Ssu-ma's moral perspective, his chronicle showed evidence of rigorous critical standards. He even compiled a separate work, the *Kao-i* ("Scrutiny"), which dealt with the discrepancies in his numerous sources and gave his reasons for preferring certain authorities.

Although the Communist government of China has attacked Confucianism, it nevertheless has high regard for Ssu-ma's scholarship. He was also an excellent poet and is the hero of modern Chinese children's books, which portray him as the child who saved a playmate from drowning by breaking the water tank into which his friend had fallen.

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**Ssu-ma Yen:** *see* Wu-ti (AD 236–290).

**Ssu-mao,** Pinyin SIMAO, formerly FU-HSING-CHEN, town in southern Yunnan *sheng* (province), China. It is situated in a small basin among mountains some 5,000 feet (1,500 m) in elevation, 19 miles (30 km) south of P'u-erh, the former centre of the Yunnanese tea trade.

Ssu-mao was already a minor town in the 14th century. It was given administrative status as a subprefecture in the 19th century and became a county town in 1912. It was then an important trading centre on the routes to Burma (Myanmar) and Laos. It was opened as a treaty port for trade with the French in Indochina in 1895 and with Burma in 1896 and subsequently had a brief period of modest prosperity. The opening of the railway from Haiphong in Indochina to K'un-ming, the provincial capital of Yunnan, in 1910 took away all of its trade, except that with Burma, to which it exported lead, tin, tea, and camphor, and its population shrunk.

Reputed as one of the most unhealthy places in Yunnan, it suffered in the 1940s from various epidemics and from the plague. In 1950 it was largely deserted, and much of the surrounding basin was also abandoned. After 1953, however, when the road from K'un-ming to southwestern Yunnan replaced the old mule trains, it again became an important regional commercial centre, distributing goods imported from K'un-ming and collecting local products, such as tea, camphor, and sisal. The town also has a small power station and some rice mills. Pop. (mid-1980s est.) 10,000–50,000.

**Ssu of Ch'en** (Chinese poet): *see* Ts'ao Chih.

**Ssu-p'ing,** Pinyin SIPING, city, southwestern Kirin *sheng* (province), China.

Centrally situated in the northern Liao River Plain, Ssu-p'ing was a place of little importance until the completion in 1902 of the railway between Ch'ang-ch'un and the port of Dairen (now Lü-ta) in what is now Liaoning province. It then became a commercial centre in an area with a rapidly growing population. Its importance was further increased with the construction in 1923 of a northwest rail link to Pai-ch'eng and to Tsitsihar (in what is now Heilungkiang province) and the opening in 1934 of a railway running south to T'unghua and to northern Korea. After 1907, under the administration of the South Manchurian Railway Company, there was considerable development. A new town was built after 1921, known as Ssu-p'ing-chieh. After 1932, under the Japanese occupation, some agriculture-based industry (brewing, oil pressing, flour milling) grew up, and in the latter part of World War II the Japanese built a refinery for the production of synthetic petroleum from coal. After the war Ssu-p'ing was virtually destroyed in four major battles between the Chinese Communist and Nationalist forces.

After 1949 the city was developed as a second-rank industrial centre. The petrochemical industry was reestablished, and various engineering plants, producing agricultural machinery and machine tools, were established. Diversified chemical manufactures have been concentrated there. The city also retains its former light industries based on local agriculture. Pop. (1990) 317,223.

**Ssu shu** (Chinese: "Four Books"), Pinyin SI SHU, four ancient Confucian texts that were used as official subject matter for civil service examinations in China from 1313 to 1905 and usually serve to introduce Chinese students to Confucian literature. Students later turn to the more extensive and, generally speaking, more difficult *Wu Ching* (Five Classics).

The publication of these four texts as a unit in 1190 with commentaries by Chu Hsi, a great Neo-Confucian philosopher, helped to revitalize Confucianism in China. From 1415 onward knowledge of Chu's (and like-minded) commentaries was as indispensable to success in civil service examinations as the texts themselves.

Even with its commentaries, the *Ssu shu* is a modest volume, the four parts of which have no consistent order. The first, *Ta hsüeh* (*q.v.*), is a short ethico-political treatise linking humane government with the personal integrity of rulers. The second, *Chung yung* (*q.v.*), is somewhat longer than *Ta hsüeh* and more abstract than the other three books. It speaks of such things as the Way of Heaven, motion, spiritual beings, and religious sacrifices. For each of these two books (both direct excerpts from *Li chi*, one of the Five Classics), Chu Hsi wrote an individual preface. The third book, *Lun yü* (*q.v.*), reputedly contains direct quotations from the ancient sage Confucius (551–479 BC) as recorded by his disciples, especially Tseng-tzu (*q.v.*). It is considered the most reliable source of the Master's teachings. *Mencius* (*q.v.*), the fourth and longest of the *Ssu shu*, contains the teachings of Mencius (371–289 BC), the most revered of all Confucian scholars.

**Ssu Tsung** (Chinese emperor): *see* Ch'ung-chen.

**St.:** *see under* Saint, Sankt, or Sint.

**Sta.:** *see under* Santa.

**Staatliche Kunstsammlungen Dresden,** English DRESDEN STATE ART COLLECTIONS, art museum in Dresden, Ger., that includes collections of painting, sculpture, graphic and applied arts, and coins. It is best known for its picture gallery, the core of which is the collection of paintings that originally belonged to the Kunstkammer, founded by Prince August in 1560. Its most popular works, however, were later acquisitions dating from the 18th century. There are a dozen subsidiary galleries, including a gallery of modern art. From 1855 to 1939 the paintings were housed in a gallery in the Zwinger Palace, built according to plans by Gottfried Semper.

The museum's holdings were dispersed for safety at the outbreak of World War II, but many of the works were nonetheless lost or destroyed. The several buildings that had been occupied by the museum were also badly damaged, but most of the collections have been rehoused in restored quarters.

**Staatliches Bauhaus:** *see* Bauhaus.

**Staatsoper:** *see* Vienna State Opera.

**Stabiae,** ancient town of Campania, Italy, destroyed by the eruption of Vesuvius in AD 79; it lies on the coast at the eastern end of the Gulf of Naples (modern Castellammare di Stabia). Originally an Oscan settlement, it entered the Social War (the war of the Italian *socii*, "allies"; 90–88 BC) against Rome in 90 BC and was destroyed by Sulla in 89, its territory being given to Nuceria as a reward for loyalty to Rome. It was noted for the medicinal properties of its waters, and the neighbourhood became a popular locality for villas. The elder Pliny perished at Stabiae, near the villa of his friend Pomponianus, in the eruption of 79. Subsequent settlement was of minor importance.

Excavations, begun in the 18th century, were recommenced in 1949. The extent of the pre-Roman town (*oppidum*) has been assessed. The layout of the later town (89 BC–AD 79), unlike the *insula* (grid) planning of many Roman towns, appears to have been adapted to the needs of a spa. One of the more striking discoveries of the later excavations was



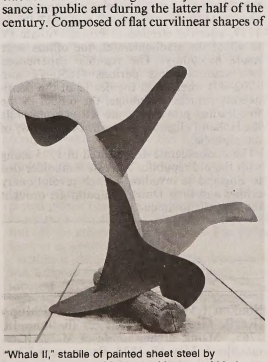
Artemis, wall painting from Stabiae; in the Museo Archeologico Nazionale, Naples

By courtesy of the Museo Nazionale, Naples; photograph, European Art Color Slides, Peter Adelberg, New York City

a number of wall paintings, which compare favourably with those of Pompeii and Herculaneum.

**stabile,** type of stationary abstract sculpture, developed by the 20th-century American artist Alexander Calder and usually characterized by simple forms executed in sheet metal; the term, coined in reference to Calder's work by Jean Arp in 1931 (*compare* mobile), was later applied to similar works by other artists.

The increasing monumentality of Calder's stabiles contributed significantly to a renaissance in public art during the latter half of the century. Composed of flat curvilinear shapes of



"Whale II," stabile of painted sheet steel by Alexander Calder, 1964; in the Museum of Modern Art, New York City

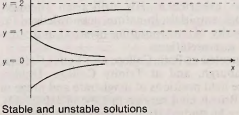
Collection, the Museum of Modern Art, New York, gift of the artist

metal welded or rivetted together and painted usually red or black, these playful, airy works are equally suited to the glass and steel confines of contemporary buildings and the free space of parks and plazas. Outstanding examples include "Flamingo" (Chicago; 1974), "Teodelapio" (Spoleto, Italy; 1962), and "El Sol Rojo" (Mexico City; 1968).

The Canadian sculptor Robert Murray (1936– ) is notable among other artists working in the monumental stabile form; his lofty curved and folded aluminum sheets, while usually more geometric and less "penetrable" than the stabiles of Calder, nonetheless share the latter's paradoxical blend of lightness and substantiality, motion and stasis.

**stability,** in mathematics, condition in which a slight disturbance in a system does not produce too disrupting an effect on that system. In terms of the solution of a differential equation, a function $f(x)$ is said to be stable if any other solution of the equation that starts out sufficiently close to it when $x = 0$ remains close to it for succeeding values of $x$. If the difference between the solutions approaches zero as $x$ increases, the solution is called asymptotically stable. If a solution does not have either of these properties, it is called unstable.

For example, the solution $y = ce^{-x}$ of the equation $y' = -y$ is asymptotically stable, because the difference of any two solutions $c_1e^{-x}$ and $c_2e^{-x}$ is $(c_1 - c_2)e^{-x}$, which always approaches zero as $x$ increases. The solution $y = ce^x$ of the equation $y' = y$, on the




Stable and unstable solutions

other hand, is unstable, because the difference of any two solutions is $(c_1 - c_2)e^x$, which increases without bound as $x$ increases. A given equation can have both stable and unstable solutions. For example, the equation $y' = -y(1 - y)(2 - y)$ has the solutions $y = 1$, $y = 0$, $y = 2$, $y = 1 + (1 + c^2e^{-2x})^{-1/2}$, and $y = 1 - (1 + c^2e^{-2x})^{-1/2}$ (*see* Graph). All these solutions except $y = 1$ are stable because they all approach the lines $y = 0$ or $y = 2$ as $x$ increases for any values of $c$ that allow the solutions to start out close together. The solution $y = 1$ is unstable because the difference between this solution and other nearby ones is $(1 + c^2e^{-2x})^{-1/2}$, which increases to 1 as $x$ increases, no matter how close it is initially to the solution $y = 1$.

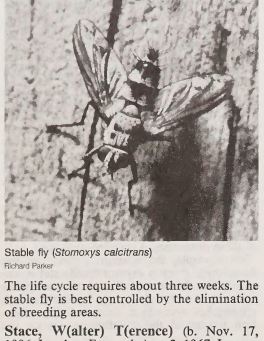
Stability of solutions is important in physical problems because if slight deviations from the mathematical model caused by unavoidable errors in measurement do not have a correspondingly slight effect on the solution, the mathematical equations describing the problem will not accurately predict the future outcome. Thus, one of the difficulties in predicting population growth is the fact that it is governed by the equation $y = ce^{ax}$, which is an unstable solution of the equation $y' = ay$. Relatively slight errors in the initial population count, $c$, or in the breeding rate, $a$, will cause quite large errors in prediction, even if no disturbing influences occur.

**stabilizer:** *see* economic stabilizer.

**stable fly** (*Stomoxys calcitrans*), a vicious bloodsucking fly of the family Muscidae, sometimes placed in a separate family Stomyxyidae (order Diptera). Though usually found in open sunny areas, the stable fly may enter a house during bad weather. Often known as a

biting housefly, it may transmit anthrax and other animal diseases.

The female must feed on blood before she can lay her eggs in rotting or fermenting straw.



Stable fly (*Stomoxys calcitrans*)
Richard Parker

The life cycle requires about three weeks. The stable fly is best controlled by the elimination of breeding areas.

**Stace, W(alter) T(erence)** (b. Nov. 17, 1886, London, Eng.—d. Aug. 2, 1967, Laguna Beach, Calif., U.S.), English-born philosopher who sought to reconcile naturalism with religious experience. His utilitarian theories, though empiricist in nature, acknowledged the necessity of incorporating mystical and spiritual interpretations.

Educated at Bath College and Fettes College, Edinburgh, and at Trinity College, Dublin, Stace held positions of magistrate and judge in the British civil service in Ceylon (1910–32), where he studied Hinduism and Buddhism before teaching philosophy at Princeton University (1932–55) in the United States. Influenced by the German philosopher G.W.F. Hegel, he published many works exploring commonalities of human thought as related to religious empiricism. His key books include *The Philosophy of Hegel* (1924), *The Theory of Knowledge and Existence* (1932), *The Concept of Morals* (1937), *Time and Eternity* (1952), and *Mysticism and Philosophy* (1960).

**Stade,** city, Lower Saxony *Land* (state), northwestern Germany. It lies along the Schwinge River, 3 miles (5 km) from its junction with the Elbe River, below Hamburg. The traditional seat of district administration and once the leading port of the lower Elbe, it was chartered in the 12th century and was a member of the Hanseatic League. Under Swedish rule from 1648 to 1712, it then passed to Denmark and in 1715 to Hanover.

Much of the old town, rebuilt and fortified by the Swedes, is still surrounded by its moat; now the modern business centre, it is dominated by the Gothic churches of St. Wilhadi and St. Cosmae and the half-timbered buildings of the old Swedish military establishment. The city's museums contain remains of the early Germanic period that were preserved in the nearby peat bogs. Stade is served by rail and sea communications, and its industries include shipbuilding, oil refining, and the production of food and chemicals. Pop. (1998 est.) 45,103.

**Städel Art Institute and Municipal Gallery,** German STÄDELSCHES KUNSTINSTITUT UND STÄDTISCHE GALERIE, museum of art located in Frankfurt am Main, Ger. It was founded in 1816 by a bequest from the banker Johann Friedrich Städel (1728–1816), who donated his fortune and his art collection to found the institution as an art museum and art school. The institute opened its art collection to the public in 1817. The museum contains examples of work from most of the western European schools of painting since the Middle Ages and is particularly rich in German, Dutch, Flemish, and Italian paintings from the 16th through the 18th century. Nineteenth-century German painting is comprehensively represented as well.

**stadholder,** also spelled STADTHOLDER, Dutch STADHOUDER, provincial executive officer in the Low Countries, or Netherlands, from the 15th through the 18th century. The office acquired extensive powers in the United Provinces of the Netherlands (Dutch Republic). Introduced by the ruling Burgundian dukes in the 15th century and continued unchanged by the succeeding Habsburg rulers, the stadholderates were at first occupied by noblemen appointed by the central government. The duties of the stadholder included presiding over the provincial states (assemblies), control and command of provincial armies, and appointment to certain offices.

During the revolt of the Netherlands against the Spanish Habsburgs (from 1568), the stadholders came to be elected, first by the States General (*q.v.*) and then by the individual provincial states. This procedure remained permanent for the seven northern provinces that won their independence from Spain and formed the Dutch Republic; in the provinces that reverted to Spanish rule, the stadholders again became royal appointees and declined in importance. The offices of the Dutch stadholders soon became exclusively associated with the house of Orange-Nassau: while William I, the leader of the revolt, had been stadholder of four provinces, his son was elected to the office in five provinces and a Nassau cousin in the remaining two; this pattern endured until 1747, when a single Orange prince was elected to all of the offices.

During the republic's existence the Orange stadholders were in almost continual conflict with the states of the dominant province of Holland, competing for leadership of the country. While theoretically subordinate to the states, the stadholder, in times of internal or foreign crisis and with the support of the lesser provinces and the lower classes, was able to replace the Holland leaders with his own allies and thus wield near-supreme power. In this fashion the stadholder gained preponderance in 1619–50, 1672–1702, and 1747–95. In 1747, after the election of Prince William IV to all of the stadholderates, the offices were made hereditary. The republic experienced two stadholderless periods (1650–72 and 1702–47) when, with the deaths of the domineering princes of Orange, the offices in the five leading provinces were left vacant, while the Holland oligarchs controlled the destiny of the republic.

The stadholderate disappeared in 1795 along with the old republic. The last stadholder fled to England as invading French revolutionary armies and their Dutch sympathizers brought the republic to an end.

*Consult the* INDEX *first*

**Stadion (-Warthausen), Johann Philipp (Karl), Graf von** (count of) (b. June 18, 1763, Mainz, archbishopric of Mainz [Germany]—d. May 15, 1824, Baden, near Vienna, Austria), statesman, foreign minister, and diplomat who served the Habsburg empire during the Napoleonic Wars.

After service in the imperial Privy Council (1783–87), Stadion was dispatched to the Austrian embassy in Stockholm. In 1790 he was sent to London, where he was influenced by the conservative philosophy of Edmund Burke and became a vigorous opponent of the French Revolution. To counter the subsequent march of Napoleonic France across Europe, he urged the formation of a union of Austria, Prussia, and Russia. Ambassadorial missions that he undertook to Berlin (1801) and St. Petersburg (1803) led to the conclusion of an Austrian-Russian defensive agreement (June 1804).

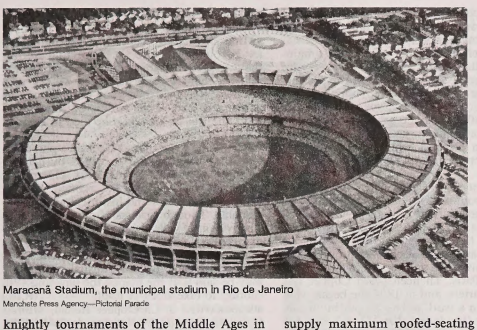
Following the disastrous Battle of Austerlitz (Dec. 2, 1805) and the Treaty of Pressburg (December 26), Stadion was summoned to replace Philipp, Count von Cobenzl, as Austria's foreign minister, primarily in order to prepare a war of revenge against the French. Believing that Napoleonic France could be overcome only by arousing German nationalist feeling, Stadion inaugurated a campaign of national awakening that was to be supplemented by political and social reforms. The lack of response by the German states doomed his project, however, and, with the resounding defeat of Austria by Napoleon in the Battle of Wagram (July 1809), Stadion resigned as foreign minister.

In 1813, with the fall of Napoleon imminent, Stadion led Austria to join the anti-French coalition of powers and served as Austrian plenipotentiary in the camp of the Allies. Charged with the direction of Austrian finances after 1814, he was appointed president of the exchequer that year and head of the Finance Ministry in 1816. He established an Austrian national bank and introduced a system of uniform land taxation.

**stadium,** enclosure that combines broad space for athletic games and other exhibitions with large seating capacity for spectators. The name derives from a Greek unit of measurement, the 'stade, the distance covered in the original Greek footraces (about 600 feet [180 m]). The course for the footrace in the ancient Olympic Games at Olympia was exactly a stade in length, and the word for the unit of measurement became transferred first to the footrace and then to the place in which the race was run. As a type of structure, the stadium played a significant role in 20th-century construction technology.

*Classical stadiums.* The first Greek stadiums were long and narrow and in the shape of a horseshoe. They were sometimes cut into the side of a hill, as at Thebes, Epidaurus, and Olympia, site of the Olympic Games, begun there in the 8th century BC. The Greeks also built hippodrome stadiums similar in layout but broad enough to accommodate four-horse chariot races, a feature of the Olympic Games as early as the 7th century BC. *See also* hippodrome.

The design of the Greek stadium was taken over and improved upon by the Romans, who built two types of stadiums: the circus and the amphitheatre. The circus was the Roman version of the hippodrome, a long, narrow, U-shaped structure designed for chariot races. The largest, and doubtless the finest ever built, was the Circus Maximus (*q.v.*) in Rome. In contrast to the circus, the amphitheatre, one of the most characteristic of all Roman buildings, was oval or round in plan and was completely enclosed on all sides. Intended for gladiatorial contests, in which the precise dimensions of the field were of slight importance, the amphitheatre was designed to afford maximum seating capacity and optimum visual facility for spectators. The giant amphitheatre built in Rome in the 1st century AD is known as the Colosseum. After the fall of Rome, amphitheatres survived for some time until the decline of the cities themselves terminated the spectacles that they had held. Nearly two millennia passed before the form was revived; much smaller, usually temporary stands sufficed for such intervening spectatorial events as the



Maracanã Stadium, the municipal stadium in Rio de Janeiro
Manchete Press Agency—Pictorial Parade

knightly tournaments of the Middle Ages in Europe. *See also* amphitheatre.

The renewal of large-scale spectator sports came about gradually in the 19th century with the growth of cities and the revival of interest in athletic contests; symbolically, the great impetus for the design of modern stadiums came from the revival of Olympic competition in 1896.

*Modern stadiums.* The stadium for the first modern Olympiad in Athens was a reconstruction of the ancient marble stadium built by Herodes Atticus on the site of an even earlier stadium in Athens. The Olympics since that time have provided a major focal point for the development of the modern stadium concept. In each four-year period since the first modern Olympiad, the host country has usually erected a permanent stadium to mark the event. The first stadium of the modern genre was constructed for the IV Olympiad in 1908 at Shepherd's Bush in London. The stands were partly roofed, and the stadium seated more than 50,000 people. Other Olympic stadiums of architectural note that were built before World War II include those at Stockholm (1912), Colombes, outside Paris (1924), Amsterdam (1927), and Berlin (1936). The Helsinki stadium built for the XII Olympiad (1940), which was canceled by the outbreak of World War II, served as the site for the XV Olympiad in 1952.

Stadiums rivaling the size of those of ancient Rome were constructed in several cities in the first half of the 20th century, notably the vast Strahov Stadium, in Prague, which was completed in 1934 for the Sokol gymnastics exhibition and had a seating capacity of more than 240,000. The Maracanã municipal stadium in Rio de Janeiro has accommodated 200,000 people for football (soccer) games. Auto racing venues often boast very large seating capacities, the largest being the Indianapolis Motor Speedway, Indianapolis, Ind. (250,000). Other stadiums seating in excess of 100,000 include Rungnado May Day Stadium, in P'yŏngyang, N.Kor. (150,000); Salt Lake Stadium, in Calcutta, India (120,000); Flemington Racecourse, in Melbourne, Austl. (120,000); Aztec Stadium, in Mexico City (114,465); and Michigan Stadium, in Ann Arbor, Mich. (107,501). Though these figures denote official "seating" capacities, these stadiums are actually capable of accommodating considerably more people.

American gridiron football inspired a new type of stadium design, the elliptical bowl, first employed in the Yale Bowl at New Haven, Conn., in 1914, and repeated in several other stadiums, including the Rose Bowl and Michigan Stadium. Because the bowl is entirely unsuited to the other principal American sport, baseball, another type of American stadium has evolved for baseball, in which the aim is to supply maximum roofed-seating capacity to protect spectators against the sunlight. A notable pioneer in this trend was triple-tiered Yankee Stadium, in New York City, built in 1923.

*Design innovations.* The shapes of stadiums have varied widely according to the variety of uses for which they were built. Some are rectangular with curved corners, whereas others are elliptical or U-shaped. The building of large stadiums in the 20th century was greatly facilitated by the use of reinforced concrete; this material has made possible the construction of daring new designs that would previously have been impossible to sustain structurally.

A basic difficulty of the roofed stadium was the interference with visibility by the columns supporting the roof. Dodger Stadium in Los Angeles was the first tiered stadium to provide column-free views from all seats (1959), followed by Shea Stadium in New York City, which added field seat sections that rotate around the stadium to permit conversion from a baseball to a football arrangement (1964). During the 1970s the multipurpose stadium (typically with artificial turf) became pervasive in the United States. In 1970 two such stadiums were built—in Cincinnati, Ohio, and Pittsburgh, Pa.

A significant development of the mid-20th century was the Astrodome, built in Houston, Texas; this was the first major fully roofed stadium. Indoor stadiums of considerable size had been built previously, notably Madison Square Garden in New York City (1890), and Chicago Stadium, Chicago (1928), capable of seating 17,500 (both original structures have been demolished). For the 1960 Olympics in Rome, the leading Italian architect-engineer Pier Luigi Nervi created the Roman sports complex, which included the Palazzetto dello Sport with a ribbed-dome roof. The Astrodome, however, was, by comparison, gigantic, with a seating capacity of 62,439 people and a large playing field. The dome, of transparent plastic panels supported by steel lattice, has a span of 642 feet (196 m) and rises 208 feet (63 m) above the playing field. The entire interior is air-conditioned.

Within a decade, however, the Astrodome was eclipsed by the New Orleans Superdome (opened 1975), which has an official seating capacity of 69,703 (though able to accommodate larger numbers); the 30-story structure is topped by a steel-ribbed roof that has a 680-foot (200-metre) clear span.

Another important development was the application of flexible steel cables to span large roof dimensions. Cables were able to contribute significantly to speed of construction, to lightness of the roof, and to economy of construction costs in covered stadiums. A stadium with this system was opened in 1982 in Minneapolis–St. Paul, Minn., and is called the Metrodome.

In the late 1980s stadiums with retractable domes began to appear, most notably Toronto's SkyDome (opened 1989). Retractable roofs became increasingly common by the turn of the 21st century.

The 1990s saw a tremendous surge in stadium construction throughout the world. New stadiums were designed to meet the needs of a particular sport and to include amenities such as luxury suites, multiple restaurants, and shopping, lodging, and banquet facilities. New baseball parks built during this period, such as Camden Yards in Baltimore, Md., combine modern amenities with the atmosphere of the classic parks of the early 20th century.

The Sapporo Dome stadium (opened in 2002) in Japan features a mobile playing surface. The stadium's natural grass field is held by a tray that allows the surface to be maintained outdoors and then moved into the stadium for matches. (L.Z./Ed.)

**stadholder:** *see* stadholder.

**Staël, Germaine de,** in full ANNE-LOUISE-GERMAINE NECKER, BARONNE (baroness) DE STAËL-HOLSTEIN, byname MADAME DE STAËL (b. April 22, 1766, Paris, France—d. July 14, 1817, Paris), French-Swiss woman of letters, political propagandist, and conversationalist, who epitomized the European culture of her time, bridging the history of ideas from Neoclassicism to Romanticism. She also gained fame by maintaining a salon for leading intellectuals. Her writings include novels, plays, moral and political essays, literary criticism, history, autobiographical memoirs, and even a number of poems. Her most important literary contribution was as a theorist of Romanticism.



Germaine de Staël, portrait by Jean-Baptiste Isabey, 1810; in the Louvre, Paris
Giraudon—Art Resource

*Early life and family.* She was born Anne-Louise-Germaine Necker, the daughter of Swiss parents, in Paris. Her father was Jacques Necker, the Genevan banker who became finance minister to King Louis XVI; her mother, Suzanne Curchod, the daughter of a French-Swiss pastor, assisted her husband's career by establishing a brilliant literary and political salon in Paris.

The young Germaine Necker early gained a reputation for lively wit, if not for beauty. While still a child, she was to be seen in her mother's salon, listening to, and even taking part in, the conversation with that lively

intellectual curiosity that was to remain her most attractive quality. When she was 16, her marriage began to be considered. William Pitt the Younger was regarded as a possible husband, but she disliked the idea of living in England. She was married in 1786 to the Swedish ambassador in Paris, Baron Erik de Staël-Holstein. It was a marriage of convenience and ended in 1797 in formal separation. There were, however, three children: Auguste (b. 1790), who edited his mother's complete works; Albert (b. 1792); and Albertine (b. 1796), who was allegedly fathered by Benjamin Constant.

*Political views.* Before she was 21, Germaine de Staël had written a romantic drama, *Sophie, ou les sentiments secrets* (1786), and a tragedy inspired by Nicholas Rowe, *Jane Gray* (1790). But it was her *Lettres sur les ouvrages et le caractère de J.-J. Rousseau* (1788; *Letters on the Works and the Character of J.-J. Rousseau*) that made her known. There is in her thought an unusual and irreconcilable mixture of Rousseau's enthusiasm and Montesquieu's rationalism. Under the influence of her father, an admirer of Montesquieu, she adopted political views based on the English parliamentary monarchy. Favouring the French Revolution, she acquired a reputation for Jacobinism. Under the Convention, she elected body that abolished the monarchy, the moderate Girondin faction corresponded best to her ideas.

Protected by her husband's diplomatic status, she was in no danger in Paris until 1793, when she retreated to Coppet, Switz., the family residence near Geneva. It was here that she gained fame by establishing a meeting place for some of the leading intellectuals of western Europe. Since 1789 she had been the mistress of Louis de Narbonne, one of Louis XVI's last ministers. He took refuge in England in 1792, where she joined him in 1793. She stayed at Juniper Hall, near Mickleham in Surrey, a mansion that had been rented since 1792 by French émigrés. There she met Fanny Burney (later Mme d'Arblay), but their friendship was cut short because Mme de Staël's politics and morals were considered undesirable by good society in England.

She returned to France, via Coppet, at the end of the Terror in 1794. A brilliant period of her career then began. Her salon flourished, and she published several political and literary essays, notably *De l'influence des passions sur le bonheur des individus et des nations* (1796; *A Treatise on the Influence of the Passions upon the Happiness of Individuals and of Nations*), which became one of the important documents of European Romanticism. She began to study the new ideas that were being developed particularly in Germany. She read the elderly Swiss critic Karl Viktor von Bonstetten; the German philologist Wilhelm von Humboldt; and, above all, the brothers August Wilhelm and Friedrich von Schlegel, who were among the most influential German Romanticists.

But it was her new lover, Benjamin Constant, the author and politician, who influenced her most directly in favour of German culture. Her fluctuating liaison with Constant started in 1794 and lasted 14 years, although after 1806 her affections found little response.

*Literary theories.* At about the beginning of 1800 the literary and political character of Mme de Staël's thought became defined. Her literary importance emerged in *De la littérature considérée dans ses rapports avec les institutions sociales* (1800; *A Treatise of Ancient and Modern Literature* and *The Influence of Literature upon Society*). This complex work, though not perfect, is rich in new ideas and new perspectives—new, at least to France. The fundamental theory, which was to be restated and developed in the positivism of Hippolyte Taine, is that a work must express the moral and historical reality, the zeitgeist, of the nation in which it is conceived. She also maintained that the Nordic and classical ideals were basically opposed and supported the Nordic, although her personal taste remained strongly classical. Her two novels, *Delphine* (1802) and *Corinne* (1807), to some extent illustrate her literary theories, the former being strongly sociological in outlook, while the latter shows the clash between Nordic and southern mentalities.

*Banishment from Paris.* She was also an important political figure and was regarded by contemporary Europe as the personal enemy of Napoleon. With Constant and his friends she formed the nucleus of a liberal resistance that so embarrassed Napoleon that in 1803 he had her banished to a distance of 40 miles (64 km) from Paris. Thenceforward Coppet was her headquarters, and in 1804 she began what she called, in a work published posthumously in 1821, her *Dix Années d'exil* (*Ten Years' Exile*). From December 1803 to April 1804 she made a journey through Germany, culminating in a visit to Weimar, already established as the shrine of J.W. von Goethe and Friedrich von Schiller. In Berlin she met August Wilhelm von Schlegel, who was to become, after 1804, her frequent companion and counselor. Her guide in Germany, however, was a young Englishman, Henry Crabb Robinson, who was studying at Jena. The journey was interrupted in 1804 by news of the death of her father, whom she had always greatly admired. His death affected her deeply, but in 1805 she set out for Italy, accompanied by Schlegel and Simonde de Sismondi, the Genevan economist who was her guide on the journey. Returning in June 1805, she spent the next seven years of her exile from Paris for the most part at Coppet.

While *Corinne* can be considered the result of her Italian journey, the fruits of her visit to Germany are contained in her most important work, *De l'Allemagne* (1810; *Germany*). This is a serious study of German manners, literature and art, philosophy and morals, and religion in which she made known to her contemporaries the Germany of the Sturm und Drang movement (1770–1780). Its only fault is the distorted picture it gives, ignoring, for example, the violently nationalistic aspect of German Romanticism. Napoleon took it for an anti-French work, and the French edition of 1810 (10,000 copies) was seized and destroyed. It was finally published in England in 1813.

Meanwhile Mme de Staël, persecuted by the police, fled from Napoleon's Europe. Having married, in 1811, a young Swiss officer, "John" Rocca, in May 1812 she went to Austria and, after visiting Russia, Finland, and Sweden, arrived, in June 1813, in England. She was received with enthusiasm, although reproached by such liberals as Lord Byron for being more anti-Napoleonic than liberal and by the Tories for being too liberal. Her guide in England was Sir James Mackintosh, the Scottish publicist. She collected documents for, but never wrote, a *De l'Angleterre:* (the material for it can be found in the *Considérations sur la Révolution française* [1818; *Considerations on the Principal Events of the French Revolution*], which represents a return to Necker's ideas and holds up the English political system as a model for France).

On the Bourbon Restoration in 1814, Mme de Staël returned to Paris but was deeply disillusioned: the fall of Napoleon had been followed by foreign occupation and had in no way reestablished liberty in France. During the Hundred Days she escaped to Coppet and in September 1815 set out again for Italy. In 1816 she returned to spend the summer at Coppet, where she was joined by Byron, in flight from England after his unhappy matrimonial experience. A strong friendship developed between the two writers.

Mme de Staël's health was declining. After Byron's departure she went to Paris for the winter. Though poorly received by the returned émigrés and suspected by the government, she held her salon throughout the winter and part of the spring, but after April 1817 she was an invalid. She died in Paris in July of that year.

*Assessment.* Germaine de Staël's purely literary importance is far exceeded by her importance in the history of ideas. Her novels and plays are now largely forgotten, but the value of her critical and historical work is undeniable. Though careless of detail, she had a clear vision of wider issues and of the achievements of civilization. Her involvement in, and understanding of, the events and tendencies of her time gave her an unusual position: it may be said that she helped the dawning 19th century to take stock of itself.
(R. Es.)

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**staff,** also spelled STAVE, in the notation of Western music, five parallel horizontal lines that, with a clef, indicate the pitch of musical notes. The invention of the staff is traditionally ascribed to Guido of Arezzo in about the year 1000, although there are earlier manuscripts in which neumes (*q.v.*; signs from which musical notes evolved) are arranged around one or two lines in order to orient the singer. Guido used three or four lines of different colours. A four-line staff is still used to notate plainchant.

The standard five-line staff appeared in about 1200 in polyphonic music. Some 16th-century keyboard music used staves of more lines. A precise staff notation made possible composition of the complex polyphonic works that characterize Western art music.

**Staff, Leopold** (b. Sept. 14, 1878, Lwów, Pol. [now Lviv, Ukraine]—d. May 31, 1957, Skarżysko-Kamienna, Pol.), influential poet associated with the Young Poland movement at the end of the 19th century.

After completing his education at Lwów University, Staff moved to Kraków. In 1901 his *Sny o potędze* ("Dreams of Power"), the first of his more than 30 volumes of verse, was published in Warsaw; two years later *Dzień duszy* (1903; "The Day of the Soul") appeared. From the very beginning Staff showed a talent for handling poetic form; he would create new forms if the old seemed insufficient. A later collection, *Ucho igielne* (1927; "The Needle's Eye"), was dominated by religious feeling, expressed in concise and direct verse. His last collection of poems appeared in 1954. Staff also made translations and wrote some dramas, though this work is less well-known than his poetry.

**Stafford,** district (borough), county of Staffordshire, England, with an area of 231 square miles (599 square km), lying along the River Sow. It includes rural agricultural areas and the urban communities of Stone (a parish with a town council) and Stafford.

Founded by Aethelflaed, daughter of Alfred the Great, the town of Stafford had its own mint from the reign of Aethelstan to that of Henry II. Stafford town was chartered in 1206 and grew as a market town. It was the historic county town of Staffordshire. In 1643, during the English Civil Wars, Royalist Stafford was

occupied by Parliamentarians who demolished its 11th-century town walls and castle. Public buildings include the Shire Hall (1798–99), Borough Hall (1876–77), Guildhall (1934), and the Municipal Central Library, with an art gallery and museum (1914, extended 1962). The College of Further Education, the College of Art, and county administrative buildings are also in the borough. The Swan Hotel was associated with the 19th-century literary figures Charles Dickens and George Borrow.

Stafford lies on the London-Birmingham-Manchester road and rail routes. Industries include electrical and mechanical engineering and the production of salt and shoes. Pop. (1981) town, 62,242; (1988 est.) district, 117,-900.

**Stafford, Edward:** *see* Buckingham, Edward Stafford, 3rd Duke of.

**Stafford, Sir Edward William** (b. April 23, 1819, Edinburgh, Scot.—d. Feb. 15, 1901, London, Eng.), landowner and statesman who served three times as prime minister of New Zealand (1856–61, 1865–69, 1872).

The son of a landed Irish family, Stafford began farming sheep in New Zealand (1843), was elected superintendent of Nelson province (1853) and representative from Nelson to the General Assembly (1855), and formed his first ministry in 1856. During this five-year term as premier, Stafford negotiated financial settlements between the British government, the New Zealand Company, and the provinces. He also secured the passage of legislation that created three new provinces out of the existing ones, thus weakening and diffusing the provinces' power. Stafford's next ministry (1865–69) was primarily concerned with the problem of New Zealand's dependence on British troops during a flareup of hostilities with the Maoris. Stafford wished to retain the troops, but popular opposition to the financial burden of their maintenance resulted in the fall of his ministry. Stafford's third ministry lasted less than a month (Sept. 6 to Oct. 4, 1872), but he remained a member of the House during the "continuous ministry" of Sir Julius Vogel as a strong advocate of the abolition of the provinces (1875). He retired from politics, returned to England (1878), and was knighted in 1879.

**Stafford, Henry:** *see* Buckingham, Henry Stafford, 2nd Duke of.

**Stafford, Jean** (b. July 1, 1915, Covina, Calif., U.S.—d. March 26, 1979, White Plains, N.Y.), American short-story writer and novelist noted for deft development of fictional characters.

After graduating from the University of Colorado at Boulder (B.A., 1936; M.A., 1936), Stafford studied at Heidelberg University in Germany (1936–37). When she returned to the United States and settled in Boston, she painstakingly completed a four-year effort, the novel *Boston Adventure* (1944), which became a best-seller, reaching 400,000 copies. Its publication launched her career and guaranteed her a position of prominence in literary circles. She later wrote two more novels, *The Mountain Lion* (1947) and *The Catherine Wheel* (1952), as well as children's books. Her *The Collected Stories of Jean Stafford* (1969) won a Pulitzer Prize, and she contributed frequently to such journals as *The New Yorker, Kenyon Review, Partisan Review,* and *Harper's Bazaar.*

Stafford's personal life was somewhat tragic, marked by bouts of alcoholism and illnesses and by three troubled marriages (to the writers Robert Lowell, Oliver Jensen, and A.J. Liebling).

**Stafford, Thomas P(atten)** (b. Sept. 17, 1930, Weatherford, Okla., U.S.), American astronaut who flew two Gemini rendezvous missions (1965–66) and commanded the Apollo 10 mission (1969)—the final test of Apollo systems before the first manned landing on the Moon—as well as the Apollo spacecraft that docked with a Soviet Soyuz craft in space in 1975.

A graduate (1952) of the U.S. Naval Academy, Annapolis, Md., Stafford transferred to the Air Force and studied at the Air Force Experimental Flight Test School.



Thomas P. Stafford, 1966

By courtesy of the National Aeronautics and Space Administration

Stafford was Walter M. Schirra's copilot on the Gemini 6 mission, launched Dec. 15, 1965. Their rendezvous with the previously launched Gemini 7 was the world's first successful space rendezvous. On June 3, 1966, Eugene A. Cernan and command pilot Stafford were launched into space in Gemini 9. Stafford performed three rendezvous with a target vehicle, but a protective covering on the target had failed to detach, preventing docking.

Apollo 10, manned by Stafford, Cernan, and John W. Young, was launched on May 18, 1969. Three days later the spacecraft attained lunar orbit. The flight rehearsed every phase of a Moon landing except the landing itself. Cernan and Stafford descended in the Lunar Module to within 9.5 miles (15 km) of the Moon's surface. Apollo 10 completed 31 orbits of the Moon before returning to Earth, landing in the Pacific Ocean on May 26.

Stafford resigned from the space program in 1975 to become commander of the Air Force Flight Test Center, Edwards Air Force Base, California. In 1978 he was promoted to lieutenant general and became Air Force Deputy Chief of Staff for Research and Development, stationed in Washington, D.C. After retiring from the Air Force in 1979, he became an executive of a transportation company in Oklahoma.

**Staffordshire,** county of central England, in the Midlands north of the Birmingham industrial area. It includes Cannock Chase, East Staffordshire, Lichfield, South Staffordshire, and Staffordshire Moorlands districts; the city of Stoke-on-Trent; and the boroughs of Newcastle-under-Lyme, Stafford, and Tamworth. Its area is 1,049 square miles (2,716 square km).

The county lies across the upper reaches of the River Trent, the third longest river in England, which rises on Biddulph Moor near the Cheshire border and then flows southeastward across the county before turning northeastward to form the boundary with Derbyshire for several miles. From north to south the county can be divided into five physical regions. The northern moorlands, developed on grit and limestone, form the southern tip of the Pennines, the upland spine of northern England. Immediately to their south lie the coal measures, consisting of sandstones, clays, and shales interspersed with coal seams. This is the northern Staffordshire coalfield region, more familiarly known as The Potteries. The central agricultural belt is developed upon sandstones and marls; beyond this undulating countryside lies a fairly extensive exposure of the pebble strata that give rise to an area of barren heathland known as Cannock Chase. This area, formerly a royal forest, rises to between 600 and 700 feet (180 and 200 m). Finally an arm of Staffordshire extends south of Cannock Chase and west of the metropolitan area of West Midlands into the headwaters of the River Stour, a tributary of the River Severn.

Traces of Neolithic and Bronze Age settlements remain, especially in the northeast where there are long, low Neolithic burial mounds, and there are several Iron Age hill forts. The Romans built roads through the forests that covered the county, including what are now Watling Street and Rykneld Street, intersecting near Lichfield. From the 7th until the 9th century the area formed the centre of the Anglo-Saxon kingdom of Mercia. Tamworth was the kingdom's political capital, and Lichfield became its religious centre. At the end of the 9th century the area was ravaged by the Danes, and during the remainder of the 10th and much of the 11th century the county was the scene of much fighting. Domesday Book (1086) noted a sparsely populated and poor area.

Staffordshire's later history is largely bound up with that of its various industries. Coal and iron have been mined on the upper River Trent and around Cannock Chase since the 13th century, but they did not achieve real importance until the 18th century. The long-established pottery industry of northern Staffordshire also became renowned during the 18th century, particularly in association with the name of Josiah Wedgwood. The brewing industry of Burton-upon-Trent acquired similar recognition in the 19th century.

The greater part of Staffordshire is still devoted to agriculture, dairying being particularly important. Arable farming is largely concerned with the production of fodder crops, except in the extreme south and around Tamworth and Lichfield, where market gardening is important. The Forestry Commission has planted conifers on large areas of Cannock Chase. The Chase and the Pennines uplands, designated part of the Peak District National Park in 1951, are important as recreational centres for the industrial population of the West Midlands. The most important industrial area is on the northern Staffordshire coalfield around the towns of Tunstall, Burslem, Hanley, Stoke-upon-Trent, Fenton, and Langton. The pottery industry is still of major importance. Most towns in the county have also attracted various modern industries: Stafford has light engineering and shoe manufacture; Stoke, shoe and glass manufacture; and Leek, silk and rayon production. Burton-upon-Trent is still famous for its beer. In 1949 the University College of North Staffordshire was founded near Newcastle-under-Lyme, and in 1962 it became the University of Keele. Pop. (1988 est.) 1,032,900.

**Staffordshire figure,** type of pottery figurine made in Staffordshire, England, from the 18th century. The earliest figures, made from about 1740, are naive but effective renderings of the human body in salt-glazed stoneware—*e.g.,* the pew groups, or figures seated on a high-backed settle. Later some particularly happy effects were achieved in clouded, lead-glazed earthenware in which a subdued range of watery-looking colours—yellow, green, pale brown, and several grays—was used. Musicians, animals, shepherds, classical deities, allegorical figures, and portraits were in the repertoire. Among known artists are the potters Ralph Wood, Sr., and Ralph Wood, Jr., and the modeler Jean Voyez. Nineteenth-century figures, mostly portraits of English and American personages, such as Queen Victoria and George Washington,

were often vivacious and colourful but rather crude. Most 19th-century figures were theatrical in origin, and these are very much



Staffordshire lead-glazed earthenware figure, *c.* 1780; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London; photograph, EB Inc.

sought, but politicians, preachers, sportsmen, and criminals were all popular subjects.

**Staffordshire Moorlands,** district, county of Staffordshire, central England, occupying an area of 222 sq mi (576 sq km) directly east of the city of Stoke-on-Trent. Staffordshire Moorlands overlaps into the Peak District National Park on the northeast, where it is characterized by many bleak gritstone and limestone moorlands. Within the southern extremity of the Pennines, the moorlands extend from northwest to southeast in long ridges separated by deep valleys and decline in elevation from more than 1,600 ft (500 m) in the north to about 600 ft in the south to form an area of more fertile, gently rolling terrain.

Staffordshire Moorlands' rich resources of fireclays in the Keupermarls of the extreme southwest and coal in the extreme west were exploited between the late 18th and early 20th century. Coal is still mined in the west, and more than a century of mining has left behind huge heaps of rubble; the fireclay extraction left large and deep pits in the marl subject to flooding. Heightened sensitivity to environmental conservation finally generated efforts in the 1980s to reclaim some of the wastelands. Sheep rough graze the uplands, and dairy farming is commonplace in the southern valleys. Coal continues to be mined in the west. The parishes (towns) in the south and west (including Biddulph, Leek, and Cheadle) manufacture assorted textiles and are local agricultural centres. St. Giles Roman Catholic church in Cheadle is a mid-19th-century Gothic Revival masterpiece built by Augustus Welby Northmore Pugin. Potholing (exploration of underground caverns) is a popular sport in the limestone moorlands in the southeastern part of the district. Leek is the district seat. Pop. (1983 est.) 95,500.

**Staffordshire terrier,** breed of terrier developed in 19th-century England for fighting other dogs in pits. The breed was created by crossing the bulldog, then a longer legged and more agile dog, with a terrier, possibly the fox terrier or one of the old breeds known as the white English and the black-and-tan terriers. Once known by such names as bull-and-terrier, half and half, and pit bull terrier, the Staffordshire is a stocky, muscular, and unusually strong dog standing 17 to 19 inches (43 to 48 centimetres), with an average weight of about 30 to 50 pounds (14 to 23 kilograms). Its coat is stiff and short and may be any canine colour, solid or variegated.

**Staffordshire ware,** lead-glazed earthenware and unglazed or salt-glazed stoneware made in Staffordshire, England, from the 17th century onward. Abundance of local clays and coal gave rise to a concentration of pottery factories that made Staffordshire one of the foremost pottery centres in Europe. Porcelain was first made at Longton Hall *c.* 1750. Among



Fair Hebe lead-glazed earthenware jug designed and signed by Jean Voyez, Staffordshire, England, 1788; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London; photograph, EB Inc.

the distinguished factories located there were Spode, Minton, Wedgwood, and New Hall.

**stag beetle,** also called PINCHING BUG, any member of the approximately 900 species of the insect family Lucanidae (order Coleoptera). The mandibles (jaws) are greatly developed in the male and resemble the antlers of a stag. In many species the elaborately branched and toothed mandibles may be as long as the beetle itself; their pinch usually draws blood from a person. In some cases, however, the mandibles are large enough to be a handicap.

Stag beetles are robust and black or brown; they are attracted to lights at night. Paintings of a few brightly coloured species have been used on postage stamps: *Chaisognathus granti* from Chile is metallic green and iridescent red; *Phalacrognathus muelleri* from Australia is metallic carmine and edged with green.

Adult stag beetles range between 8 and 40 millimetres (1/3 to 1 2/3 inches) in length, although the male of the East Indian *Odontolabis alces* is more than 100 mm long. The male giraffe stag beetle (*Cladognathus giraffa*) of India and Java is almost as long, and its jaws make up about half of its total length. Most stag beetles live around rotting logs; they feed on sap.

**stage design,** the aesthetic composition of a dramatic production as created by such aspects of stagecraft as lighting, set, costume, sound, and stage architecture and machinery.

A brief treatment of stage design follows. For full treatment, *see* MACROPAEDIA: Theatrical Productions.

The evolution of staging in European culture can be seen as variations on the principles established by the classical Greek and Roman theatres. In the Hellenistic period, from the 4th century BC, the Greek theatre was already using within its permanent semicircular structure a number of movable scenic elements. These are thought to have included painted screens, wheeled platforms, and cranes for "flying" actors.

Most of the innovations in indoor staging that occurred during the Renaissance came from the Italian theatre. On its recreated classical stage, it enhanced the scenic background by applying the perspective techniques recently discovered in painting. Initially, two-dimensional street scenes were depicted, but with the development of the proscenium arch, more complex perspective architectural settings emerged. These included painted backdrops and flat wings at the sides of the stage. The visual effects became increasingly elaborate, often with numerous changes of scenery taking place before the audience's eyes.

Outside this tradition, the English Elizabethan theatre, with its deep thrust stage, featured a permanent architectural structure at the rear that enabled the action to take place vertically on different levels as well as horizontally in different directions. Although the actors used properties extensively, locations were suggested through the poetry rather than through painted scenery. This allowed a swiftness of action not possible in theatres where scene changes were cumbersome.

During the Baroque period, from the 17th century, the Italian influence spread through Europe. The demand for scenic spectacle meant a deepening of the stage to accommodate the newly developed machinery and the elaborate effects that came to dominate both opera and ballet. Italian staging was introduced to England in 1605 by the architect Inigo Jones, who designed many court masques adapting ideas that he had seen in Italy.

With the Romantic movement and its sentimentalization of nature, the landscape became a popular alternative to the architectural setting, and the scene painter became increasingly influential. The most common type of staging during the 19th century was a series of flats or cut-outs forming natural arches across the stage, through which could be seen a panorama at the back.

Changes in theatre architecture and improvements in stage machinery led to a new naturalism at the end of the 19th century, partly initiated by the Duke of Saxe-Meiningen. In his company, which toured throughout Europe, scenic details were determined by archaeological research rather than artistic fancy. In England this trend was reflected in lavish but historically accurate productions of the classics and in realistic box settings for modern plays. David Belasco, the American producer, carried realism to extremes by using live animals on stage.

As the perspective painters had influenced the Renaissance theatre, so the Cubists and Expressionists made their mark on the theatre of the early 20th century in a reaction against Realism. The emphasis changed from illusion to style. Such designers as Adolphe Appia and Gordon Craig introduced bolder, more symbolic shapes to interpret the mood of the play.

This simplification in staging meant that the actor, who had formerly been overwhelmed by the scenery, now became preeminent. A consequence in England was that Shakespeare's plays could, for the first time in centuries, be played as a continuous flow of action. In the 1920s the French director Jacques Copeau rediscovered the advantages of the bare platform stage. By the 1960s, Jerzy Grotowski introduced in Poland "poor theatre," a rejection of elaborate costumes, make-up, and scenery, with a more fluid actor-audience arrangement determined by the requirements of each play. Often the actors and audience occupied almost the same space.

The other major influence on 20th-century staging was the "alienation effect" introduced by the German dramatist Bertolt Brecht. He exposed the equipment of the stage to discourage the spectator from being swept away by the spell of theatre and, thus, losing objectivity.

One of the greatest influences on staging and scenic design has been the advancements made in stage lighting. Until the 16th century, theatre was mainly an outdoor activity. When the indoor theatres of the Renaissance ap-

peared, illumination was provided by torches, tallow candles, and open-wick lamps.

Reflectors to intensify the light were used in the 17th century, and, toward the end of the 18th century, glass-chimney oil lamps appeared, although the level of light was still very low. In order to make their features more distinctive, the actors resorted to painting their faces with cosmetics. Gas lighting, introduced to the London stage in 1803, was much brighter, and its intensity could be easily adjusted. Following Thomas Edison's invention in 1879, electric lighting was first used on stage by the Paris Opéra in 1880, and the other theatres were quick to follow.

It was the development of spotlights in the early part of the 20th century that made stage lighting a refined art. Though the visibility of the actor is regarded as the prime function of lighting, modern techniques have given designers complete lighting control of the stage space, allowing them to "paint with light," using it where and as they need it, rather than having to drench the stage with as bright a wash as possible. Similarly, make-up techniques have become more subtle, and, in smaller theatres, actors often use no make-up at all.

Today, the lighting designer has at his disposal a wide range of powerful spots and floodlights, as well as projectors capable of simulating water, cloud and fire effects, and other moving images. Lighting control boards also have reached a high efficiency through computerization, making them easy to operate however complex the lighting plot and however large the number of cues. With its almost limitless possibilities, modern stage lighting has become a vital means of unifying all the visual elements in a stage production.

Because of the immense size of the auditorium, costumes in the Greek and Roman theatre were usually stereotyped, so that the characters, who also wore masks, could be instantly identified. In the Renaissance theatre, classical modes of dress, though exaggerated and embellished, were the main inspiration for theatrical costume. These were taken to greater levels of extravagance and fantasy in the Baroque operas and ballets of the late 17th century, though by the end of the 18th century there was a trend toward historical authenticity.

The most imaginative innovations in costume design during the 20th century have been in the field of dance, which has frequently attracted avant-garde artists. Today, the designer has a choice between authentic and interpretative costume. A classical play may therefore be dressed in an indeterminate period to suggest the universality of the play.

**stage machinery,** devices designed for the production of theatrical effects, such as rapid scene changes, lighting, sound effects, and illusions of the supernatural or magical. Theatrical machinery has been in use since at least the 5th century BC, when the Greeks developed deus ex machina (*q.v.*), by which an actor could be lowered to the stage. During the Hellenistic period, the Greeks also used movable scenery, mounted on wheels or on revolving prisms called *periaktoi* (*q.v.*). The Romans elaborated on these devices, adding traps (*see* trap) and underground pumping systems so that their outdoor theatres could be flooded for aquatic shows. The mystery plays of the Middle Ages also used stage machinery, including a trapdoor, or a hellmouth, for the emergence of devils and flying machines for angels. But the art did not reach its zenith until the Italian Renaissance.

In the late 14th century Italian artists, architects, and engineers began to design elaborate machinery for spectacles produced in the churches on holy days. One such device was the Paradiso, a system of ropes and pulleys by which a whole chorus of angels was made to descend, singing, from a heaven of cotton clouds. Greek and Roman stage machinery was rediscovered, and Bastiano de Sangallo developed new variations on the ancient method of using *periaktoi* for quick changes of scenery. Italian stage machinery eventually became so elaborate that it was necessary to introduce a highly decorated proscenium arch to hide it. The early Italian operas were famous for their special effects: ocean waves were simulated on stage by painted spiral columns, laid across the stage in diminishing perspective and slowly turned; mock sea monsters and other fabulous creatures were operated by teams of men inside them; deities mounted on clouds flew on complicated systems of wires; and portions of the theatres could even be flooded for water spectacles.

In the 17th century the English masque designer Inigo Jones and Giacomo Torelli, one of the greatest Italian stage engineers, invented many important pieces of stage equipment, some of which are in use today. The most famous was a system for moving the wings at either side of the stage, thus making it possible to change scenery almost instantaneously.

The tradition of mechanical spectacle on stage was carried on into the 18th century by court theatres and by the Jesuit college theatre, but there was little new development. When lighting methods improved enormously in the 19th century, with such inventions as the limelight (*q.v.*), it became possible to spotlight the actors and to create special effects such as sunlight and moonlight. Magical illusions were also developed to a high art on the 19th-century English stage, which produced great refinements in the use of trapdoors and mirror devices for the simulation of ghosts and apparitions. In general, the "picture frame" stage of the later 19th century allowed the refinement of extraordinarily vivid spectacles, realistic and otherwise, by the use of treadmills, moving panoramas, and other stage machinery.

In the early 20th century, particularly in Germany, much use was made of revolving turntables and hydraulically elevated stages, on which complex scenes could be preset and then brought into view when needed, but such machinery was generally found to be too elaborate and expensive. The trend toward increasing intimacy between the actor and his audience led in the second half of the 20th century to the return of open stages and theatre-in-the-round, which require little scenery or stage machinery of any kind.

**stage wagon,** early, four-wheeled, American vehicle, used to carry both passengers and cargo. It was a precursor of the stagecoach. The first stage wagons had no springs, backless wooden benches, sides of wood, and canvas tops. Later improvements were roll-up leather curtains, solid flat tops, backrests, and springs or straps for the seats. A stage wagon of 1771, whose owner called it "The Flying Machine," was able to travel the 90-odd miles between Philadelphia and New York City in a day and a half.

In England stage wagons referred to great covered wagons, probably first used in the middle of the 16th century to carry freight and, later, passengers who could not afford stagecoach fares. Through a series of modifications the stage wagon evolved into the coach by the early 19th century.

**stagecoach,** any public coach regularly travelling a fixed route between two or more stations (stages). Used in London at least by 1640, and about 20 years later in Paris, stagecoaches reached their greatest importance in England and the United States in the 19th century, where the new macadam roads made travel quicker and more comfortable. In the United States, coaches were the only means that many people had to travel long overland distances. In 1802 one could travel by different coaches 1,200 miles (1,900 kilometres) between Boston and Savannah, Ga., with the total price of travel and lodging amounting to $100. In England, in 1828, coaches ran 12 times daily from Leicester to London alone. They were also very quick; the London–Edinburgh stagecoach travelled its 400-mile route at an average speed of 10 miles an hour. Washington Irving's essay "The Stage Coach" describes a journey by stagecoach in England and provides an interesting picture of the coachmen. Many of Dickens' novels retrospectively present the great age of the stagecoach. Gradually, after the 1840s, coaches succumbed to the railroad, although they continued to be used in less accessible places into the 20th century.



Stagecoach, *c.* 1868; in the Henry Ford Museum, Dearborn, Mich.
Owned by the Henry Ford Museum

Stagecoaches have passed into folklore and literature. Few films with a locale in the American West would be complete without one. Especially notable is John Ford's *Stagecoach*, which uses the coach to present a little ark of humanity thrown together to react to and learn from each other and so follows such literary examples as Smollett's *The Expedition of Humphry Clinker* and Maupassant's "Boule de suif." *See also* Concord coach; diligence.

**staged rocket,** vehicle driven by several rocket systems mounted in vertical sequence. The lowest, or first stage, ignites and then lifts the vehicle at increasing velocity until exhaustion of its propellants. At that point the first stage drops off, lightening the vehicle, and the second stage ignites and accelerates the vehicle further. Most space launch vehicles have three stages. *See also* launch vehicle.

**Stagg, Amos Alonzo** (b. Aug. 16, 1862, West Orange, N.J., U.S.—d. March 17, 1965, Stockton, Calif.), U.S. college football coach who had the longest coaching career—71 years—in the history of the sport. In 1943, at the age of 81, he was named college coach of the year, and he remained active in coaching until the age of 98. He is the only person selected for the National Football Hall of Fame, New Brunswick, N.J., as both a player and a coach. He was also important in the development of intercollegiate basketball.

As an end for Yale, where he was also an outstanding baseball pitcher, Stagg was chosen for Walter Camp's first All-America football team (1889). He then attended the International Young Men's Christian Association Training School, afterward Springfield (Mass.) College; there he both played and coached football and became one of the first enthusiasts of basketball, which was invented by James Naismith at the Springfield school in 1891. On Jan. 18, 1896, Stagg's University of Chicago team defeated the University of Iowa in the first intercollegiate basketball game with five players on each side.

During Stagg's 41-year tenure (1892–1932)

as football coach at Chicago, the Maroons won six Western Conference (Big Ten) championships outright (1899, 1905, 1907, 1908, 1913, 1924) and tied for another (1922). They were undefeated and untied in two seasons (1905, 1913) and undefeated but tied at least once in two other years (1899, 1908). For his Chicago teams he devised the end-around play, the man in motion, the huddle (also credited to Bob Zuppke, coach at the University of Illinois), the shift (later employed with great success by Knute Rockne at the University of Notre Dame), and the dummy for tackling practice. After his enforced retirement from Chicago at the age of 70, he was head coach at the College (now University) of the Pacific, Stockton, Calif. (1933–46); advisory coach at Susquehanna University, Selinsgrove, Pa., under his son, head coach Amos Alonzo Stagg, Jr. (1947–52); and advisory coach at Stockton Junior College (1953–60).

**staghead,** progressive slow death of tree branches from the top down. *See* dieback.

**staghorn fern,** member of the genus *Platycerium* (family Polypodiaceae), which is bizarre in appearance and frequently displayed in conservatories and other collections. *Platycerium* is epiphytic—*i.e.,* the plants grow upon



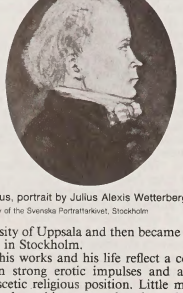
*Platycerium*
John Kohout from Root Resources—EB Inc.

other plants. The leaves are of two forms; one type is elongated, erect or pendulous, and repeatedly forked, hence the name staghorn. The other leaf type is flat or bowl-shaped and grows closely appressed to the support on which the plant lives. Termed mantle leaves, these provide in some species a kind of cavity in which humus collects and roots develop and absorb moisture and nutrients. The spore-producing structures (sporangia) are variously disposed on the lower sides of these leaves according to species.

Staghorn fern is also a common name for 10 species constituting the genus *Gleichenia,* native to subtropical and south temperate areas. They have small leaf segments and form dense growths in sunny places.

**Stagnelius, Erik Johan** (b. Oct. 14, 1793, island of Öland, Sweden—d. April 3, 1823, Stockholm), one of the strangest and most romantic of the Swedish Romantic poets.

Most of his childhood and youth were spent on the island of Öland where he was born. Educated by tutors and self-taught from his clergyman father's library, he attended the



Stagnelius, portrait by Julius Alexis Wetterbergh
By courtesy of the Svenska Portrattarkivet, Stockholm

University of Uppsala and then became a civil servant in Stockholm.

Both his works and his life reflect a conflict between strong erotic impulses and a radically ascetic religious position. Little more is known about him; even the chronology of most of his works cannot be determined with any certainty. During the last few years of his short life, he did, however, publish two dramas, *Martyrerna* (1821; "The Martyrs") and *Backanterna* (1822; "The Bacchantes"), as well as a collection of religious lyrics, *Liljor i Saron* (1821; "Lilies in Sharon"). His *Samlade skrifter* (1824–26; "Collected Works"), containing his vast unpublished material, appeared shortly after his death.

**Stahl, Franklin W(illiam)** (b. Oct. 8, 1929, Boston), U.S. geneticist who (with Mathew Meselson) elucidated (1958) the mode of replication of deoxyribonucleic acid (DNA; the gene substance), a double-stranded helix that dissociates to form two strands, each of which directs the construction of a new sister strand.

Educated at Harvard and the University of Rochester, Stahl pursued his research at the California Institute of Technology (1955–58) and the University of Missouri (1958–59). He joined the faculty of the University of Oregon in 1970.

**Stahl, Georg Ernst** (b. Oct. 21, 1660, Ansbach, Franconia—d. May 14, 1734, Berlin), German physician and chemist who developed the phlogiston theory of combustion and of such related biological processes as respiration, fermentation, and decay. The theory dominated chemical thought for almost a century. He also, at times, believed in alchemy and animism.



Georg Ernst Stahl, detail of a copper engraving attributed to a member of the Bernigeroth family, 18th century
By courtesy of the Bildersammlung des Universitatsarchivs, Martin-Luther-Universitat Halle, Wittenberg, E.Ger

*Life.* Stahl grew up under the influence of Pietism, a vigorous movement for moral reform in the Lutheran Church that had begun to spread across Germany. German Pietism stressed the inward, practical, devotional, and tolerant aspects of Christianity in a manner not unlike that of the Friends (Quakers) in England.

Stahl studied medicine at Jena, Thüringen. His teacher, Georg Wolfgang Wedel (1645–1721), was a proponent of the chemiatric school, which sought to explain life processes in terms of chemical composition. Even when Stahl later broke new ground in chemistry as well as in medicine, his early training remained apparent in his firm belief in the essential unity of these two sciences. At Jena, Stahl formed a close friendship with his fellow student Friedrich Hoffmann (1660–1742). Stahl was graduated in 1684, having begun to teach the year before. In 1687 he was appointed court physician by Johann Ernst, duke of Sachsen-Weimar.

In 1694, Frederick III, elector of Brandenburg, founded the University of Halle. When Hoffmann was asked to organize the medical school of the new university, he asked Stahl to join him. For the next 20 years the two worked side by side; Stahl taught theoretical medicine, physiology, pathology, dietetics, pharmacology, and botany, while Hoffmann lectured on practical medicine, anatomy, physics, and chemistry. Gradually, however, deep temperamental differences, which were reflected in increasingly divergent views on theoretical questions, divided them. Hoffmann became an ardent convert to the school of iatromechanics, which saw living organisms as machines to be explained by the laws of classical mechanics. Stahl could not accept such an oversimplification. He remained faithful to his iatrochemical training in seeing physiological processes as chemical changes, but he insisted that neither mechanical nor chemical laws alone were sufficient to account for the phenomenon of life. To live, an organism required direction by a force for which Stahl used the Latin word *anima.* That word, the full meaning of which is not well caught in the usual translations of "soul" or "spirit," gave rise to the name animism for this theory. Vitalism and animaterialism are later words for very similar views.

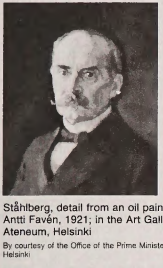
Their opposition in scientific matters eventually destroyed the friendship between Stahl and Hoffmann. The friends became rivals and, at last, enemies. Stahl must have welcomed his call in 1716 to Berlin, where he served as personal physician to Frederick William I, king of Prussia.

*Assessment.* Stahl's contributions to science are to an extraordinary degree reflections of his personality. By character he was contemplative, melancholy, and deeply inclined toward the inner-directed religious Pietism of the late 17th century. His intellect, on the other hand, was analytical and sweeping and compelled him toward large abstractions in the manner of the 18th century. Stahl bridged two ages, as did his phlogiston theory. It was the first systematic account of chemical transformation, but without the concepts of atom or element. The roots of his ideas lie not in the prior use of the word phlogiston by Jan Baptist van Helmont (1577–1644) or in the vaguer theories of Johann Joachim Becher (1635–82) but in Aristotelian thought: phlogiston is the property of being combustible that is lost in the process of combustion but that may be regained by contact with materials especially rich in phlogiston, such as coal. On an ancient philosophical foundation, Stahl built a practical theory that clarified fundamental chemical concepts. (C.W.B.)

BIBLIOGRAPHY. There is no published biography of Stahl; biographical information may be found in the article by C.W. Beck, "Georg Ernst Stahl," *J. Chem. Educ.,* 37:506–510 (1960).

**Ståhlberg, Kaarlo Juho** (b. Jan. 28, 1865, Suomussalmi, Oulu county, Fin.—d. Sept. 22, 1952, Helsinki), architect of the Finnish constitution and the first president of independent Finland.

Joining the Constitutionalist Party, Ståhlberg was elected to the Diet in 1904 and entered the government of the autonomous Grand Duchy of Finland in 1905 but resigned in 1907. From 1908 to 1918 he was professor of administrative law at the University of Helsinki.



Ståhlberg, detail from an oil painting by Antti Favén, 1921; in the Art Gallery of Ateneum, Helsinki

By courtesy of the Office of the Prime Minister, Helsinki

Consistently democratic in outlook, he was among the first Finnish politicians to call for universal suffrage. His draft of a republican constitution (1917) became the basis of the actual constitution of 1919. In the reshuffling of the political parties when national independence was achieved, Ståhlberg joined the National Progressive Party. Elected president of the new republic (1919), he set the pattern for his successors by making full use of his constitutional powers. He did his utmost to narrow the gap between "Reds" and "Whites" after the Civil War. At the end of his term (1925) he did not seek reelection, for he thought that the right wing would become more easily reconciled to the republic if he stood aside. He lost the presidential election of 1931 by two votes and that of 1937 by one vote.

**stained glass,** in the arts, the coloured glass used for making decorative windows and other objects through which light passes. Stained glass itself is no different from other coloured glass, being glass to which metallic oxides have been added in order to create colour. The adjective stained has traditionally been reserved to describe the glass used to create pictorial windows. Stained glass, which is purely a Western phenomenon, reached the status of a fine art in the 12th and 13th centuries, when it was combined with Gothic architecture to create brilliant and moving effects.

A brief treatment of stained glass follows. For full treatment, *see* MACROPAEDIA: Decorative Arts and Furnishings.

The effect of a stained-glass window is created not by the coloured glass itself but by light passing through the glass and by the setting in which that light is perceived. Contrast is a vital aspect of the effect, which is why the windows that light the vast, dark, Gothic interiors of medieval cathedrals seem so intensely jewellike and brilliant. Light is constantly changing—with the time of day, the seasons, and the weather—so the effect of stained glass varies almost from moment to moment. Certain effects of light will bring out certain tones, and intensity will vary from the soft and mute to the brilliant. Stained glass is similar to painting in certain respects but is probably more akin to the art of mosaic, where tiny, individually coloured components are assembled by the artist to create a unified overall design, and to the art of enameling, particularly the cloisonné technique, where raised metal strips separate the various coloured enamels and form an intrinsic part of the design.

Stained glass existed in Early Christian times but did not evolve as an important decorative art until much later. The earliest existing pictorial windows are those at the Cathedral of Augsburg in Germany. Other important 12th-century glass was made for the Abbey of St. Denis, near Paris. In the second quarter of the 13th century the Sainte-Chapelle in Paris was glazed with brilliant walls of stained glass, in a cycle of 1,134 scenes in 15 windows. The finest remaining 13th-century glass in England is at Canterbury Cathedral.

Medieval stained glass was cut from thin coloured sheets, and then the design or picture was assembled by fitting the pieces of glass into lead strips that became an integral part of the design. Black vitreous enamel was used to paint details of the design onto the glass pieces. The separately assembled lead panels were then inserted into iron framing members that formed the windows. Some windows reached enormous size—that at Chartres Cathedral depicting the life of Christ covers more than 250 square feet (23.2 square m). As window sizes increased, the stained glass assumed ever increasing importance from both an aesthetic and a catechistic point of view. Themes were usually taken from the Scriptures, and common subjects included the lives of the saints, prophets, Christ, and the Virgin, as well as the Last Judgment and the Apocalypse.

After the 13th century, stained glass began to decline as an art form, though important examples were made until the 16th century. Its decline began when stained-glass artists began to seek the realistic effects sought by Renaissance painters, effects for which the technique was less suited and that diverted artists from exploiting its intense light-refracting quality.

In the 19th century a revival of interest in medieval stained glass was part of the Gothic revival, and its techniques led to the production of many brilliant windows in England by the leader of the Arts and Crafts movement, William Morris, to designs by the artist Edward Burne-Jones and in the United States by Louis Comfort Tiffany. The Art Nouveau movement saw an increasing use of stained glass for decorative purposes, and Frank Lloyd Wright used it in much of his architectural work. In the 20th century brilliant stained glass was designed by such painters as Henri Matisse, Marc Chagall, and Fernand Léger.

**stainer** (insect): *see* red bug.

**Stainer, Sir John** (b. June 6, 1840, London, Eng.—d. March 31, 1901, Verona, Italy), English organist and church composer and a leading early musicologist.

As a boy Stainer sang in the choir of St. Paul's Cathedral (1847–56). At the age of 16 he was appointed organist at the newly opened St. Michael's College, Tenbury, a school for church musicians. Named organist at St. Paul's in 1872, Stainer served in that prestigious position until 1888, when he resigned because of failing eyesight. He was a founder of the (later Royal) Musical Association in 1874 and taught at the National Training School for Music, opened in 1876. Knighted in 1888, Stainer was professor of music at the University of Oxford from 1889 to his death.

Stainer's Romantic church music is now mainly performed in England, although his best-known oratorio, *The Crucifixion* (1887), is also performed in other English-speaking countries. He wrote songs as well as cantatas, services, anthems, and other music for the church service. He also published treatises on the organ and music theory and collaborated on a dictionary of musical terms. Stainer's most lasting contribution is his compilation *Early Bodleian Music*, with musical examples from the 12th to the 16th century, and *Dufay and His Contemporaries* (publication begun in 1898), an edition of 15th-century music prepared with the help of his children. Both publications helped open the way to the study of Medieval and Renaissance music, which during Stainer's time was almost unknown.

**Staines,** locality in Spelthorne district, county of Surrey, England, on the left bank of the River Thames. A residential community on the western fringe of Greater London, Staines marks a crossing of the Thames used since Roman times by the major road from London to the southwest of Britain. Nearby are large reservoirs where Thames water is pumped, purified, and stored for London's Metropolitan Water Board. Pop. (1981) 53,815.

**stainless steel,** any one of a family of alloy steels usually containing 10 to 30 percent chromium. In conjunction with low carbon contents, chromium imparts remarkable resistance to corrosion and heat. Other elements such as nickel, molybdenum, titanium, aluminum, niobium, copper, nitrogen, sulfur, phosphorus, and selenium may be added to increase corrosion resistance to specific environments, enhance oxidation resistance, and impart special characteristics.

Most stainless steels are first melted in electric-arc or basic oxygen furnaces and subsequently refined in another steelmaking vessel, mainly to lower the carbon content. In the argon-oxygen decarburization process, a mixture of oxygen and argon gas is injected into the liquid steel. By varying the ratio of oxygen and argon, it is possible to remove carbon to controlled levels by oxidizing it to carbon monoxide without also oxidizing and losing expensive chromium. Thus, cheaper raw materials, such as high-carbon ferrochromium, may be used in the initial melting operation.

There are three major groups in the family of stainless steels: austenitic, ferritic, and martensitic. Austenitic steels, which contain 16 to 26 percent chromium and up to 35 percent nickel, usually have the highest corrosion resistance. They are not hardenable by heat treatment and are nonmagnetic. The most common type is the 18/8, or 304, grade, which contains 18 percent chromium and 8 percent nickel. Typical applications include aircraft and the dairy and food-processing industries. Standard ferritic steels contain 10.5 to 27 percent chromium and are nickel-free; because of their low carbon content (less than 0.2 percent), they are not hardenable by heat treatment and have less critical anticorrosion applications, such as architectural and auto trim. Martensitic steels typically contain 11.5 to 18 percent chromium and up to 1.2 percent carbon with nickel sometimes added. They are hardenable by heat treatment, have modest corrosion resistance, and are employed in cutlery, surgical instruments, wrenches, and turbines.

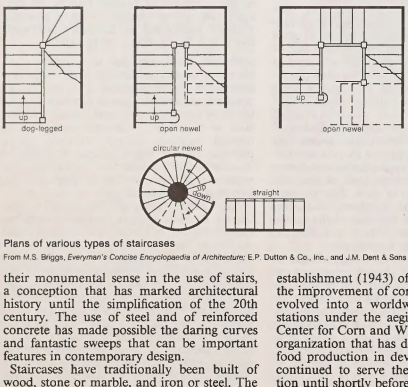
**Stainville, Étienne-François de Choiseul, Count** (comte) **de:** *see* Choiseul, Étienne-François de Choiseul, Duke de.

**stair-step moss** (*Hylocomium splendens*), plant of the order Bryales that covers areas of coniferous forest floor of the Northern Hemisphere and also occurs on dunes, ledges, and tundra. The fernlike shoots have many branches and reddish, glossy caulids (stems) with phyllids (leaves) up to 3 mm (0.12 inch) long. The capsules (spore cases) of the female plant are borne on setae (stalks) about 2 cm (0.8 inch) long.

**staircase,** series, or flight, of steps between two floors. Traditionally staircase is a term for stairs accompanied by walls, but contemporary usage includes the stairs alone.

The origin of the staircase is uncertain. On the road up Tai Shan (mountain) in China there are many great flights of ancient granite

steps; the earliest staircases seem to have been built with walls on both sides, as in Egyptian pylons that date from the 2nd millennium BC. The Cretan palaces, as at Knossos and Phaistos (both *c.* 1500 BC), make important use of stairs, and the Assyrian ziggurat of the 9th or 8th century BC was often adorned with massive stairs. The palace terrace at Persepolis has a double flight of steps (6th century BC) of great beauty. The Romans were noted for




Plans of various types of staircases
From M.S. Briggs, *Everyman's Concise Encyclopaedia of Architecture*; E.P. Dutton & Co., Inc., and J.M. Dent & Sons Ltd.

their monumental sense in the use of stairs, a conception that has marked architectural history until the simplification of the 20th century. The use of steel and of reinforced concrete has made possible the daring curves and fantastic sweeps that can be important features in contemporary design.

Staircases have traditionally been built of wood, stone or marble, and iron or steel. The horizontal surface of a step is called its tread and the vertical front its riser; steps are placed between strings that are inclined to the angle of the staircase; strings are supported by newel posts that also support the handrail, forming a balustrade.

**staircase shell** (snail): *see* wentletrap.

**Staked Plain** (United States): *see* Llano Estacado.

**Stakhanov,** also spelled STACHANOV, formerly (until 1978) KADIYEVKA, also spelled KADIJEVKA, city, Luhansk *oblast* (province), eastern Ukraine. It is situated in the northern part of the Donets Coal Basin. The city developed in the 19th century as a coal-mining settlement. From 1935 to 1943, it was known as Sergo. Stakhanov is one of the major coal-mining towns of the Donets Basin, though it is declining in importance as pits become worked out and as other fuels increase in importance. There are coke-chemical and ferroalloy works and an artificial textile mill to diversify its industry. The town was renamed in 1978 for A. Stakhanov, the legendary Soviet model coal miner whose use of innovative working methods to greatly increase his personal productivity became the basis for the Stakhanovite movement in the Soviet Union. Pop. (1991 est.) 112,700.

**Stakman, Elvin Charles** (b. May 17, 1885, Algoma, Wis., U.S.—d. Jan. 22, 1979, St. Paul, Minn.), pioneering American plant pathologist and educator who established the methods for identifying and combatting diseases of wheat and other important food crops.

Stakman received his B.A. (1906), M.A. (1910), and Ph.D. (1913) from the University of Minnesota. In 1909 he became instructor in the newly established department of plant pathology, and in 1940 he became head of the department, a position he held until his retirement in 1953. Through the years he also held an appointment in the U.S. Department of Agriculture, where he organized and directed research at the Federal Cereal Rust Laboratory, which reflected Stakman's deep interest and prolific research in the behaviour and control of fungi-produced leaf rust in cereals.

His work with food crops led him to take an active role in international scientific affairs. In 1941 he was on a panel that advised the Rockefeller Foundation on the feasibility of cooperation between the Mexican government and the Rockefeller Foundation to improve crop production. The outcome was the establishment (1943) of a research station for the improvement of corn (maize), which then evolved into a worldwide network of such stations under the aegis of the International Center for Corn and Wheat Improvement, an organization that has done much to improve food production in developing countries. He continued to serve the Rockefeller Foundation until shortly before his death.

In addition to scientific papers, Stakman published *Principles of Plant Pathology* (1957; with J.G. Harrar), and *Campaign Against Hunger* (1967), with R. Bradfield and P. Mangelsdorf, his fellow consultants to the Rockefeller Foundation's agricultural program.

**stalactite and stalagmite,** elongated forms of various minerals deposited from solution by slowly dripping water. A stalactite hangs like an icicle from the ceiling or sides of a cavern. A stalagmite appears like an inverted stalactite, rising from the floor of a cavern.

Stalactites hanging from the ceilings of caverns commonly exhibit a central tube or the trace of a former tube whose diameter is that of a drop of water hanging by surface tension. A drop on the tip of a growing stalactite leaves a deposit only around its rim. Downward growth of the rim makes the tube. The simplest stalactite form, therefore, is a thin-walled stone straw, and these fragile forms may reach lengths of 0.5 m (20 inches) or more where air currents have not seriously disturbed the growth. The more common form is a downward-tapering cone and is simply a thickening of the straw type by mineral deposition from a film of water descending the exterior of the pendant.

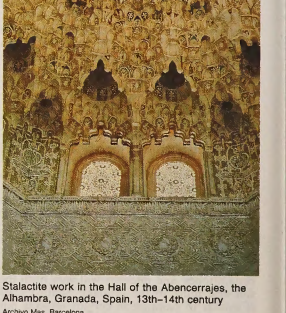
Stalagmites have thicker proportions and grow up on the bottom of a cavern from the same drip-water source, the mineral from which is deposited after the water droplet falls across the open space in the rock. Not every stalactite has a complementary stalagmite, and many of the latter may have no stalactite above them. Where the paired relation exists, however, continual elongation of one or both may eventually result in a junction and the formation of a column.

The dominant mineral in such deposits is calcite (calcium carbonate), and the largest displays are formed in caves of limestone and dolomite. Other minerals that may be deposited include other carbonates, opal, chalcedony, limonite, and some sulfides.

Conditions that favour the deposition are: (1) a source rock above the cavern; (2) downward percolation of water supplied from rain; (3) tight but continuous passageways for this water, which determine a very slow drip; and (4) adequate air space in the void to allow either evaporation or the escape of carbon dioxide from the water, which thus loses some of its solvent ability.

**stalactite work,** also called HONEYCOMB WORK, Arabic AL-ḤALĪMĀT AL-ʿULIYĀ ("the overhang"), pendentive form of architectural ornamentation, resembling the geological formations called stalactites. This type of ornamentation is characteristic of Islāmic architecture and decoration. It consists of a series of little niches, bracketed out one above the other, or of projecting prismatic forms in rows and tiers that are connected at their upper ends by miniature squinch arches. Its infinite varieties may be classified into three groups, the first consisting of those basically niche shaped, in which the concave curve is the most important feature; the second group includes those in which the vertical edges between the niches are the most important feature; the last group consists of elaborately intersecting, miniature arches. The first two groups occur commonly in Syrian, Moorish, and Turkish work and, in their simpler forms, in Persia; the last group is typically Persian and is also found in Mughal work in India.

Stalactite ornamentation developed comparatively late in Islāmic art, the earliest buildings in Syria, Egypt, and North Africa showing no traces of it. It seems to appear suddenly throughout the Islāmic world toward the beginning of the 12th century, reaching its highest development in the 14th and 15th centuries, when it became the usual decoration for door heads, niches, and the bracketing under cornices and minaret galleries. The richest examples of the prismatic type are found in Moorish work in Spain, especially in the intricate wood and plaster ornament of such palaces as the 14th- and 15th-century Alhambra in Granada and the 14th-century Alcázar in Seville. A peculiar type of faceted, crystal-



Stalactite work in the Hall of the Abencerrajes, the Alhambra, Granada, Spain, 13th–14th century
Archivo Mas, Barcelona

shaped stalactite is found in Turkey; this form became the most common Turkish capital decoration. Stalactite ornamentation was also used to decorate Islāmic furniture and accessory furnishings.

**Stalin, Joseph,** Russian in full IOSIF VISSARIONOVICH STALIN, original name (Georgian) IOSEB DZHUGASHVILI (b. Dec. 21 [Dec. 9, Old Style], 1879, Gori, Georgia, Russian Empire—d. March 5, 1953, Moscow, Russia, U.S.S.R.), secretary-general of the Communist Party of the Soviet Union (1922–53) and premier of the Soviet state (1941–53), who for a quarter of a century ruled the Soviet Union as dictator and transformed it into a major world power.

A brief treatment of Joseph Stalin follows. For full treatment, *see* MACROPAEDIA: Stalin.

Though originally trained for the priesthood, Stalin joined an underground Georgian revolutionary organization in 1900 and the Bolshevik faction of the Russian Social Democrats in 1903. A relatively minor figure in the party before the Bolshevik Revolution, he served as commissar for nationalities (1917–23) and for state control (1919–23) in the Soviet government; in 1922 he also became secretary-general of the party's Central Committee, a post that later provided the power base for his dictatorship. After Vladimir Lenin died (1924), Stalin successfully overcame his rivals in the party power struggles and became the dominant figure in Soviet politics. In 1928 he launched an intensive industrialization program that forced collectivization of agriculture and sweeping, often brutal social reorganization. During the 1930s he also supervised massive purges of the Communist Party and of Soviet population in general. Although he concluded a nonaggression pact with Adolf Hitler (1939), the German invasion of the Soviet Union (1941) drew him into World War II as an ally of Great Britain and, later, the United States. Having assumed the posts of head of the Soviet government and supreme commander in chief (1941), he directed the Soviet armies as they repulsed the German invaders and occupied the eastern European lands. After the war, Stalin was a key figure of the Cold War era, establishing Soviet hegemony in eastern Europe and rivaling the United States for world leadership. At home, he continued his repressive measures to control dissent. He remained the Soviet Union's leader until his death in 1953.

**Stalinabad** (Tajikistan): *see* Dushanbe.

**Stalingrad** (Russia): *see* Volgograd.

**Stalingrad, Battle of** (summer 1942–Feb. 2, 1943), unsuccessful German assault on the city of Stalingrad (now Volgograd) in the Russian S.F.S.R. during World War II that marked the furthest extent of the German advance into the Soviet Union. As a major industrial centre, Stalingrad was an important prize in itself, and control of the city would have cut Soviet transport links with southern Russia via the Volga River. The German campaign against Stalingrad also served to anchor the northern flank of the larger German drive into the oil fields of the Caucasus.

During the summer of 1942 the Germans advanced to the suburbs of Stalingrad but failed to take the city itself against a determined defense by the Red Army, despite repeated attacks by the 6th Army under Friedrich Paulus and part of the 4th Panzer Army under Hermann Hoth. By September they reached the city's centre, where they encountered stiff resistance from the Soviet 62nd Army under General Vasily I. Chuikov. The city's Soviet defenders had been driven almost to the Volga by mid-October, but the Germans' supplies were beginning to run low, their tanks were of little value in the constant street fighting, and winter was approaching.

On November 19 the Soviets launched a counterattack in the form of pincer movements north and south of the city, and by the 23rd they had encircled the 6th Army and part of the 4th within Stalingrad. A German attempt to relieve Paulus failed in mid-December. Under orders from Adolf Hitler, Paulus continued to fight on, making possible the eventual escape of the beleaguered German forces from the Caucasus. On Jan. 31, 1943, Paulus disobeyed Hitler and surrendered, and on February 2 the last of his remaining 91,000 troops turned themselves over to the Soviets. The Soviets recovered 250,000 German and Romanian corpses in and around Stalingrad and total Axis losses (Germans, Romanians, Italians, and Hungarians) are estimated to have been 800,000 dead. Official Russian military historians esitmate that 1,100,000 Soviet soldiers lost their lives in the campaign to defend the city.

**Staliniri** (Georgia): *see* Tskhinvali.

**Stalinism,** the method of rule, or policies, of Joseph Stalin, Soviet Communist Party and state leader from 1929 until his death in 1953. Stalinism is associated with a regime of terror and totalitarian rule.

In a party dominated by intellectuals and rhetoricians, Stalin stood for a practical approach to revolution, devoid of ideological sentiment. Once power was in Bolshevik hands, the party leadership gladly left to Stalin tasks involving the dry details of party and state administration. In the power struggle that followed Vladimir Lenin's death in 1924, the intellectual sophistication and charismatic appeal of Stalin's rivals proved no match for the actual power he had consolidated from positions of direct control of the party machinery. By 1929 his major opponents were defeated; and Stalinist policies, which had undergone several shifts during the power struggle, became stabilized. Stalin's doctrine of the monolithic party emerged during the battle for power; he condemned the "rotten liberalism" of those who tolerated discussion on or dissent from party policies. Lenin's pronouncements, except those uncomplimentary to Stalin, were codified as axioms not open to question. Persons opposed to these new dogmas were accused of treason to the party. What came to be called the "cult of personality" developed as Stalin, presenting himself as Lenin's heir, came to be recognized as the sole infallible interpreter of party ideology.

Basic to Stalinism was the doctrine of "socialism in one country," which held that, though the socialist goal of world proletarian revolution was not to be abandoned, a viable classless society could be built within Soviet boundaries and despite encirclement by a largely capitalist world. Stalin, appealing both to socialist revolutionary fervour and to Russian nationalism, launched in the late 1920s a program of rapid industrial development of unprecedented magnitude. A "class war" was declared on the rich farmers in the name of the poor, and Russian agriculture was rapidly collectivized, against considerable rural resistance, to meet the needs of urban industry. The need for expertise and efficiency in industry postponed the egalitarian goals of the Bolshevik Revolution; Stalin denounced "levelers" and instituted systems of reward that established a socioeconomic stratification favouring the technical intelligentsia. Heavy industry was emphasized to ensure Russia's future economic independence from its capitalist neighbours.

While socialist ideology foresaw a "withering away" of the state as the classless society became a reality, Stalin asserted that the state must instead become stronger before it could be eliminated. Stalinism held that the enemies of socialism within and without Russia would try to avert the final victory of the Revolution. To face these efforts and protect the cause, it was argued, the state must be strong. Power became more and more centralized in Stalin, who in the late 1930s launched a bloody purge of all those he regarded as even potentially dangerous to the Soviet state. As part of the struggle against those whom he considered political rivals, Stalin identified political opposition with treason and used this as a weapon in his struggle against Leon Trotsky and Nikolay I. Bukharin and their supporters. By February 1939 most of the "Old Bolsheviks," those revolutionaries who in 1917 had begun the Revolution, had been exterminated. Millions more (estimated at from 7 million to 15 million) were sent to the forced-labour camps that Stalin made an integral part of the Soviet economy.

Three years after Stalin's death in 1953, Soviet leaders led by Nikita Khrushchev denounced the cult of Stalin and the terrorism perpetrated by his regime; they saw Stalinism as a temporary aberration in Soviet socialist development. Others saw it as a brutal but necessary and inevitable phase of that development. Still others saw in Stalinism an irrevocable Soviet break with the ideals of the Revolution.

In 1989 the Soviet historian Roy Medvedev estimated that about 20 million died as a result of the labour camps, forced collectivization, famine, and executions. Another 20 million were victims of imprisonment, exile, and forced relocation.

**Stalino** (Ukraine): *see* Donetsk.

**Stalinogorsk** (Russia): *see* Novomoskovsk.

**Stalinsk** (Russia): *see* Novokuznetsk.

**stalk-eyed fly,** any member of the insect family Diopsidae (order Diptera), characterized by eyes mounted on long stalks near the antennae. This arrangement, although advantageous to vision, is an aerodynamic handicap.

The one species in North America (*Sphyracephala brevicornis*) is sometimes found on skunk cabbage. The other species are tropical.

*Consult the* INDEX *first*

**Stalwart,** in U.S. history, member of a faction of the Republican Party that opposed the civil-service reform policies of President Rutherford B. Hayes and sought unsuccessfully a third presidential term for Ulysses S. Grant. The Stalwarts, or regular Republicans, vied with the generally more liberal Half-Breeds for control of the party in the 1870s and '80s. Among Stalwart leaders were Roscoe Conkling of New York and Chester A. Arthur, vice president under James A. Garfield.

**Stamboliyski, Aleksandŭr** (b. March 1, 1879, Slavovitsa, Bulg.—d. June 14, 1923, near Slavovitsa), leader of the Agrarian Party in Bulgaria, supporter of the Allied cause during World War I in opposition to his pro-German king Ferdinand, and prime minister of a reformist government after the war (1919–23).



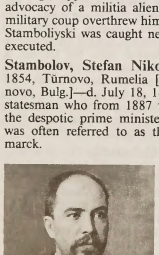
Stamboliyski
EB Inc.

After attending an agricultural college in Germany, Stamboliyski turned to journalism, becoming editor of the newly formed Agrar-

ian League's organ in 1902. A lifelong supporter of peasant interests, he entered the National Assembly in 1908 as head of the Bulgarian Agrarian Union (Peasant Party). His recurrent disputes with King Ferdinand finally climaxed in 1915, when Bulgaria prepared to enter World War I on Germany's side. Stamboliyski, who viewed Russia as the liberator of the Slavs, favoured the Allied cause and threatened the person of the king. Court-martialed, he received a life sentence but was freed in September 1918. While Bulgaria's armed forces began to disintegrate near the end of World War I, he led an insurrection, forced Ferdinand's abdication, and proclaimed Bulgaria a republic. Although he was defeated and the monarchy was restored under Ferdinand's son Boris, Stamboliyski became a cabinet member in January 1919 and prime minister in October of that year. He signed the Treaty of Neuilly with the Allies (Nov. 27, 1919), which considerably decreased Bulgaria's territory; despite that unpopular act, his Agrarians gained a majority in the March 1920 elections. Stamboliyski's government, with a strong anti-urban and anti-industrial bias, redistributed land to the peasantry, reformed the judicial system, and favoured peasant cooperatives, universal suffrage, and more local self-government.

Stamboliyski loyally carried out the stipulations of the Treaty of Neuilly, winning from the Allies a reduction in reparations. He established ties with Polish and Czechoslovak peasant leaders in the hope of creating a "Green International" (in opposition to the Communist "Red International"), but this international peasant movement never lived up to his expectations. Improving relations with Yugoslavia through the Treaty of Niš (1922), Stamboliyski hoped to establish a South Slav federation. He won the 1923 election by a landslide, but his domestic policies, pacifist leanings, rapprochement with Yugoslavia, and advocacy of a militia alienated the army. A military coup overthrew him on June 9, 1923; Stamboliyski was caught near his village and executed.

**Stambolov, Stefan Nikolov** (b. Jan. 31, 1854, Türnovo, Rumelia [now Veliko Türnovo, Bulg.]—d. July 18, 1895, Sofia, Bulg.), statesman who from 1887 to 1894 served as the despotic prime minister of Bulgaria; he was often referred to as the Bulgarian Bismarck.



Stambolov, detail of a painting by Klissourov, 1892

By courtesy of the Embassy of the People's Republic of Bulgaria, London

The son of an innkeeper, Stambolov early joined the Bulgarian underground revolutionary movement against Turkish rule and led small anti-Turkish risings in 1875 and 1876. He fought with Bulgarian irregulars against Turkey in the Russo-Turkish War (1877–78), and, soon after Bulgaria gained autonomy in 1878, he was elected to the new Bulgarian assembly (Sobranye). Elected president of the assembly in 1884, he successfully urged upon Bulgaria's prince, Alexander I, a course of union with Eastern Rumelia (1885), despite the opposition of Russia. Following the forced abdication and abduction of Alexander in August 1886, Stambolov established a counter-revolutionary regime loyal to the prince at Türnovo, which undermined the pro-Russian provisional government at Sofia. Following Alexander's formal abdication (September 1886), Stambolov headed the regency council and, after successfully thwarting Russian attempts at intervention, secured the election of Prince Ferdinand of Saxe-Coburg-Gotha to the Bulgarian throne (July 7, 1887).

Under Bulgaria's new prince, Stambolov formed a ministry that remained in power from September 1887 to May 1894. Continued opposition to Russia coloured his regime, which was marked also by a rapprochement with Turkey and the dissemination of Bulgarian influence in Macedonia. Recurrent anti-dynastic conspiracies and armed risings in Bulgaria, however, led him to employ terrorist tactics to secure the continuation of the government. Moreover, his initial domination of Ferdinand was eventually overcome by the prince, who finally harassed his chief minister into resigning (May 31, 1894). Hounded for months by his enemies after his fall, Stambolov died after suffering a brutal street assault in Sofia.

**Stamford,** town ("parish"), South Kesteven district, county of Lincolnshire, England, on the River Welland. It is an ancient market town incorporated in 1462. Built of local limestone, it is largely unspoiled by modern industry and preserves much of its traditional character and architectural distinction. Noteworthy churches include St. Mary's, All Saints, and St. Martin's, and there are remains of the 7th-century Benedictine Priory of St. Leonard and of a Carmelite monastery (1291). Pop. (1981) 16,393.

**Stamford,** city, coextensive with the town ("township") of Stamford, Fairfield county, southwestern Connecticut, U.S. It lies at the mouth of the Rippowam River on Long Island Sound and is 36 miles (58 km) northeast of New York City. The town, named for its English counterpart, was founded in 1641 by 28 pioneers from Wethersfield (near Hartford). Stamford was a farming community until the railroad reached it in the 1840s, after which the town grew in size and began to acquire industries. A city government was formed within the town in 1893, and the town and city merged in 1949.

Until the late 1960s, Stamford was a residential suburb of New York City and had some industry and several industrial-research laboratories. Beginning in the early 1970s, however, several major corporations moved their headquarters from New York City to downtown Stamford, thereby revitalizing the city's economic life. Stamford's decaying downtown was razed and rebuilt with modern skyscrapers. By the late 1980s, the city had become the site of one of the largest concentrations of corporate headquarters in the United States. A branch of the University of Connecticut is situated in Stamford, and there is a branch of the Whitney Museum of American Art. Inc. 1893. Pop. (1991 est.) city, 108,183; Stamford PMSA, 202,794.

**Stamitz, Carl (Philipp)** (b. May 7, 1745, Mannheim, Palatinate [Germany]—d. Nov. 9, 1801, Jena, Saxony [Germany]), German composer of the last generation of Mannheim symphonists.

Stamitz was the son of Johann Stamitz, the founder of the Mannheim school. He played violin in the court orchestra at Mannheim in 1762 and was also a viola and viola d'amore player. He toured England and Russia and settled in Paris in 1785. In 1794 he became conductor of the orchestra at Jena. He wrote a large number of instrumental works, including symphonies, concerti and concertante works, and quartets, trios, and sonatas.

**Stamitz, Johann (Wenzel Anton)** (b. June 19, 1717, Deutschbrod, Bohemia [now Havlíčkův Brod, Czech Republic]—d. March 27, 1757, Mannheim, Palatinate [Germany]), German composer who founded the Mannheim school of symphonists, which had an immense influence on Wolfgang Amadeus Mozart.

Stamitz received early musical education from his father and appeared as a violinist at the coronation of the emperor Charles VII in Frankfurt am Main in 1742. He became a chamber musician to Prince Karl Theodor (Elector Palatine after 1743) and in 1745 was appointed concertmaster of the court orchestra at Mannheim.

Stamitz brought the Mannheim orchestra to a standard unrivaled in its day for both precision and scope of expression. The orchestral effects of a gradual crescendo and diminuendo, though not his invention, became a hallmark of his style and were imitated by later composers. Another characteristic of his style was the use of "sighing" suspensions, particularly at cadences. These were incorporated into Rococo-style music throughout Europe.

His use of the minuet and trio as the third movement of a four-movement symphony was similarly adopted by Classical composers, in place of the three-movement symphony previously common. He contributed to the evolution of the Classical sonata form by introducing contrasting themes within a single movement.

It is difficult to overestimate Stamitz' influence. Although contemporary composers in Berlin, Vienna, and Italy likewise developed some of these features, it was the first generation of Mannheimers (Stamitz and his associates) who were most influential in establishing the mid-18th-century style of orchestral writing.

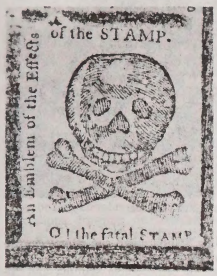
**stammering:** *see* stuttering.

**Stammler, Rudolf** (b. Feb. 19, 1856, Alsfeld, Hesse [Germany]—d. April 25, 1938, Wernigerode, Ger.), German jurist and teacher who is considered to have been one of the most influential legal philosophers of the early 20th century.

Stammler was professor of law in Marburg (1882–84), Giessen (1884), Halle (1885–1916), and Berlin (1916–23). By distinguishing the concept of law, which is a purely formal definition, from the idea of law, which is the realization of justice, he emphasized, unlike most 19th-century legal philosophers, the search for ideals with which law ought to conform. Those ideals, in Stammler's view, were not immutable but reflected the degree of social harmony possible in a particular place and time. One of his major works, *Die Lehre von dem richtigen Rechte* (1902), was translated by Isaac Husik as *The Theory of Justice* (1925).

**Stamp Act** (1765), in U.S. colonial history, first British parliamentary attempt to raise revenue through direct taxation of all colonial commercial and legal papers, newspapers, pamphlets, cards, almanacs, and dice. The devastating effect of Pontiac's War (1763–64) on colonial frontier settlements added to the enormous new defense burdens resulting from Great Britain's victory (1763) in the French and Indian War. The British chancellor of the Exchequer, Sir George Grenville, hoped to meet at least half of these costs by the combined revenues of the Sugar Act (1764) and the Stamp Act, a common revenue device in England. Completely unexpected was the avalanche of protest from the colonists, who effectively nullified the Stamp Act by outright refusal to use the stamps as well as by riots, stamp burning, and intimidation of

colonial stamp distributors. Colonists passionately upheld their rights as Englishmen to be taxed only by their own consent through their own representative assemblies, as had been




"An Emblem of the Effects of the STAMP," a warning against the Stamp Act published in the Pennsylvania *Journal*, October 1765; in The New York Public Library

Rare Books and Manuscripts Division, The New York Public Library, Astor, Lenox and Tilden Foundations

the practice for a century and a half. In addition to nonimportation agreements among colonial merchants, the Stamp Act Congress was convened in New York (October 1765) by moderate representatives of nine colonies to frame resolutions of "rights and grievances" and to petition the king and Parliament for repeal of the objectionable measures. Bowing chiefly to pressure (in the form of a flood of petitions to repeal) from British merchants and manufacturers whose colonial exports had been curtailed, Parliament, largely against the wishes of the House of Lords, repealed the act in early 1766. Simultaneously, however, Parliament issued the Declaratory Act, which reasserted its right of direct taxation anywhere within the empire, "in all cases whatsoever." The protest throughout the colonies against the Stamp Act contributed much to the spirit and organization of unity that was a necessary prelude to the struggle for independence a decade later.

**stamp collecting,** the hobby of collecting postage stamps. *See* philately.

**Stampa, La** (Italian: "The Press"), morning daily newspaper published in Turin, one of Italy's most influential newspapers.

It was established in 1868 as the *Gazetta Piedmontese* and became an important voice in Italy's struggle for liberation and unification. The *Gazetta* was purchased in 1895 by two of its editors, Luigi Roux and Alfred Frassati, who changed the paper's name to *La Stampa.* When Mussolini came to power in 1926, Frassati was still editor and, by then, sole proprietor, and *La Stampa* was famous as a liberal journal with an intellectual tone and as a staunch defender of democracy. Rejecting invitations to support the Fascists, Frassati sold the paper and left the business. A Fascist staff took over, and the paper became a propaganda sheet.

After World War II *La Stampa,* temporarily renamed *La Nuova Stampa,* reappeared as a quality paper, carrying on its prewar tradition. It has maintained its long-standing concern for Italian social problems.

**standard atmosphere,** atmospheric model with a given vertical distribution of temperature, pressure, and humidity, which by international agreement is taken as a worldwide average of these parameters.

In such a model, the atmosphere is assumed to obey the perfect gas law and to be in hydrostatic equilibrium (*i.e.,* without accelerations of the air in the vertical direction). Further assumptions are that the air is dry and that the acceleration of gravity does not change with height.

Under the above conditions, the vertical variations of pressure and density may be determined for a given set of values at sea level and for any vertical distribution of temperature. Even though the real atmosphere may vary considerably from the assumed standard atmosphere, the latter is useful for such purposes as pressure altimeter calibrations, aircraft and missile designs, ballistic trajectories, and other problems. For many of these purposes, deviations of the real atmosphere from the standard do not cause serious errors in the calculations.

**standard deviation,** in statistics, a measure of the variability (dispersion or spread) of any set of numerical values about their arithmetic mean. It is specifically defined as the square root of the arithmetic mean of the squared deviations. *See also* mean.

**Standard Limited, The,** formerly EAST AFRICAN STANDARD, English-language daily newspaper published in Nairobi, Kenya. It was established in Mombasa in 1902 as a weekly, the *African Standard,* by a Parsi (Indian Zoroastrian), A.M. Jeevanjee, and an English editor-reporter, W.H. Tiller. In 1910 the paper became a daily, changed its name to the *East African Standard,* and moved to Nairobi, which was then fast developing as a commercial centre. It had already come under British ownership. In its early years the paper defended the interests of Kenya's white settlers, but by the 1970s it had developed a more balanced approach to news reporting and had built a reputation for fine writing and technical excellence. After independence the paper retained the freedom to publish but was not allowed to criticize the government's single political party or its leaders. It is published mornings except Sundays.

**standard model,** the combination of two theories of particle physics into a single framework to describe all interactions of subatomic particles, except those due to gravity. The two components of the standard model are electroweak theory, which describes interactions via the electromagnetic and weak forces, and quantum chromodynamics, the theory of the strong nuclear force. Both these theories are gauge field theories, which describe the interactions between particles in terms of the exchange of intermediary "messenger" particles that have one unit of intrinsic angular momentum, or spin.

In addition to these force-carrying particles, the standard model encompasses two families of subatomic particles that build up matter and that have spins of one-half unit. These particles are the quarks and the leptons, and there are six varieties, or "flavours," of each, related in pairs in three "generations" of increasing mass. Everyday matter is built from the members of the lightest generation: the "up" and "down" quarks that make up the protons and neutrons of atomic nuclei; the electron that orbits within atoms and participates in binding atoms together to make molecules and more complex structures; and the electron-neutrino that plays a role in radioactivity and so influences the stability of matter. Heavier types of quark and lepton have been discovered in studies of high-energy particle interactions, both at scientific laboratories with particle accelerators and in the natural reactions of high-energy cosmic-ray particles in the atmosphere.

The standard model has proved a highly successful framework for predicting the interactions of quarks and leptons with great accuracy. Yet it has a number of weaknesses that lead physicists to search for a more complete theory of subatomic particles and their interactions. The present standard model, for example, cannot explain why there are three generations of quarks and leptons. It makes no predictions of the masses of the quarks and the leptons nor of the strengths of the various interactions. Physicists hope that, by probing the standard model in detail and making highly accurate measurements, they will discover some way in which the model begins to break down and thereby find a more complete theory. This may prove to be what is known as a grand unified theory, which uses a single theoretical structure to describe the strong, weak, and electromagnetic forces.

(Ch.Su.)

**standard of living:** *see* living, standard of.

**Standard Oil Company (Indiana):** *see* Amoco Corporation.

**Standard Oil Company (New Jersey):** *see* Exxon Corporation.

**Standard Oil Company and Trust,** American company and corporate trust that from 1870 to 1911 was the industrial empire of John D. Rockefeller and associates, controlling almost all oil production, processing, marketing, and transportation in the United States.

The company's origins date to 1863, when Rockefeller joined Maurice B. Clark and Samuel Andrews in a Cleveland refining business; in 1865 Rockefeller bought out Clark and two years later brought in Henry M. Flagler. By 1870 the firm of Rockfeller, Andrews, and Flagler was operating the largest refineries in Cleveland, and these and related facilities became the property of the new Standard Oil Company, incorporated in Ohio in 1870. By 1880, through elimination of competitors, mergers with other firms, and use of favourable railroad rebates, it controlled the refining of 90 to 95 percent of all oil produced in the United States.

In 1882 the Standard Oil Company and affiliated companies that were engaged in producing, refining, and marketing oil were combined in the Standard Oil Trust, created by the Standard Oil Trust Agreement signed by nine trustees, including Rockefeller. By the agreement, companies could be purchased, created, dissolved, merged, or divided; and eventually the trustees governed some 40 corporations, of which 14 were wholly owned. The trust embraced a maze of legal structures, making its workings virtually impervious to public investigation and understanding. As Ida Tarbell wrote in her *History of the Standard Oil Company* (1904), "You could argue its existence from its effects, but you could not prove it." In 1892 the Ohio Supreme Court ordered the trust dissolved, but it effectively continued to operate from headquarters in New York City.

In 1899 Standard Oil Company (New Jersey) was incorporated in New Jersey as a holding company, and all assets and interests formerly grouped in the trust were transferred to the New Jersey company.

Although consolidation did advance large-scale production and distribution of oil products, many critics believed that the resulting concentration of economic power was becoming excessive. In 1906 the U.S. government brought suit against Standard Oil Company (New Jersey) under the Sherman Anti-Trust Act; and in 1911 the New Jersey company was ordered to divest itself of its major holdings—33 companies in all.

In 1911, after dissolution of the Standard Oil empire, eight companies retained "Standard Oil" in their names; by the late 20th century the name had almost passed into history. In 1931 Standard Oil Company of New York merged with Vacuum Oil Company

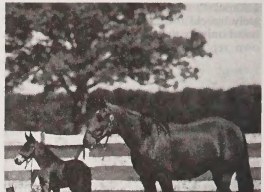
(another trust company) to form Socony-Vacuum, which in 1966 became Mobil Oil Corporation. Standard Oil (Indiana) absorbed Standard Oil of Nebraska in 1939 and Standard Oil of Kansas in 1948 and was renamed Amoco Corporation in 1985. Standard Oil of California acquired Standard Oil of Kentucky in 1961 and was renamed Chevron Corporation in 1984. Standard Oil Company (New Jersey) changed its name to Exxon Corporation in 1972. British Petroleum Company PLC completed the purchase of Standard Oil Company (Ohio) in 1987. Other companies that once were part of the trust include Atlantic Richfield Company, Buckeye Pipe Line Company (Ohio), Chesebrough-Pond's Inc., Pennzoil Company, and Union Tank Car Company (New Jersey).

**Standard Oil Company of California:** *see* Chevron Corporation.

**standard time,** the time of a region or country that is established by law or general usage as civil time.

The concept of standard time was adopted in the late 19th century in an attempt to end the confusion that was caused by each community's use of its own solar time. Some such standard became increasingly necessary with the development of rapid railway transportation and the consequent confusion of schedules that used scores of different local times kept in separate communities. (Local time varies continuously with change in longitude.) The need for a standard time was felt most particularly in the United States and Canada, where long-distance railway routes passed through places that differed by several hours in local time. Sir Sandford Fleming, a Canadian railway planner and engineer, outlined a plan for worldwide standard time in the late 1870s. Following this initiative, in 1884 delegates from 27 countries met in Washington, D.C., and agreed on a system basically the same as that now in use.

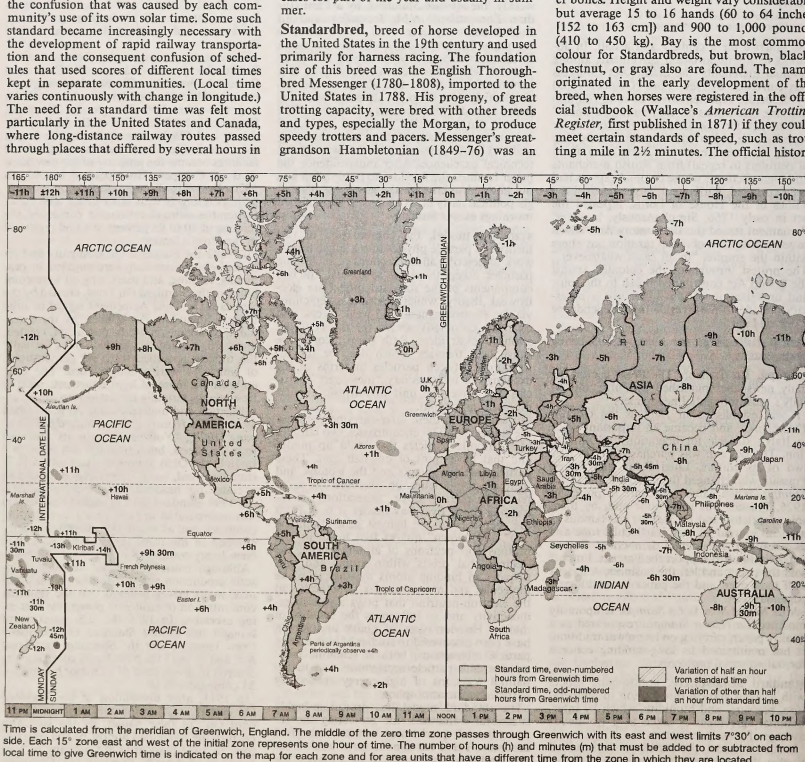
The present system employs 24 standard meridians of longitude spaced 15° apart, starting with the prime meridian through Greenwich, Eng. These meridians are theoretically the centres of 24 standard time zones (*see* Figure), although in practice the zones often are subdivided or altered in shape for the convenience of inhabitants; a notable example is the eastward extension of the International Date Line around the Pacific island country of Kiribati. Time is the same throughout each zone and differs from the international basis of legal and scientific time, Coordinated Universal Time, by an integral number of hours; minutes and seconds are the same. In a few regions, however, the legal time kept is not that of one of the 24 standard time zones because half-hour or quarter-hour differences are in effect there. In addition, daylight saving time (*q.v.*) is a common system by which time is advanced one hour from standard, in most cases for part of the year and usually in summer.



Standardbred mare and foal
Grant Heilman

**Standardbred,** breed of horse developed in the United States in the 19th century and used primarily for harness racing. The foundation sire of this breed was the English Thoroughbred Messenger (1780–1808), imported to the United States in 1788. His progeny, of great trotting capacity, were bred with other breeds and types, especially the Morgan, to produce speedy trotters and pacers. Messenger's great-grandson Hambletonian (1849–76) was an outstanding Standardbred sire whose descendants now dominate the breed.

Possessed of considerable stamina and endurance, Standardbreds closely resemble Thoroughbreds but are usually smaller and have longer and lower bodies, flatter ribs, and heavier bones. Height and weight vary considerably but average 15 to 16 hands (60 to 64 inches [152 to 163 cm]) and 900 to 1,000 pounds (410 to 450 kg). Bay is the most common colour for Standardbreds, but brown, black, chestnut, or gray also are found. The name originated in the early development of the breed, when horses were registered in the official studbook (Wallace's *American Trotting Register,* first published in 1871) if they could meet certain standards of speed, such as trotting a mile in 2½ minutes. The official history




Time is calculated from the meridian of Greenwich, England. The middle of the zero time zone passes through Greenwich with its east and west limits 7°30′ on each side. Each 15° zone east and west of the initial zone represents one hour of time. The number of hours (h) and minutes (m) that must be added to or subtracted from local time to give Greenwich time is indicated on the map for each zone and for area units that have a different time from the zone in which they are located.

Based on data from the U.S. Defense Mapping Agency Hydrographic/Topographic Center

of the breed dates from the establishment in 1871 of the National Association of Trotting Horse Breeders, which was succeeded by the American Trotting Register Association, now the U.S. Trotting Association.

**standardization,** in industry, the development and application of standards that permit large production runs of component parts that can be readily fitted to other parts without adjustment. Standardization allows for clear communication between industry and its suppliers, relatively low cost, and manufacture on the basis of interchangeable parts.

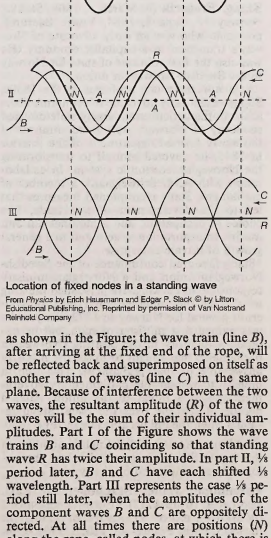
A standard is that which has been selected as a model to which objects or actions may be compared. Standards for industry may be devices and instruments used to regulate colour, size, weight, and other product attributes, or they may be physical models. Standards may also be written mathematical or symbolical descriptions, drawings, or formulas setting forth the important features of objects to be produced or actions to be performed. Standards that are applied in an industrial setting include engineering standards, such as properties of materials, fits and tolerances, terminology, and drafting practices; and product standards intended to describe attributes and ingredients of manufactured items and embodied in drawings, formulas, materials lists, descriptions, or models.

Certain fundamental standards among firms are required to prevent conflict and duplication of effort. The standards activities of governmental departments, trade associations, and technical associations serve in part to meet national standards needs, but one specialized standardizing organization is needed to coordinate the diverse standardization activities of many different types of organizations and promote general acceptance of basic standards. In the United States the American National Standards Institute (ANSI) performs this function. It does not initiate or write standards but provides the means by which national engineering, safety, and industrial standards can be coordinated. All interested groups may participate in the decision-making process, and compliance with the national standard is voluntary. The international body that serves this function is the International Organization for Standardization (ISO). Developing an international standard presents the greater challenge because of the breadth of representation and the diversity of needs and viewpoints that must be reconciled.

**standing to sue,** in law, the requirement that a person who brings a suit be a proper party to request adjudication of the issue involved. The test traditionally applied was whether the party had a personal stake in the outcome of the controversy presented and whether the dispute touched upon the legal relations of the parties having adverse legal interests.

The U.S. Supreme Court noted in *Flast* v. *Cohen* (1968) that "the issue of standing is related only to whether the dispute sought to be adjudicated will be presented in an adversary context and in a form historically viewed as capable of judicial resolution." Clearly, a plaintiff who claims physical injury or economic loss has standing. In the United States, until the 1960s, the courts took a relatively strict approach to standing. For instance, in *Frothingham* v. *Mellon* (1923) the Supreme Court held that a plaintiff who alleged that her tax liability would be increased as a result of the Maternity Act of 1921 lacked standing to challenge the act. During the 1960s the court, under the leadership of Chief Justice Earl Warren, was so lenient in recognizing standing that a federal trial court commented, in granting standing to a plaintiff challenging the secrecy of Central Intelligence Agency expenditures, that the concept of standing "has now been almost completely abandoned" by the Supreme Court. However, the court was not willing to abandon the concept completely. Reversing the trial court in the previously mentioned case, *United States* v. *Richardson* (1974), Chief Justice Warren E. Burger, writing for the majority, rejected Richardson's standing, commenting that Richardson was seeking "to employ a federal court as a forum in which to air his generalized grievances about the conduct of government."

**standing wave,** also called STATIONARY WAVE, combination of two waves moving in opposite directions, each having the same amplitude and frequency. The phenomenon is the result of interference—that is, when waves are superimposed, their energies are either added together or cancelled out. In the case of waves moving in the same direction, interference produces a traveling wave; for oppositely moving waves, interference produces an oscillating wave fixed in space. A vibrating rope tied at one end will produce a standing wave,



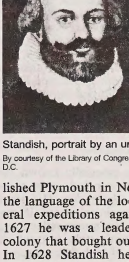

Location of fixed nodes in a standing wave

From *Physics* by Erich Hausmann and Edgar P. Slack © by Litton Educational Publishing, Inc. Reprinted by permission of Van Nostrand Reinhold Company

as shown in the Figure; the wave train (line *B*), after arriving at the fixed end of the rope, will be reflected back and superimposed on itself as another train of waves (line *C*) in the same plane. Because of interference between the two waves, the resultant amplitude (*R*) of the two waves will be the sum of their individual amplitudes. Part I of the Figure shows the wave trains *B* and *C* coinciding so that standing wave *R* has twice their amplitude. In part II, ⅛ period later, *B* and *C* have each shifted ⅛ wavelength. Part III represents the case ⅛ period still later, when the amplitudes of the component waves *B* and *C* are oppositely directed. At all times there are positions (*N*) along the rope, called nodes, at which there is no movement at all; there the two wave trains are always in opposition. On either side of a node is a vibrating antinode (*A*). The antinodes alternate in the direction of displacement so that the rope at any instant resembles a graph of the mathematical function called the sine, as represented by line *R*. Both longitudinal (*e.g.,* sound) waves and transverse (*e.g.,* water) waves can form standing waves.

**Standish, Myles,** Myles also spelled MILES (b. *c.* 1584, Lancashire, Eng.—d. Oct. 3, 1656, Duxbury, Mass.), British-American colonist and military leader of the Plymouth colony.

As a young man, Standish fought in the Netherlands, where he probably met the English religious exiles who later became known as the Pilgrims. He sailed with them to America on the "Mayflower" in 1620, serving as their military leader when they established Plymouth in New England. He learned the language of the local Indians and led several expeditions against hostile tribes. In 1627 he was a leader of the group in the colony that bought out the London investors. In 1628 Standish helped to break up the colony of Thomas Morton at nearby Merry Mount when it proved too unpuritanical to suit Plymouth. He also served as assistant governor and as treasurer of the Plymouth colony (1644–49). He moved to Duxbury in 1631.



Standish, portrait by an unknown artist

By courtesy of the Library of Congress, Washington, D.C.

There is no historical evidence for the story that he asked John Alden to propose marriage for him to Priscilla Mullins, as told in Longfellow's poem *The Courtship of Miles Standish.*

**Stanfield, Robert L(orne)** (b. April 11, 1914, Truro, Nova Scotia, Can.—d. Dec. 16, 2003, Ottawa), Canadian politician who, as leader of the Progressive Conservative Association in Nova Scotia, served as that province's premier from 1956 to 1967.

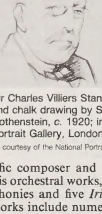
After graduating in 1939 from Harvard University Law School, Stanfield was called to the bar in 1940. From 1939 to 1945 he served on the Halifax staff of the Wartime Prices and Trade Board. In 1947 he became president of the provincial Progressive Conservative Association, a party that held no seats in the local legislature. The following year he became provincial party leader, and in 1949 he was elected to the legislature. He led his party to victory in 1956, ending 23 years of uninterrupted Liberal rule. Stanfield took up the posts of premier, provincial treasurer, and minister of education. After resigning in 1967, he served as member of parliament for Halifax, Nova Scotia (1968–79). Until 1976 he led the federal Conservative party in the House of Commons and as its leader continuously attacked Prime Minister Pierre Trudeau's economic policies.

Known as the best prime minister Canada never had, Stanfield sought the office in 1968, 1972, and 1974 but was defeated by Trudeau in each election. Stanfield subsequently served as chairman of the Institute for Research on Public Policy.

**Stanford, Sir Charles Villiers** (b. Sept. 30, 1852, Dublin, Ire.—d. March 29, 1924, London, Eng.), Anglo-Irish composer, conductor, and teacher who greatly influenced the next generation of British composers; Ralph Vaughan Williams, Sir Arthur Bliss, and Gustav Holst were among his pupils.

Stanford studied at Trinity College, Dublin, and Queen's College, Cambridge, and between 1874 and 1877 with Karl Reinecke in Leipzig and Friedrich Kiel in Berlin. He became professor of composition at the Royal College of Music in London in 1883 and professor of mu-

sic at Cambridge in 1887. He also conducted the London Bach Choir (1885–1902) and the Leeds Triennial Festival orchestra (1901–10). He was knighted in 1901. Stanford was a pro-



Sir Charles Villiers Stanford, pencil and chalk drawing by Sir William Rothenstein, *c.* 1920; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

lific composer and was especially known for his orchestral works, which include seven symphonies and five *Irish Rhapsodies.* His other works include numerous choral pieces, 10 operas, and many songs. His music reflects the late 19th-century Romantic style, into which he introduced elements of Irish folk song.

**Stanford, Leland,** in full AMASA LELAND STANFORD (b. March 9, 1824, Watervliet, N.Y., U.S.—d. June 21, 1893, Palo Alto, Calif.), American senator from California and one of the builders of the first U.S. transcontinental railroad.

Stanford practiced law in Port Washington, Wis., from 1848 to 1852, before moving to Sacramento, Calif., where he achieved much success in retailing mining supplies and general merchandise. He also became active in local politics. A Republican, he served as governor of California from 1861 to 1863.



Leland Stanford

By courtesy of Stanford University Photographic Department, Stanford, Calif.

Stanford invested heavily in the plan to build a transcontinental railroad, and, when the Central Pacific Railroad was organized in 1861, he became its president (1861–93). He was instrumental in the success of the Central Pacific, which was built eastward to join with the Union Pacific at Promontory, Utah, in 1869. He also played a major role in railroad development throughout California and the Southwest. From 1885 to 1893 he served in the U.S. Senate. Stanford and his wife, Jane, founded Stanford University in 1885.

**Stanford Linear Accelerator Center:** *see* SLAC.

**Stanford University,** official name LELAND STANFORD JUNIOR UNIVERSITY, private coeducational institution of higher learning at Stanford, Calif., U.S. The university was founded in 1885 and opened in 1891 by railroad magnate Leland Stanford and his wife, Jane (*née* Lathrop), and was dedicated to their deceased only child, Leland, Jr. The doors were opened in 1891 to 559 students. The university campus consists largely of Stanford's former Palo Alto farm. The buildings, conceived by Frederick Law Olmsted, are of soft buff sandstone in a style similar to the old California mission architecture, being long and low with wide colonnades, open arches, and red-tiled roofs.

Stanford maintains branch campuses in France, Italy, Germany, Austria, and England. About half of its undergraduates study overseas at them for six-month periods. Advanced-study centres are maintained in Japan, Taiwan, and several other countries. The departments of the university are organized into schools of law, medicine, education, engineering, business, earth sciences, and humanities and sciences.

In 1921 the Food Research Institute of Stanford University was organized. The Hoover Institution on War, Revolution, and Peace, founded by Stanford alumnus Herbert Hoover during World War I, contains more than 1,000,000 printed and manuscript items dealing with 20th-century international relations. The Stanford Linear Accelerator Center (SLAC) was established in 1961 and has become a major centre for research in particle physics. The Stanford Medical Center, completed on the campus in 1959, now has more than 550 beds. The Hopkins Marine Station is maintained by the university at Pacific Grove on the Bay of Monterey.

**Stang, Frederik** (b. March 4, 1808, Stokke, Norway—d. June 8, 1884, Vestre Baerum), politician who was an early advocate of Norway's transition to a capitalist economy. He was also the first minister of state for Norway in the Swedish-Norwegian union.

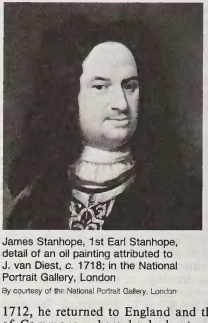
As a university law professor in the 1830s, Stang was an early advocate of economic liberalism in the agricultural, largely state-directed economy of Norway. Appointed minister of the newly formed department of the interior in 1845, he devoted himself to transforming the Norwegian economic system. In collaboration with A.M. Schweigaard, a member of parliament, Stang championed measures that led to the development of free trade, free choice of occupation, and a national rail and marine transportation system and to a general growth of private enterprise.

Stang favoured continuance of the Swedish-Norwegian union and a Norwegian ministry responsible to the king. He persuaded the king to abolish the much-resented post of governor-general for Norway in 1872, the year he was named first minister of state, but he opposed a majority in the Storting (Norwegian parliament) that sought to make the ministry answerable to that parliament. This step, a prelude to responsible parliamentary government, posed a threat to the union. After a decade of struggle over the issue, Stang resigned when the bill became law in June 1880.

**Stanhope,** EARLS, titled English nobility, in the family Stanhope, grouped below chronologically and indicated by the symbol •.

**• Stanhope, James Stanhope, 1st Earl,** also called (from 1717) VISCOUNT STANHOPE OF MAHON, BARON STANHOPE OF ELVASTON (b. 1673, Paris, France—d. Feb. 5, 1721, London, Eng.), British soldier and statesman, the dominant minister during the first half (1714–21) of the reign of King George I. His policy of alliance with France secured the peace and minimized foreign support for the Jacobites, who sought to restore the Stuart monarchy in England.

The grandson of the 1st Earl of Chesterfield and the son of a British diplomat, Stanhope began a brilliant military career in 1691. In 1708, during the War of the Spanish Succession against France (1701–14), he became commander in chief of the English army in Spain and captured Minorca, but French forces defeated and captured him at Brihuega in December 1710. After his release in August



James Stanhope, 1st Earl Stanhope, detail of an oil painting attributed to J. van Diest, *c.* 1718; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

1712, he returned to England and the House of Commons, where he had sat as a Whig since 1701 and had played a major role in the attack against Henry Sacheverell in 1710.

When the Whigs came to power upon the accession of King George I, Stanhope was appointed secretary of state for the south. Although he shared with Robert Walpole the leadership of the House of Commons, it was in foreign policy that Stanhope revealed his genius. He negotiated the Triple Alliance between England, France, and Holland in 1717, and in the following year he brought Austria into the pact. He then used this quadruple alliance to enforce upon Spain a settlement of its differences with Austria. Stanhope's alliance with France thus made Britain for 15 years the diplomatic arbiter of Europe. Turning to northern Europe, Stanhope resolved England's conflicts with Sweden and thereby assured his country's continued access to the invaluable Swedish naval stores. He was a consummate practitioner of summit diplomacy.

In 1716–17 Walpole and his colleague Viscount Charles Townshend left the government in protest over Stanhope's policy of involvement in European affairs. Stanhope then became first lord of the treasury (1717–18) as well as secretary of state. At this time he distinguished himself by his policy on religious toleration toward Protestant dissenters and Roman Catholics. He received a viscountcy in 1717 and an earldom in 1718. Two years later the South Sea Company scandal, a financially disastrous speculation involving government officials, discredited his ministry without implicating him in any wrongdoing.

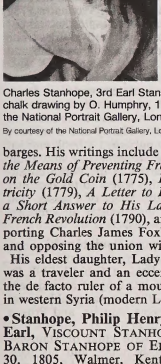
BIBLIOGRAPHY. Basil Williams, *Stanhope: A Study in Eighteenth-Century War and Diplomacy* (1932, reprinted 1979); Aubrey Newman, *The Stanhopes of Chevening* (1969).

**• Stanhope, Charles Stanhope, 3rd Earl,** VISCOUNT STANHOPE OF MAHON, BARON STANHOPE OF ELVASTON (b. Aug. 3, 1753, London, Eng.—d. Dec. 15, 1816, Chevening, Kent), radical English politician and noted experimental scientist, a brilliant eccentric in both capacities.

The second but eldest surviving son of Philip, 2nd Earl Stanhope, he was styled Viscount, or Lord, Mahon from 1763 to 1786. He was educated at Eton and was a member of the House of Commons from 1780 until his accession to the peerage in 1786. He became chairman of the Revolution Society (founded 1788), which urged the democratization of Parliament. Calling himself Citizen Stanhope, he sympathized with the French republicans and opposed Great Britain's war with Revolutionary France. Later, he attacked the suspension (1794) of the Habeas Corpus Act, Anglo-Irish parliamentary unification (1800), and the slave trade in British overseas possessions.

An early experimenter with electricity, Stan-

hope invented two calculating machines; a kind of printing press and a microscope lens, both of which bear his name; a stereotyping machine; a steam carriage; a variety of cement much more durable than ordinary mortar; and an artificial slate, or tile. He projected a canal between the Bristol Channel and his estate at Holsworthy, Devon, and experimented with methods of raising and lowering canal barges. His writings include *Considerations on the Means of Preventing Fraudulent Practices on the Gold Coin* (1775), *Principles of Electricity* (1779), *A Letter to Burke, Containing a Short Answer to His Late Speech on the French Revolution* (1790), and pamphlets supporting Charles James Fox's libel bill (1792) and opposing the union with Ireland (1800).



Charles Stanhope, 3rd Earl Stanhope, chalk drawing by O. Humphry, 1796; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

His eldest daughter, Lady Hester Stanhope, was a traveler and an eccentric who became the de facto ruler of a mountain community in western Syria (modern Lebanon).

**• Stanhope, Philip Henry Stanhope, 5th Earl,** VISCOUNT STANHOPE OF MAHON, BARON STANHOPE OF ELVASTON (b. Jan. 30, 1805, Walmer, Kent, Eng.—d. Dec. 24, 1875, Bournemouth, Hampshire), English politician and historian who was chiefly responsible for the founding of Britain's National Portrait Gallery.

Stanhope studied at Christ Church, Oxford, and entered Parliament in 1830. Although he made no special mark in politics, he was chiefly responsible for passage of the Literary Copyright Act of 1842, which, in part, provided that books be protected by copyright for the life of the author plus seven years. He was a trustee of the British Museum and in 1856 proposed the foundation of a National Portrait Gallery; its creation was brought about by his executors. Stanhope was president of the Society of Antiquaries from 1846, and the establishment of the historical manuscripts commission in 1869 was largely the result of his efforts. His published works include *History of the War of the Succession in Spain* (1832), *History of England from the Peace of Utrecht to the Peace of Versailles* (1836–54), and *Life of William Pitt* (1861–62).

**Stanhope, Philip Dormer:** *see* Chesterfield, Philip Dormer Stanhope, 4th Earl of.

**Stanhope, William:** *see* Harrington, William Stanhope, 1st Earl of.

**Stanislaus** OF KRAKÓW, SAINT, also called SAINT STANISLAUS OF SZCZEPANOW, Stanislaus also spelled STANISLAS, Polish ŚWIĘTY STANISŁAW Z KRAKOWA, OR ZE SZCZEPANOWA (b. *c.* 1030, Szczepanów, Pol.—d. April 11, 1079, Kraków; canonized 1253; feast day April 11, feast day in Kraków May 7), patron saint of Poland, the first Pole to be canonized.

Of noble birth, Stanislaus studied at Gniezno, Pol., and probably at Paris. While serving as canon and preacher at Kraków (Cracow), he was elected—after Pope Alexander II nominated him—bishop of Kraków in 1072. During that time Poland was in a state of political unrest, with active opposition to King Bolesław II the Bold. Stanislaus joined the opposition under the leadership of Władysław Herman, the king's brother, and excommunicated Bolesław.

In 1079 Stanislaus was accused of treason. The royal court found him guilty and sentenced him to dismemberment. When the knights who had been ordered to carry out the execution hesitated, Bolesław himself killed Stanislaus in St. Michael Chapel, after which the king fled to Hungary. This act has remained a matter of controversy between those Polish historians who believe Stanislaus was part of a Bohemian-German plot designed to remove Bolesław and replace him with Władysław, and those who describe the execution as a contemptible act of revenge against a saintly bishop who had excommunicated a cruel, licentious king. In any case, miracles and legends spread the cult of the martyred bishop to Lithuania, Belorussia, and Ukraine, and Stanislaus became the patron saint of his native Poland.

**Stanislavsky, Konstantin Sergeyevich,** Stanislavsky also spelled STANISLAVSKI, original name KONSTANTIN SERGEYEVICH ALEKSEYEV (b. Jan. 5 [Jan. 17, New Style], 1863, Moscow, Russia—d. Aug. 7, 1938, Moscow), Russian actor, director, and producer, founder of the Moscow Art Theatre (opened 1898). He is best known for developing the system or theory of acting called the Stanislavsky system, or Stanislavsky method (*q.v.*).

*Early influences.* Stanislavsky's father was a manufacturer, and his mother was the daughter of a French actress. Stanislavsky first appeared on his parents' amateur stage at the age of 14 and subsequently joined the dramatic group that was organized by his family and called the Alekseyev Circle. Although initially an awkward performer, Stanislavsky obsessively worked on his shortcomings of voice, diction, and body movement. His thoroughness and his preoccupation with all aspects of a production came to distinguish him from other members of the Alekseyev Circle, and he gradually became its central figure. Stanislavsky also performed in other groups as theatre came to absorb his life. He adopted the pseudonym Stanislavsky in 1885, and in 1888 he married Maria Perevoshchikova, a schoolteacher, who became his devoted disciple and lifelong companion, as well as an outstanding actress under the name Lilina.

Stanislavsky regarded the theatre as an art of social significance. Theatre was a powerful influence on people, he believed, and the actor must serve as the people's educator. Stanislavsky concluded that only a permanent theatrical company could ensure a high level of acting skill. In 1888 he and others established the Society of Art and Literature with a permanent amateur company. Endowed with great talent, musicality, a striking appearance, a vivid imagination, and a subtle intuition, Stanislavsky began to develop the plasticity of his body and a greater range of voice. Praise came from famous foreign actors, and great Russian actresses invited him to perform with them. Thus encouraged, Stanislavsky staged his first independent production, Aleksey K. Tolstoy's *The Fruits of Enlightenment,* in 1891, a major Moscow theatrical event. Most significantly, it impressed a promising writer and director, Vladimir Nemirovich-Danchenko (1858–1943), whose later association with Stanislavsky was to have a paramount influence on the theatre.

Nemirovich-Danchenko followed Stanislavsky's activities until their historic meeting in 1897, when they outlined a plan for a people's theatre. It was to consist of the most talented amateurs of Stanislavsky's society and of the students of the Philharmonic Music and Drama School, which Nemirovich-Danchenko directed. As the Moscow Art Theatre, it became the arena for Stanislavsky's reforms. Nemirovich-Danchenko undertook responsibility for literary and administrative matters, while Stanislavsky was responsible for staging and production.

The Moscow Art Theatre opened on Oct. 14 (Oct. 26, New Style), 1898, with a performance of Aleksey K. Tolstoy's *Tsar Fyodor Ioannovich.* But Stanislavsky was disappointed in the acting that night. He found it to be merely imitative of the gestures, intonations, and conceptions of the director. To project important thoughts and to affect the spectators, he reflected, there must be living characters on stage, and the mere external behaviour of the actors is insufficient to create a character's unique inner world. To seek knowledge about human behaviour, Stanislavsky turned to science. He began experimenting in developing the first elements of what became known as the Stanislavsky method. He turned sharply from the purely external approach to the purely psychological. A play was discussed around the table for months. He became strict and uncompromising in educating actors. He insisted on the integrity and authenticity of performance on stage, repeating for hours during rehearsal his dreaded criticism, "I do not believe you."

Stanislavsky's successful experience with Anton Chekhov's *The Seagull* confirmed his developing convictions about the theatre. With difficulty Stanislavsky had obtained Chekhov's permission to restage *The Seagull* after its original production in St. Petersburg in 1896 had been a failure. Directed by Stanislavsky and Nemirovich-Danchenko in 1898, *The Seagull* became a triumph, heralding the birth of the Moscow Art Theatre as a new force in world theatre. Chekhov, who had resolved never to write another play after his initial failure, was acclaimed a great playwright, and he later wrote *The Three Sisters* (1901) and *The Cherry Orchard* (1903) specially for the Moscow Art Theatre.



Stanislavsky as Vershinin in Chekhov's *Three Sisters,* 1901
By courtesy of the Moscow Art Theatre Museum; photograph, Sovfoto

Staging Chekhov's play, Stanislavsky and Nemirovich-Danchenko discovered a new manner of performing: they emphasized the ensemble and the subordination of each individual actor to the whole, and they subordinated the director's and actors' interpretations to the dramatist's intent. Actors, Stanislavsky felt, had to have a common training and be capable of an intense inner identification with the characters that they played, while still remaining independent of the role in order to subordinate it to the needs of the play as a whole. Fighting against the artificial and highly stylized theatrical conventions of the late 19th century, Stanislavsky sought instead

the reproduction of authentic emotions at every performance.

In 1902 Stanislavsky successfully staged both Maksim Gorky's *The Petty Bourgeois* and *The Lower Depths*, codirecting the latter with Nemirovich-Danchenko. Among the numerous powerful roles performed by Stanislavsky were Astrov in *Uncle Vanya* in 1899 and Gayev in *The Cherry Orchard* in 1904, by Chekhov; Doctor Stockman in Henrik Ibsen's *An Enemy of the People* in 1900; and Satin in *The Lower Depths.* Both as an actor and as a director, Stanislavsky demonstrated a remarkable subtlety in rendering psychological patterns and an exceptional talent for satirical characterization. Commanding respect from followers and adversaries alike, he became a dominant influence on the Russian intellectuals of the time. He formed the First Studio in 1912, where his innovations were adopted by many young actors. In 1918 he undertook the guidance of the Bolshoi Opera Studio, which was later named for him. There he staged Peter Ilich Tchaikovsky's *Eugene Onegin* in 1922, which was acclaimed as a major reform in opera.

In 1922–24 the Moscow Art Theatre toured Europe and the United States with Stanislavsky as its administrator, director, and leading actor. A great interest was stirred in his system. During this period he wrote his autobiography, *My Life in Art.* Ever preoccupied in it with content and form, Stanislavsky acknowledged that the "theatre of representation," which he had disparaged, nonetheless produced brilliant actors. Recognizing that theatre was at its best when deep content harmonized with vivid theatrical form, Stanislavsky supervised the First Studio's production of William Shakespeare's *Twelfth Night* in 1917 and Nikolay Gogol's *The Government Inspector* in 1921, encouraging the actor Michael Chekhov in a brilliantly grotesque characterization. His staging of Aleksandr Ostrovsky's *An Ardent Heart* (1926) and of Pierre-Augustin Caron de Beaumarchais's *The Marriage of Figaro* (1927) demonstrated increasingly bold attempts at theatricality. His monumental *Armoured Train 14–69*, V.V. Ivanov's play about the Russian Revolution, was a milestone in Soviet theatre in 1927, and his *Dead Souls* was a brilliant incarnation of Gogol's masterpiece.

While acting in *The Three Sisters* during the Moscow Art Theatre's 30th anniversary presentation on Oct. 29, 1928, Stanislavsky suffered a heart attack. Abandoning acting, he concentrated for the rest of his life on directing and educating actors and directors.

The Stanislavsky method, or system, developed over 40 long years. He tried various experiments, focusing much of the time on what he considered the most important attribute of an actor's work—bringing an actor's own past emotions into play in a role. But he was frequently disappointed and dissatisfied with the results of his experiments. He continued nonetheless his search for "conscious means to the subconscious"—*i.e.,* the search for the actor's emotions. In 1935 he was taken by the modern scientific conception of the interaction of brain and body and started developing a final technique that he called the "method of physical actions." It taught emotional creativity; it encouraged actors to feel physically and psychologically the emotions of the characters that they portrayed at any given moment. The method also aimed at influencing the playwright's construction of plays. (S.M./Ed.)

BIBLIOGRAPHY. David Magarshack, *Stanislavsky* (1950, reprinted 1986); and Jean Benedetti, *Stanislavski,* 2nd ed. (1990), are biographies. Discussions of the Stanislavsky method include Nikolai M. Gorchakov, *Stanislavsky Directs* (1954, reprinted 1985); Sonia Moore, *The Stanislavski System,* 2nd rev. ed. (1965); and *Training an Actor: The Stanislavski System in Class,* rev. ed. (1979), a work based on class tape recordings demonstrating the Stanislavsky technique in practice.

**Stanislavsky method,** also called THE METHOD, or STANISLAVSKY SYSTEM, highly influential system of dramatic training developed over years of trial and error by the Russian actor, producer, and theoretician Konstantin Stanislavsky. He began with attempts to find a style of acting more appropriate to the greater realism of 20th-century drama than the histrionic acting styles of the 19th century. He never intended, however, to develop a new style of acting but rather to codify in teaching and performing regimens the ways in which great actors always have achieved success in their work, regardless of prevailing acting styles.

The method requires that an actor utilize, among other things, his emotional memory (*i.e.,* his recall of past experiences and emotions). The actor's entrance onto the stage is not considered to be a beginning of the action or of his life as the character but a continuation of the set of preceding circumstances. The actor has trained his concentration and his senses so that he may respond freely to the total stage environment. Through empathic observation of people in many different situations, he attempts to develop a wide emotional range so that his onstage actions and reactions appear as if they were a part of the real world rather than a make-believe one.

A risk in the Stanislavsky method is that, when role interpretation is based on the inner impulses of the performer, a scene may unexpectedly take on new directions. (This temptation was opposed by Stanislavsky himself, who demanded that the actor subordinate himself to the play.) Some directors are disposed against the method, seeing in it a threat to their control of a production. Many, however, find it especially useful during rehearsals in uncovering unsuspected nuances of character or of dramatic action.

The method was widely practiced in the Soviet Union and in the United States, where experiments in its use began in the 1920s and continued in many schools and professional workshops, such as the prestigious Actors Studio in New York City.

*To make the best use of the Britannica, consult the* INDEX *first*

**Stanislaw,** English STANISLAUS, or STANISLAS, name of Polish kings grouped below chronologically and indicated by the symbol •.

**•Stanislaw I,** original name STANISŁAW LESZCZYŃSKI (b. Oct. 20, 1677, Lwów, Pol. [now Lviv, Ukraine]—d. Feb. 23, 1766, Lunéville, Fr.), king of Poland (1704–09, 1733) during a period of great problems and turmoil; he was a victim of foreign attempts to dominate Poland.

Leszczyński was the only son of a Polish noble. His education was completed by travels in western Europe. In 1702 King Charles XII of Sweden invaded Poland as part of a continuing series of conflicts between the powers of northern Europe. Charles forced the Polish nobility to depose Poland's king, Augustus II (Frederick Augustus I of Saxony), and then placed Stanisław on the throne (1704).

Poland, weak and fragmented, had become a marching ground for foreign armies who ravaged the country at will. In 1709 Charles was defeated by the Russians at the Battle of Poltava and withdrew to Sweden, leaving Stanisław without any real support. Augustus II regained the Polish throne, and Stanisław left the country to settle in the French province of Alsace. In 1725 Stanisław's daughter Marie married Louis XV of France.

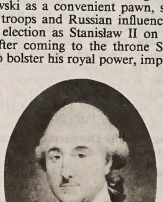
When Augustus died in 1733, Stanisław sought to regain the Polish throne with the help of French support for his candidacy. After traveling to Warsaw in disguise, he was elected king of Poland by an overwhelming majority of the Diet. But before he could be crowned, Russia and Austria, fearing Stanisław would unite Poland in the Swedish-French alliance, invaded the country to annul his election. Stanisław was once more deposed, and, under Russian pressure, a small minority in the Diet elected the Saxon elector Frederick Augustus II to the Polish throne as Augustus III. Stanisław retreated to the city of Gdańsk (Danzig) to wait for French assistance, which did not come. Fleeing before the city fell to its Russian besiegers, he then journeyed to Königsberg in Prussia, where he directed guerrilla warfare against the new king and his Russian supporters. The Peace of Vienna in 1738 recognized Augustus III as king of Poland but allowed Stanisław to keep his royal titles while granting him the provinces of Lorraine and Bar for life.

In Lorraine, Stanisław proved to be a good administrator and promoted economic development. His court at Lunéville became famous as a cultural centre, and he founded an academy of science at Nancy and a military college. In 1749 he published a book entitled *Free Voice to Make Freedom Safe,* an outline of his proposed changes in the Polish constitution. Editions of his letters to his daughter Marie (1901), to the kings of Prussia, and to Jacques Hulin, his minister at Versailles (1920), have been published.

**•Stanisław II August Poniatowski,** original name STANISŁAW PONIATOWSKI (b. Jan. 17, 1732, Wołczyn, Pol.—d. Feb. 12, 1798, St. Petersburg, Russia), last king of an independent Poland (1764–95). He was unable to act effectively while Russia, Austria, and Prussia dismembered his nation.

He was born the sixth child of Stanisław Poniatowski, a Polish noble, and his wife, Princess Konstancja Czartoryska. After a careful education he traveled in western Europe as a young man. In 1757 he was sent by his mother's enormously powerful family to St. Petersburg to obtain Russian support for their plan to dethrone the Polish king Augustus III. While at the Russian court, he apparently did little for the family's interests but succeeded in becoming the lover of the future empress, Catherine II.

Poland at this time was in a period of steady decline, and, following the death of Augustus III in 1763, Catherine sought to ensure that the situation continued. Seeing the young Poniatowski as a convenient pawn, she used Russian troops and Russian influence to ensure his election as Stanisław II on Sept. 7, 1764. After coming to the throne Stanisław sought to bolster his royal power, improve the



Stanisław II, detail of a painting by M. Bacciarelli, 1783; in the Museum in Toruń, Ratusz, Pol.
By courtesy of the Museum in Toruń, Ratusz, Pol.

administration of government, and strengthen the parliamentary system. These reforms were opposed by some Polish nobles and by Cather-

ine, who threatened to have him deposed. The reforms were dropped, and Catherine then interfered in Poland even further by pressing for full rights for non-Catholic religious dissenters. A revolt by Roman Catholics followed in 1768 and was not fully suppressed for four years. Its effect was to make Stanisław even more dependent on Russian support.

In 1772 Russia, Prussia, and Austria each annexed portions of Polish territory, despite Stanisław's appeals to the Western powers. In the years following this partition, Stanisław saw his own personal power cut away and limited by the manipulations of the partitioning powers. Fighting back, he succeeded in strengthening his position and achieved a full reform of Polish education. A more basic requirement to prevent further national decay was constitutional reform; after long and arduous debate, the Sejm (Diet) finally approved a new constitution on May 3, 1791. To oppose this constitution the Confederation of Targowica was formed by a group of Polish nobles with Russian backing. In a subsequent invasion by Russia, despite valiant efforts by a small Polish army, the Russians succeeded in crushing the movement for a new constitution.

Stanisław was then forced to participate in the Russian-controlled Sejm at Grodno in 1793, which agreed to the second partitioning of Poland, this time between Russia and Prussia. The response was a Polish insurrection in 1794, during which Tadeusz Kościuszko overrode all royal authority. After the Russians had crushed the uprising, Stanisław abdicated on Nov. 25, 1795, as Poland was being partitioned again by Russia, Prussia, and Austria, the three countries this time annexing its entire territory. He died in semicaptivity at St. Petersburg. His two-volume *Mémoires* was published by S.M. Goryaninov (1914–24).

**Stanisławów** (Ukraine): *see* Ivano-Frankovsk.

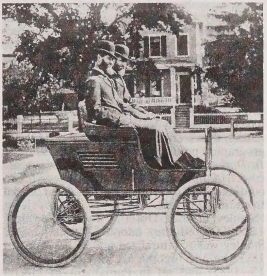
**Stanley,** town, northwestern Tasmania, Australia, on the eastern shore of Circular Head, a promontory extending into Bass Strait. Originally a penal colony, it was the first (1826) settlement of the Van Diemen's Land Company in that part of the state. First called Circular Head, the town was renamed in 1833 for Lord Stanley, then colonial secretary. Just off the Bass Highway and terminus of a rail line from Launceston (105 miles [170 km] southeast), Stanley serves a region yielding timber (milled in the town), dairy products, potatoes, and turnips. Crayfish and shark are processed by a local packing plant. Pop. (1986) 588.

**Stanley,** also called PORT STANLEY, only town and, since 1842, capital of the Falkland Islands, a British dependent territory in the South Atlantic Ocean. It lies on the northeast coast of East Falkland Island, along the southern shore of Port William inlet. Its fine inner and outer harbours attracted the early British settlers because of the protection afforded their sailing vessels. Stanley was an important base for Antarctic whaling operations and a British naval base during World War II, but its port now serves mostly merchant ships.

About one-half of the people of the Falklands reside in Stanley. It exports wool, sheepskins, and seal oil and imports foodstuffs, coal, oil, clothing, and timber. External communications are via Stanley Airport and a wireless station maintained by the British government. The town is the site of Christ Church Cathedral (1892) and the islands' only hospital. The Town Hall houses a library, as well as public offices and a chamber for the Town Council; the latter levies rates (taxes) to meet the cost of public services. A large garrison of British troops was stationed near Stanley in 1983 after the defeat of invading Argentine forces the previous year. In the environs are penguin rookeries. Pop. (1986) 1,232.

**Stanley, Edward:** *see* Derby, Edward (George Geoffrey Smith) Stanley, 14th Earl of.

**Stanley, Francis Edgar; and Stanley, Freelan O.** (respectively b. June 1, 1849, Kingfield, Maine, U.S.—d. July 31, 1918, Ipswich, Mass.; b. June 1, 1849, Kingfield, Maine, U.S.—d. Oct. 2, 1940, Boston, Mass.), American inventors, twin brothers, the most famous manufacturers of steam-driven automobiles.

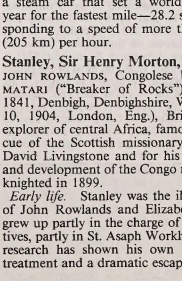


F.E. and F.O. Stanley seated in an early version of the Stanley Steamer, 1897
By courtesy of the National Museum of American History

In 1883 Francis invented a photographic dryplate process, and together the brothers began to manufacture the plates. In 1897 they began developing their steam-powered cars, and their company, the Stanley Motor Company, continued building Stanley Steamers until the 1920s. They competed in racing events from 1902 to 1909, frequently beating larger, gasoline-powered cars. In 1906 the brothers built a steam car that set a world's record that year for the fastest mile—28.2 seconds, corresponding to a speed of more than 127 miles (205 km) per hour.

**Stanley, Sir Henry Morton,** original name JOHN ROWLANDS, Congolese byname BULA MATARI ("Breaker of Rocks") (b. Jan. 28, 1841, Denbigh, Denbighshire, Wales—d. May 10, 1904, London, Eng.), British-American explorer of central Africa, famous for his rescue of the Scottish missionary and explorer David Livingstone and for his discoveries in and development of the Congo region. He was knighted in 1899.

*Early life.* Stanley was the illegitimate son of John Rowlands and Elizabeth Parry and grew up partly in the charge of reluctant relatives, partly in St. Asaph Workhouse. Modern research has shown his own account of ill treatment and a dramatic escape to be almost entirely a fantasy. There seem to have been no extraordinary events attending his departure from the workhouse at the age of 15, after receiving a reasonable education. The humiliations of institutional life and his mother's consistent neglect did, however, leave deep marks on his personality. After an interlude of dependence on relatives, he sailed from Liverpool as a cabin boy, landing at New Orleans in 1859.



Sir Henry Morton Stanley, detail of a portrait by Sir Hubert von Herkomer; in the City Art Gallery, Bristol, Eng.
By courtesy of the City Art Gallery, Bristol, Eng.

There Rowlands was befriended by a merchant, Henry Hope Stanley, whose first and last names the boy adopted in an apparent effort to make a fresh start in life with a new identity; "Morton" was added later. Passages in Stanley's *Autobiography* concerning this period contain serious misstatements, particularly in regard to the movements of Mr. and Mrs. Henry Hope Stanley and the degree of intimacy that existed between them and young Rowlands. For some years Stanley led a roving life; a soldier in the American Civil War, a seaman on merchant ships and in the U.S. Navy, a journalist in the early days of frontier expansion—he even managed a trip to Turkey, recorded in *My Early Travels and Adventures in America and Asia* (1895).

In 1867 Stanley offered his services to James Gordon Bennett of the *New York Herald* as a special correspondent with the British expeditionary force sent against Tewodros II of Ethiopia, and Stanley was the first to report the fall of Magdala in 1868. An assignment to report the Spanish Civil War followed, and in 1869 he received instructions to undertake a roving commission in the Middle East, which was to include the relief of Dr. David Livingstone, of whom little had been heard since his departure for Africa in 1866 to search for the source of the Nile.

*Relief of Livingstone.* On Jan. 6, 1871, Stanley reached Zanzibar, the starting point for expeditions to the interior, and, intent on a scoop, left on March 21 without disclosing his intentions. His secretive conduct caused much offense to the authorities, especially to Sir John Kirk, the British consul, who had been having difficulty in making contact with Livingstone. Leading a well-equipped caravan and backed by American money, Stanley forced his way through country disturbed by fighting and stricken by sickness to Ujiji on Lake Tanganyika, Livingstone's last known port of call. There he found the old hero, ill and short of supplies, and greeted him with the famous words "Dr. Livingstone, I presume?"

A cordial friendship sprang up between the two men, and when Stanley returned to the coast he dispatched fresh supplies to enable Livingstone to carry on. The older man's quest ended a year later with his death in the swamps of Lake Bangweulu still vainly seeking the Nile in a region that in fact gives rise to the Congo (Zaire) River.

*How I Found Livingstone* was published soon after Stanley's arrival in England in the late summer of 1872, when the exploits of this hitherto unknown adventurer gave rise to controversy. Members of the Royal Geographical Society (RGS) resented an American journalist having succeeded in relieving the famous traveler when they, his friends, had failed. Stanley did, however, receive the RGS Patron's Gold Medal. In 1873 Stanley went to Ashanti (in modern Ghana) as war correspondent for the *New York Herald,* and in 1874 was published his *Coomassie and Magdala: The Story of Two British Campaigns in Africa.*

*Discovery and development of the Congo.* When Livingstone died in 1873, Stanley resolved to take up the exploration of Africa where he had left off. The problem of the Nile sources and the nature of the central African

lakes had been only partly solved by earlier explorers. Stanley secured financial backing from the *New York Herald* and the *Daily Telegraph* of London for an expedition to pursue the quest, and the caravan left Zanzibar on Nov. 12, 1874, heading for Lake Victoria. His visit to King Mutesa I of Buganda led to the admission of Christian missionaries to the area in 1877 and to the eventual establishment of a British protectorate in Uganda. Circumnavigating Lake Victoria, Stanley confirmed the explorer John H. Speke's estimate of its size and importance. Skirmishes with suspicious tribespeople on the lakeshore, which resulted in a number of casualties, gave rise in England to criticism of this new kind of traveler with his journalist's outlook and forceful methods. Lake Tanganyika was next explored and found to have no connection with the Nile system. Stanley and his men pressed on west to the Lualaba River (the very river that Livingstone had hoped was the Nile but that proved to be the headstream of the Congo). There they joined forces with the Arab trader Tippu Tib, who accompanied them for a few laps downriver, then left Stanley to fight his way first to Stanley Pool (now Malebo Pool) and then (partly overland) down to the great cataracts he named Livingstone Falls. Stanley and his men reached the sea on Aug. 12, 1877, after an epic journey described in *Through the Dark Continent* (1878).

Failing to enlist British interests in the development of the Congo, Stanley took service with the king of Belgium, Leopold II, whose secret ambition it was to annex the region for himself. From August 1879 to June 1884 Stanley was in the Congo basin, where he built a road from the lower Congo up to Stanley Pool and launched steamers on the upper river. (It is from this period, when Stanley persevered in the face of great difficulties, that he earned, from his men, the nickname of Bula Matari ["Breaker of Rocks"]). Originally under international auspices, Stanley's work was to pave the way for the creation of the Congo Free State, under the sovereignty of King Leopold. These strenuous years are described in *The Congo and the Founding of its Free State* (1885).

*Relief of Emin Paşa.* Stanley's last expedition in Africa was for the relief of Mehmed Emin Paşa, governor of the Equatorial Province of Egypt, who had been cut off by the Mahdist revolt of 1882 in the environs of Lake Albert. Stanley was appointed to lead a relief expedition and decided to approach Lake Albert by way of the Congo, counting on Tippu Tib to supply porters. Stanley left England in January 1887 and arrived at the mouth of the Congo in March. The expedition reached the navigable head of the river in June, and there, at Yambuya, Stanley left a rear column with orders to await Tippu Tib's porters. The failure of the rear column to rejoin the main body later gave rise to controversy harmful to Stanley's reputation. Eventually the expedition was assembled at Lake Albert and, despite Emin's initial reluctance to leave his province, on April 10, 1889, some 1,500 persons set out for the east coast, arriving at Bagamoyo on December 4. On the way the Ruwenzori Range was revealed to explorers for the first time (identified as Ptolemy's Mountains of the Moon) and the Semliki River was shown to link Lakes Edward and Albert; thus were cleared up the few doubtful geographic points regarding the Nile sources. *In Darkest Africa* (1890) is Stanley's own account of his last adventure on the African continent. He received a Special Gold Medal from the RGS.

Stanley married Dorothy Tennant on July 12, 1890, and they adopted a son, Denzil. Stanley was renaturalized a British subject in 1892 (he had become a U.S. citizen on May 15, 1885) and sat in Parliament as Liberal Unionist for North Lambeth from 1895 to 1900. In 1897 he visited South Africa and wrote *Through South Africa* (1898). He was awarded a Grand Cross of the Bath in 1899, becoming Sir Henry Morton Stanley. The remaining years before his death were spent mainly at Furze Hill near Pirbright, Surrey, a small estate that he bought in 1898.

BIBLIOGRAPHY. Stanley's story as told in his *The Autobiography of Sir Henry Morton Stanley,* ed. by Dorothy Stanley (1909), was closely adhered to by Frank Hird, *H.M. Stanley: The Authorized Life* (1935); by Ian Anstruther, *I Presume* (1956, reissued 1988, also published as *Dr. Livingstone, I Presume,* 1957); and by Byron Farwell, *The Man Who Presumed* (1957, reprinted 1989). A new light was thrown on the subject by Richard Hall, *Stanley: An Adventurer Explored* (1974), a penetrating biography based on most of the extant manuscript collections pertaining to Stanley. This work was carried on by Frank McLynn, *Stanley: The Making of an Explorer* (1989); and by John Bierman, *Dark Safari: The Life Behind the Legend of Henry Morton Stanley* (1990). Eyewitness accounts of Stanley in the field are quoted by Iain R. Smith, *The Emin Pasha Relief Expedition, 1886–1890* (1972). Norman R. Bennett (ed.), *Stanley's Despatches to the New York Herald, 1871–1872, 1874–1877* (1970), contains an illuminating introduction that reassesses Stanley and his place in the history of 19th-century exploration. (D.Mi.)

**Stanley, James:** *see* Derby, James Stanley, 7th Earl of.

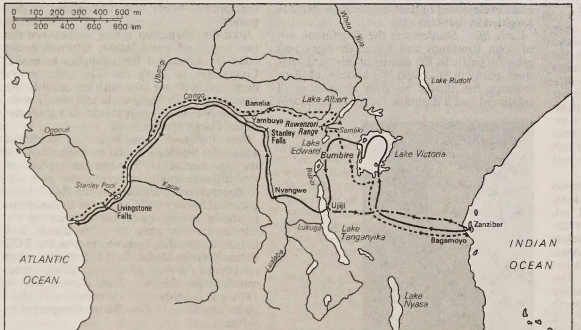
**Stanley, Thomas** (b. 1625, Cumberlow, Hertfordshire, Eng.—d. April 12, 1678, London), English poet, translator, and the first English historian of philosophy.

Stanley was the son of Sir Thomas Stanley, himself the grandson of Thomas Stanley, a natural son of Edward Stanley, 3rd Earl of Derby. The younger Stanley was educated by William Fairfax, son of the translator of Torquato Tasso. He became a good classical scholar and an enthusiastic student of French, Italian, and Spanish poetry. Stanley entered Pembroke Hall (later College), Cambridge, in 1639 and studied there and at the University of Oxford, graduating with an M.A. in 1641.

Stanley was the friend of many poets and himself a prolific translator and writer of verse. He traveled on the European continent during the English Civil Wars and on his return lived in the Middle Temple, London, where he devoted himself to literary work. His first volume of poems appeared in 1647. Subsequent volumes included translations from Anacreon, Bion, Decimus Magnus Ausonius, Battista Guarini, Giambattista Marino, Petrarch, Pierre de Ronsard, and others. His classic renderings of the Anacreontic poems were published in 1651, and the same collection contains his version of Pico della Mirandola's *A Platonick Discourse upon Love.* Stanley's *The History of Philosophy,* which long remained a standard work, was published in 1655–62, and his edition of Aeschylus with Latin translation and commentary in 1663. He had a graceful if tenuous gift as a lyrical poet and was a versatile and accomplished translator.

**Stanley, Thomas Stanley, 2nd Baron:** *see* Derby, Thomas Stanley, 1st Earl of.

**Stanley, Wendell Meredith** (b. Aug. 16, 1904, Ridgeville, Ind., U.S.—d. June 15, 1971, Salamanca, Spain), American biochemist who received (with John Northrup and James Sumner) the Nobel Prize for Chemistry in 1946 for work in the purification and crystallization of viruses, thus demonstrating their molecular structure.




The expeditions of Henry Morton Stanley in central Africa

Working from 1932 to 1948 at the Rockefeller Institute for Medical Research (now Rockefeller University) facilities in Princeton, N.J., Stanley in 1935 crystallized tobacco mosaic virus (TMV, the causative agent of a



Wendell Stanley, 1970
By courtesy of the Molecular Biology & Virus Laboratory, University of California, Berkeley

plant disease) and showed that it is a rod-shaped aggregate of protein and nucleic acid molecules. His work enabled other scientists, utilizing methods of X-ray diffraction, to ascertain unambiguously the precise molecular structures and the modes of propagation of several viruses.

A professor of biochemistry and director of the laboratory for virus research at the University of California, Berkeley (1948–71), Stanley also studied influenza viruses, for which he developed a preventive vaccine.

**Stanley Cup,** trophy awarded to the winner of the world's professional ice hockey championship, an annual play-off that culminates the season of the National Hockey League. The Stanley Cup was first awarded in the 1893–94 season and is the oldest trophy that can be won by professional athletes in North America. The cup's donor was a governor-general



The Stanley Cup
By courtesy of the National Hockey League

of Canada, Frederick Arthur, Lord Stanley of Preston, for whom it is named. It was originally intended to go to the outstanding Canadian team, as determined by a play-off, and the first winner was the Montreal Amateur Athletic Association. Amateurs competed for the cup in the early years, but, as the number of professional teams grew, amateurs dropped out of the competition. The cup became the sole property of the National Hockey League in 1926. *See also* Sporting Record: *Ice hockey.*

**Stanley Falls** (Zaire): *see* Boyoma Falls.

**Stanley Pool** (Congo-Zaire): *see* Malebo Pool.

**Stanleyville** (Zaire): *see* Kisangani.

**Stann Creek** (Belize): *see* Dangriga.

**stannite,** a sulfide mineral, chemical formula $Cu_2FeSnS_4$, that is an ore of tin. It is ordinarily found associated with other sulfide minerals in tin veins, as at Cornwall, England; Zeehan, Tasmania; and Bolivia. Stannite is a member of the chalcopyrite group of sulfides. Stannite crystals have tetragonal symmetry. For chemical formula and detailed physical properties, *see* sulfide mineral (table).

**Stanovoy Range,** also spelled STANOVOJ, Russian STANOVOY KHREBET, mountain range along the boundary between Amur *oblast* (province) and Yakutiya (Yakut-Sakha), Russia. It trends east to west, linking the mountains of Transbaikalia to the Dzhugdzhur Mountains, and is part of the watershed between the Pacific and Arctic oceans, separating the Lena River basin to the north from the Amur River basin to the south. The mountains are generally not high, although they reach 7,913 feet (2,412 m) in the east. They are densely forested with swampy forest, or taiga, dominated by larch, but the higher summits are bare. The mountains contain deposits of gold, coal, and mica. The Amur to Yakutsk Highway, linking Yakutiya to the Trans-Siberian Railroad, and a parallel railroad from the Trans-Siberian Railroad to southern Yakutiya both cross the range.

**Stans,** capital of Nidwalden half *canton,* central Switzerland, southeast of Luzern. First mentioned in 1172, it was the scene in 1481 of the Diet of Stans. Stans was stormed by the French in 1798, when it revolted against the Helvetic Republic, and educator Johann Heinrich Pestalozzi gathered the children orphaned by the conflict for his first school. Notable landmarks are the parish church (1641–47) with a Romanesque tower, the town hall (1715), and the historical museum. The Landsgemeinde (open-air elections of the half canton, with voting by show of hands) are held annually in the town square. Surrounded by orchards, Stans is a tourist centre with a funicular railway to the summit of the nearby Stanserhorn (6,227 feet [1,898 m]). Pop. (1998) 6,637.

**Stans, Diet of** (Dec. 22, 1481), agreement whereby civil war among the member states of the Swiss Confederation was averted. When the five rural cantons of the federation—Uri, Schwyz, Unterwalden, Zug, and Glarus—concluded a treaty of common citizenship between themselves and the bishopric of Constance (1477), the three other, urban cantons—Luzern, Bern, and Zürich—retorted by concluding a similar treaty for themselves with two other cities, Fribourg and Solothurn. The rural cantons objected to this, chiefly because it seemed to portend the admission of two new cities in the federation and so to upset the existing five-to-three majority of the rural districts over the urban. The ensuing controversy threatened to disrupt the confederation. A conference at Stans, in the Nidwalden subdivision of Unterwalden, in November 1481 failed to achieve anything until a pious hermit of Obwalden, Niklaus von Flüe (Bruder Klaus), was asked to mediate. On his advice, both the five and the three denounced their controversial treaties; and all eight made a new alliance with Fribourg and Solothurn, which thus entered the confederacy on the understanding that they were to make no separate alliances of their own without the approval of a majority among the eight. The result was a positive strengthening of the federal union, which was to be sworn formally every five years; and the admission of French-speaking Fribourg to a federation that had hitherto been exclusively a German-speaking one was highly significant for the future development of Switzerland.

**Stansfield, Grace:** *see* Fields, Dame Gracie.

**Stansgate (of Stansgate), Anthony Neil Wedgwood Benn, 2nd Viscount:** *see* Benn, Tony.

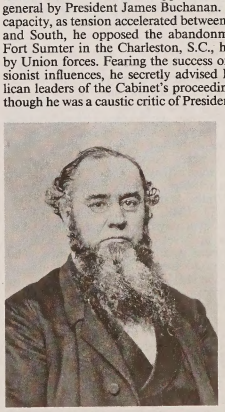
**Stanthorpe,** town, southeastern Queensland, Australia, on the New South Wales border. Tin, discovered in 1872 in the locality, led to the development of the town, which was first called Stannum (Latin: "tin"). Lead and silver were found in 1880, and Stanthorpe was gazetted in 1902. On a rail line from Brisbane (105 miles [170 km] northeast) and the New England Highway, the town now serves a region of sheep, vegetable, and fruit farming. Limestone is quarried, and the alluvial tin workings, dormant since 1900, have been reactivated. Stanthorpe is the centre of the Granite Belt, a region of spectacular geologic formations, much of which are protected in the Sundown and Girraween national parks. The town is a popular resort. Pop. (1996) 4,154.

*Consult the* INDEX *first*

**Stanton, Edwin M(cMasters)** (b. Dec. 19, 1814, Steubenville, Ohio, U.S.—d. Dec. 24, 1869, Washington, D.C.), secretary of war who, under President Abraham Lincoln, tirelessly presided over the giant Union military establishment during most of the American Civil War (1861–65).

Admitted to the Ohio bar in 1836, Stanton became a highly successful attorney. In 1847 he moved to Pittsburgh and nine years later to Washington, D.C., where he built a wide practice in the federal courts.

During all these years Stanton remained a staunch Democrat but grew steadily more outspoken in support of antislavery measures. In December 1860 he was appointed attorney general by President James Buchanan. In that capacity, as tension accelerated between North and South, he opposed the abandonment of Fort Sumter in the Charleston, S.C., harbour by Union forces. Fearing the success of secessionist influences, he secretly advised Republican leaders of the Cabinet's proceedings. Although he was a caustic critic of President-elect



Stanton
Brown Brothers

Lincoln in this period, he was, nevertheless, made legal adviser to Lincoln's secretary of war, Simon Cameron, and, when Cameron resigned under fire less than a year later, Stanton accepted appointment as his successor (Jan. 13, 1862). During the remainder of the Civil War, he proved an able, energetic administrator, despite his nervous, asthmatic constitution and cranky, contradictory temperament. Exceedingly patriotic and zealous in his honesty, he

insisted on tighter management of his department, gave short shrift to patronage seekers, and continually pushed for a more aggressive prosecution of the war. He provoked violent quarrels with nearly every important federal military commander.

After the assassination of Lincoln (April 1865), Stanton played a leading role in the investigation and trial of the conspirators, and for a short time he virtually directed the conduct of government in the stricken capital. He agreed to continue in his post under Pres. Andrew Johnson and skillfully managed the demobilization of Union forces. Stanton was soon at loggerheads with Johnson, however, over the nature of Reconstruction policy toward the defeated South. The secretary of war used his position to foster stricter Reconstruction measures than the president desired; in addition Stanton acted as the secret representative, within the Cabinet, of the Radical Republicans in Congress, who were Johnson's bitter enemies. The situation finally became so untenable that Johnson tried to remove Stanton from office, but the stubborn secretary refused to be dismissed, claiming that the Tenure of Office Act—passed by the Radicals in Congress (1867) over the president's veto—protected his official position. Johnson's persistence resulted in his impeachment by an unsympathetic House of Representatives. When the Senate vote fell one short of conviction, Stanton had no alternative but to surrender his office (May 26, 1868) and return to private law practice. He died four days after his appointment to the U.S. Supreme Court by Pres. Ulysses S. Grant.

**Stanton, Elizabeth Cady,** *née* ELIZABETH CADY (b. Nov. 12, 1815, Johnstown, N.Y., U.S.—d. Oct. 26, 1902, New York, N.Y.), American leader in the women's rights movement who in 1848 formulated the first organized demand for woman suffrage in the United States.

While studying law in the office of her father, Daniel Cady, a U.S. congressman and later a New York Supreme Court judge, she learned of the discriminatory laws under which women lived and determined to win equal rights for her sex. In 1840 she married Henry Brewster Stanton, a lawyer and abolitionist. In 1848 she circulated petitions that helped to secure the passage of a New York statute giving property rights to married women. She and Lucretia Mott led the first women's rights convention in the United States, at Seneca Falls, N.Y., July 19–20, 1848, and in Rochester, N.Y., on subsequent days. For this meeting Stanton drew up a set of resolutions demanding improvement in the status of women. The convention adopted all these resolutions, including one, of which Mott disapproved, in favour of woman suffrage.

In 1850 Stanton began an association with another outstanding suffragist, Susan B. Anthony, who managed the business affairs of the movement while Stanton did most of the writing. They edited a women's-rights newspaper, the *Revolution* (1868–70), and, with Matilda Joslyn Gage, the first three volumes of *The History of Woman Suffrage,* 6 vol. (1881–1922). Stanton's autobiography was entitled *Eighty Years and More 1815–1897* (1898).

BIBLIOGRAPHY. Lois W. Banner, *Elizabeth Cady Stanton: A Radical for Women's Rights* (1980); and Elisabeth Griffith, *In Her Own Right: The Life of Elizabeth Cady Stanton* (1984), portray her private life and her development as a leader.

**Stanton, Frank (Nicholas)** (b. March 20, 1908, Muskegon, Mich., U.S.), innovative American radio and television executive who was president of the Columbia Broadcasting System (CBS) from 1946 to 1971.

Stanton grew up in Dayton, Ohio, and attended Ohio Wesleyan University and Ohio State University. His doctoral dissertation on measuring the reactions of broadcast audiences to radio programming led to a summer job with the network. His subsequent rise in the broadcasting hierarchy was rapid, and by age 38 he was president of CBS.

Stanton's career included several decisive actions. In the late 1950s, when scandals had tarnished numerous personalities in televised quiz programs, he discontinued the network's remaining quiz shows. In 1960 Stanton flouted the Federal Communications Commission's "equal time" regulation to broadcast debates between John F. Kennedy and Richard M. Nixon, the only presidential candidates he considered significant. A decade later he refused to submit to Congress CBS's preparatory materials for the controversial documentary "The Selling of the Pentagon." In 1971 he argued in hearings in Washington, D.C., that broadcasting should enjoy the same freedoms as the press under the First Amendment of the U.S. Constitution.

Stanton received many honours, including awards in 1960 and 1970 from the Television Academy of Arts and Sciences; he was elected to the Hall of Fame in 1986. After retiring from CBS, he served as chairman of the American Red Cross from 1973 to 1979.

**Stanwyck, Barbara,** original name RUBY STEVENS (b. July 16, 1907, Brooklyn, N.Y., U.S.—d. Jan. 20, 1990, Santa Monica, Calif.), American motion-picture and television actress.

She became a chorus girl at the age of 15 and danced in nightclubs and in touring companies before being picked to play the role of a cabaret dancer in the Broadway play *The Noose* in 1926. At this time she adopted the name Barbara Stanwyck. Her performance in the leading role in *Burlesque* (1927) resulted in movie offers, and she appeared in her first leading role in a motion picture, *The Locked Door,* in 1929. She went on to appear in more than 80 films, among the more notable of which were *Union Pacific* and *Golden Boy* (both 1939), *Meet John Doe* and *The Lady Eve* (both 1941), *The Strange Love of Martha Ivers* (1946), *Clash by Night* (1952), and *Executive Suite* (1954). She received Academy Award nominations for her performances in *Stella Dallas* (1937), *Ball of Fire* (1941), *Double Indemnity* (1944), and *Sorry, Wrong Number* (1948), but she did not win an Oscar until 1982, when she received an honorary award. She played a wide variety of roles but was best in dramatic parts as a strong-willed, independent woman of complex character. She worked mainly in television during the 1960s and early '70s, notably as a proud widow, matriarch of the Barkley clan, in "The Big Valley" (1965–69), a western series.

**stanza,** unit of a poem that consists of two or more lines of verse organized according to content and form and usually repeated as a recurring pattern in the poem. The structure of a stanza (also called a strophe, or a stave) is determined by the number of lines, the dominant metre, and the rhyme scheme. Thus, a stanza of four lines of iambic pentameter, rhyming *abab,* could be described as a quatrain.

Some of the most common stanzaic forms are designated by the number of lines in each unit—*e.g.,* tercet or terza rima (three lines) and ottava rima (eight lines). Other forms are named for their inventors or those who perfected the form—*e.g.,* the Spenserian stanza or the *In Memoriam* stanza, popularized by Alfred Tennyson in that poem.

**Staphylococcus,** genus of spherical bacteria of the family Micrococcaceae, the best known species of which are universally present in great numbers on the mucous membranes and skin of humans and other warm-blooded animals. The term staphylococcus, generally used for all the species, refers to the cells' habit of aggregating in grapelike clusters.

Staphylococci are microbiologically characterized as gram-positive (in young cultures), non-spore-forming, nonmotile, facultative anaerobes (not requiring oxygen). Their cells average 1 $\mu$m (micrometre; 1 $\mu m = 10^{-6}$ metre) in diameter and are usually clustered.

Of significance to humans are two variants of the species *S. aureus,* an important agent of wound infections, boils, and other human skin infections and one of the most common causes of food poisoning. *S. aureus* also causes udder inflammation, or mastitis, in domestic animals and breast infections in women. It is a difficult hospital pathogen because of its resistance to antibiotics. *S. epidermis* is a milder pathogen that is opportunistic in persons with lowered resistance.

**Stapledon, Sir (Reginald) George** (b. Sept. 22, 1882, Northam, Devon, Eng.—d. Sept. 16, 1960, Bath, Somerset), British agriculturalist and pioneer in the development of grassland science.

Stapledon graduated in 1904 from the University of Cambridge and returned there in 1906 to begin a study of plant sciences. In 1910 he was appointed to the staff of the Royal Agricultural College, Cirencester. In 1912 he went to the University College of Wales in Aberystwyth, where he became an advisory officer in agricultural botany. Stapledon's attempts to devise techniques for separating weed seeds from commercial seeds during World War I led to the establishment of the Seed Testing Station in London. In 1919 he returned to the University College of Wales and served as director of the Welsh Plant Breeding Station until 1942. While there he developed and improved strains of oats, clovers, and other grasses.

Stapledon next established a second agricultural station, at Drayton, Warwickshire, that was devoted entirely to the improvement of grassland areas in Great Britain. He remained there until his retirement in 1946. On the basis of Stapledon's improvements, the government established the Grassland Research Station at Hurley, Berkshire.

In 1939 Stapledon was knighted and elected a Fellow of the Royal Society.

**Stapledon, (William) Olaf** (b. May 10, 1886, Wirral Peninsula, near Liverpool, Merseyside, Eng.—d. Sept. 6, 1950, Cheshire), English novelist and philosopher whose "histories of the future" are a major influence on contemporary science fiction.

A pacifist, Stapledon served with a Friends' ambulance unit in World War I and was awarded the Croix de Guerre. He received a Ph.D. in philosophy and psychology from the University of Liverpool. In 1929 he published *A Modern Theory of Ethics* and seemed destined for an academic career, but after the success of his novel *Last and First Men* (1930), he turned to fiction.

*Last and First Men* traces the history of humanity from the First Men (present-day) to the Eighteenth Men, one of whom serves as narrator. The tale illustrates Stapledon's belief that to emphasize either the physical (the flying Seventh Men of Venus) or the mental (the giant-brained Fourth Men) to the exclusion of the other spells certain disaster. He emphasized the ideals of community, necessary for individual fulfillment and embodied by the Eighteenth Men, and of spirit, which gives purpose to human existence. He used themes of antiquity and myths of the past to create a myth of the future.

Stapledon also wrote for technical and scholarly reviews on ethics and philosophy. His other works include *The Last Men in London* (1932), *Odd John* (1935), *Philosophy and Living* (1938), *Star Maker* (1937), and *Sirius* (1944).

**star,** any massive, self-luminous celestial body of gas that shines by radiant energy generated within its interior. The universe contains trillions of stars, only a very small percentage of which are visible to the unaided eye.

A brief treatment of stars follows. For full treatment, *see* MACROPAEDIA: Stars and Star Clusters.

The closest star to the solar system is Proxima Centauri, which is approximately 4.3 light-years from the Sun. The most distant stars lie in galaxies billions of light-years away. Stars may occur singly, as in the case of the Sun. More commonly, however, they exist in pairs, multiple systems with several members, or clusters consisting of numerous components. Furthermore, stars vary greatly in brightness, colour, temperature, mass, size, chemical composition, and age.

*Stellar properties.* The observed brightness of a star is expressed by its apparent magnitude, with a decrease of one magnitude corresponding to an increase in brightness of 2.512 times (*i.e.,* a star of the first magnitude is 2.512 times as bright as one of the second magnitude). Some stars are so bright as to be given negative magnitudes, as for example Sirius, with an apparent magnitude of −1.5. Stars visible to the unaided eye have values of six or lower. A star's apparent magnitude is not a direct indicator of its luminosity. Such intrinsic brightness is given in terms of absolute magnitude, which is the magnitude that a star would have if it were viewed at a standard distance of 10 parsecs (32.6 light-years).

Stars differ widely in colour, ranging from blue-white to red. Stellar colours can be measured by several methods. The most widely employed technique requires the use of a photoelectric photometer, which can measure stellar colours with the aid of filters.

The atmospheric, or surface, temperature of a star can be estimated by studying its spectrum, because temperature largely determines the types of absorption lines present. In nearly all stars, hydrogen is the most abundant element, but it is completely ionized in the outer layers of stars having a temperature in excess of 25,000 K and thus produces virtually no absorption lines. In cooler stars of about 10,000 K, many hydrogen atoms remain nonionized, and a sufficient number are excited to higher energy levels to yield strong absorption lines (*e.g.,* Balmer series). The spectra of stars with still lower surface temperatures manifest different absorption line patterns. The prevailing system of spectral classification divides stars into seven broad groups in order of decreasing temperature: O, B, A, F, G, K, and M. This O-M spectral sequence is also a colour sequence. For example, the O-type stars, which are the hottest of all stellar bodies, have an estimated surface temperature of more than 25,000 K and are intrinsically blue in colour. G-type stars, including the Sun, are relatively cool, with a temperature of 5,000–6,000 K, and are white to yellow. The M type are the coolest stars; they are characterized by temperatures of less than 3,500 K and a deep reddish colour. The O-M group is often supplemented by R, N, and S stars, which differ from the others in chemical composition.

Spectral analyses have provided much information about stellar composition. With several exceptions, such as ionized hydrogen in extremely hot stars, only the atoms of the more abundant constituent elements in a star are able to produce observable absorption lines. The spectrum of a G star, for instance, is dominated by the lines of such metals as iron, calcium, sodium, magnesium, and titanium.

The mass of a star is difficult to determine directly except in the case of visual binaries (*i.e.,* stellar objects that can be seen as double stars in optical telescopes). Binaries, particularly those consisting of a dwarf and a supergiant star, provide the most extensive data on stellar dimensions. The angular diameters of supergiants were measured in the 1920s with the Michelson stellar interferometer. This instrument, based on the principle of light interference, provided an effective means of measuring the large angular diameters of bright stars, but it could not be used for stellar bodies of smaller apparent size. Several decades later, astronomers developed the photo-correlation interferometric method suitable for measuring the diameters of such stars. Since the late 1960s investigators have relied on another procedure, known as speckle interferometry, to reproduce the true disks of red supergiants.

Important generalizations concerning the nature and evolution of stars can be made from correlations between certain observed properties and from statistical results. The correlation between spectrum and absolute magnitude (or luminosity) is of particular significance. A graph called the Hertzsprung-Russell (H-R) diagram is generally used to show the absolute magnitudes of stars plotted against their spectral classes. The stars tend to cluster together in certain parts of the diagram. Most of them fall along a narrow band designated the main sequence that extends from the upper left of the diagram (hot, luminous stars) to its lower right (cool, dim stars). The stars of the main sequence, which includes the Sun, are the dwarf stars. Another relatively large number of stars congregate above the main sequence in the upper right portion of the diagram. These cool stars of high luminosity are the giants, which are about 100 times as bright as the Sun. Even more luminous stars, the supergiants, lie at the very top of the diagram. Below the main sequence at the lower left are the white dwarfs, stars with high surface temperatures but low luminosity.

*Stellar evolution.* A star forms when a dense interstellar cloud of hydrogen and dust grains collapses inward under the force of its own gravity. As the cloud condenses, its density and internal temperature increase until reaching incandescence with a faint red glow. At this stage the star shines by energy from its gravitational contraction. As its interior temperature rises to a few million degrees, deuterium (heavy hydrogen) is first destroyed, followed by the transformation of lithium, beryllium, and boron into helium. The temperature of the core region continues to increase until it reaches a level high enough to support thermonuclear reactions—the proton-proton chain or the carbon cycle. The star ceases to contract at this juncture, entering the main-sequence stage, where it remains for much of its life. As time passes, the star's chemical composition changes. The hydrogen in its core is converted into helium, and the central temperature gradually rises.

The change in composition is accompanied by changes in the star's structure, size, and luminosity. When all the hydrogen of the core has been exhausted and the central region consists almost entirely of inert helium, energy production begins to occur in a thin shell around the core. The core gradually increases in mass but shrinks in size because ever-increasing amounts of inert elements are fed in through the hydrogen-burning shell. The outer layers of the star expand significantly and cool, causing the star to become red in colour. At the same time, energy from the contracting core heats up the hydrogen in the surrounding region, which accelerates nuclear reactions and thereby increases luminosity.

The final stages of a star's evolution depend largely on two factors: (1) the mass of the stellar body, and (2) whether it is a component of a close binary system. A solitary star of less than 1.4 solar masses usually evolves from a red giant to a white dwarf when its outer layers drift away and leave behind a hot, compact core. This dense core constitutes the white dwarf star, and the expanding gaseous shell that temporarily surrounds it is known as a planetary nebula. When a lightweight star of a close binary system reaches the white-dwarf stage while its companion is becoming a red giant, it may acquire material from the latter's outer layers. This matter accumulates on the surface of the white dwarf and eventually triggers thermonuclear reactions. The star becomes a nova when the energy from these reactions blows off the accumulated matter in a brief but violent explosion.

Single stars that are more than five times as massive as the Sun can continue generating energy by fusion after having depleted their hydrogen supplies because their gravitational potential energy enables them to build up extremely high pressures and temperatures deep in their interior. In this way, they can successively create elements as heavy as iron in their cores. It is thought, however, that reactions involving iron fusion result in the catastrophic collapse of the stellar core. The outer layers of such a heavyweight star explode violently as a supernova, shining $10^9$ times more brightly than a normal star for several months. Elements heavier than iron are created by neutron-capture reactions in the explosion itself, enriching the interstellar medium for future star-formation. After the supernova event, the core may remain as a neutron star. Composed of tightly packed neutrons, this type of star has a density many times greater than that of the Sun but a diameter of only about 20 km (12 miles). Many neutron stars emit radio radiation in the form of short pulses at very regular intervals. Such stellar objects are commonly called pulsars. If the remnant mass of the supernova is more than two or three solar masses, it is thought to continue collapsing inward and eventually to form a black hole, an object with so powerful a gravitational field that no form of matter or energy—not even light—can escape from it.

**star apple** (*Chrysophyllum cainito*), tropical American tree, of the sapodilla family (Sapotaceae), native to the West Indies and Central America. It is cultivated for its edible



Star apple (*Chrysophyllum cainito*)
Walter Dawn

fruit, which is the size and shape of an apple and is named for the star-shaped core. The surface of the fruit is firm and smooth. Both the skin and the flesh, which is sweet and tasty, vary in colour, ranging from white to purple. The tree grows about 7.5–15 m (25–50 feet) tall and has purplish white flowers.

**star catalog,** list of stars, usually according to position and magnitude (brightness) and, in some cases, other properties (*e.g.,* spectral type) as well. Numerous catalogs and star atlases have been made, some of fundamental

importance to stellar astronomy. A star may well appear in several catalogs and be assigned as many different designations.

Hipparchus completed the first known catalog in 129 BC, giving the celestial longitudes and latitudes of about 850 stars. This work was enlarged and improved by Ptolemy, the Alexandrian astronomer and mathematician, in his *Almagest* (*c.* AD 140). At Samarkand (now in Uzbekistan), Ulugh Beg (1394–1499), grandson of Timur (Tamerlane), working in his own observatory in the years 1420–37, compiled a catalog that became known in Europe in the 1500s and was printed there in 1665.

The last and finest catalog of the pretelescope era was made by the skilled Danish observer Tycho Brahe (1546–1601). It was included in expanded form in the *Rudolphine Tables* of the mathematical astronomer Johannes Kepler. Tycho's catalog was the first in which Greek letters were assigned to stars to indicate their relative brightnesses within each constellation. The English astronomer John Flamsteed (1646–1719) published his catalog, *Historia coelestis Britannica*, in 1725. Some of his designations are still in use, *e.g.*, 61 Cygni for the star having the 61st-greatest right ascension in the constellation Cygnus. Friedrich W.A. Argelander of Germany compiled the *Bonner Durchmusterung* (BD) catalog, which lists more than 324,000 stars and was published 1859–62. Extensive supplements to the BD include the *Córdoba Durchmusterung* and *Cape Photographic Durchmusterung*. With the *Henry Draper Catalogue* (HD), prepared in the late 19th and early 20th centuries at Harvard Observatory, began the present (Harvard) classification of stars by spectral type.

**Star Chamber, Court of,** in English law, the court made up of judges and privy councillors that grew out of the medieval king's council as a supplement to the regular justice of the common-law courts. It achieved great popularity under Henry VIII for its ability to enforce the law when other courts were unable to do so because of corruption and influence, and to provide remedies when others were inadequate. When, however, it was used by Charles I to enforce unpopular political and ecclesiastical policies, it became a symbol of oppression to the parliamentary and Puritan opponents of Charles and Archbishop William Laud. It was, therefore, abolished by the Long Parliament in 1641.

Finding its support from the king's prerogative (sovereign power and privileges) and not bound by the common law, Star Chamber's procedures gave it considerable advantages over the ordinary courts. It was less bound by rigid form; it did not depend upon juries either for indictment or for verdict; it could act upon the petition of an individual complainant or upon information received; it could put an accused person on oath to answer the petitioner's bill and reply to detailed questions. On the other hand, its methods lacked the safeguards that common-law procedures provided for the liberty of the subject. Parliaments in the 14th and 15th centuries, while recognizing the occasional need for and usefulness of those methods, attempted to limit their use to causes beyond the scope or power of the ordinary court.

It was during the chancellorship of Thomas Wolsey (1515–29) that the judicial activity of Star Chamber grew with greatest rapidity. In addition to prosecuting riot and such crimes, Wolsey used the court with increased vigour against perjury, slander, forgery, fraud, offenses against legislation and the king's proclamations, and any action that could be considered a breach of the peace. Wolsey also encouraged suitors to appeal to it in the first instance, not after they had failed to find an efficient remedy in the ordinary courts.

The court used the procedures of the king's council. Cases began upon petition or information. Depositions were taken from witnesses, but no jury was used. The punishments, which were arbitrary, included imprisonment, fine, the pillory, whipping, branding, and mutilation, but never death.

The Court of Star Chamber retained its popularity throughout the reign of James I but during the 1630s began to attract opposition from the common-law courts, which saw Star Chamber as a rival; from the parliamentary faction that opposed Charles I's attempt to govern without Parliament; and from the Puritans, who were the most severely punished by the court. The Court of Star Chamber was used to enforce the increased number of Charles's royal proclamations, such as those against enclosures and sheriffs who refused to collect ship money. Considerable opposition against Star Chamber came from the gentry, who protested against the centralization of government and who were revolted by the use of the pillory and corporal punishment on religious dissenters, many of whom were gentlemen and who, therefore, would not have been subjected to such treatment in the common-law courts. Consequently, when the Long Parliament began sitting in 1641, one of its earliest acts was to abolish Star Chamber along with some of the other prerogative courts.

**star cluster,** either of two general types of stellar assemblages held together by the mutual gravitational attraction of its members, which are physically related through common origin. The two types are open (formerly called galactic) clusters and globular clusters. *See also* stellar association.

A brief treatment of star clusters follows. For full treatment, *see* MACROPAEDIA: Stars and Star Clusters.

Open and globular clusters differ markedly in their physical properties and in their distribution. They occur in distinct regions of the Milky Way Galaxy, the vast stellar system in which the Sun and its planets are located. A large number of the star clusters have also been found in the external galaxies, such as those of the Local Group and the Virgo cluster of galaxies.

More than 1,000 open clusters have so far been discovered in the Milky Way Galaxy, most of them in or near its spiral arms, which are embedded in the galactic disk. Their distribution is similar in other spiral galaxies. Open clusters are so called because their stars are much more dispersed than those in the compact globular variety. All known open clusters in the Galaxy contain from about 10 to many hundreds of stars, virtually all of which are Population I objects (*i.e.*, younger stars). Well-known examples of open clusters include the Pleiades and Hyades in the constellation Taurus, Praesepe in Cancer, and the Coma Cluster in Coma Berenices.

Astronomers have identified about 100 globular clusters in the Milky Way. The majority of them occur above and below the galactic disk in the region known as the halo. Globular clusters contain many more stars than do open clusters, each having about 10,000 to 1 million members. The component stars are closely packed, particularly near the centre of a cluster, in a symmetrical, nearly spherical form. In contrast to the members of open clusters, these stellar bodies are Population II objects (*i.e.*, old stars). As globular clusters are so distant from the solar system (in some cases as far away as 60,000 light-years), most of them are not visible to the unaided eye. Omega Centauri, M13 in the constellation Hercules, and a few others can be seen without a telescope as hazy patches of light. Since the mid-1970s astronomers, making use of telescopes on board Earth-orbiting satellites, have detected bursts of X-ray pulses from various globular clusters. This has led to the speculation that a massive black hole (invisible object with an intense gravitational field) exists at the centre of such stellar assemblages.

**star finch,** species of grass finch (*q.v.*).

**star of ———:** *see under* substantive word (*e.g.*, Bethlehem, Star of; David, Star of), except as below.

**Star of Africa,** also called CULLINAN I, the largest (530.2 carats) gem cut from the Cullinan diamond (*q.v.*).

**Star of India,** a large, cabochon-cut, grayblue star sapphire, slightly oval in shape. The polished but unfaceted gem weighs 536 carats and was found in Ceylon (now Sri Lanka). It was presented to the American Museum of Natural History, in New York City, by J.P. Morgan.

**Star of South Africa,** also called the DUDLEY DIAMOND, first large diamond found in South Africa; it was discovered in 1869 on the banks of the Orange River by an African shepherd boy, who traded it to a Boer settler for 500 sheep, 10 oxen, and a horse. It weighed about 84 carats in rough form and was cut to about 48 carats. When news of its huge size reached Europe, it set off the South African diamond rush. Called the Dudley diamond after the Earl of Dudley, who purchased it, it should not be confused with the much larger Star of Africa, cut from the Cullinan diamond.

**Star of the South,** unblemished, 129-carat white diamond with a rosy glow, one of the largest ever found in Brazil; it weighed about 262 carats in rough form. It was discovered in 1853 in the Bagagem River (in Minas Gerais state) by a slave woman, who was given her freedom and pensioned as a reward.

**Star-Spangled Banner, The,** national anthem of the United States. Francis Scott Key, a lawyer, wrote the lyrics after watching the British attack Fort McHenry, Maryland, in 1814, during the War of 1812. The melody was taken from "To Anacreon in Heaven," a drinking song of the Anacreontic Society (of London) that was written by the British composer John Stafford Smith. Key's words were first published in a broadside in 1814 under the title "Defence of Fort M'Henry." The song's title was changed when it appeared in sheet-music form later the same year. After a century of general use, the four-stanza song was officially adopted as the national anthem by act of Congress in 1931.

Innumerable publications of the song through the years have shown variations in both words and music. An official arrangement was prepared by John Philip Sousa for the U.S. Army and Navy, and music educators have spent much time and effort in arriving at a practical version. The second and third stanzas are customarily omitted out of courtesy to the British. The accepted text of "The Star-Spangled Banner" is as follows:

Oh, say can you see by the dawn's early light
What so proudly we hail'd at the twilight's last gleaming,
Whose broad stripes and bright stars through the perilous fight
O'er the ramparts we watch'd were so gallantly streaming?
And the rockets' red glare, the bombs bursting in air,
Gave proof through the night that our flag was still there.
Oh, say does that star-spangled banner yet wave
O'er the land of the free and the home of the brave?

On the shore dimly seen through the mists of the deep,
Where the foe's haughty host in dread silence reposes,

What is that which the breeze, o'er the towering steep,
As it fitfully blows, half conceals, half discloses?
Now it catches the gleam of the morning's first beam,
In full glory reflected now shines in the stream.
'Tis the star-spangled banner, oh, long may it wave
O'er the land of the free and the home of the brave!

And where is that band who so vauntingly swore
That the havoc of war and the battle's confusion
A home and a country should leave us no more?
Their blood has wash'd out their foul footstep's pollution.
No refuge could save the hireling and slave
From the terror of flight or the gloom of the grave,
And the star-spangled banner in triumph doth wave
O'er the land of the free and the home of the brave.

Oh, thus be it ever when freemen shall stand
Between their lov'd home and the war's desolation!
Blest with vict'ry and peace may the heav'n-rescued land
Praise the power that hath made and preserv'd us a nation!
Then conquer we must, when our cause it is just,
And this be our motto, "In God is our Trust,"
And the star-spangled banner in triumph shall wave
O'er the land of the free and the home of the brave.

**Star Wars** (military technology): *see* Strategic Defense Initiative.

**Stara Zagora,** town, central Bulgaria. It lies in the southern foothills of the Sredna Mountains and on the fringe of the fertile Stara Zagora plain. The town has varied industries producing cotton, textiles, chemicals, fertilizers, agricultural implements, machine tools, and cigarettes as well as brewing and canning. Power is obtained from the Stara Zagora hydroelectric station. In and around the town are vineyards and cypress, fig, almond, and pomegranate orchards. Northwest of the town is Stara Zagora spa, where previously there were Roman and Turkish baths. Stara Zagora has a strong cultural tradition, especially in opera.

On the site, an ancient Thracian settlement known as Beroea later became the Roman Augusta Trajana. This was devastated in the 4th–5th century by barbarians. In Byzantine times it was called Irenopolis. Falling to the Turks in 1370, the town stagnated, becoming a trade, craft, and market centre. During the Russo-Turkish War (1877–78) the town was destroyed by the Turks before its liberation in 1878. Rebuilt as a planned town, Stara Zagora saw much new development after 1945. Pop. (1989 est.) 158,151.

**Starachowice,** town, central Kielce *województwo* (province), southeastern Poland. It lies along the Kamienna River, which is a tributary of the Vistula River. It is an industrial centre located in the Staropolskie Zagłębie Przemysłowe (Old Poland Industrial Basin) on the rail line between Skarżysko-Kamienna and Sandomierz. Starachowice's economy relies upon iron mining and the manufacture of trucks, buses, and machinery.

Beginning as a mining settlement in the 16th century, the town grew with the building of its iron foundries in 1789. By 1920 Starachowice was a major Polish industrial centre, but its industry was largely destroyed in World War II. Vehicle-assembly plants were built after the war. Pop. (1990 est.) 56,300.

**Staraya Russa,** also spelled STARAIA RUSSA, or STARAJA RUSSA, river port and capital of the Staraya Russa *rayon* (sector), Novgorod *oblast* (province), northwestern Russia, on the Polist River. It is one of the oldest settlements by Lake Ilmen, having been mentioned in documents as early as 1167. Its mineral springs made it an important spa town in the 19th century, and the mineral baths were reconstructed after World War II. The city has wood-processing, chemical, machine-building, and textile industries. Pop. (1991 est.) 41,700.

**Starbuck Island,** formerly VOLUNTEER ISLAND, coral atoll in the Central and Southern Line Islands, part of Kiribati, southwest Pacific Ocean. It lies 2,000 miles (3,200 km) south of Honolulu. A barren formation rising only to 15 feet (5 m), it has a land area of 8 square miles (21 square km) and a lagoon 5.5 miles by 2 miles (9 by 3 km). Sighted in 1823 by Valentine Starbuck, the British master of a whaling ship, it was claimed by the United States under the Guano Act of 1856 but was annexed by Britain in 1866. Guano deposits on the island were worked from 1870 to 1920. With the other Central and Southern Line Islands, Starbuck became a part of the Gilbert and Ellice Islands Colony in 1972 and a part of independent Kiribati in 1979. The island is uninhabited.

**starch,** a white, granular, organic chemical that is produced by all green plants. Starch is a soft, white, tasteless powder that is insoluble in cold water, alcohol, or other solvents. The basic chemical formula of the starch molecule is $(C_6H_{10}O_5)_n$. Starch is a polysaccharide (*q.v.*) comprising glucose monomers joined in $\alpha$ 1,4 linkages. The simplest form of starch is the linear polymer amylose; amylopectin is the branched form.

Starch is manufactured in the green leaves of plants from excess glucose produced during photosynthesis and serves the plant as a reserve food supply. Starch is stored in chloroplasts in the form of granules and in such organs as the roots of the tapioca plant; the tuber of the potato; the stem pith of sago; and the seeds of corn, wheat, and rice. When required, starch is broken down, in the presence of certain enzymes and water, into its constituent monomer glucose units, which diffuse from the cell to nourish the plant tissues. In humans and other animals, starch is broken down into its constituent sugar molecules, which then supply energy to the tissues.

Most commercial starch is made from corn, although wheat, tapioca, and potato starch are also used. Commercial starch is obtained by crushing or grinding starch-containing tubers or seeds and then mixing the pulp with water; the resulting paste is freed of its remaining impurities and then dried. Aside from their basic nutritional uses, starches are used in brewing and as thickening agents in baked goods and confections. Starch is used in paper manufacturing to increase the strength of paper and is also used in the surface sizing of paper. Starch is used in the manufacture of corrugated paperboard, paper bags and boxes, and gummed paper and tape. Large quantities of starch are also used in the textile industry as warp sizing, which imparts strength to the thread during weaving.

**stare decisis** (Latin: "let the decision stand"), in Anglo-American law, principle that a question once considered by a court and answered must elicit the same response each time the same issue is brought before the courts. The principle is observed more strictly in England than in the United States. Since no court decision can have universal application, the courts, in practice, must often decide that a previous decision does not apply to a particular case even though the facts and issues appear to be closely similar. A strict application of stare decisis may lead to rigidity and to legal hairsplitting, whereas too much flexibility may result in uncertainty as to the law.

**starets** (Slavic translation of Greek *gerōn*, "elder"), plural STARTSY, in Eastern Orthodoxy, a monastic spiritual leader. Eastern Christian monasticism understood itself as a way of life that aimed at a real experience of the future kingdom of God; the starets, as one who had already achieved this experience, was the charismatic spiritual guide who could aid others in attaining spiritual progress and success. In eremitic, or Hesychastic, monasticism, which flourished from the 4th and 5th centuries throughout Egypt, Palestine, and Syria, monastic obedience consisted primarily in the personal relationship between the *gerōn* and the disciple. In Byzantine monasteries the personal charismatic leadership of elders was normally combined with the disciplinary authority of the abbot. Private confession to elders, who were not usually ordained to the priesthood, was a normal practice.

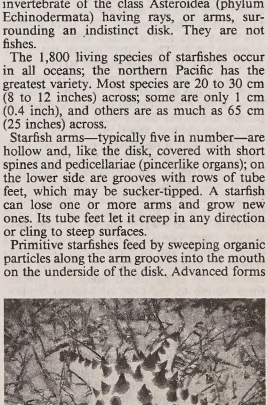
From Byzantium the traditions of this charismatic ministry went to Russia, where they were perpetuated by such famous startsy as St. Sergius of Radonezh (*c.* 1314–92) and St. Nil Sorsky (1433–1508). The translation of the *Philokalia,* a collection of Greek monastic texts, into Old Slavic by the starets Paissy Velitchkovsky (1722–94) contributed to a revival of *starchestvo* ("staretsism"), which was furthered by the great St. Seraphim of Sarov (1759–1833) and the startsy of the monastery of Optina Pustyn, who inspired the personage of Zossima in Fyodor Dostoyevsky's novel *The Brothers Karamazov.* At a time when religion appeared to many as nothing more than a bureaucratic establishment, the Russian startsy, especially of Optina Pustyn, maintained a remarkable witness to Christianity, directly influencing such writers and intellectuals as Nikolay Gogol, Aleksey Stepanovich Khomyakov, Vladimir Sergeyevich Solovyov, and Leo Tolstoy.

**starfish,** also called SEA STAR, any marine invertebrate of the class Asteroidea (phylum Echinodermata) having rays, or arms, surrounding an indistinct disk. They are not fishes.

The 1,800 living species of starfishes occur in all oceans; the northern Pacific has the greatest variety. Most species are 20 to 30 cm (8 to 12 inches) across; some are only 1 cm (0.4 inch), and others are as much as 65 cm (25 inches) across.

Starfish arms—typically five in number—are hollow and, like the disk, covered with short spines and pedicellariae (pincerlike organs); on the lower side are grooves with rows of tube feet, which may be sucker-tipped. A starfish can lose one or more arms and grow new ones. Its tube feet let it creep in any direction or cling to steep surfaces.

Primitive starfishes feed by sweeping organic particles along the arm grooves into the mouth on the underside of the disk. Advanced forms



Starfish (*Protoreaster nodosus*)
Douglas Faulkner

either evert (turn outward) the stomach upon the prey (bivalve mollusks, coral polyps, other echinoderms) for external digestion or swallow the prey whole. The internal skeleton of the starfish consists of limy plates. Respiration usually is through skin structures. Light-sensitive spots occur at the tips of the arms.

Starfish reproduction typically is heterosexual, but hermaphroditism (reproductive organs of both sexes in one animal) occurs, and a few sea stars reproduce asexually by division of the body (fission). Some brood their eggs and young; nonbrooders may release into the water as many as 2.5 million eggs at a time.

Starfishes belong to three orders: Phanerozonia, Spinulosa, and Forcipulata. Edged starfishes, order Phanerozonia, have distinct marginal plates and therefore tend to be rigid. Members of the order have suction-tube feet; the anus may be lacking. Most of the deep-sea starfishes belong to this order, and many are burrowers. *Albatrossaster richardi* has been taken at a depth of 6,035 m (19,800 feet) near the Cape Verde Islands. The mud star (*Ctenodiscus crispatus*), about 10 cm (4 inches) across, with blunt, short arms and a broad, yellow disk, is abundant worldwide on mud bottoms of northern coasts. A number of starfish genera distributed throughout the Northern Hemisphere have longer, more pointed, spine-fringed arms; among these genera are *Astropecten, Psilaster,* and *Luidia.* The largest West Indies starfish, *Oreaster reticulatus,* is sometimes 50 cm (20 inches) across. Members of the chiefly Indo-Pacific genus *Linckia* can grow a new individual from a small piece of arm.

Spiny starfishes, order Spinulosa, typically have clusters of spines; they have suction-tube feet but rarely pedicellariae. A common example in stony-bottomed European waters is the gibbous starlet (*Asterina gibbosa*). The sea bat (*Patiria miniata*) usually has webbed arms; it is common from Alaska to Mexico. Sun stars of the genera *Crossaster* and *Solaster* are found in northern waters; they have numerous short rays and a broad, often sunburst-patterned disk. The widely distributed *S. endeca* is 10-rayed and sometimes 50 cm across; the very common spiny sun star (*Crossaster papposus*) has as many as 15 arms. Cushion stars, of the circumboreal genus *Pteraster,* are plump five-rayed forms with raised tufts of spines and webbed, short, blunt arms.

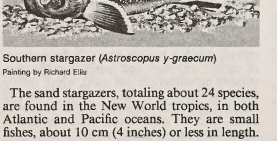
Starfishes with long-stalked, two-valved pedicellariae comprise the order Forcipulata—the "forceps carriers." The pedicellariae have protective and, sometimes, food-taking functions. In most species the arms are long and rounded, and the disk is small. The order includes common shallow-water species worldwide—among them predators on bivalves such as clams, oysters, and mussels—such as *Asterias rubens* of northern Europe, *A. vulgaris* from Labrador to Long Island Sound, *A. forbesi* from Maine to the Gulf of Mexico, and *A. amurensis* from the Bering Sea to Korea. They use their suction feet to force open the bivalve's shell, then insert the stomach, and digest the prey. *Pisaster brevispinus*—at 65 cm (26 inches) one of the world's largest starfish—inhabits the western coast of North America; it preys on other echinoderms known as sand dollars, which burrow to escape it. Perhaps the most common sea star of the American Pacific coast is *P. ochraceus,* a five-rayed species sometimes 35 cm (14 inches) across; it is usually reddish but has other colour phases. The many-rayed sunflower starfish (*Pycnopodia helianthoides*) of Alaska to California has 15 to 24 arms and is often 60 cm (24 inches) across. *Heliaster,* a broad-disked, short-rayed genus of the western coast of Central America, may have as many as 50.

For other echinoderms of similar name, *see* brittle star; feather star. For a species of special interest, *see* crown-of-thorns starfish.

**Stargard Szczeciński,** German STARGARD, city, Szczecin *województwo* (province), northwestern Poland, on the Ina River. The city was chronicled from the 12th century, although it existed earlier. It was badly damaged in the 17th century during the Thirty Years' War and fell to Brandenburg in 1648. Heavy bombing during World War II devastated many of its fine historical sites and destroyed 75 percent of the city. St. Mary's Church (13th–15th century) and the 16th-century town hall have been rebuilt. The modern city contains railroad workshops, flour mills, cosmetic and soap laboratories, and agricultural-tool plants. Pop. (1990 est.) 70,000.

**stargazer,** fish of two related families, Uranoscopidae (electric stargazers) and Dactyloscopidae (sand stargazers), both of the order Perciformes. Stargazers are elongated fishes that habitually bury themselves in the bottom. They have tapered bodies and big, heavy, flat heads. Their mouths slant vertically, their lips are fringed, and their eyes are on top of the head (hence the common name).

The electric stargazers comprise about 25 species found worldwide in warm and temperate seas. Some of these fishes have a large spine on each shoulder, and some (*Astroscopus*) have electrical organs on top of the head. The largest members of the family grow to about 9 kg (20 pounds) in weight.



Southern stargazer (*Astroscopus y-graecum*)
Painting by Richard Ellis

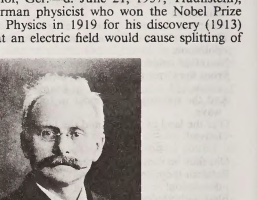
The sand stargazers, totaling about 24 species, are found in the New World tropics, in both Atlantic and Pacific oceans. They are small fishes, about 10 cm (4 inches) or less in length.

**Starhemberg, Ernst Rüdiger, Fürst von** (prince of) (b. May 10, 1899, Eferding, Austria—d. March 15, 1956, Schruns), politician, leader of the Austrian Heimwehr (a paramilitary defense force), and in 1934–36 the head of the government-sponsored right-wing coalition of parties called the Fatherland Front (Vaterländische Front).

Although he was a participant in the Nazi Munich (Beer Hall) Putsch (1923), Starhemberg later broke with Hitler and Nazism but not with fascism. A former local leader of the Heimwehr, he became its national head in September 1930; in the same month, he was appointed Austrian minister of the interior despite his openly pro-fascist, antiparliamentary allegiances and activities. His newly formed Heimatblock (the political arm of the Heimwehr) failed to show electoral strength, however, and he was excluded from the government two months later. After Engelbert Dollfuss became chancellor in 1932, Starhemberg was summoned by Dollfuss to assist in the formation of the Fatherland Front. Starhemberg was appointed vice chancellor in May 1934. After Dollfuss' assassination (July 25, 1934), Starhemberg became head of the Fatherland Front and thus the second most powerful leader in Austria after Chancellor Kurt von Schuschnigg. Starhemberg sought to maintain a fascist and totalitarian Austrian state that would nevertheless be independent of Nazi Germany. Differences with Schuschnigg resulted in Starhemberg's expulsion from the government (May 1936). He fled from Austria a short time after the incorporation of Austria into Nazi Germany in March 1938. Following a brief period of service early in World War II in the British and Free French air forces, Starhemberg went to Argentina in 1942 and lived there until 1955, when he returned to Austria.

**Starij Oskol** (Russia): *see* Stary Oskol.

**Stark, Johannes** (b. April 15, 1874, Schickenhof, Ger.—d. June 21, 1957, Traunstein), German physicist who won the Nobel Prize for Physics in 1919 for his discovery (1913) that an electric field would cause splitting of



Johannes Stark
Historia-Photo

the lines in the spectrum of light emitted by a luminous substance; the phenomenon is called the Stark effect (*q.v.*).

Stark became a lecturer at the University of Göttingen in 1900, and from 1917 until he retired in 1922 Stark served as professor of physics at the University of Greifswald and, later, at the University of Würzburg. A supporter of Hitler and an anti-Semitic racial theorist, Stark was president of the Reich Physical-Technical Institute from 1933 to 1939. In 1947 a denazification court sentenced him to four years in a labour camp.

**Stark, John** (b. Aug. 28, 1728, Londonderry, N.H.—d. May 8, 1822, Manchester, N.H., U.S.), prominent U.S. general during the U.S. War of Independence who led attacks that cost the British nearly 1,000 men and contributed to the surrender of the British general John Burgoyne at Saratoga by blocking his retreat line across the Hudson River (1777).

From 1754 to 1759, Stark served in the French and Indian War with Rogers' Rangers, first as a lieutenant and later as a captain. Made a colonel at the outbreak of the American Revolution, he fought at Bunker Hill (June 17, 1775), in the invasion of Canada, and in New Jersey.

In March 1777 he resigned his commission, but when Burgoyne invaded New York he was made brigadier general of militia. On August 16 his hastily raised troops attacked and defeated British and Hessian detachments at the Battle of Bennington, Vt. Stark was thereupon raised to the rank of brigadier general in the Continental Army. He helped force the surrender of Burgoyne at Saratoga, N.Y., in October 1777 and served in Rhode Island (1779) and at the Battle of Springfield, N.J. (1780). The same year, he was a member of the court-martial that condemned Major John André, who served as a British spy. In September 1783 he was made a major general.

**Stark effect,** the splitting of spectral lines observed when the radiating atoms, ions, or molecules are subjected to a strong electric field. The electric analogue of the Zeeman effect (*i.e.,* the magnetic splitting of spectral lines), it was discovered by a German physicist, Johannes Stark (1913). Earlier experimenters had failed to maintain a strong electric field in conventional spectroscopic light sources because of the high electrical conductivity of

luminous gases or vapours. Stark observed the hydrogen spectrum emitted just behind the perforated cathode in a positive-ray tube. With a second charged electrode parallel and close to this cathode, he was able to produce a strong electric field in a space of a few millimetres. At electric field intensities of 100,000 volts per centimetre, Stark observed with a spectroscope that the characteristic spectral lines, called Balmer lines, of hydrogen were split into a number of symmetrically spaced components, some of which were linearly polarized (vibrating in one plane) with the electric vector parallel to the lines of force, the remainder being polarized perpendicular to the direction of the field except when viewed along the field. This transverse Stark effect resembles in some respects the transverse Zeeman effect, but, because of its complexity, the Stark effect has relatively less value in the analysis of complicated spectra or of atomic structure. Historically, the satisfactory explanation of the Stark effect (1916) was one of the great triumphs of early quantum mechanics.

**Starley, James** (b. April 21, 1830, Albourne, Sussex, Eng.—d. June 17, 1881, Coventry, Warwickshire), British inventor and father of the bicycle industry.

In 1855 Starley moved to London, where he was employed in the manufacture of sewing machines, and two years later he moved to Coventry, where he became managing foreman at the Coventry Sewing Machine Company (later the Coventry Machinists' Company Ltd.). There he invented and patented new models, and many of his features are used in modern sewing machines.

In 1868 Starley became interested in bicycle improvement. His first bicycle, the Coventry, was quickly followed by the Ariel (1871), notable for its use of centre pivot steering. Considered the first true bicycle by many historians, the Ariel was the immediate precursor of the high-wheel ordinary and was the standard of bicycle design for the next decade.

Starley invented and manufactured the tangentially spoked wheel, with the spokes connected to the hub at a tangent. His design was a great improvement over radially spoked wheels and is still in use. In 1876 he introduced the highly successful Coventry tricycle and the following year incorporated into it the patented use of the differential gear in conjunction with chain drive.

In 1885 Starley's nephew, John Starley, designed and manufactured the Rover, regarded as the first successful safety bicycle and the prototype of all modern bicycles.

**starling,** any of a number of birds composing most of the family Sturnidae (order Passeriformes), especially *Sturnus vulgaris,* a 20-centimetre (8-inch) chunky iridescent black bird with a long sharp bill. It was introduced from Europe and Asia to most parts of the world (South America excepted). The millions in North America are descendants of 100 birds released in New York City in 1890–91. They often damage fruit and grain crops—though they also consume harmful insects—and usurp native songbirds' nest holes. *S. vulgaris* feeds on the ground and flies in tight flocks; vocal year-round, it mimics other birds' notes and utters wheezy sounds of its own.

The bare-eyed, or pied, starling (or myna, *q.v.; S. contra*), from India to Java, is black, white, and reddish-brown, with yellow eye skin. Glossy starlings, with highly iridescent plumage, include the superb starling (*Spreo superbus*) of eastern Africa and the shining starling (*Aplonis metallica*) of Pacific Islands and northeastern Australia. The 36-cm golden-breasted, or regal, starling (*Cosmopsarus regius*) of eastern Africa, is green, blue, and yellow, with a long tail. The wattled starling (*Creatophora cinerea*) is brown, gray, and white; uniquely, the breeding male becomes bald, showing bright yellow skin, and grows large black wattles on the crown and throat. For military starlings, *see* blackbird.





(Top) Superb starling (*Spreo superbus*), (bottom) starling (*Sturnus vulgaris*)

(Top) Eric Hosking, (bottom) George W. Robinson from Root Resources—EB Inc.

**Starling, Ernest Henry** (b. April 17, 1866, London—d. May 2, 1927, Kingston Harbour, Jamaica), British physiologist whose prolific contributions to a modern understanding of body functions, especially the maintenance of



Starling

The Mansell Collection

a fluid balance throughout the tissues, the regulatory role of endocrine secretions, and mechanical controls on heart function, made him one of the foremost scientists of his time.

While serving as an instructor (1889–99) at Guy's Hospital, London (M.D., 1890), Starling undertook investigations of lymph secretion that resulted in his clarification of the nature of fluid exchanges between vessels and tissues. Formulating what is known as Starling's hypothesis (1896), he stated that, because the capillary wall may be considered a semipermeable membrane, allowing salt solutions to pass freely through it, the hydrostatic pressure forcing these solutions into tissues is balanced by the osmotic pressure—generated by colloidal (protein) solutions trapped in the capillary—forcing an absorption of fluid from the tissues.

As professor of physiology at University College, London (1899–1923), Starling began a highly profitable collaboration with the British physiologist William Bayliss that immediately saw their demonstration (1899) of the nervous control of the peristaltic wave, the muscle action responsible for the movement of food through the intestine. In 1902 they isolated a substance that they called secretin, released into the blood from the epithelial cells of the duodenum (between the stomach and small intestine), which in turn stimulates secretion into the intestine of pancreatic digestive juice. Two years later, Starling coined the term hormone to denote such substances released in a restricted part of the body (endocrine gland), carried by the bloodstream to unconnected parts, where, in extremely small quantities, they are capable of profoundly influencing the function of those parts.

After government-sponsored World War I research concerning poison gas defense, Starling developed an isolated heart-lung preparation that enabled him to formulate (1918) his "law of the heart," stating that the force of muscular contraction of the heart is directly proportional to the extent to which the muscle is stretched.

Studying kidney function, he found (1924) that water, chlorides, bicarbonates, and glucose, lost in the excretory filtrate, are reabsorbed at the lower end of the kidney tubules (glomeruli). His *Principles of Human Physiology* (1912), continually revised, remains a standard international text.

**Starover** (in Russian Orthodoxy): *see* Old Believer.

**Starr, Bart,** byname of BRYAN BARTLETT STARR (b. Jan. 1934, Montgomery, Ala., U.S.), U.S. collegiate and professional football quarterback and professional coach, who led the National Football League (NFL) Green Bay Packers to five league championships and two Super Bowl victories (1967–68).

Starr was quarterback for the University of Alabama (Montgomery; 1952–55), completing 8 of 12 passes in the 1953 Orange Bowl victory over Syracuse and directing the team to a loss in the 1954 Cotton Bowl. He was drafted in the 17th round by the Packers in 1956 and played with them through the 1971 season. He became regular quarterback in 1959, the first season Vince Lombardi coached the Packers. A great leader and field tactician, Starr was particularly effective in postseason games: in six NFL title games, he completed 84 of 145 passes attempted for 1,090 yards with only one interception. His performance in his two Super Bowl games was outstanding, and he was named Most Valuable Player in both of his Super Bowl appearances. Four times a member of the Pro-Bowl team, he led the league in percentage of passes completed (1962, 1966, and 1968–69), passing yardage (1962, 1964, and 1966), and average yards gained (1966–68). In 1964–65, he attempted 294 passes without interception, a record that survived into the 1980s.

After retiring as a player in 1972, Starr became an assistant coach for the Packers and, from 1975, head coach. His coaching success did not equal his success as a player, however, and the Packers dismissed him as head coach at the end of the 1983 season. He was elected to the football Hall of Fame in 1977.

**Starr, (Myra) Belle,** *née* SHIRLEY (b. Feb. 5, 1848, Washington County, Mo., U.S.—d. Feb. 3, 1889, near Briartown, Okla.), U.S. outlaw of Texas and the Oklahoma Indian Territory.

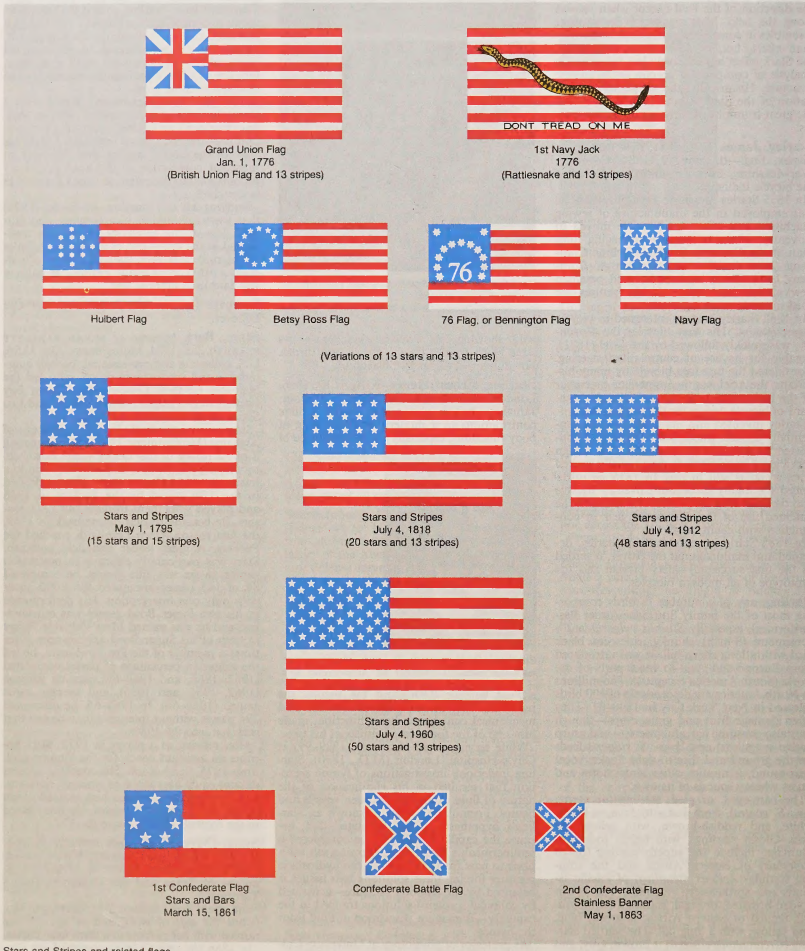
She spent her childhood in Carthage, Mo. (from the age of two), and at age 15 she moved with her parents to a farm near Dallas.

In 1866 she met Cole Younger (of the out-

law Younger brothers), who probably fathered her first child, Pearl, and for whom she retained a lifelong fondness. A year later she took up with another outlaw, Jim Reed, who fathered her second child, Edward, after they had moved to California. In 1869 they were back in Texas, rustling horses and cattle and committing petty thievery; she fashioned herself as the "bandit queen," costumed in either velvet and feathers or buckskin and moccasins. In 1874 Reed was killed by a member of his own gang; and, after a succession of lovers, Belle in 1880 became the common-law wife of a Cherokee Indian named Sam Starr. She settled with him near Briartown, Okla., on a large ranch, renamed Younger's Bend, which became an outlaws' hideout. In 1883 Belle and Sam were convicted of horse theft and spent a few months in the federal prison in Detroit. In 1886 Sam was killed in a gunfight, and Belle soon took a new lover, a young, long-haired Creek Indian named Jim July.

On Feb. 3, 1889, Belle was killed near the ranch, shot down from behind. The murderer was never identified, though both a neighbour named Wilson and her own son Edward were suspects.

**Stars and Stripes,** also called OLD GLORY, or STAR-SPANGLED BANNER, flag of the United States of America, consisting of white stars (50 from July 4, 1960) on a blue canton, with a field of 13 alternate stripes, 7 red and 6 white. The 50 stars stand for the 50 states of the Union, and the 13 stripes stand for the original 13 states.




Stars and Stripes and related flags

After the beginning of the American Revolution, the first unofficial national flag—known variously as the Grand Union Flag, the Great Union Flag, the Cambridge Flag, or the Continental Colours—was hoisted outside Boston, probably at Prospect Hill in Somerville but perhaps at Cambridge, on Jan. 1, 1776; it was hoisted, it appears, at the behest of General George Washington, whose headquarters were nearby. The flag had seven red and six white horizontal stripes and, in the canton, the British Union Flag (the immediate predecessor of the Union Jack). It was used at forts and on naval vessels. Another early popular flag, the first Navy Jack, had the 13 stripes with a rattlesnake overall and the motto "Don't Tread on Me."

The first national flag formally approved by the Continental Congress—on June 14, 1777—was the Stars and Stripes. The blue canton was to contain 13 stars, but the layout of the stars was left undefined, and several patterns are known. The first such Stars and Stripes to be flown during a land engagement was the 76 Flag, flown at the Battle of Bennington (Aug. 16, 1777). The Stars and Stripes with a diamond-shaped field of 13 stars is attributed to a cordwainer and magistrate, John Hulbert, and the Stars and Stripes with a circle of 13 stars is attributed to Betsy Ross (*q.v.*), but both attributions are questionable.

The Stars and Stripes remained unchanged until May 1, 1795, when two more stars and two more stripes were added to reflect the admission to the union of Vermont (1791) and Kentucky (1792). (This is the "Star-Spangled Banner" that Francis Scott Key saw at Fort McHenry in September 1814, inspiring his patriotic poem.) In 1818, after five more states had been admitted, Congress enacted that henceforth the stripes should remain 13, that the number of stars should always match the number of states, and that any new star should be added on the July 4 following a state's admission. This has been the system ever since. In all, from 1777 to 1960 (after the admission of Hawaii) there were 27 changes in the flag—25 being changes in the stars only. An executive order of Oct. 29, 1912, standardized the proportions and relative sizes of the elements of the flag; in 1934 the exact shades of colour were standardized.

During the American Civil War, the Confederate States of America adopted its first national flag, the Stars and Bars, on March 5, 1861. Soon after, a Confederate Battle Flag was also adopted. On May 1, 1863, a new national flag, the Stainless Banner, was adopted. (A third flag, a modification of the Stainless Banner, was adopted, rather futilely, about a month before the end of the war in April 1865.)

**Stars and Stripes, The,** newspaper for U.S. military personnel that has been published periodically as either a weekly or a daily since single editions appeared during the American Civil War (1861–65). It was revived in 1918 as a weekly for U.S. troops in Europe at the end of World War I, was discontinued in 1919, and was reestablished in 1942, first as a weekly and then a daily. The European edition has been published continuously since that time. A Pacific edition was launched in 1945 and also continues.

Many outstanding writers, editors, cartoonists, and photographers have worked for *The Stars and Stripes*. The paper is under the jurisdiction of the American Forces Information Service, a part of the office of the U.S. assistant secretary of defense for public affairs. In light of the paper's military sponsorship, the relative freedom that it enjoys from military censorship and control has been remarkable and occasionally controversial.

**startle reaction,** also called STARTLE PATTERN, an extremely rapid psychophysiological response of an organism to a sudden and unexpected stimulus such as a loud sound or a blinding flash of light. In human beings it is characterized by involuntary bending of the limbs and a spasmodic avoidance movement of the head. Musculature returns to normal in less than one second, although elevations in heart rate, respiration, and skin conductance persist slightly longer. The startle pattern occurs in all normal humans and all mammals when tested in a relatively uniform manner. The pattern is resistant to extinction or modification by learning, although its intensity may be reduced by repetition or anticipation. The response seems to be an instinctive mechanism for self-defense and, in humans, is probably the initiating element of more general emotional reactions, both motor expressions and conscious experiences. The startle reaction is particularly conspicuous in infants up to three or four months old.

**startsy** (Eastern Orthodoxy): *see* starets.

**Stary Oskol,** also spelled STARIJ OSKOL, or STARYI OSKOL, city and centre of Stary Oskol *rayon* (sector), Belgorod *oblast* (province), Russia. It lies along the Oskol River. It was founded as a fortress called Oskol in 1593 for the defense against Crimean Tatars and was named Stary ("Old") Oskol in 1655. Machinery and food industries reflect the city's mineral and agricultural hinterland. One of the largest cement plants in central Russia has been constructed at Stary Oskol. The city is also the site of a major iron and steel complex. Iron-ore deposits of the Kursk Magnetic Anomaly lie just southwest of the city. There is a geologic college and a medical school. Pop. (2002 prelim.) 216,000.

**Stasi,** official name MINISTERIUM FÜR STAATSICHERHEIT (German: "Ministry for State Security"), secret police agency of the former German Democratic Republic (East Germany).

The Stasi developed out of the internal security and police apparatus established in the Soviet zone of occupation in Germany after World War II. The law creating the ministry was passed in February 1950, four months after the founding of the German Democratic Republic. The Stasi was responsible for both domestic political surveillance and foreign espionage. Its staff was at first quite small, and its chief responsibilities were counterintelligence against Western agents and the suppression of the last vestiges of Nazism. Soon, however, the Stasi became known for kidnapping former East German officials who had fled the country; many of those who were forcibly returned were executed.

Under Erich Mielke, its director from 1957 to 1989, the Stasi became a highly effective secret police organization. It infiltrated every institution of society and every aspect of daily life, largely through a vast network of informants and unofficial collaborators (*inoffizielle Mitarbeiter*), who spied on and denounced colleagues, friends, neighbours, and even family members. By 1989 the Stasi relied on 500,000 to 2,000,000 collaborators and 100,000 regular employees, and it maintained files on approximately 6,000,000 East German citizens.

The Stasi's foreign espionage activities were largely directed against the West German government and the North Atlantic Treaty Organization. Under Markus Wolf, its chief of foreign operations from 1958 to 1987, the Stasi extensively penetrated West Germany's government and military and intelligence services, including the inner circle of West German Chancellor Willy Brandt (1969–74).

The Stasi also had links to various terrorist groups, most notably the Red Army Faction (RAF) in West Germany. It worked closely with Abu Nidal, Ilich Ramírez Sánchez (commonly known as Carlos, or "the Jackal"), and the Palestine Liberation Organization and facilitated the activities of Libyan agents whose bombing of a discotheque in West Berlin (April 1986) killed two U.S. servicemen.

Shortly after the opening of the Berlin Wall in 1989, the Stasi was formally disbanded. In 1991, after considerable debate, the unified German parliament (Bundestag) passed the Stasi Records Law, which granted to Germans and foreigners the right to view their Stasi files. By the early 21st century, nearly two million people had done so. (J.D.Ca.)

**State College,** borough (town), Centre county, Pennsylvania, U.S. It lies in the Nittany Valley between Bald Eagle Mountain (northwest) and Tussey Mountain (southeast), near the state's geographic centre. Settled in 1859, it was named for Pennsylvania State College (now Pennsylvania State University), which was established there in 1855. The Old Main building (1859) on the campus contains a renowned American mural, the "Land Grant Mural" by Henry Varnum Poor. The town, a service centre for the university (in University Park), has high-technology industries and is also a shipping point for surrounding farmlands. Inc. 1896. Pop. (2002 est.) borough, 38,098; (2000) State College MSA, 135,758.

**State Shintō,** Japanese KOKKA SHINTŌ, nationalistic official religion of Japan from the Meiji Restoration in 1868 through World War II. It focused on ceremonies of the imperial household and public Shintō shrines.

State Shintō was founded on the ancient precedent of *saisei itchi,* the unity of religion and government. Traditionally, the *kami* (gods, or sacred powers), the Japanese emperor, the citizens, and the nation were all considered descendants of common ancestors, and the prosperity of all was assured by coincidence between human politics and the will of the gods. But Shintō came to be dominated by Buddhism and neo-Confucianism, and the emperor was overshadowed by military rulers. Various efforts to restore Shintō and the emperor came to naught in the medieval period.

Finally, in the midst of the complex social and cultural changes that accompanied Japan's modernization during the Meiji period (1868–1912), the government set about to institutionalize Shintō. It assumed control of the Shintō shrines, established a Department of Shintō (later changed to the status of a Shintō Ministry), and adopted restrictive policies against the other religions, including sect movements within Shintō. Though the 1889 constitution included a nominal guarantee of religious freedom, obeisance at Shintō shrines was considered the patriotic duty of all Japanese, a point of view in time adopted by Christians, Buddhists, and followers of Kyōha Shintō (*q.v.*). The administration of the country's more than 100,000 Shintō shrines was carried on by the government; Shintō moral teaching (*shūshin*) was made compulsory in the schools, and the divine status of the emperor was fostered by the political authorities.

State Shintō was abolished in 1945 by a decree of the Allied occupation forces that forbade government subsidy and support to Shintō shrines and repudiated the emperor's divinity. The ban was continued in the postwar constitution. Most of the shrines previously administered by the government reorganized themselves as Shrine Shintō (*q.v.*).

**Staten Island,** island and borough, New York City, southeastern New York state, U.S. The island lies in New York Harbor south of Manhattan and between New Jersey and Brooklyn. With several smaller islands, it forms Richmond county and the Staten Island borough of New York City. Roughly triangular, the island has about 35 miles (56 km) of waterfront and an area of almost 60 square

miles (155 square km). It is connected with Manhattan by the Staten Island Ferry, which carries passengers and automobiles; with New Jersey by several bridges; and with Brooklyn by the Verrazano-Narrows Bridge. The opening of the latter in 1964 spurred considerable development of the island.

Attempted European colonization of the island, which was occupied by Unami Indians of the Delaware tribe, began in 1630 by the Dutch. Indian attacks dispelled permanent settlers until 1661, when the Dutch West India Company granted lands to French Waldenses and Huguenots and a colony was established at Oude Dorp ("Old Town"), a few miles south of the Narrows (the channel separating the island from Brooklyn). The island was named for the Staten-Generaal ("States General") of the Dutch Republic. Following the acquisition of New Netherland in 1664 by Great Britain, English and Welsh farmers established homes and farms on the island.

The Billopp, or Conference, House in Tottenville was the scene (Sept. 11, 1776) of talks between representatives of the Continental Congress and the British in an unsuccessful attempt at reconciliation during the American Revolutionary War. In 1898 Staten Island became one of New York City's boroughs.

Staten Island is mostly residential but has some manufacturing; trade-related industries are also important. It is the seat of Wagner College (founded 1883 in Rochester, moved in 1918) and the College of Staten Island (1956) and contains a branch campus of St. John's University. Points of interest include the Staten Island Institute of Arts and Sciences, the Jacques Marchais Center of Tibetan Art, Richmondtown, the Staten Island Zoo, and High Rock Park Nature Conservation Center. Staten Island is the site of New York's largest garbage-disposal site as well as the largest park in the city. Pop. (2000) 443,728.

**States General** (France): *see* Estates-General.

**States General,** also spelled STATES-GENERAL, Dutch STATEN-GENERAAL, body of delegates representing the United Provinces of the Netherlands (Dutch Republic; 1579–1795). It is not to be confused with the present Netherlands parliament of the same name.

The States General was instituted in the 15th century by the ruling dukes of Burgundy and was retained by the succeeding Habsburg rulers. The States General was convened on the command of the central government for the purpose of coordinating the assessment of provincial subsidies for the ruler's treasury. It was made up of deputies of the provincial States (assemblies). Originally designed to facilitate control by a foreign ruler, the States General after a time became an important vehicle for the awakening of the Netherlands' national consciousness.

During the revolt of the Netherlands against Spanish rule (1568–1609), the States General met without Spanish sanction in 1576 and became the central organ of a general Netherlands union; many sovereign prerogatives were then arrogated to it. As defections by the southern provinces and the advance of Spanish arms reduced the number of rebelling provinces, those remaining entered into a new pact, the 1579 Union of Utrecht, which clearly defined the powers of the States General vis-à-vis the provincial States. As the central organ of the republic founded by this union, it was to have responsibility for foreign and military affairs; no important national decision, however, could be taken without the unanimous vote of the seven provincial States, the delegates of which composed the States General. Thus, each province of the Dutch Republic was sovereign; no part of that sovereignty was given over to the States General. Internally, the States General had responsibility for the daily administration and taxation of the Generality lands (those areas of the republic that lay outside the seven provinces and that had been secured against Spanish reconquest).

Because of the great provincial particularism in the two centuries of the republic's existence, the States General functioned smoothly only when the integrity of the state was threatened or when one of the contending political forces—the States of Holland or the stadholder, the chief provincial executive—gained ascendancy. Even then, however, unanimity in the States General was not guaranteed; occasionally majority decisions were unconstitutionally acted upon.

When the old republic collapsed in 1795 and gave way to the more democratic Batavian Republic, the States General was retained for a year. It was replaced by a National Assembly in 1796.

The term States General was revived for the bicameral parliament of the Kingdom of The Netherlands, established in 1814.

**states' rights,** the powers retained by the regional governments of a federal union under a federal constitution. In the United States, Switzerland, and Australia, the powers of the regional governments are those that remain after the powers of the central government have been enumerated in a constitution. In contrast, the constitutions of Canada and Germany clearly specify the powers of government at both the state or regional level and the national level.

The concept of states' rights is closely related to that of state rights, which was invoked from the 18th century in Europe to legitimate the powers vested in sovereign national governments. Doctrines asserting states' rights were developed in contexts in which states functioned as distinct units in a federal system of government. In the United States, supporters of states' rights argued that each state had inherent rights and sovereignty. Before and after the American Civil War (1861–65), many U.S. states shared the belief that they were sovereign and should have jurisdiction over their own affairs. By the end of the 20th century, the term was applied broadly to efforts aimed at reducing the powers of national governments.

*The meaning of states' rights.* Advocates of states' rights put greater trust and confidence in regional or state governments than in national ones. State governments, according to them, are more responsive to popular control, more sensitive to state issues and problems, and more understanding of the culture and values of the state's population than are national governments. For these reasons, they argue, state governments are better able to address important problems and protect individual rights. In the United States, proponents of states' rights maintain that strong state governments are more consistent with the vision put forward by the Founding Fathers, citing in support of their view the Tenth Amendment to the U.S. Constitution, which reserves for the states the residue of powers not given the federal government nor denied to the states.

In the United States, the term *states' rights* has been applied to a variety of political programs. Before the Civil War, it was the rallying cry of Southern opponents of Northern-inspired tariffs and Northern proposals to abolish or restrict slavery. The doctrine also was used as an argument for the theory known as nullification (*q.v.*), according to which states had the right to annul acts of the federal government within their boundaries, and for the claim that the states, by virtue of their sovereignty, had the right to secede from the Union. A century later the doctrine was used to justify opposition to federal efforts to enforce racial desegregation.

Such uses of states' rights in the United States and elsewhere prompted some critics to claim that the doctrine serves parochial interests. According to them, states' rights are invoked by majorities in the states to justify laws and practices that discriminate against various ethnic, religious, or other minority groups. These critics contend that a strong national government is necessary to ensure that states respect the rights guaranteed to all citizens in the national constitution.

States' rights advocates also addressed issues related to environmental protection and education. In the western United States, for example, some groups questioned the power of the federal government to issue pollution standards and regulations on water and land use, arguing that they amounted to an unconstitutional infringement on the right of states to manage their own natural resources. Many states also resisted the imposition of national educational testing standards out of concern that they would undermine the states' historical control over education.

*International trends.* After 1900 the powers of state or regional governments in most major federal systems declined rapidly for a variety of reasons, including increased efforts by central governments to control interstate commerce, vast national measures aimed at combating economic depression and expanding the welfare state, and, in some systems, economic and regulatory changes brought about by participation in World Wars I and II. What powers remained with state governments varied according to formal constitutional provisions and the historical role played by the states in the respective countries.

At the end of the 20th century, there was renewed interest in many countries in expanding the autonomy of regional governments. Movements favouring devolution—that is, the granting of power to state or regional levels of government—were active in the United States, Australia, Italy, and even some countries with historically strong national governments, such as Spain and the United Kingdom (where regional assemblies were introduced in both Scotland and Wales). In addition, in many other countries there were secessionist or independence movements. (F.D.D.)

**States' Rights Democrat** (U.S. political group): *see* Dixiecrat.

**Statesman, The,** English-language daily newspaper published in Calcutta and, with the *Times of India* and *The Hindu,* generally regarded as one of the most influential in India.

It was established in 1875 by Robert Knight as an outgrowth of an earlier paper, *The Friend of India* (founded 1817). On Knight's death in 1890, his sons, Paul and Robert, assumed control. *The Statesman* soon became one of India's leading dailies in a country where such papers wield significantly greater influence than do the smaller papers published in the various Indian languages.

*The Statesman* has a liberal-independent editorial stance, and it is respected for the fairness of its coverage of differing points of view. Its audience includes opinion leaders and intellectuals from throughout Indian society. Like other major Indian dailies, it allots a relatively high proportion of its space—about one-fourth—to foreign news.

**statics,** in physics, the subdivision of mechanics that is concerned with the forces that act on bodies at rest under equilibrium conditions. Its foundations were laid more than 2,200 years ago by the ancient Greek mathematician Archimedes and others while studying the force-amplifying properties of simple machines such as the lever and the axle. The methods and results of the science of statics have proved especially useful in designing buildings, bridges, and dams, as well as cranes and other similar mechanical devices. To be

able to calculate the dimensions of such structures and machines, architects and engineers must first determine the forces that act on their interconnected parts. Statics provides the analytical and graphical procedures needed to identify and describe these unknown forces.

Statics assumes that the bodies with which it deals are perfectly rigid. It also holds that the sum of all the forces acting on a body at rest has to be zero (*i.e.,* the forces involved balance one another) and that there must be no tendency for the forces to turn the body about any axis. These three conditions are independent of one another, and their expression in mathematical form comprises the equations of equilibrium. When all the forces lie in the same equations, there are only three equations, and so only three unknown forces can be calculated. If more than three unknown forces exist, it means that there are more components in the structure or machine than are required to support the applied loads or that there are more restraints than are needed to keep the body from moving. Such unnecessary components or restraints are termed redundant (*e.g.,* a table with four legs has one redundant leg) and the system of forces is said to be statically indeterminate. The number of equations available in statics is limited because of a neglect of the deformations of loaded bodies, a direct consequence of the underlying premise that any solid body under consideration is ideally rigid and immutable as to shape and size under all conditions.

**statistical mechanics,** branch of physics that combines the principles and procedures of statistics with the laws of both classical and quantum mechanics. It aims to predict and explain the measurable properties of macroscopic systems on the basis of the properties and behaviour of the microscopic constituents of those systems. Statistical mechanics, for example, interprets thermal energy as the energy of atomic particles in disordered states and temperature as a quantitative measure of how energy is shared among such particles. Statistical mechanics draws heavily on the laws of probability, so that it does not concentrate on the behaviour of every individual particle in a macroscopic substance but on the average behaviour of a large number of particles of the same kind.

The mathematical structure of statistical mechanics was established by the U.S. physicist J. Willard Gibbs in his book *Elementary Principles in Statistical Mechanics* (1902), but two earlier physicists, James Clerk Maxwell of Great Britain and Ludwig E. Boltzmann of Austria, are generally credited with having developed the fundamental principles of the field with their work on thermodynamics. Over the years the methods of statistical mechanics have been applied to such phenomena as Brownian motion (*i.e.,* the random movement of minute particles suspended in a liquid or gas) and electric conduction in solids. They also have been used in relating computer simulations of molecular dynamics to the properties of a wide range of fluids and solids.

**statistics,** science of making valid inferences about the characteristics of a group of persons or objects on the basis of numerical information obtained from a randomly selected sample of the group. There are two broad subdivisions of this subject: descriptive statistics and theoretical statistics.

A brief treatment of statistics follows. For full treatment, *see* MACROPAEDIA: Statistics.

The principal descriptive quantity derived from sample data is the mean, which is the arithmetic average of the sample data. However, if the sample contains a few values that are so large or so small that they have an exaggerated effect on the value of the mean, the sample is more accurately represented by the median, the value that half the sample values fall below and half above.

As measures of the dispersion of the values about their mean, the quantities most commonly used are the variance and its square root, the standard deviation. The variance is calculated by determining the mean, subtracting it from each of the sample values (yielding the deviation of the samples), and then averaging the squares of these deviations. The mean and standard deviation of the sample are used as estimates of the corresponding characteristics of the entire group from which the sample was drawn. They do not, in general, completely describe the distribution of values within either the sample or the parent group; indeed, different distributions may have the same mean and standard deviation.

Theoretical statistics is grounded in probability and in idealized concepts known as the population and the sample. The statistician may view the population as a set of balls from which the sample is selected at random—that is, in such a way that each ball has the same chance for inclusion in the sample. The characteristic of interest in the population is idealized as a physical property of the balls; for example, they may be of two colours, red and blue. Such models have been studied in the context of probability theory since the 17th century. It has been shown that when the sample is drawn at random, the membership of the sample is governed by the composition of the population according to well-determined laws of probability. Statistics makes use of these laws by devising methods of inferring the composition of the population from that of the sample. The theory of statistics makes it possible to evaluate the performance of a statistical procedure in terms of the proportions of samples leading to a correct conclusion.

Inferences made in statistics are of two types. The first is estimation, which involves the determination, with a possible error due to sampling, of the unknown value of a population characteristic, such as the proportion having a specific attribute or the average value of some numerical measurement. Estimates of population characteristics are generally accompanied by the "standard errors" of the estimates; these are margins that determine the possible errors arising from the fact that the estimates are based on random samples and not on a complete population census. The second type of inference is hypothesis testing. It involves the definitions of a "hypothesis" as one set of possible population values and an "alternative," a different set. There are many statistical procedures for determining on the basis of a sample whether the true population characteristic belongs to the set of values in the hypothesis or the alternative.

Statistics is ubiquitous in scientific, commercial, and industrial work. For very large populations, the size of the sample needed for standard statistical procedures is entirely independent of the size of the underlying population. This is illustrated in a very dramatic way in general elections for public office. Statisticians are able to make very accurate estimates of the outcome of the election on the basis of very small sample returns.

**Statius,** in full PUBLIUS PAPINIUS STATIUS (b. *c.* AD 45, Neapolis, Italy—d. 96, probably Neapolis?), one of the principal Roman epic and lyric poets of the Silver Age of Latin literature (AD 18–133). His occasional poems, collected under the title *Silvae* ("Forests"), apart from their literary merit, are valuable for their description of the life style of a wealthy and fashionable class—the *libertini,* or freedmen—during the reign of the emperor Domitian.

His father was also a poet, and Statius seems to have been trained as one from childhood. Little is known of his life. He lived at Rome and was a court poet under Domitian, who awarded him a prize in 89 or 90. He was, however, unsuccessful in the Capitoline competition at Rome, probably on its third celebration in 94, and shortly afterward returned to Neapolis.

The role of court poet seems to have suited Statius, who used without scruple the flattery that was inevitable under Domitian and exploited it in a way that suited his own nature. He was talented, and his poetic expression, despite its faults, is rich, buoyant, and felicitous.

Statius is at his best in the five books of the *Silvae.* Of the 32 poems, five are devoted to flattery of the Emperor and his favourites. Another group gives picturesque descriptions of the villas and gardens of his friends, members of an acquisitive and ostentatious class who surrounded themselves with art works and antiques and patronized the poet in return for his versified praises. There is a striking description of the gifts and amusements provided by the Emperor for the Roman populace at the Saturnalia, the festival of the winter solstice, and his birthday ode honouring the poet Lucan has, along with the usual exaggerations, some good lines and shows an appreciation of earlier Latin poets. Also estimable are poems dealing with family affection and personal loss and one poem to sleep.

Statius completed one epic, the 12-book *Thebaid,* but only two books of another, the *Achilleid.* The *Thebaid,* a more ambitious work, describes the struggle of the brothers Polyneices and Eteocles for the throne of the ancient Greek city of Thebes. It has many features borrowed from Virgil, but suffers from overstatement and exaggeration. The work begins and ends, however, with passages that convey an atmosphere of dramatic tension and considerable tragic power. The *Achilleid* gives a charming account of the early education of Achilles, but at the point at which he is taken off to Troy by Odysseus, the poem was evidently interrupted by the poet's death. There is an edition of Statius' works with an English translation by J.H. Mozley in the Loeb Classical Library, 2 vol. (1928).

**Statius Caecilius:** *see* Caecilius, Statius.

**Statue of Liberty,** formally LIBERTY ENLIGHTENING THE WORLD, colossal statue on Liberty Island in Upper New York Bay, U.S., commemorating the friendship of the peoples



Statue of Liberty on Liberty Island in New York Harbor
© Tom Sobolik—Black Star

of the United States and France. Standing 305 feet (93 m) high including its pedestal, it represents a woman holding a torch in her raised right hand and bearing a tablet with the adoption date of the Declaration of Independence (July 4, 1776) in her left. The torch, which measures 29 feet (8.8 m) from the flame tip to the bottom of the handle, is accessible via a 42-foot (12.8-m) service ladder inside the arm (this ascent was open to the public from 1886 to 1916). An elevator carries visitors to the observation deck in the pedestal, which may also be reached by stairway, and a spiral staircase leads to an observation platform in the figure's crown. A plaque at the pedestal's entrance is inscribed with a sonnet, "The New Colossus" (1883) by Emma Lazarus. It was written to help raise money for the pedestal, and it reads:

Not like the brazen giant of Greek fame,
With conquering limbs astride from land to land;
Here at our sea-washed, sunset gates shall stand
A mighty woman with a torch, whose flame
Is the imprisoned lightning, and her name
Mother of Exiles. From her beacon-hand
Glows world-wide welcome; her mild eyes
command
The air-bridged harbor that twin cities frame.
"Keep, ancient lands, your storied pomp!"
cries she
With silent lips. "Give me your tired, your poor,
Your huddled masses yearning to breathe free,
The wretched refuse of your teeming shore.
Send these, the homeless, tempest-tost to me,
I lift my lamp beside the golden door!"

A French historian, Edouard de Laboulaye, made the proposal for the statue. Funds were contributed by the French people, and work began in France in 1875 under sculptor Frédéric-Auguste Bartholdi. The statue, designed by Eugène-Emmanuel Viollet-le-Duc and Alexandre-Gustave Eiffel, was constructed of copper sheets, hammered into shape by hand and assembled over a framework of four gigantic steel supports. In 1885 the completed statue, 151 feet 1 inch (46 m) high and weighing 225 tons, was disassembled and shipped to New York City. The pedestal, designed by American architect Richard Morris Hunt and built within the walls of Fort Wood on Bedloe's Island, was completed later. The statue, mounted on its pedestal, was dedicated by President Grover Cleveland on Oct. 28, 1886. Over the years, the torch underwent several modifications, including its conversion to electric power in 1916 and its redesign (with repoussé copper sheathed in gold leaf) in the mid-1980s, when the statue was repaired and restored by both American and French workers for a centennial celebration held in July 1986. The site was added to UNESCO's World Heritage List in 1984.

The statue was at first administered by the U.S. Lighthouse Board, as the illuminated torch was considered a navigational aid. Because Fort Wood was still an operational army post, responsibility for the maintenance and operation of the statue was transferred in 1901 to the War Department. It was declared a national monument in 1924, and in 1933 the administration of the statue was placed under the National Park Service. Fort Wood was deactivated in 1937, and the rest of the island was incorporated into the monument. In 1956 Bedloe's Island was renamed Liberty Island, and in 1965 nearby Ellis Island, once the country's major immigration station, was added to the monument's jurisdiction, bringing its total area to about 58 acres (about 24 ha). Exhibits on the history of the Statue of Liberty, including the statue's original 1886 torch, are contained in the statue's base.

**status, social:** *see* social status.

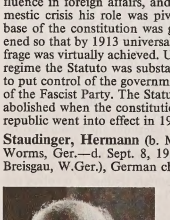
**statute of ——:** *see under* substantive word (*e.g.,* Westminster, Statute of; limitations, statute of).

**Statuto Albertino** (March 4, 1848), constitution granted to his subjects by King Charles Albert of Piedmont-Sardinia; when Italy was unified under Piedmontese leadership (1861), it became the constitution of the Kingdom of Italy. Originally it was a rather conservative document that set up a strong constitutional monarchy; its spirit was subsequently altered, at first in a liberal way, to adapt it to the parliamentary government of the late 19th and early 20th centuries, and then in an authoritarian direction under Benito Mussolini's Fascist regime (1922–43).

The Statuto, which was granted by the king during the liberal Revolutions of 1848, was based on the French Charter of 1830. It ensured citizens equality before the law and gave them limited rights of free assembly and of free press but gave voting rights to less than 3 percent of the population. The Statuto established the three classic branches of government: the executive, which meant the king; the legislative, divided between the royally appointed Senate and an elected Chamber of Deputies; and a judiciary, also appointed by the king. Originally, it was the king who possessed the widest powers: he controlled foreign policy and had the prerogative of nominating and dismissing ministers of state.

In practice, the Statuto was modified to weaken the king's power. The ministers of state became responsible to the parliament, and the office of prime minister, not provided for in the constitution, became prominent. The king, however, retained an important influence in foreign affairs, and in times of domestic crisis his role was pivotal. The social base of the constitution was gradually broadened so that by 1913 universal adult male suffrage was virtually achieved. Under the Fascist regime the Statuto was substantially modified to put control of the government in the hands of the Fascist Party. The Statuto was officially abolished when the constitution of the Italian republic went into effect in 1948.

**Staudinger, Hermann** (b. March 23, 1881, Worms, Ger.—d. Sept. 8, 1965, Freiburg im Breisgau, W.Ger.), German chemist who won



Staudinger
Bavaria-Verlag

the 1953 Nobel Prize for Chemistry for demonstrating that polymers are long-chain molecules. His work laid the foundation for the great expansion of the plastics industry later in the 20th century.

Staudinger studied chemistry at the universities of Darmstadt and Munich, and he received his Ph.D. from the University of Halle in 1903. He held academic posts at the universities of Strassburg (now Strasbourg) and Karlsruhe before being called in 1926 to the Albert Ludwig University of Freiburg im Breisgau. He retired in 1951.

Staudinger's work on polymers began with research he conducted for the German chemical firm BASF on the synthesis of isoprene (1910), the monomer of which natural rubber is composed. The prevalent belief at the time was that rubber and other polymers are composed of small molecules that are held together by "secondary" valences or other forces. In 1922 Staudinger and J. Fritschi proposed that polymers are actually giant molecules (macromolecules) that are held together by normal covalent bonds, a concept that met with resistance from many authorities. Throughout the 1920s, the researches of Staudinger and others showed that small molecules form long, chainlike structures (polymers) by chemical interaction and not simply by physical aggregation. Staudinger showed that such linear molecules could be synthesized by a variety of processes and that they could maintain their identity even when subject to chemical modification. Staudinger's work provided the theoretical basis for polymer chemistry and greatly contributed to the development of modern plastics.

**Staudt, Karl George Christian von** (b. Jan. 24, 1798, Rothenburg [Germany]—d. June 1, 1867, Erlangen, Bavaria), German mathematician who developed the first complete theory of imaginary points, lines, and planes in projective geometry.

Staudt was professor of mathematics at the Polytechnic School at Nürnberg from 1827 to 1835, when he was appointed to the staff of the University of Erlangen. He found a way to construct a regular inscribed polygon of 17 sides using only compasses and created a geometry of position, independent of all measurement. He also worked on the arithmetical properties of Bernoulli numbers, and the Von Staudt–Clausen theorem is named in part for him. Among his works are *Geometrie der Lage* (1847; "The Geometry of Projection") and *Beiträge zur Geometrie der Lage* (1856–60; "The Basis of Projective Geometry").

**Stauffenberg, Claus, Graf** (Count) **Schenk von** (b. Nov. 15, 1907, Jettingen, Ger.—d. July 20, 1944, Berlin), German army officer who, as the chief conspirator of the July Plot (*q.v.*), carried out an unsuccessful attempt to assassinate Adolf Hitler.

Stauffenberg entered the German army in 1926 and won distinction as a staff officer with a panzer division in the campaigns in Poland and northern France (1939–40). After he was transferred to the front in the Soviet Union, however, he became disillusioned with the German occupation's brutal policies toward Slavs and Jews. At his own request, he was transferred to the North African campaign, where he was a staff officer in a panzer division. In that campaign he was severely wounded (losing his left eye, right hand, and two fingers of his left hand) in April 1943.

While convalescing from his wounds, Stauffenberg decided that Hitler must be eliminated. In the ever-widening conspiracy of army officers against Hitler, he assumed a leading role and reserved for himself the central task of carrying out the proposed assassination. His chance came in July 1944, after he had been promoted to colonel and reassigned to the post of chief of staff to the Reserve Army command; this post gave him access to situation conferences personally attended by Hitler. After two preliminary attempts, Stauffenberg succeeded in placing a bomb in Hitler's headquarters at Rastenburg (July 20, 1944), which, however, failed to kill the dictator. A planned simultaneous coup in Berlin likewise miscarried; Stauffenberg and a few of his coconspirators were summarily executed the night of July 20 in Berlin—the first of several thousands who ultimately died in the bloody aftermath of the conspiracy.

**Stauning, Thorvald** (b. Oct. 26, 1873, Copenhagen, Den.—d. May 3, 1942, Copenhagen), Danish statesman who, as prime minister (1924–26, 1929–42), passed key economic and social welfare legislation.

A tobacco worker and trade unionist, Stauning was elected secretary of the Social Democratic Party in 1898 and entered the Folketing (lower house of Parliament) in 1906. After becoming party chairman in 1910, he served from 1916 to 1920 in the Radical-Liberal ministry of Carl Theodor Zahle.

The monetary reforms of Stauning's first administration aggravated depressed conditions in industry and agriculture and led to his defeat in the 1926 elections. Returning to office in 1929 to head a Social Democratic–Radical-Liberal coalition, he soon gained support for measures reducing military expenditures and reforming the nation's criminal code. In 1931 he achieved a compromise with the opposition parties that provided relief to farmers and the unemployed through increased taxation, the first of a series of "compromise agreements."

After leading the Social Democratic Party to its greatest electoral victory in 1935, Stauning benefitted from improving economic conditions in the late 1930s. He failed in 1939, however, to gain a constitutional reform to create a unicameral parliamentary system. Although his government signed a nonaggression treaty with Germany in May 1939, German forces occupied Denmark the following year. He remained as head of a coalition government under German occupation until his death.

**Staunton,** city, seat (1738) of Augusta county (though administratively independent of it), north-central Virginia, U.S. It lies along the Shenandoah River, between Shenandoah National Park (east) and George Washington National Forest (west). Settled in 1736 and laid out in 1747, it was named for Lady Rebecca Staunton, wife of Sir William Gooch, a colonial governor of Virginia. From 1738 to 1770 it was the capital of what was then the Northwest Territory, and the Virginia legislature met for a brief period there during the American Revolution. Staunton became a transportation centre after the arrival of the railroad in 1854. An important supply base during the American Civil War, the town was twice occupied by Union troops. Staunton was the first U.S. community to adopt the city-manager government plan (1908).

Staunton's diversified manufactures include medical supplies, razors, furniture, textiles, and air conditioners. Mary Baldwin College (1842) and the Virginia School for the Deaf and Blind (1838) are in the city. President Woodrow Wilson was born there, and his birthplace (1846) was made a national shrine in 1941; the Woodrow Wilson Museum (1990) is adjacent. A memorial to inventor Cyrus Hall McCormick that includes his restored farm and workshop is nearby. Inc. town, 1801; city, 1871. Pop. (2000) 23,853.

**Staunton, Howard** (b. 1810—d. June 22, 1874, London, Eng.), British chess master who was considered to be the world's leading player in the 1840s. In 1841 Staunton founded the first English chess magazine, and in 1851 he took the lead in organizing the first modern international chess tournament in London, where, however, he came in only fourth.

Little is known about Staunton's early life. He wrote on William Shakespeare, publishing an edition of his plays in monthly parts. After he won most of a series of 21 games against the top French player, Saint Amant, in 1843, he was proclaimed Europe's leading player, but he refused a match with Paul Morphy in 1858; it is generally believed that he would have been beaten by Morphy. The standard tournament chess piece design was created about 1835, and patented in 1849, by Nathaniel Cook. Following Staunton's endorsement and extensive promotion, the design became known as the Staunton pattern.

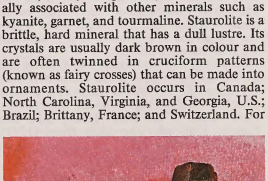
**Staupitz, Johann von** (b. 1468/69, Motterwitz, near Leisnig, Wettin Lands [Germany]—d. Dec. 28, 1524, Salzburg, Austria), vicar-general of the German Augustinians during the revolt against the Roman Catholic church led by Martin Luther, of whom, for a time, he was teacher, patron, and counselor.

From 1483 to 1489 Staupitz studied at the universities of Cologne and Leipzig, becoming an Augustinian. A doctor of theology (1500), he helped found the University of Wittenberg, where he became the theological faculty's first dean in 1502. The following year he was chosen vicar-general of the Augustinians.

At Wittenberg from 1508, Staupitz began his highly influential relationship with Luther, whom he spiritually directed. His attempt to revive stricter discipline and to unite two branches of the Augustinians in Germany led to revolt, and Luther was one of two monks chosen to present at Rome the appeal of some of the order's dissident houses. The appeal failed, and Luther returned to become Staupitz' loyal supporter, particularly of his campaign against indulgences. He encouraged Luther to take a doctorate and become a teacher, and Luther succeeded him in the chair of biblical theology at Wittenberg.

As Luther's theological difficulties became acute and led to his break with the Roman Catholic church, Staupitz gradually withdrew his support from his protégé. In 1520 he resigned as vicar-general, becoming, at Salzburg in 1522, a Benedictine and subsequently abbot of St. Peter's Abbey. In the end Staupitz no longer sympathized with Luther's doctrine, which he finally condemned as heresy.

**staurolite,** silicate mineral produced by regional metamorphism in rocks such as mica schists, slates, and gneisses, where it is generally associated with other minerals such as kyanite, garnet, and tourmaline. Staurolite is a brittle, hard mineral that has a dull lustre. Its crystals are usually dark brown in colour and are often twinned in cruciform patterns (known as fairy crosses) that can be made into ornaments. Staurolite occurs in Canada; North Carolina, Virginia, and Georgia, U.S.; Brazil; Brittany, France; and Switzerland. For



Staurolite from (left) New Mexico and (right) South Carolina
Floyd R. Gelsinger

chemical formula and detailed physical properties, *see* silicate mineral (table).

**Stavanger,** city and seaport, seat of Rogaland *fylke* (county), southwestern Norway. It is situated on the east side of a peninsula, with the Norwegian Sea on the west and Gand Fjord, a south branch of broad Bokn Fjord, on the east. Stavanger was settled in the 8th century and became the seat of a bishopric in the 12th century, when the Cathedral of St. Swithin was built. Although it received a royal charter as a trading town in 1425, Stavanger grew very slowly. After the Protestant Reformation its bishopric was transferred to Kristiansand in 1682, but a new Lutheran bishopric was reestablished there in 1925.

Food processing, especially the canning of sardines and other fish products, shipbuilding, and shipping are the city's chief economic activities together with the refining of North Sea oil, first drilled in 1971. Stavanger became the centre for all service activities connected with Norway's burgeoning North Sea oil and gas industry. Its protected ice-free harbour is the closest major Norwegian port to Great Britain. The Norwegian Canning School is located there, as are the Kongsgård Grammar School (formerly a royal residence), the Valbergtårn Watchtower, an art gallery, and a museum. The Cathedral of St. Swithin, with its Norman and Gothic architecture, is a popular tourist attraction. Pop. (1992 est.) mun., 99,764.

**stave** (music): *see* staff.

**stave church,** in architecture, type of wooden church built in northern Europe mainly during the Middle Ages. Between 800 and 1,200 stave churches may have existed in the mid-14th century, at which time construction abruptly ceased.



Stave church, at Heddal, Telemark, Nor., built in the 13th century
© SuperStock

About 30 stave churches survive in Norway, nearly all dating from the 12th and 13th centuries; Sweden, Poland, and England each have one of these churches. In the typical Scandinavian type of stave church, a foundation of boulders supports a horizontal wooden frame, on which rest four corner posts, or staves. The staves are connected above by a rectangle of beams that complete a boxlike frame; all elements are joined by wooden pegs or by dovetailing. The outer wall timbres of stave churches are positioned vertically, in contrast to the more common "log" horizontal placement used in wooden structures. The simplest stave churches consist only of a nave and chancel. The plans of larger churches are sometimes cruciform, and they may include an ambulatory as well as an apse. The most well-known stave churches are characterized by a roof with multiple tiers of triangular frames that gradually diminish in size. Many also have portals embellished with fine woodcarving and wall paintings that feature pagan and Christian motifs.

The largest extant stave church was built in Heddal, Norway, about 1150. Another typical and well-preserved example of the stave church is the Borgund church (*c.* 1150) in Sogn og Fjordane county, Norway. Its complicated, ambulatory plan utilizes freestanding posts in the nave to support the tall central portion of the structure. The church's six levels of gable roofs, shell-like exterior shingles, and elaborate carvings of grotesque masks and other motifs give it a picturesque and vigorous appearance. Some extant stave churches continue to be used as active houses of worship.

**Stavisky affair,** French financial scandal of 1933 that, by triggering right-wing agitation, resulted in a major crisis in the history of the Third Republic (1870–1940).

The scandal came to light in December 1933 when the bonds of a credit organization in Bayonne, founded by the financier Alexandre Stavisky, proved worthless. When Stavisky was found dead in January 1934, police officials said that he had committed suicide. Members of the French right believed, however, that Stavisky had been killed to prevent revelation of a scandal that would involve prominent people, including ministers and members of the legislature. Attempts by the government to hush up the affair encouraged popular belief in the essential corruption of the parliamentary regime. The flourishing antirepublican leagues, principally the fascistlike Action Française and the Croix de Feu, led popular demonstrations in hopes of overthrowing the regime. These agitations, which culminated in the riot of Feb. 6, 1934, in which 15 persons were killed outside the Chamber of Deputies, were sufficiently widespread to force the resignations of two successive prime ministers of the ruling left-wing coalition. But the establishment of a centre government of national union under former president Gaston Doumergue in February 1934 restored confidence and ended the threat to the republic.

**Stavropol** (city, Samara *oblast,* Russia): *see* Tolyattigrad.

**Stavropol,** *kray* (region), southwestern Russia, on the northern flank of the Great Caucasus. The territory stretches from the crestline, which reaches 13,274 feet (4,046 m) in Mount Dombay-Ulgen, across the lower parallel ranges, which are broken by deep river gorges, and then across the extensive foreland known as the Stavropol Upland, to the low plains of the Manych Depression and the Caspian Depression. The mountain area, which forms the republic of Karachayevo-Cherkesiya within the *kray,* is densely forested on the lower slopes with deciduous trees, giving way higher up to conifers, above which are alpine meadows and bare rock and ice. The foreland and lowlands are mostly fertile steppe soils, now largely under cultivation; in the drier east (the Nogay Steppe), semidesert conditions prevail, with sage vegetation predominating.

Agriculture in the territory is highly developed and is dominated by wheat, corn (maize), fodder, and industrial crops, chiefly sunflowers, flax, mustard, castor beans, and potatoes. Large numbers of cattle and sheep are kept, mainly based on transhumance between the high mountain pastures in summer and the dry Nogay Steppe in winter. Most of Stavropol's industries are based on the processing of farm produce, but there are large deposits of natural gas, first discovered in 1910. The gas is piped as far as Moscow and also is used locally in the chemical industries of Nevinnomyssk. In the Caucasus foothills are many mineral springs and a number of spa and resort towns. Area 31,100 square miles (80,600 square km). Pop. (1991 est.) 2,926,500.

**Stavropol,** city and administrative centre of Stavropol *kray* (region), southwestern Russia, situated on the Stavropol Upland near the source of the Grachovka River. It was founded in 1777 as a fortress. Although it was at first a major route and administrative centre, the city was later bypassed by the Rostov–Baku railway, and its original functions declined. Between 1935 and 1943 the city was known as Voroshilovsk. Today Stavropol's main importance is in processing farm produce from its fertile hinterland, especially flour milling, wine making, and meat-packing; machine building and the chemical and clothing industries are also important. An attractive city with tree-lined streets laid out on a grid pattern, Stavropol has medical, agricultural, linguistic, and teacher-training institutes and a research institute for sheep and goat husbandry. Pop. (1991 est.) 328,500.

**Ste.:** *see under* Sainte.

**Stead, Christina Ellen** (b. July 17, 1902, Rockdale, Sydney, Australia—d. March 31, 1983, Sydney), Australian novelist known for her political insights and firmly controlled but highly individual style.

Stead was educated at New South Wales Teachers College; she traveled widely and at various times lived in the United States, Paris, and London. In the early 1940s she worked as a screenwriter for Metro-Goldwyn-Mayer studios, and in 1952 she married William Blake, an American writer of historical romances, with whom she settled in London. In 1974, however, she returned to her native Australia.

Her first published work was a collection of short stories, *The Salzburg Tales* (1934). *Seven Poor Men of Sydney,* published later the same year, deals with a band of young revolutionaries and provides a fascinating portrayal of Sydney's waterfront. Her finest and most highly praised novel, and one which went virtually unrecognized for 25 years, is *The Man Who Loved Children* (1940; rev. ed. 1965). The work depicts marriage as a state of savage and continuous warfare, in which the husband reveals himself to be basically fascistic, far removed from the civilized man he thinks he is, while his wife has become a bitter termagant. The novel's theme epitomizes the author's concern with the human craving for two seemingly irreconcilable qualities, those of personal freedom and love. The book is utterly unsentimental and in the first half achieves moments of real comedy, but its overall effect is bitter and tragic. Stead is generally regarded as a feminist writer, although she shunned such a label.

Stead's other works include *The Beauties and Furies* (1936), *House of All Nations* (1938), *For Love Alone* (1944), *A Little Tea, a Little Chat* (1948), *The People with the Dogs* (1952), *Dark Places of the Heart* (1966; U.K. title *Cotters' England*), *The Little Hotel* (1973), and *Miss Herbert* (1976). *A Christina Stead Reader* was published in 1979.

**Stead, William Thomas** (b. July 5, 1849, Embleton, Northumberland, Eng.—d. April 15, 1912, at sea, North Atlantic), British journalist, editor, and publisher who founded the noted periodical *Review of Reviews* (1890).

Stead was educated at home by his father, a clergyman, until he was 12 years old and then attended Silcoates School at Wakefield. He became an apprentice in a merchant's countinghouse and in about 1870 began to contribute to the Liberal daily newspaper *Northern Echo* at Darlington. The following year he was invited to become the *Echo*'s editor. He and the paper diligently supported Prime Minister W.E. Gladstone. In 1880 he went to London as assistant editor of the *Pall Mall Gazette* under John Morley, later Viscount Morley. When Morley went into Parliament, Stead succeeded him as editor and made of the *Pall Mall Gazette* a sprightly and unconventional journal. He introduced such modern journalistic techniques as the use of illustrations. He also developed the interview form in newspaper writing. His press campaigns effected many changes, including the improvement of British naval defenses.

In 1890 Stead decided to give up daily journalism in favour of the monthly journal he founded, *Review of Reviews.* He was known for his crusades in the journal's pages on behalf of such diverse causes as British-Russian friendship, ending child prostitution, the reform of England's criminal codes, and the maintenance of international peace. As editor and publisher of the *Review of Reviews,* he wrote on psychic phenomena, spiritualism, the "civic church," and many other subjects. In 1904 Stead tried to found a newspaper, *The Daily Paper,* but it failed, and he narrowly avoided bankruptcy.

Stead was traveling as a passenger on the British transatlantic liner *Titanic* when the ship struck an iceberg and sank, and he was one of the 1,517 passengers who perished.

**steady-state theory,** in cosmology, a view that the universe is always expanding but maintaining a constant average density, matter being continuously created to form new stars and galaxies at the same rate that old ones become unobservable as a consequence of their increasing distance and velocity of recession. A steady-state universe has no beginning or end in time; and from any point within it the view on the grand scale—*i.e.,* the average density and arrangement of galaxies—is the same. Galaxies of all possible ages are intermingled.

The theory was first put forward by Sir James Jeans in about 1920 and again in revised form in 1948 by Hermann Bondi and Thomas Gold. It was further developed by Sir Fred Hoyle to deal with problems that had arisen in connection with the alternative big-bang hypothesis. Observations since the 1950s have produced much evidence contradictory to the steady-state picture and supportive of the big-bang model (*q.v.*).

**stealth,** any military technology intended to make vehicles or missiles nearly invisible to enemy radar or other electronic detection.

Research in antidetection technology began soon after radar was invented. During World War II, the Germans coated their U-boat snorkels with radar-absorbent material. In the postwar era, researchers sought to discover the nature of "radar echoes," trying to determine what factors contribute to the echoes, or beams of electromagnetic radiation (notably at radio wavelengths), that are bounced off objects of various shapes, sizes, surfaces, and composition. Saving aircraft from detection became a special concern, and by the 1980s the United States had developed models of stealth technology, including a prototype stealth bomber.

Although specific details concerning stealth technology are classified, some general information is known. For example, surface materials and coatings can absorb radar transmissions, reducing reflections to an enemy's radar receiver. Reflections are also reduced by the use of smooth, rounded shapes instead of sharp edges and points. If missiles and other weapons can be recessed into the aircraft structure—carried conformally rather than as protrusions—the aircraft will be less detectable, and its drag will be reduced as well. The engine exhaust is the main contributor to an aircraft's infrared signature, and shielding it may make detection more difficult.

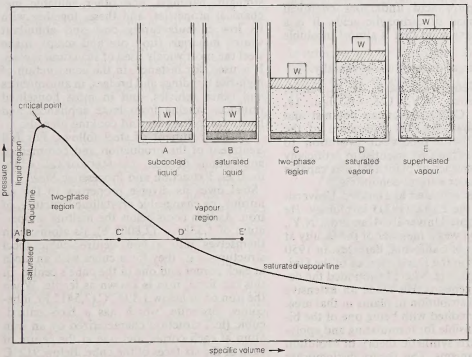
Although a conformal weapon-carriage benefits aerodynamics as well as stealth, use of the stealth technology generally imposes penalties. Rounded surfaces often are not the best design. Absorbent materials make an aircraft heavier and reduce its range or payload. Minimizing doors and other openings in the fuselage makes surfaces smoother, especially after the wear and tear of normal operations over a period of years, but it causes maintenance of the aircraft to be more difficult. Virtually all of these measures, including weapon modifications for conformal carriage, increase costs.

**steam,** odourless, invisible gas consisting of vaporized water. It is usually interspersed with minute droplets of water, which gives it a white, cloudy appearance. In nature, steam is produced by the heating of underground water by volcanic processes and is emitted from hot springs, geysers, fumaroles, and certain types of volcanoes. Steam also can be generated on a large scale by technological systems, as for

example those employing fossil-fuel-burning boilers and nuclear reactors.

Steam power constitutes an important power source for modern industrial society. Water is heated to steam in power plants, and the pressurized steam drives turbines that produce electrical current. The thermal energy of steam is thus converted to mechanical energy, which in turn is converted into electricity. The steam used to drive the turbogenerators furnishes most of the world's electric power. Steam is also widely employed in such industrial processes as the manufacture of steel, aluminum, copper, and nickel; the production of chemicals; and the refining of petroleum. In the home, steam has long been used for cooking and heating.

The stages that occur during the transformation of liquid water to its vapour (steam) are shown in the Figure, in which A–E depict a cylindrical vessel containing a fixed quantity




State (liquid, vapour, or both) of a fixed mass of water under varying conditions of pressure and volume; in the two-phase region (C) both saturated liquid and saturated vapour are present

of water subject to the constant pressure exerted by a weighted (W) movable piston. A′–E′ are corresponding points on a graph showing, for a range of pressures and volumes, whether a specific mass of water is entirely liquid, entirely vapour, or a mixture of the two phases. A and A′ represent this system under conditions of pressure, volume, and temperature such that the water is entirely in the subcooled liquid state (that is, the temperature is below the boiling point of water at the prevailing pressure). The addition of heat causes the water to expand slightly and the temperature to rise until the water reaches its boiling point; at this stage, represented by B and B′, the water is said to be in the saturated liquid state. If more heat is added, boiling begins: the liquid starts to vaporize (turn into steam), forcing the piston upward more rapidly than before, as illustrated in C.

When liquid water and steam coexist in any proportions, the system is said to be in the two-phase region of the graph. In this region, the mixture remains at the boiling-point temperature: the addition of heat merely causes more of the liquid to vaporize, and the removal of heat causes part of the vapour to condense. Though the temperature remains constant, the volume depends upon the proportions of liquid and vapour.

If just enough heat is added to vaporize the last droplet of liquid, the entire volume will be occupied by steam. At this stage, represented by D and D′, the steam is called a saturated vapour. Because there is no more liquid to boil, the addition of more heat causes the temperature and the volume to increase. At any point to the right of D′, such as E′, the graph represents superheated steam, *i.e.*, steam heated above its condensation temperature. As indicated in E, the volume of a quantity of superheated steam is greater than the volume of the same mass of saturated steam when both are under the same pressure.

The temperature at which water will boil depends on its pressure. For example, at standard atmospheric pressure of 14.7 psia (pounds per square inch absolute), the temperature at which water boils is 212° F (100° C). If the pressure is reduced, the boiling-point temperature is also reduced. As the pressure is increased, more molecular activity is required to effect the escape of water molecules from the liquid into the gaseous state, thus requiring a higher temperature. The amount of heat required to vaporize one pound of saturated liquid into one pound of saturated vapour is called the latent heat of vaporization. This latent heat varies with the pressure, being greatest at low pressures and diminishing to zero at the so-called critical point, which is the combination of temperature and pressure above which the liquid and the vapour are indistinguishable. At its critical temperature (705.47° F; 374.15° C) and pressure (3,208.2 psia; 218.2 atmospheres) the volume of 1 gram of water is 0.001805 litre (*i.e.*, its density is 554.1 grams/litre). *See also* water.

**steam engine,** machine using steam power to perform mechanical work through the agency of heat.

A brief treatment of steam engines follows. For full treatment of steam power and production and of steam engines and turbines, *see* MACROPAEDIA: Energy Conversion.

In a steam engine, hot steam, usually supplied by a boiler (*q.v.*), expands under pressure, and part of the heat energy is converted into work. The remainder of the heat may be allowed to escape, or, for maximum engine efficiency, the steam may be condensed in a separate apparatus, a condenser, at comparatively low temperature and pressure. For high efficiency, the steam must fall through a wide temperature range as a consequence of its expansion within the engine. The most efficient performance—that is, the greatest output of work in relation to the heat supplied—is secured by using a low condenser temperature and a high boiler pressure. The steam may be further heated by passing it through a superheater on its way from the boiler to the engine. A common superheater is a group of parallel pipes with their surfaces exposed to the hot gases in the boiler furnace. By means of superheaters, the steam may be heated beyond the temperature at which it is produced by boiling water.

In a reciprocating engine, the piston and cylinder type of steam engine, steam under pressure is admitted into the cylinder by a valve mechanism. As the steam expands, it pushes the piston, which is usually connected to a crank on a flywheel to produce rotary motion. In the double-acting engine, steam from the boiler is admitted alternately to each side of the piston. In a simple steam engine, expansion of the steam takes place in only one cylinder, whereas in the compound engine there are two or more cylinders of increasing size for greater expansion of the steam and higher efficiency; the first and smallest piston is operated by the initial high-pressure steam and the second by the lower-pressure steam exhausted from the first.

In the steam turbine, steam is discharged at high velocity through nozzles and then flows through a series of stationary and moving blades, causing a rotor to move at high speeds. Steam turbines are more compact and usually permit higher temperatures and greater expansion ratios than reciprocating steam engines. The turbine is the universal means used to generate large quantites of electric power with steam.

The earliest steam engines were the scientific novelties of Hero of Alexandria in the 1st century AD, such as the aeolipile (*q.v.*), but not until the 17th century were attempts made to harness steam for practical purposes. In 1698 Thomas Savery patented a pump with hand-operated valves to raise water from mines by suction produced by condensing steam. In about 1712 another Englishman, Thomas Newcomen, developed a more efficient steam engine with a piston separating the condensing steam from the water. In 1765 James Watt greatly improved the Newcomen engine by adding a separate condenser to avoid heating and cooling the cylinder with each stroke. Watt then developed a new engine that rotated a shaft instead of providing the simple up-and-down motion of the pump, and he added many other improvements to produce a practical power plant.

A cumbersome steam carriage for roads was built in France by Nicholas-Joseph Cugnot as early as 1769. Richard Trevithick in England was the first to use a steam carriage on a railway; in 1803 he built a steam locomotive that in February 1804 made a successful run on a horsecar route in Wales. The adaptation of the steam engine to railways became a commercial success with the *Rocket* of English engineer George Stephenson in 1829. The first practical steamboat was the tug *Charlotte Dundas,* built by William Symington and tried in the Forth and Clyde Canal, Scotland, in 1802. Robert Fulton applied the steam engine to a passenger boat in the United States in 1807.

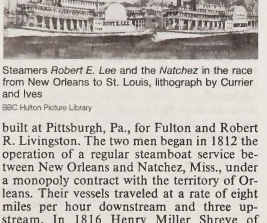
Though the steam engine gave way to the internal-combustion engine as a means of vehicle propulsion, interest in it revived in the second half of the 20th century because of increasing air-pollution problems caused by the burning of fossil fuels in internal-combustion engines.

**steam generator:** *see* boiler.

**steamboat,** any watercraft propelled by steam, but more narrowly, a shallow-draft paddle wheel steamboat widely used on rivers in the 19th century, and particularly on the Mississippi River and its principal tributaries in the United States.

Steamboat pioneering began in America in 1787 when John Fitch made a successful trial

of such a vessel. Robert Fulton's profitable experimentation followed, but not until 1811 was a vessel built specifically to traverse the lower Mississippi River—the *New Orleans,*



Steamers *Robert E. Lee* and the *Natchez* in the race from New Orleans to St. Louis, lithograph by Currier and Ives
BBC Hulton Picture Library

built at Pittsburgh, Pa., for Fulton and Robert R. Livingston. The two men began in 1812 the operation of a regular steamboat service between New Orleans and Natchez, Miss., under a monopoly contract with the territory of Orleans. Their vessels traveled at a rate of eight miles per hour downstream and three upstream. In 1816 Henry Miller Shreve of Shreveport, La., made history by launching his steamboat *Washington;* before long it was making the trip from New Orleans to Louisville, Ky., in 25 days. Shreve broke the Fulton-Livingston monopoly of steam navigation on the river, but his title as the father of Mississippi navigation stems more from his adaptations of steamboat design to fit the shallow waters of the river; he used a high-pressure steam engine (to make progress upstream), hoisted it high up above the water line, and mounted it on a hull that was as shallow as that of a barge. A tall second deck was added, and Shreve's experiment became the prototype of all subsequent Mississippi steamboats. From then on and until about 1870, the steamboat dominated the economy, agriculture, and commerce of the middle area of the United States. In 1814 New Orleans had counted hardly 20 steamboat arrivals; within 20 years the figure had reached 1,200. The steamboats' major cargoes were cotton and sugar, along with passengers.

Most larger steamboats were luxuriously appointed affairs; they had "lounges" in the style of ornate hotel lobbies, with rich rugs, oil paintings, and chandeliers. Many steamboats could boast of famous chefs, orchestras, and large staffs of maids and butlers to assist their cabin passengers. Steamboat pilots had to memorize or cunningly estimate the depths and potential obstacles along long stretches of river in order to navigate safely.

The average life span of a steamboat was only four to five years, owing to the vessels being poorly constructed and maintained, being sunk by snags and other obstructions in the river, or having their boilers explode. Over the years, however, the boats' speeds increased; Shreve's 25-day run from New Orleans to Louisville in 1816 had been shortened to 4.5 days by 1853. Spontaneous races between the captains of two steamboats were common and contributed greatly to the approximately 4,000 deaths in steamboat disasters between 1810 and 1850.

Steamboating thrived again after the interruptions caused by the Civil War, but by the 1870s railroads had become more efficient modes of transport and gradually caused the retirement of almost all the steamboats from the river. Of many literary references to the Mississippi steamboat, Mark Twain's *Life on the Mississippi*—recollections of his own cub-pilot days—remains the outstanding classic.

**stearic acid,** also called OCTADECANOIC ACID, one of the most common long-chain fatty acids, found in combined form in natural animal and vegetable fats. Commercial "stearic acid" is a mixture of approximately equal amounts of stearic and palmitic acids and small amounts of oleic acid. It is employed in the manufacture of candles, cosmetics, shaving soaps, lubricants, and pharmaceuticals.

In nature stearic acid occurs primarily as a mixed triglyceride, or fat, with other long-chain acids and as an ester of a fatty alcohol. It is much more abundant in animal fat than in vegetable fat; lard and tallow often contain up to 30 percent stearic acid.

Alkaline hydrolysis, or saponification, of fats yields soaps, which are the sodium or potassium salts of fatty acids; pure stearic acid is obtained with difficulty from such a mixture by crystallization, vacuum distillation, or chromatography of the acids or suitable derivatives. The pure acid undergoes chemical reactions typical of carboxylic acids. It is a colourless, waxy solid that is almost insoluble in water.

**steatitis** (animal disease): *see* myopathy.

**Stebbins, George Ledyard, Jr.** (b. Jan. 6, 1906, Lawrence, N.Y., U.S.—d. Jan. 19, 2000, Davis, Calif.), American botanist and geneticist known for his application of the modern synthetic theory of evolution to plants. He was the first scientist to artificially synthesize a species of plant that was capable of thriving under natural conditions.

Stebbins was educated at Harvard University, receiving the Ph.D. (1931) in biology. He taught at Colgate University, Hamilton, N.Y., and until 1973 was a member of the faculty at the University of California, Berkeley. In 1950 he transferred to the Davis campus of the University of California, where he founded the department of genetics. He made an extensive study of the distribution of plants in that area.

Stebbins is credited with being one of the biologists responsible for formulating and applying the modern synthetic theory of evolution to higher organisms. This theory distinguishes the basic processes of gene mutation and recombination, natural selection, changes in structure and number of chromosomes, and reproductive isolation. The publication of his *Variation and Evolution in Plants* (1950) established Stebbins as the first biologist to apply this theory to plant evolution. Working with several species of flowering plants, Stebbins and his coworker, Ernest B. Babcock, studied polyploid plants, which are new species of plants that have originated from a spontaneous doubling of the chromosomes of an existing species. When a technique was developed for doubling a plant's chromosomal number artificially, Stebbins used it to produce polyploids from several species of wild grass, of which the new species *Ehrharta erecta* was established in a natural environment in 1944.

His *Processes of Organic Evolution* appeared in 1966. Later works by Stebbins include *Flowering Plants: Evolution Above the Species Level* (1974) and *Evolution* (1977; with T. Dobzhansky, F. Ayala, and J. Valentine).

**Stebnitsky** (Russian author): *see* Leskov, Nikolay Semyonovich.

**Stedelijk Museum** (Dutch: "City Museum"), in Amsterdam, municipal museum (established 1895) that has a famous collection of 19th- and 20th-century painting and sculpture. It features notable collections of canvases by Vincent van Gogh, artists of the de Stijl movement, and European and American trends since 1950.

The museum maintains fine collections of drawings, prints, applied arts, photographs, and films. Its library contains more than 15,000 volumes and 70,000 catalogs.

**Stedman, Edmund Clarence** (b. Oct. 8, 1833, Hartford, Conn., U.S.—d. Jan. 18, 1908, New York, N.Y.), poet, critic, and editor, whose writing was popular in the United States during the late 19th century.

Stedman attended Yale, from which he was expelled, and became successively a newspaper proprietor and a stockbroker, writing all the while. As a critic Stedman wrote of contemporary authors in *Victorian Poets* (1875) and *Poets of America* (1885); he also edited the works of Edgar Allan Poe and Walter Savage Landor and was an important figure in the New York literary world. His *Poetical Works* appeared in 1875, *Hawthorne and Other Poems* in 1877, *Lyrics and Idylls, with Other Poems* in 1879, and *Mater Coronata* in 1900.

**steel,** an alloy of iron and carbon in which the carbon content amounts to about 2 percent or less. The addition of this tiny amount of carbon results in a substance that exhibits great strength, hardness, and other valuable mechanical properties, and these, together with its low manufacturing cost and abundant source materials (iron ore and scrap), make steel the most widely used of structural metals. It is used, for instance, in the construction of high-rise buildings and bridges, in automobiles and other vehicles, and in most household products ranging from large appliances and hardware to flatware and cooking utensils.

A brief treatment of steel follows. For full treatment of the production and commercial applications of steel, *see* MACROPAEDIA: Industries, Extraction and Processing: *Steel.*

Steel owes its diverse properties to the allotropy, or changeable crystalline structure, of iron. As iron cools below the melting temperature of 1,538° C (2,800° F), its atoms align themselves into a body-centred-cubic (bcc) structure—*i.e.,* they form cubes with an atom at each corner and one in the cube's centre. In this bcc form, iron is known as ferrite. When the iron cools below 1,394° C (2,541° F), it becomes austenite, which has a face-centred-cubic (fcc) structure characterized by an iron atom at each corner and one at the centre of each of the six faces of the cube. Below 912° C (1,674° F), the atoms revert to the ferritic structure.

Pure iron is about as soft as copper and is of little structural value, but it is greatly hardened by the addition of small amounts of carbon. (Steel contains up to 2 percent carbon; higher carbon content creates cast iron, a metal of very different properties.) Carbon remains dissolved more readily in austenite than in ferrite because there is more room in the former's crystalline structure for carbon atoms to lodge in the interstices, or gaps, between the iron atoms. As steel with a carbon content of about 0.77 percent is cooled past the austenite zone and assumes the ferritic form, the excess carbon atoms in it may precipitate as iron carbide (also known as cementite) and form pearlite, a harder steel that consists of alternating platelets of ferrite and cementite. The use of a somewhat higher carbon content—*e.g.,* 1.05 percent—results in an even harder steel that consists of islands of pearlite in a continuous network of cementite. Adjusting the carbon content is thus the simplest way to change the hardness of steel, since the many variations of steel's basic microstructures depend on that content, as well as on the rate at which the steel is cooled. Each particular microstructure has its specific degrees of hardness, strength, toughness, corrosion resistance, and electrical resistivity. The properties of a steel may be further modified by heat treating, by mechanically working it at cold or hot temperatures, or by adding other alloying elements besides carbon. These alloys include manganese, silicon, nickel, chromium, molybdenum, vanadium, tungsten, niobium, and zirconium. Such elements are added during

the refining process to give special properties such as superior strength, hardness, durability, or corrosion resistance.

Based on the quantity of alloying elements, steels can be grouped into three major classes: the carbon steels, low-alloy steels, and high-alloy steels. Carbon steels are the most widely used and account for about 90 percent of the world's steel production. They contain from less than 0.015 to slightly more than 2 percent carbon. Carbon steels are used extensively for automobile bodies, appliances, machinery, ships, containers, and the structures of buildings. Low-alloy steels, which contain up to 8 percent alloying elements, are exceptionally strong and are used for machine parts, aircraft landing gear, shafts, hand tools, gears, and the structural members of buildings and bridges.

High-alloy steels, which contain more than 8 percent alloying elements, are prized for their unusual properties. Typical of these are the stainless steels, which are used when resistance to corrosion and oxidation are required, as in jet-engine parts, chemical equipment, tableware and cooking utensils, and cutting tools. Stainless steels contain from 16 to 26 percent chromium and up to 35 percent nickel.

In principle, steelmaking is a melting, purifying (refining), and alloying process carried out at approximately 1,600° C (2,900° F) under molten conditions. Steel is obtained by refining pig iron or scrap steel in a furnace, and then using further refining in a number of steps to produce a metal with desired specific characteristics. Steel can be produced in basic-oxygen, open-hearth, or electric-arc furnaces. Basic-oxygen and open-hearth furnaces make steel from liquid (*i.e.,* molten) blast-furnace iron and varying quantities of scrap steel, while electric-arc furnaces remelt scrap steel or refine briquettes of direct-reduced iron ore. Refining consists essentially of burning off excess carbon and such impurities as silicon, manganese, and phosphorus, which separate from the molten steel as gases or as molten slag. Refining is also the stage at which desired alloying elements are added. The molten steel is tapped into a ladle, where further refining is carried out—most importantly, the removal of dissolved gases and the addition of further alloying elements. From there the molten steel can be poured into molds for solidification into ingots; these can later be reheated and rolled into semifinished shapes such as blooms or slabs, which are in turn worked into finished products such as bars, sheets, tubes, rods, or wire. Some of the steps taken in ingot pouring can be saved by continuous casting, in which molten steel is tapped from the ladle into a mold, extracted as a long strand, and immediately cut, worked, and treated in one continuous operation.

Forming semifinished steel into the finished shapes that are used in manufacturing and construction is done by two major methods, called hot- and cold-working. Hot-working consists primarily of hammering, pressing, rolling, and extruding the steel under conditions of high heat. Hammering and pressing are together called forging, which dates back to the earliest age of steelmaking. Hammering was first done by hand, later by water power, and now by steam-powered hammers. Pressing is accomplished by a hydraulic forging press that relies on pressure to force a die down on a plate of steel. Extrusion relies on forcing the hot steel through a chamber at one end of which is a die with an opening that is the desired shape. A very large force is required to force the steel through the opening. Rolling (*q.v.*) is the most widely used method for shaping steel. Basically, it consists of passing the steel between two rollers revolving at the same speed but in opposite directions. The temperature of the rolling steel, the distance between the rollers and the pressure exerted by them, and the velocity of the rolling process determines the result.

Cold-working, which includes rolling, extrusion, and drawing (pulling steel through a die rather than pushing it, as in extrusion), is generally used to make bars, wire, tubes, sheets, and strips where better machinability, particular size accuracy, and a bright surface are desired. Thinner gauges of steel can be attained more economically by cold-working. Cold-rolling normally follows hot-rolling to yield a more highly refined product.

Molten steel can also be cast directly into products as diverse as small valves or huge turbine blades. A number of steel products, particularly those made from sheets, are given a corrosion-resistant coating through chromeplating, galvanizing (coating with zinc), or tinplating.

**steel drum,** tuned gong made from the unstoppered end and part of the wall of a metal shipping drum. The end surface is hammered concave, and several areas are outlined by acoustically important chiseled grooves. It is heated and tempered, and bosses, or domes, are hammered into the outlined areas. The depth, curvature, and size of each boss determine its pitch. The drums are struck with rubber-tipped hammers.

Steel drums originated in Trinidad, in the West Indies, in the 20th century and are



Steel drum
Saunders and Associates

played in ensembles, or steel bands, of about 4 to 100 performers. Drums are commonly made in four sizes from bass to treble, called boom, cellopan, guitar pan, and ping pong.

**Steele, Sir Richard,** pseudonym ISAAC BICKERSTAFF (b. 1672, Dublin, Ire.—d. Sept. 1, 1729, Carmarthen, Carmarthenshire, Wales), English essayist, dramatist, journalist, and politician, best known as principal author (with Joseph Addison) of the periodicals *The Tatler* and *The Spectator.*

*Early life and works.* Steele's father, an ailing and somewhat ineffectual attorney, died



Steele, detail of an oil painting by Sir Godfrey Kneller, 1711; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

when the son was about five, and the boy was taken under the protection of his uncle Henry Gascoigne, confidential secretary to the Duke of Ormonde, to whose bounty, as Steele later wrote, he owed "a liberal education." He was sent to study in England at Charterhouse in 1684 and to Christ Church, Oxford, in 1689. At Charterhouse he met Joseph Addison, and thus began one of the most famous and fruitful of all literary friendships, which lasted until disagreements (mainly political) brought about a cooling and a final estrangement shortly before Addison's death in 1719. Steele moved to Merton College in 1691 but, caught up with the excitement of King William's campaigns against the French, left in 1692 without taking a degree to join the army. He was commissioned in 1697 and promoted to captain in 1699, but, lacking the money and connections necessary for substantial advancement, he left the army in 1705.

Meanwhile, he had embarked on a second career, as a writer. Perhaps partly because he gravely wounded a fellow officer in a duel in 1700 (an incident that inspired a lifelong detestation of dueling), partly because of sincere feelings of disgust at the "irregularity" of army life and his own dissipated existence, he published in 1701 a moralistic tract, "The Christian Hero," of which 10 editions were sold in his lifetime. This tract led to Steele's being accused of hypocrisy and mocked for the contrast between his austere precepts and his genially convivial practice. In the same year (1701) Steele wrote his first comedy, *The Funeral.* Performed at Drury Lane "with more than expected success," this play made his reputation and helped to bring him to the notice of King William and the Whig leaders. Late in 1703 he followed this with his only stage failure, *The Lying Lover,* which ran for only six nights, being, as Steele said, "damned for its piety." Sententious and ill-constructed, with much priggish moralizing, it is nevertheless of some historical importance as one of the first sentimental comedies.

A third play, *The Tender Husband,* with which Addison helped him (1705), had some success, but Steele continued to search for advancement and for money. In the next few years he secured various minor appointments, and in 1705, apparently actuated by mercenary motives, he married a widow, Margaret Stretch, who owned considerable property in Barbados. Almost immediately the estate was entangled in his debts (he lost two actions for debt, with damages, in 1706), but, when, late in 1706, Margaret conveniently died, she left her husband with a substantial income. Steele's second marriage, contracted within a year of Margaret's death, was to Mary Scurlock, who was completely adored by Steele, however much he might at times neglect her. His hundreds of letters and notes to her provide a vivid revelation of his personality during the 11 years of their marriage. Having borne him four children (of whom only the eldest, Elizabeth, long survived Richard), she died, during pregnancy, in 1718.

*Mature life and works.* Steele's most important appointment in the early part of Queen Anne's reign was that of gazetteer—writer of *The London Gazette,* the official government journal. Although this reinforced his connection with the Whig leaders, it gave little scope for his artistic talents, and, on April 12, 1709, he secured his place in literary history by launching the thrice-weekly essay periodical *The Tatler.* Writing under the name (already made famous by the satirist Jonathan Swift) of Isaac Bickerstaff, Steele created the mixture of entertainment and instruction in manners and morals that was to be perfected in *The Spectator.* "The general purpose of the whole," wrote Steele, "has been to recommend

truth, innocence, honour, and virtue, as the chief ornaments of life"; and here, as in the later periodical, can be seen his strong ethical bent, his attachment to the simple virtues of friendship, frankness, and benevolence, his seriousness of approach tempered by the colloquial ease and lightness of his style. Addison contributed some 46 papers and collaborated in several others, but the great bulk of the 271 issues were by Steele himself, and, apart from bringing him fame, it brought a measure of prosperity. The exact cause of *The Tatler's* demise is uncertain, but probably the reasons were mainly political: in 1710 power had shifted to the Tories and Steele, a Whig, had lost his gazetteership and had come near to losing his post of commissioner of stamps. *The Tatler* had contained a good deal of political innuendo, some of it aimed at Robert Harley, the Tory leader, himself, and Harley may well have put pressure on Steele to discontinue the paper.

*The Tatler's* greater successor, first appearing on March 1, 1711, was avowedly nonpolitical and was enormously successful. *The Spectator* was a joint venture; Steele's was probably the more original journalistic flair, and he evolved many of the most celebrated ideas and characters (such as Sir Roger de Coverley), although later Addison tended to develop them in his own way. Steele's attractive, often casual style formed a perfect foil for Addison's more measured, polished, and erudite writing. Of the 555 daily numbers, Steele contributed 251 (though about two-thirds made up from correspondents' letters).

Of Steele's many later ventures into periodical journalism, some, such as *The Englishman,* were mainly politically partisan. *The Guardian* (to which Addison contributed substantially) contains some of his most distinguished work, and *The Lover* comprises 40 of his most attractive essays. Other, short-lived, periodicals, such as *The Reader, Town-Talk,* and *The Plebeian,* contain matter of considerable political importance. Steele became, indeed, the chief journalist of the Whigs in opposition (1710–14), his writings being marked by an unusual degree of principle and integrity. His last periodical and his last extended literary work was *The Theatre.*

Steele's political writings had stirred up enough storms to make his career far from smooth. He resigned as commissioner of stamps in 1713 and was elected to Parliament, but, as a consequence of his anti-Tory pamphlets "The Importance of Dunkirk Consider'd" and "The Crisis," he was expelled from the House of Commons for "seditious writings." Calmer weather, however, and rewards followed on George I's accession: Steele was appointed to the congenial and fairly lucrative post of governor of Drury Lane Theatre in 1714, knighted in 1715, and reelected to Parliament in the same year.

Steele's health was gradually undermined by his cheerful intemperance, and he was long plagued by gout. Nevertheless, he busied himself conscientiously with parliamentary duties and, more erratically, with his part in the management of Drury Lane. One of his main contributions to that theatre's prosperity was his last and most successful comedy, *The Conscious Lovers*—one of the most popular plays of the century and perhaps the best example of English sentimental comedy.

In 1724 Steele retired to his late wife's estate in Wales and began to settle his debts. His closing years were quiet, but his health continued to deteriorate.

*Assessment.* Both as man and writer Steele is one of the most attractive figures of his time, much of his writing—easy, rapid, slipshod, but deeply sincere—reflecting his personality. "There appears in his natural temper," wrote his contemporary, the philosopher George Berkeley, "something very generous and a great benevolence to mankind." An emotional, impetuous, good-natured, and idealistic man, he always found it easier to get money than to keep it, and his career can be seen as in part shaped by the constant need to keep his head above the waters of debt.

(R.P.C.M.)

BIBLIOGRAPHY. There is no systematic bibliography of Steele's works. Aitken's *Life* (see below) has a bibliography, as does Richard's edition of *The Christian Hero* (see below). Rae Blanchard has edited *The Christian Hero* (1932), the *Correspondence* (1941, reprinted 1970 with additional letters), *Tracts and Pamphlets* (1944, reprinted 1967), *Occasional Verse* (1952), *The Englishman* (1955), and *Periodical Journalism, 1714–16* (1959). John Loftis has edited *The Theatre, 1720* (1962); and Shirley Strum Kenny, *The Plays* (1971). Donald F. Bond has edited *The Spectator,* 5 vol. (1965); *The Tatler* was edited by G.A. Aitken, 4 vol. (1898–99, reprinted 1970). The most fully documented biography is G.A. Aitken, *The Life of Richard Steele,* 2 vol. (1889, reprinted 1968); more up-to-date are the biographies by Willard Connely, *Sir Richard Steele* (1934); and Calhoun Winton, *Captain Steele: The Early Career of Richard Steele* (1964) and *Sir Richard Steele, M.P.: The Late Career* (1970). See also John Loftis, *Steele at Drury Lane* (1952). Critical studies include Walter J. Graham, *The Beginnings of English Literary Periodicals: A Study of Periodical Literature, 1665–1715* (1926, reprinted 1972); F.W. Bateson, *English Comic Drama, 1700–1750* (1929); and A.R. Humphreys, *Steele, Addison, and Their Periodical Essays* (1959).

**steelhead,** saltwater form of rainbow trout (*q.v.*).

**Steelyard, Merchants of the,** in the later Middle Ages, members of the Hanseatic League, an association of north German towns, who resided at its London establishment, known as the Steelyard (probably from Low German *stålgard,* a courtyard). German merchants from Cologne had enjoyed privileges in London from Anglo-Saxon times, and by the late 13th century had been joined there by others from east German towns such as Lübeck and Hamburg. The Steelyard was off Thames Street, near Blackfriars, with a frontage on the river. In that area the Germans were exempt from English jurisdiction. English merchants always resented their privileges, but their loans were useful to the English crown and their carrying trade of value to the economy. But by the late 16th century, English trade outweighed theirs, and in 1598 Queen Elizabeth I closed the Steelyard.

**Steen, Jan (Havickszoon)** (b. *c.* 1626, Leiden, Neth.—d. Feb. 3, 1679, Leiden), Dutch painter, ranked immediately after Rembrandt and Hals as a painter of everyday scenes. Steen is unique among leading 17th-century Dutch painters for his humour; he has often been compared to the French comic playwright Molière, his contemporary, and indeed both men treated life as a vast comedy of manners. Some of the artist's biblical and classical paintings such as "Anthony and Cleopatra" (Kunstsammlung der Universität, Göttingen, Ger.) may have been inspired by the contemporary stage. His portraits of rhetoricians (Musées Royaux des Beaux-Arts, Brussels; Worcester Art Museum, Mass.) attest to his interest in these groups of amateur actors.

Steen was enrolled at the University of Leiden in 1646 and in 1648 was one of the founding members of the Leiden painters' Guild of St. Luke. His early teachers seem to have been the historical painter Nicolaus Knupfer at Utrecht, genre and landscape painter Adriaen van Ostade at Haarlem, and the landscapist Jan van Goyen at The Hague. In 1649 Steen married van Goyen's daughter and settled at The Hague for the next few years. He moved to Delft in 1654 and to Haarlem in 1661. In 1670 he was back in Leiden, and in 1673 he married again.

In Steen's landscapes, including his winter scenes, small earthy figures recall those of Adriaen and of Isack van Ostade. In his later works the figures are larger, less crowded, and



"The World Upside-down," oil painting by Jan Steen, 1663; in the Kunsthistorisches Museum, Vienna
By courtesy of the Kunsthistorisches Museum, Vienna

more individually characterized. He shows them playing cards or skittles, or carousing in their cups, as in "Skittle Players Outside an Inn" (*c.* 1660; National Gallery, London). His frequent use of inns probably reflects his own background as the son of a brewer and sometime brewer and tavernkeeper himself. He was a master at capturing subtleties of facial expression, especially in children. His best works display great technical skill, particularly in the handling of colour.

During Steen's last years, his paintings began to anticipate the Rococo style of the 18th century, becoming increasingly elegant and somewhat less energetic, as in the "Serenade" (*c.* 1675; Národní Galerie, Prague), and showing a heavy French influence and an increased flamboyance.

**Steensen, Niels:** *see* Steno, Nicolaus.

**steeple,** tall ornamental tower, sometimes a belfry, usually attached to an ecclesiastical or public building. The steeple, usually composed of a series of diminishing stories, does not necessarily include the spire, cupola, pyramid, or other construction that frequently tops it, but in ordinary usage it is the entire structure.

**steeple cup,** tall standing cup, the cover of which characteristically bears an obelisk finial (sometimes surmounted by a figure) that rises



Gold steeple cup by F. Terry, English, 1625; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London; photograph, A.C. Cooper Ltd.

on scrolled brackets from the cover. With an egg-shaped or globular bowl and cover, a short baluster stem, and a tall, trumpet-shaped foot, these cups seem to have emerged only in England and for a short period between about 1590 and the 1630s. They were usually made of silver or silver gilt and appear to have been used as chalices in some cases, several having been found among collections of church plate. They are usually decorated on the bowl and cover with embossed, engraved, or chased ornament consisting of various floral and classical motifs and strapwork.

**steeplechase,** in horse racing, a race over jumps or obstacles. Although dating back to Xenophon (4th century BC), it derives its name from impromptu races by fox hunters in 18th-century Ireland over natural country in which church steeples served as course landmarks. It differs from hurdle racing, in which the barriers or hurdles are portable. Steeplechasing was long a favourite sport of cavalry officers. It is popular in England, France, and Ireland and to a lesser extent in the United States.

Because of the stamina that is required, mature horses are preferred, and racing through age 10 and beyond is not uncommon. Many steeplechasers are "half-bred," the term applied to any horse that is not a pure Thoroughbred. The most famous steeplechase race is the Grand National held annually at Aintree, near Liverpool, Eng., over a distance of 4 miles 855 yards (7,180 m) with 30 or so fences. It has been won several times by horses carrying 175 pounds (79 kg). Other steeplechase events include the Irish Grand National and the Grand Steeplechase de Paris. An American steeplechase, the Maryland Hunt Cup, was first run in 1894 in Glyndon, Md.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**steeplechase,** in track-and-field athletics, a footrace over an obstacle course that includes such obstacles as water ditches, open ditches, and fences.

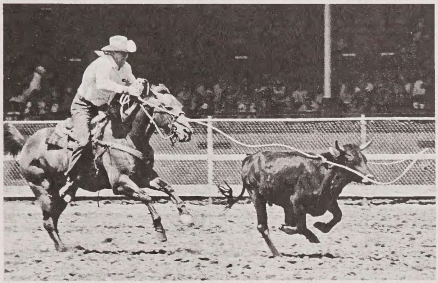
The sport dates back to a cross-country race at the University of Oxford in 1850. As an Olympic track event it was run in 1900–08 and standardized at 3,000 m, or about 7½ laps of a 400-metre course, in the 1920 Games. Runners of the standard course face a total of 7 water jumps and 28 hurdling jumps. Hurdles are 3 feet high, and one of them



Steeplechase
Don Chadez

is placed immediately in front of the water jump, an area of 12 square feet. *See* Olympic Games.

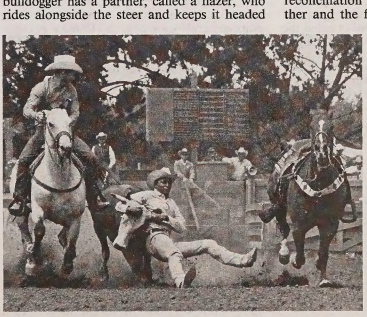
**steer roping,** rodeo event in which a mounted cowboy pursues a full-grown steer; lassos it with his rope, catching the animal by the horns; fastens the rope to his saddle; and stops his horse suddenly, throwing the steer to the ground. The cowboy then quickly dismounts and ties three of the steer's feet, raising



Steer roping
E.W. Marugg Photography

both hands to signal completion. The event is timed, and the contestant with the lowest elapsed time is the winner.

**steer wrestling,** also called BULLDOGGING, rodeo event in which a mounted cowboy chases a full-grown steer, dives from his horse on top of the animal, grasps its horns, digs his heels in the ground to bring the animal to a stop, and twists it to the ground. The event is timed from the moment a barrier in front of the cowboy is released to the moment the steer is judged down—*i.e.,* flat on its side with all four legs and head in the same direction and the cowboy still in contact. The contestant with the lowest elapsed time wins. Each bulldogger has a partner, called a hazer, who rides alongside the steer and keeps it headed



Steer wrestling
E.W. Marugg Photography

in a straight line while the bulldogger makes his approach.

**Stefan** (Polish, Romanian, Serbo-Croatian, etc., personal name): *see under* Stephen, except as below.

**Stefan DUŠAN,** also called STEFAN UROŠ IV, English STEPHEN DUSHAN, OF STEPHEN UROŠ IV (b. 1308—d. Dec. 20, 1355), king of Serbia (1331–46) and "Emperor of the Serbs and Greeks" (1346–55), the greatest ruler of medieval Serbia, who promoted his nation's influence and gave his people a new code of laws.

*Background and early years.* Stefan Dušan was the son of Stefan Uroš III, who was the eldest son of the reigning king, Stefan Uroš II Milutin. While Dušan was still a boy, his father, who governed the maritime provinces of the Serbian state, rebelled against his own father. Milutin took him prisoner, blinded him in order to make him unfit to claim the throne, and about 1314 exiled him to Constantinople. With his father and mother, Stefan Dušan therefore spent several years in the Byzantine capital. Life in Constantinople as an exile, without any prospect of occupying the throne, had a lasting influence on the formation of his character. In addition to a basic education, he acquired a familiarity with the ways of government of the Byzantine world by which he was later to be guided.

The exile in Constantinople ended with the reconciliation of Dušan's father and grandfather and the family's return to Serbia about 1320. After Milutin's death in 1321, Dušan's father greatly increased his chances in the contention for the crown by demonstrating that he was not blind, claiming a miraculous cure. With the support of a great majority of the nobility, he succeeded in defeating his enemies and was crowned king early in 1322. Dušan, still a youth, was crowned "young king," or heir apparent.

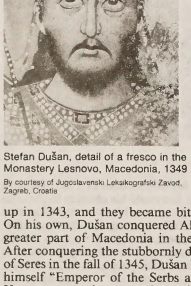
Too young to be able to pursue more active policies, Dušan as "young king" governed the maritime provinces of the state. He had to reconcile himself to the loss of Hum (Hercegovina), the most westerly region of Serbia,

which the ruler of neighbouring Bosnia conquered in 1326. He gained valuable military experience, however, and the reputation of an able commander in the campaigns against the Bosnians; he particularly distinguished himself in the great battle against the Bulgarians of Velbužd in 1330. Although this victory freed Serbia of the great danger of an allied attack by both the Bulgarian and the Byzantine emperors, dissension soon arose between Dušan and his father. War broke out between them in the fall of 1330. Peace was concluded in the spring of 1331, but soon afterward Dušan rose again against his father and deposed him.

Dušan's reign began peacefully in September 1331. He subdued the sporadic revolts of the nobility, who had become more powerful during the period of civil wars, and strengthened his alliance with the new Bulgarian emperor, John Alexander, by marrying his sister Helen in 1332. Relations with Bulgaria remained untroubled to the end of Dušan's reign.

In 1334, however, he began his war of conquest against Byzantium. After taking the border fortresses, Dušan penetrated deep into Byzantine territory to the gates of Salonica, although he did not achieve lasting success in subduing the cities. He made peace with Emperor Andronicus III Palaeologus in August 1334, having extended the territories of his state close to what is today the northern border of Greece. The next year he secured his northern borders against the Hungarians. During the course of his entire reign, Dušan remained on the defensive in the north, although he succeeded in preventing Hungary from extending its boundaries south of the fortresses on the Save and Danube rivers.

*Emperor of the Serbs and Greeks.* With the death of Andronicus III in 1341, the Byzantine Empire once more fell prey to family quarrels and civil war. Dušan, arriving before the gates of Salonica, received an unexpected ally in John Cantacuzenus, the late emperor's general, who took up arms against the regents of the young successor, John V Palaeologus, and proclaimed himself emperor. Dušan aided the Byzantine pretender, but their alliance broke



Stefan Dušan, detail of a fresco in the Monastery Lesnovo, Macedonia, 1349

By courtesy of Jugoslavenski Leksikografski Zavod, Zagreb, Croatia

up in 1343, and they became bitter enemies. On his own, Dušan conquered Albania and a greater part of Macedonia in the same year. After conquering the stubbornly defended city of Seres in the fall of 1345, Dušan began to call himself "Emperor of the Serbs and Greeks." He was crowned emperor in April 1346.

After subjugating other parts of the Byzantine Empire, Epirus and Thessaly, in 1348, he found himself master of a vast territory from the rivers Save and Danube to the Bay of Corinth and from the Adriatic and Ionian shores to the Aegean. Although Dušan was helped by the weakness of his adversaries, he would never have attained his great successes without the forces provided by the militant nobility of the old Serbian provinces and by his German mercenaries. Dušan regarded the subdued Byzantine lands, "Romania," as his own "imperial lands," whereas the old Serbian provinces were formally the "royal lands" of his son. In reality, he governed both territories himself, but his administrative reforms concerned mostly the Serbian provinces.

On the eve of the coronation he raised the Serbian archbishopric to the status of a patriarchate, for in the Orthodox East an emperor was inconceivable without a patriarch. He introduced the Byzantine system of titles and ranks, and the imperial chancellery was organized on the Byzantine model, as was the uniform organization of local authorities. Dušan, moreover, considered the introduction of a law code part of his imperial duties, and in the Diets of 1349 and 1354 he promulgated a code containing more than 200 statutes. The code covered mainly criminal law and the relations between the classes.

From the time he imposed himself as co-ruler of Constantinople with the young emperor John V Palaeologus, John VI Cantacuzenus had posed a serious threat to Dušan, especially after he acquired Turkish auxiliary forces, which had twice defeated the Serbs—in 1344 and in 1352. During Dušan's campaign against Bosnia in 1350, Cantacuzenus' supporters in the Greek cities sent their armies to attack him in the south, thus forcing him to return to Macedonia and to give up his plans for reconquering Hercegovina. Plans for the conquest of Constantinople drew Dušan into close relations with Venice. The republic was sympathetic to him but remained indifferent toward his proposals for direct action against the Byzantine emperors.

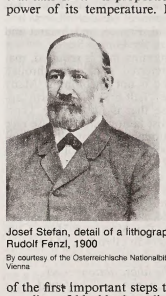
In his last years Dušan maintained cordial relations with the Pope in Avignon. Like some of his predecessors he showed a readiness to accept a union of the churches, especially since in 1350 the Patriarch of Constantinople had proclaimed an anathema on both the Serbian emperor and the patriarch. Enmity between local Orthodox and Catholic clerics stood in his way, as did Hungary's unsuccessful attack on Serbia in 1354, which upset the work of the papal legation. This attack also frustrated Dušan's desire to be designated by the Pope as captain of a crusade against the Turks, who at this time had gained a foothold on European soil and had become a danger to the Christians of the Balkans.

Dušan died suddenly in December 1355. He was succeeded by his son Uroš, who was unable to preserve his father's large empire. The peripheral regions of the empire seceded under their powerful governors, and large areas fell to the Turks. Only 15 years after Dušan's death, the territory of Serbia was smaller than that from which he had set out on his conquests.

*Assessment.* Dušan's popularity was especially great during the era of national awakening and wars for liberation in the 19th century. "Dušan the Mighty" represented at that time a symbol of former glory and greatness, while the restoration of Dušan's empire was stressed as the ideal goal of contemporary Serbian politics. Modern historians stress his accomplishment in elevating the Serbian state to predominance in the Balkans and in introducing internal reforms, transplanted from Byzantine practices and institutions and aimed at centralizing and unifying the administrative system. Outlasting his other accomplishments was Dušan's law code, which remained in use until the end of the medieval Serbian state and later became a valuable source for the study of medieval society. (S.M.Ci.)

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**Stefan, Josef** (b. March 24, 1835, St. Peter, Austria—d. Jan. 7, 1893, Vienna), Austrain physicist who in 1879 formulated a law which states that the radiant energy of a blackbody—a theoretical object that absorbs all radiation that falls on it—is proportional to the fourth power of its temperature. His law was one



Josef Stefan, detail of a lithograph by Rudolf Fenzl, 1900

By courtesy of the Osterreichische Nationalbibliothek, Vienna

of the first important steps toward the understanding of blackbody radiation, from which sprang the quantum idea of radiation.

At the University of Vienna, Stefan rose from lecturer in mathematical physics in 1858 to professor ordinarius of physics in 1863 and to director of the Physical Institute in 1866. Five years after he derived his law empirically, it was derived theoretically by Ludwig Boltzmann of Austria and hence became known as the Stefan–Boltzmann law.

**Stefan–Boltzmann law,** statement that the total radiant-heat energy emitted from a surface is proportional to the fourth power of its absolute temperature. Formulated in 1879 by Josef Stefan, an Austrian physicist, as a result of his experimental studies, the same law was derived in 1889 by Ludwig Boltzmann, also an Austrian physicist, from thermodynamical considerations: if $E$ is the radiant heat energy emitted from a unit area in one second and $T$ is the absolute temperature (in degrees Kelvin), then $E = \sigma T^4$, the Greek letter sigma ($\sigma$) representing the constant of proportionality, called the Stefan–Boltzmann constant. This constant has the value $1.36 \times 10^{-4}$ kilocalories per metre$^2$-second-K$^4$. The law applies only to blackbodies, theoretical surfaces that absorb all incident heat radiation.

**Štefánik, Milan (Rastislav)** (b. July 21, 1880, Kosariska, near Myjava, Slovakia, Austria-Hungary—d. April 4, 1919, Wenor, near Bratislava, Czech.), Slovakian astronomer and general who, with Tomáš Masaryk and Edvard Beneš, helped found the new nation of Czechoslovakia in 1918–19.

After study at the University of Prague, from which he received a doctorate of philosophy in 1904, Štefánik went to Paris. Joining the staff of the astronomical observatory at Meudon, he served on scientific expeditions to Africa, the Americas, and Oceania. Becoming a naturalized French citizen, he joined the army after the outbreak of World War I and eventually was drawn to the Czechoslovak liberation

movement. Encouraged by the French government, he was sent on military and political missions to the United States, Russia, Italy, and other Allied powers. In 1918 he became minister of war in the provisional Czechoslovak government. The following year he perished in an airplane crash.

**Stefano** DI GIOVANNI: *see* Sassetta.

**Stefánsson, Davíd** (b. Jan. 21, 1895, Fagriskógur, Eyjafjördur, Ice.—d. March 1, 1964, Akureyri), Icelandic poet and novelist, best known as a poet of humanity. He wrote a powerful sociological novel, *Sólon Islandus* (1940), a successful play, *Gullna hlidid* (1941; *The Golden Gate,* 1967, in *Fire and Ice: Three Icelandic Plays*), and other prose works, but they are overshadowed by his verse. His early poetry, including most of his folk themes and love lyrics, appeared in *Svartar fjadrir* (1919, "Black Feathers"), *Kvædi* (1922, "Poems"); *Kvedjur* (1924; "Greetings"), and *Ný Kvædi* (1929; "New Poems"), which were combined and published as a collected volume in 1930. His later poetry—darkening in social satire, reformatory zeal against capitalism and organized religion, and despair over the war—was published as *I byggdum* (1933; "Among Human Habitations"), *Ad nordan* (1936; "From the North"), *Ný kvædabók* (1947; "A New Book of Poems"), and the posthumous *Sídustu ljód* (1966; "Last Poems").

Stefansson came of a cultured yeoman family and was brought up with a love for his land, its literature, and its folklore. He frequently journeyed abroad, but lived most of his life in the little town of Akureyri, where he was a librarian (1925-52). His lyrics often have the delicacy of a cradle song; yet his heroic verse shows the virility of an epic poet.

**Stefansson, Vilhjalmur** (b. Nov. 3, 1879, Arnes, Man., Can.—d. Aug. 26, 1962, Hanover, N.H., U.S.), explorer and ethnologist who spent five consecutive record-making years exploring vast areas of the Canadian



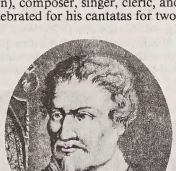
Stefansson
EB Inc.

Arctic after adapting himself to the Eskimo way of life.

Of Icelandic descent, Stefansson lived for a year among the Eskimo in 1906–07, acquiring an intimate knowledge of their language and culture and forming the belief that Europeans could "live off the land" in the Arctic by adopting Eskimo ways. From 1908 to 1912, he and the Canadian zoologist Rudolph M. Anderson carried out ethnographical and zoological studies among the Mackenzie and Copper Eskimo of Coronation Gulf, in Canada's Northwest Territories.

Between 1913 and 1918 Stefansson extended his exploration of the Northwest Territories. His party was divided into two groups; the southern one, under Anderson, did survey and scientific work on the north mainland coast from Alaska eastward to Coronation Gulf, while the northern group travelled extensively in the northwest, discovering the last unknown islands of the Canadian archipelago, Borden, Brock, Meighen, and Longheed. Stefansson's knowledge of the Canadian Arctic led him to predict that the area would become economically important. In World War II he was an adviser to the U.S. government, surveyed defense conditions in Alaska, and prepared reports and manuals for the armed forces. From 1947 he was Arctic consultant at Dartmouth College, Hanover, N.H. He wrote a number of books, including *My Life with the Eskimo* (1913), *The Friendly Arctic* (1921), *Unsolved Mysteries of the Arctic* (1939), and *Discovery* (1964).

**Steffani, Agostino** (b. July 25, 1654, Castelfranco, Tuscany—d. Feb. 12, 1728, Frankfurt am Main), composer, singer, cleric, and diplomat, celebrated for his cantatas for two voices.



Steffani, detail of a lithograph by E.V. Wiecker, 1816
By courtesy of the Österreichische Nationalbibliothek, Vienna

Steffani studied music in Venice, Rome, and Munich, where he served the Elector of Bavaria from 1674 to 1688, becoming by 1681 director of chamber music. He left Munich and entered the service of the Duke of Brunswick, later elector of Hanover, where he remained until his death. After some years he ceased to be musical director, however, and entered upon a new career. While continuing to practice music, he became important as a diplomat, going on several missions and acting for a short time as ambassador in Brussels. It was he who induced Handel to settle in Hanover and hence, indirectly, in London, when the new elector became King George I. Steffani was ordained in 1680 and later became papal protonotary for north Germany, with the status of bishop. He composed about 20 operas, most of them before 1700. It was, however, his numerous chamber duets in cantata form—following, with considerable melodic and structural distinction, the models of Luigi Rossi, Giacomo Carissimi, and Alessandro Stradella—that won for Steffani a European reputation; more than 100 of these are known.

**Steffano, Giovanni de** (Baroque painter): *see* Lanfranco, Giovanni.

**Steffen, Albert** (b. Dec. 10, 1884, Murgenthal, Switz.—d. July 13, 1963, Dornach), Swiss novelist and dramatist, one of the leading writers of the anthroposophical movement founded by Rudolf Steiner (*q.v.*).

Steffen's early works were compassionate messages of alarm at the disastrous effects of modern technological civilization and secularized thought in human relations. Moved by these problems, he joined the anthroposophical movement in 1907, settling at its centre in Dornach, near Basel. (Steffen was later president of the Anthroposophical Society and was editor of its review, *Das Goetheanum.*) From that time his numerous writings became visions of a world permeated by metaphysical powers of good and evil, as revealed in old and esoteric European and Asiatic traditions. His novels include *Die Erneuerung des Bundes* (1913) and *Aus Georg Archibalds Lebenslauf* (1950); his plays, *Hieram und Salomo* (1927), *Das Todeserlebnis des Manes* (1934), and *Barrabas* (1949; *Christ or Barrabas?,* 1950); and his essays, *Der Künstler zwischen Westen und Osten* (1925; *The Artist Between West and East,* 1946). *Buch der Rückschau* (1939) is autobiographical.

**Steffens, Henrik** (b. May 2, 1773, Stavanger, Nor.—d. Feb. 13, 1845, Berlin), philosopher and physicist, who combined scientific ideas with German Idealist metaphysics.

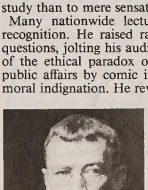
Steffens spent his early years at Copenhagen, where he attended the university. He later studied at Kiel, Jena, and Berlin and by 1799 was an established figure in German literary and philosophical circles and on friendly terms with Schelling, Goethe, and Friedrich Schleiermacher. After publishing *Beiträge zur innern Naturgeschichte der Erde* (1801; "Contributions to the Internal Natural History of the Earth"), he took up an academic career, beginning as a lecturer at Copenhagen in 1802 and becoming professor of mineralogy at Halle in 1804 and professor of physics at Breslau in 1811. Steffens spent almost all his adult life in Germany, which he regarded as his home, and was a fervent supporter of German nationalism. He fought with the Prussian Army against Napoleon in 1813 and 1814. He was professor of physics at Berlin from 1832 until his death.

Steffens did much sound scientific work as a physicist, but as a philosopher he was characterized by a fondness for using scientific fact as a basis for the construction of fanciful analogies and quite arbitrary metaphysical conclusions. His exposition of a philosophy of nature in *Grundzüge der philosophischen Naturwissenschaft* (1806; "Philosophical Characteristics of Natural Science") showed a typical combination of profound scientific knowledge and Schellingian speculation. He also wrote *Anthropologie,* 2 vol. (1824); an autobiography, *Was ich erlebte,* 10 vol. (1840–44; "What I Experienced"); and some novels and poetry.

**Steffens, (Joseph) Lincoln** (b. April 6, 1866, San Francisco—d. Aug. 9, 1936, Carmel, Calif., U.S.), U.S. journalist, lecturer, and political philosopher, a leading figure among the writers whom Theodore Roosevelt called muckrakers.

After attending the University of California, Steffens studied psychology with Wilhelm Wundt in Leipzig and with Jean-Martin Charcot in Paris, which confirmed his basic positivist orientation. During nine years of New York City newspaper work ending in 1901, Steffens discovered abundant evidence of the corruption of politicians by businessmen seeking special privileges. In 1901 after he became managing editor of *McClure's Magazine,* he began to publish the influential articles later collected as *The Shame of the Cities* (1906), a work closer to documented sociological case study than to mere sensational exposure.

Many nationwide lecture tours won him recognition. He raised rather than answered questions, jolting his audience into awareness of the ethical paradox of private interest in public affairs by comic irony rather than by moral indignation. He revealed the shortcom-



Lincoln Steffens, 1912
By courtesy of the Library of Congress, Washington, D.C.

ings of the popular dogmas that connected economic success with moral worth, and national progress with individual self-interest.

Events in Mexico and Russia turned Steffens' attention from reform to revolution. After a trip to Petrograd (now Saint Petersburg) in 1919 he wrote a friend, "I have seen the future; and it works." His unorthodoxy lost him his American audience during the 1920s; he continued to study revolutionary politics in Europe and became something of a legendary character for the younger expatriates. After the great success of his *Autobiography* (1931), he supported many communist activities but refused identification with any party or doctrine.

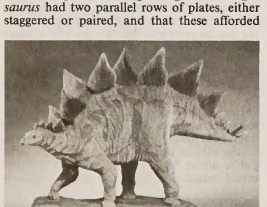
**Stegner, Wallace,** in full WALLACE EARL STEGNER (b. Feb. 18, 1909, Lake Mills, Iowa, U.S.—d. April 13, 1993, Santa Fe, N.M.), American author whose works, set mainly in the western United States, are informed by what he termed "the geography of promise" symbolized by the West.

Stegner grew up in Canada and in several western states. Receiving a Ph.D. (1935) from the University of Iowa, he taught, among other places, at Stanford University, where he directed the creative-writing program (1945–71). His fifth novel, *The Big Rock Candy Mountain* (1943), the story of an American family seeking their fortune in the West, was his first great success. Stegner's novels include the Pulitzer Prize-winning *Angle of Repose* (1971) and *The Spectator Bird* (1976), which won a National Book Award.

Among Stegner's nonfiction works are two histories of the Mormon settlement of Utah. A book of essays, *Where the Bluebird Sings to the Lemonade Springs: Living and Writing in the West,* was published in 1992.

**Stegosaurus,** a genus of plated dinosaurs (Stegosauria) of the Late Jurassic Period (163 million to 144 million years ago) recognizable by its spiked tail and series of large, triangular, bony plates along the back. *Stegosaurus* reached a length of 9 m (about 30 feet), but the skull and brain were very small for such a large animal. The forelimbs were much shorter than the hind limbs, giving the back its characteristically arched appearance. The feet were short and broad.

Various hypotheses have been posed to explain the arrangement and use of the plates. Paleontologists had long thought that *Stegosaurus* had two parallel rows of plates, either staggered or paired, and that these afforded

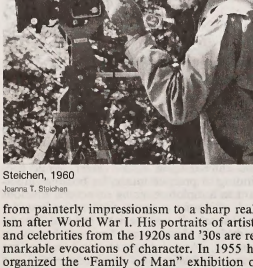


*Stegosaurus,* model by Stephen Czerkas, 1986

© Stephen Czerkas; photograph, by courtesy of the Natural History Museum of Los Angeles County

protection to the animal's backbone and spinal cord. However, new discoveries and reexamination of existing *Stegosaurus* specimens since the 1970s suggest that the plates alternated along the backbone, as no two plates from the same animal have exactly the same shape or size. Because the plates contained many blood vessels, the alternating placement appears consistent with a hypothesis of thermoregulation. This hypothesis proposes that the plates acted as radiators, releasing body heat to a cooler ambient environment; conversely, the plates could also collect heat when faced toward the sun like living solar panels. Two pairs of pointed bony spikes were present on the end of the tail. These are presumed to have served as defensive weapons, but they may have been ornamental. The spinal cord in the region of the sacrum was enlarged and was actually larger than the brain, giving rise to the misconception that *Stegosaurus* possessed two brains. It is more likely, however, that much of the sacral cavity was used for storing glycogen, as occurs in many present-day animals.

**Steichen, Edward** (b. March 27, 1879, Luxembourg—d. March 25, 1973, West Redding, Conn., U.S.), pioneer of American photography who, with Alfred Stieglitz, was a leader of the Photo-Secession Group. His style evolved



Steichen, 1960
Joanna T. Steichen

from painterly impressionism to a sharp realism after World War I. His portraits of artists and celebrities from the 1920s and '30s are remarkable evocations of character. In 1955 he organized the "Family of Man" exhibition of 503 photographs selected from more than 2,000,000 submitted worldwide.

*Training and early career.* In 1882 Steichen's parents moved from Luxembourg to the United States and settled in Hancock, Mich. Later the family moved to Milwaukee, Wis., where, at the age of 15, Steichen was apprenticed to a commercial lithographer. He studied painting but became interested in photography, and by 1900 several of his pictures had been shown in Philadelphia and Chicago.

Steichen's early photographs were influenced by his training as a painter. He frequently brushed on silver salts and other chemicals to eliminate or add images to negative or paper to achieve prints resembling soft, fuzzy mezzotints or loose wash drawings. These misty pictures were considered by most critics of the day to be the highest achievement of photographic art. Stieglitz, the best-known American photographer of the time—although himself a purist who did not tamper with either his negatives or his prints—concurred.

In 1902 Stieglitz invited Steichen to join him and 11 other photographers in founding the Photo-Secession, an organization dedicated to promoting photography as a fine art. In time, the Photo-Secessionists succeeded in transforming American photography from a craft that recorded and increasingly embellished to an art that freely experimented and explored. They showed that photographs of ordinary subjects and everyday scenes printed from the negative without manipulation can exert a far greater aesthetic appeal than artificial compositions printed by arcane methods.

In 1905 Photo-Secession opened, at 291 Fifth Avenue, New York City, its Little Galleries (called "291" for short). It was designed by Steichen, and Stieglitz was its director. Steichen, who had become a friend of the sculptor Auguste Rodin in 1910 when he was studying painting in Paris, arranged exhibitions of the work of Rodin and that of other friends at the gallery, including paintings by Henri Matisse, Gordon Craig, Max Weber, Paul Cézanne, and Pablo Picasso and sculpture by Constantin Brancusi. Many of these avant-garde artists' works were shown for the first time in America at "291," starting eight years before the Armory Show of 1913, at which modern European art received its first full-scale display in the United States. The Photo-Secessionist venture was successful; for the first time in the United States, photographs by Photo-Secessionists, Steichen prominently among them, ranked with paintings and drawings as artistic works.

During World War I, Steichen was put in command of the photographic division of the U.S. Army's air force and retired as a lieutenant colonel in 1918. During the war, realism had been the only purpose of the pictures Steichen took. The experience led to a significant change in his mode of artistic expression—in fact, he made a bonfire of all his paintings. He ceased painting and renounced his impressionistic photography with its broad, simple effects. Instead, he concentrated on creating a precise, clean-cut, more realistic picture. In order to achieve maximum realism, he photographed a white cup and saucer against a black velvet background more than a thousand times in his search for the perfect rendering of the subtle gradations in white, black, and gray.

From 1923 to 1938 Steichen operated a commercial studio in New York City that specialized in portraits and advertising illustrations and soon became a successful enterprise. What he knew of art and design as a painter, combined with his masterful photographic technique, enabled him to produce memorable portraits of the literary and artistic personalities and the socially prominent who came to pose. In addition, he was in 1923 induced by Frank Crowninshield, the editor, to become chief photographer for the fashion magazines *Vogue* and *Vanity Fair.* Steichen's photographs of the 1920s and '30s form a vital pictorial record of American culture. He created such striking images as the veiled Gloria Swanson, the hands-to-head portrait of Greta Garbo, and the smiling Charlie Chaplin.

*Later years.* At the outbreak of World War II, Steichen, rejected by the army because of age, was commissioned by the U.S. Navy to organize a department to photograph the war at sea. Soon after the Japanese attack on Pearl Harbor in 1941, his photographic exhibition entitled "Road to Victory" was presented in New York City's Museum of Modern Art, followed three years later by a similar exhibit, "Power in the Pacific."

From 1947 to 1962, Steichen was director of photography at the Museum of Modern Art. In 1955 he organized one of the most popular exhibitions of photographs ever presented, "The Family of Man." The exhibition was based on the concept of human solidarity that is the motif of his brother-in-law Carl Sandburg's biography of Abraham Lincoln. Together with his assistant Wayne Miller, Steichen selected 503 from the more than 2,000,000 prints submitted from all over the world. After its opening at the Museum of Modern Art in 1955, the exhibition toured most of the major museums in the world and was seen by more than 9,000,000 people in all.

Early in his career, Steichen rejected the idea that there was one system of aesthetics in American photography. Such a notion, he felt, served only to confine and inhibit the creative photographer. As a consequence, he

was always eager to serve as a promoter for American photography, arranging for exhibits, purchasing photographs, and generally acting as patron of younger photographers, regardless of the style of their work. According to Steichen, it is this variety—based on the unique vision of the individual photographer—that has made photography the vigorous art it is today. (P.J.P.)

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**Steiermark,** English STYRIA, *Bundesland* (federal province), southeastern and central Austria, bordering Slovenia on the south and bounded by *Bundesländer* Kärnten (Carinthia) on the south, Salzburg on the west, Oberösterreich and Niederösterreich (Upper and Lower Austria) on the north, and Burgenland on the east. It has an area of 6,327 sq mi (16,387 sq km). Upper Steiermark extends in the north from the Limestone Alps to the eastern groups of the Central Alps, embracing the valleys of the Mur, Mürz, Salza, and Upper Enns rivers. The Lower Steiermark upland and hill country consists of the middle Mur Valley with the Grazerfeld "plain" in the centre; the Koralpe and Packalpe rising above 6,500 ft (2,000 m) in the west; and a gravel, loam-covered hill country in the east.

Inhabited since the Stone Age and mined as early as the Bronze Age, the region became part of the Celtic kingdom of Noricum, which was incorporated into the Roman Empire *c.* 15 BC. In the 5th century it was overrun by Germanic tribes, followed by the Avars and their Slav subjects (Slovenes). Subjected by the Bavarians in the 8th century, the country became a mark, or frontier territory, of the Frankish Empire. Further German colonization led to Germanization by *c.* 1300, except in the southern countryside. The area of modern Steiermark belonged to the duchy of Carinthia (Kärnten) after 976, but other northern areas of modern Steiermark were acquired in the 11th and 12th centuries by the counts, or margraves, of Traungau, whose main seat was at Styraburg, or modern Steyr (Oberösterreich). In 1180 the entire area became the duchy of Steiermark, or Styria, which passed to the Babenberg duke of Austria in 1192 until the extinction of the Babenberg line in 1246. In 1276 most of the area was ceded to the Habsburgs, and it became a crown land in 1282. Thereafter, its history was merged with that of Austria, although it was ruled only by junior branches of the House of Habsburg from 1379 to 1439 and from 1564 to 1619. After World War I, 2,329 sq mi of southern Steiermark, including Marburg (Maribor), Cilli (Celje), and Pettau (Ptuj), were ceded to Yugoslavia. Steiermark has been a *Bundesland* ever since, except for the years 1938–45 when most of it formed a *Reichsgau* (party district) under the *Anschluss*, or incorporation into Germany.

Ethnically, Steiermark is German. Most inhabitants are Roman Catholic. Ancient folklore, song, and dance are preserved in the mountainous areas and the gray-green Steiermark suit is almost an Austrian national costume. The principal urban centres are Graz, the capital, Leoben, Kapfenberg, Bruck, Eisenerz, Knittelfeld, Köflach, Mürzzuschlag, and Fohnsdorf.

Steiermark's economic development has always been determined by its mineral resources. The Erzberg near Eisenerz supplies most of Austria's iron ore and has been mined since Celtic times. Brown coal (lignite) is mined at Fohnsdorf and Köflach and magnesite in the Shale Alps. It also produces sizable amounts of graphite, talc, gypsum, and salt. Thermoelectricity, based on brown coal, is generated, and there are hydroelectric plants on the Mur and other rivers. Heavy industry is concentrated in the Mur Valley below Fohnsdorf and in the Mürz Valley. Metal and machine industries, sawmills, and paper and cellulose industries are important; chemicals, textiles, leather, and food products are also manufactured. Agriculture employs more than 40 percent of the working population; livestock raising is widespread, and corn (maize) and fruit are cultivated in the southeast. There is a significant tourist trade, based on numerous mountain resorts. Pop. (1991) 1,184,593.

**Steiger, Niklaus Friedrich von** (b. May 17, 1729, Bern—d. Dec. 3, 1799, Augsburg, Ger.), Swiss statesman, *Schultheiss* (chief magistrate) of the canton of Bern, and the most prominent political figure during the last years of the old Swiss Confederation.

From a Bernese patrician family, Steiger was dispatched to Halle in Germany and Utrecht, Neth., for his education, eventually returning to Bern in 1754. Thereafter, he held several minor government offices, served as cantonal emissary to Neuchâtel, Aarau, and Geneva, and finally was elected *Schultheiss* of Bern (1787), a position he retained until the fall of the confederation in 1798.

A bitter enemy of the French Revolution, Steiger headed the Swiss party that favoured resistance against the French Revolutionary armies, for which purpose he allowed English, Spanish, and Sardinian recruitment of Swiss mercenaries in 1793 and 1795. The French defeat of the Bernese at Grauholz, Switz. (March 5, 1798), ensured the demise of the confederation, and he fled to Bavaria. In exile he continued to lead a party of Swiss émigrés in plotting the overthrow, with Austrian support, of the French-protected Helvetic Republic and the restoration of the old confederation.

**Stein, Sir (Mark) Aurel** (b. Nov. 26, 1862, Budapest—d. Oct. 26, 1943, Kābul, Afg.), Hungarian–British archaeologist and geographer whose travels and research in central Asia, particularly in Chinese Turkistan, revealed much about its strategic role in history.

Principal of the Oriental College, Lahore, Punjab, India (now in Pakistan; 1888–99), in 1892 he published his Sanskrit edition of the only known surviving ancient Indian historical work, the 12th-century *Rājataraṅgiṇī* by Kalhaṇa. His English translation, *A Chronicle of the Kings of Kaśmīr*, followed in 1900.

In that year he began the first of his central Asian expeditions, travelling through westernmost China to Khotan. In the course of this and three other expeditions (1906–08, 1913–16, and 1930), he traced the ancient caravan routes between China and the West, made valuable geographical observations on little-known regions, and collected many documents and artifacts, from Neolithic stone tools to 8th-century-AD grave findings and textiles. Near Tan Huang he discovered the Cave of the Thousand Buddhas, which, with its extraordinary assemblage of paintings, temple banners, and documents, had been walled up since the 11th century. Many of the treasures he found are in the Asian Antiquities Museum, New Delhi. The results of his work of this period were published in *Ancient Khotan,* 2 vol. (1907), *Serindia,* 5 vol. (1921), and *Innermost Asia,* 4 vol. (1928).



Sir Aurel Stein

By courtesy of the Royal Geographical Society, London

Superintendent of the Indian Archaeological Survey (1910–29), Stein was also interested in Greco-Buddhist remains and in tracing Alexander the Great's eastern campaigns. In 1926, at Pir Sarāi, near the Indus River, he identified the site of Alexander's storming of the nearly impregnable Rock of Aornos. Other studies of his added to precise knowledge of Alexander's movements in Asia. In an effort to elucidate the relationship between Mesopotamian and Indus civilizations, Stein investigated ancient mounds in Iran and Baluchistan. He also carried out an aerial photographic reconnaissance of the Roman frontiers in Iraq. Near his 81st birthday, his long-standing wish to explore in Afghanistan was granted, but he died there before he could commence his work. A British subject from 1904, he was knighted in 1912.

**Stein, Charlotte von,** *née* VON SCHARDT (b. Dec. 25, 1742, Eisenach, Saxe-Weimar—d. Jan. 6, 1827, Weimar), German writer and an intimate friend of and important influence on Goethe; she was the inspiration for the female figures Iphigenie in *Iphigenie auf Tauris* and Natalie in *Wilhelm Meister.* She remained for Goethe an unattainable feminine ideal and should not be confused with the warm and simple Lotte, heroine of *The Sorrows of Young Werther,* who was inspired by Goethe's earlier attachment to Charlotte Buff.



Charlotte von Stein, detail of an engraving after a portrait by Karl, Freiherr von Imhoff; in a private collection

Historia-Photo

The eldest daughter of the Weimar master of the court ceremonies, Stein became lady in waiting to the duchess Anna Amalia (1758), subsequently marrying Friedrich, Freiherr von Stein (1764), equerry to Duke Karl August of Saxe-Weimar. On Goethe's arrival in Weimar (1775) an intimate friendship began, and the ensuing *Seelenbund* ("union of souls") was of considerable influence on Goethe's life and work; Goethe's letters and poems to Frau von Stein demonstrate their close attachment. After Goethe's return from Italy (1788), his relations with Christiane Vulpius, whom he later married, resulted in a complete break in the friendship.

Stein's own works include *Rino* (1776), a small humorous piece on Goethe and ladies

of the court, and a prose tragedy *Dido* (1792; published 1867), a work containing many allusions to her break with him.

**Stein, Edith,** original name of BLESSED TERESA BENEDICTA OF THE CROSS, Latin, BEATA TERESIA BENEDICTA A CRUCE (b. Oct. 12, 1891, Breslau, Ger. [now Wrocław, Pol.]—d. Aug. 9/10, 1942, Auschwitz, Pol.), Roman Catholic convert from Judaism, Carmelite



Edith Stein
Archiv für Kunst und Geschichte, Berlin

nun, philosopher, and spiritual writer who was executed by the Nazis because of her Jewish ancestry and who is regarded as a modern martyr.

Born into an Orthodox Jewish family, Stein renounced her faith in 1904 and became an atheist. As a student at the University of Göttingen, she became acquainted with Edmund Husserl and became interested in his philosophy, phenomenology, which sought to describe phenomena as consciously experienced, without employing theories about their causal explanation. Also at Göttingen, she first came into contact with Roman Catholicism. When Husserl moved to the University of Freiburg, he asked Stein to join him there as his assistant: she received her doctorate in philosophy (1916), became a member of the faculty, and established a reputation as one of the university's leading philosophers.

Attracted to Roman Catholicism, Stein returned on a vacation in 1921 to Breslau, where her profound encounter with the autobiography of the mystic St. Teresa of Avila caused her swift conversion. She was baptized on Jan. 1, 1922, and gave up her assistantship with Husserl to teach (1922–32) at a Dominican girls' school in Speyer. While at Speyer she translated St. Thomas Aquinas' *De veritate* ("On Truth") and familiarized herself with Roman Catholic philosophy in general.

In 1932 she became a lecturer at the Institute for Pedagogy at Münster but, because of anti-Semitic legislation passed by the Nazi government, was forced to resign the post the following year. In 1934 she entered the Carmelite convent at Cologne, taking the religious name Teresa Benedicta of the Cross, after the mystic who had inspired her conversion. There she completed her metaphysical work *Endliches und ewiges Sein* ("Finite and Eternal Being"), an attempt to synthesize the diverse philosophies of Aquinas and Husserl. Other philosophical and spiritual works followed. In 1938, with the Nazi threat growing, she was transferred to the Carmelite convent at Echt in The Netherlands, where it was thought she would be safe from persecution. There she wrote her important treatise *Studie über Joannes a Cruce: Kreuzeswissenschaft* (1950; *The Science of the Cross*), a phenomenological study of St. John of the Cross.

Removal from Germany, however, proved insufficient to ensure her safety. The condemnation of Nazi anti-Semitism by the Dutch bishops of occupied Holland (July 26, 1942) provoked Adolf Hitler to order the arrest of all non-Aryan Roman Catholics. With her sister Rosa, also a convert, Teresa Benedicta was seized by the Gestapo and shipped to the concentration camp at Auschwitz. Survivors of the death camp testified that she helped all other sufferers with great compassion. She was sent to the gas chamber, where she died with her sister.

The Edith Stein Guild for aiding converts was founded (1955) in the United States, and the Archivum Carmelitanum Edith Stein was established at Louvain, Belg., for the study and publication of her works. On May 1, 1987, she was beatified by Pope John Paul II.

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**Stein, Gertrude** (b. Feb. 3, 1874, Allegheny, Pa., U.S.—d. July 27, 1946, Paris), avant-garde American writer, eccentric, and self-styled genius, whose Paris home was a salon for the leading artists and writers of the period between World Wars I and II.

Stein spent her infancy in Vienna and Paris and her girlhood in Oakland, Calif. At Radcliffe College she studied psychology with the philosopher William James. After further study at Johns Hopkins medical school she went to Paris, where she was able to live by private means. From 1903 to 1912 she lived with her brother Leo, who became an accomplished art critic; thereafter she lived with her lifelong companion Alice B. Toklas (1877–1967).



Gertrude Stein, oil painting by Pablo Picasso, about 1906; in the Metropolitan Museum of Art, New York City
By courtesy of the Metropolitan Museum of Art, New York City, bequest of Gertrude Stein, 1946

Stein and her brother were among the first collectors of works by the Cubists and other experimental painters of the period, such as Pablo Picasso (who painted her portrait), Henri Matisse, and Georges Braque, several of whom became her friends. At her salon they mingled with expatriate American writers, such as Sherwood Anderson and Ernest Hemingway, and other visitors drawn by her literary reputation. Her literary and artistic judgments were revered, and her chance remarks could make or destroy reputations. In her own work, she attempted to parallel the theories of Cubism, specifically in her concentration on the illumination of the present moment and her use of slightly varied repetitions and extreme simplification and fragmentation. The best explanation of her theory of writing is found in the essay *Composition and Explanation*, which is based on lectures that she gave at the universities of Oxford and Cambridge and was issued as a book in 1926. Among her work that was most thoroughly influenced by Cubism is *Tender Buttons* (1914), which carries fragmentation and abstraction beyond the borders of intelligibility.

Her first published book, *Three Lives* (1909), the stories of three working-class women, has been called a minor masterpiece. *The Making of Americans*, a long composition written in 1906–08 but not published until 1925, was too convoluted and obscure for general readers, for whom she remained essentially the author of such lines as "A rose is a rose is a rose is a rose." Her only book to reach a wide public was *The Autobiography of Alice B. Toklas* (1933), actually Stein's own autobiography. The performance in the United States of her *Four Saints in Three Acts* (1934), which the composer Virgil Thomson had made into an opera, led to a triumphal American lecture tour in 1934–35. Thomson also wrote the music for her second opera, *The Mother of Us All* (published 1947), based on the life of feminist Susan B. Anthony.

Stein became a legend in Paris, especially after surviving the German occupation of France and befriending the many young American servicemen who visited her. She wrote about these soldiers in *Brewsie and Willie* (1946).

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**Stein, Johann Andreas** (b. May 6, 1728, Heidesheim, Speyer [Germany]—d. Feb. 29, 1792, Augsburg, Bavaria [Germany]), German piano builder, and also a maker of organs and harpsichords, who was the first of a distinguished family of piano makers.

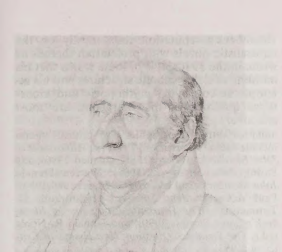
The son of an organ builder, Stein apprenticed with the famous instrument maker Johann Andreas Silbermann in 1748–49. For a time he evidently lived in Paris, but he was most active in Augsburg, where he was a church organist as well as an instrument maker.

W.A. Mozart in 1777 enthusiastically described a Stein piano on which he had played. Among its features were knee levers for raising the dampers (the function of the far right pedal on modern pianos) and a cleverly devised and sensitive mechanism for setting the hammers in motion (escapement action). After about 1770 Stein's action, or key mechanism, was widely copied in Germany and became the model for the Viennese action. Several of his pianos have been preserved in museums and by private owners.

After Stein's death his daughter Maria Anna (Nannette; 1769–1833) and son Matthäus Andreas (1776–1842) continued his business; Matthäus began working independently in 1802. Nannette, who was a talented pianist, moved with her husband, the noted pianist Johann Andreas Streicher, to Vienna. Stein's son Friedrich (1784–1809) was an excellent pianist.

Matthäus' son Karl Andreas (1797–1863) was widely known as a pianist, teacher, composer, and piano maker to the court in Vienna. Nannette's son Johann Baptist Streicher became the head of a family of musicians and piano makers that continued into the 20th century.

**Stein, (Heinrich Friedrich) Karl, Reichsfreiherr vom und zum** (imperial baron of) (b. Oct. 26, 1757, Nassau an der Lahn, Nassau [Germany]—d. June 29, 1831, Schloss Cappenberg, Westphalia [Germany]), Rhinelander-born Prussian statesman, chief minister of Prussia (1807–08), and personal counselor to the Russian tsar Alexander I (1812–15). He sponsored widespread reforms in Prussia during the Napoleonic Wars and influenced the formation of the last European coalition against Napoleon.



Karl vom Stein, portrait by Friedrich Olivier, 1820

By courtesy of the Stadelsches Kunstinstitut, Frankfurt/M.

*Childhood and youth.* Stein was born into a family of the imperial nobility. His father, although a Protestant, was chamberlain to the Catholic elector and archbishop of Mainz. Karl Stein's ancestral tradition, as he himself declared, imbued him with "ideas of piety, patriotism, class and family honour, and the duty of devoting one's life to the community's needs and of acquiring the necessary proficiency for such purposes by diligence and effort." He grew up to feel a strong attachment to the old German Reich and to the imperial dynasty of the Habsburgs and a fervent German patriotism.

His parents wished him to become a judge at one of the imperial courts of the old German empire, and in 1773 he was accordingly sent to study law at the University of Göttingen. Stein studied not only law but statistics, economics, and history as well. From his readings in early German history, in English literature and constitutional theory, and in the works of Montesquieu, he received impressions that were to be of significance for his later activity as a statesman.

*Influence of August Rehberg.* August Wilhelm Rehberg, whom he met in Göttingen, became a close friend and exercised a greater influence on Stein than did any of his academic teachers. Rehberg was a political thinker who advocated a liberal–conservative policy to preserve the old where it had proved itself and to make reforms where conditions demanded them. It was in the constant exchange of ideas with Rehberg that Stein developed his own reform ideas in the quarter century between 1775 and 1800. He attempted to find a middle way between revolution and absolutism that could unite tradition and progress.

In 1777 Stein left the university and used the next three years to study the legal procedures of the institutional organs of the Reich, namely the Imperial Chamber at Wetzlar, the Imperial Court Council in Vienna, and the Reichstag, or Diet, of the empire at Regensburg. In the course of his work he decided against joining the imperial service and to enter the Prussian civil administration instead. In 1780, through his friendship with Friedrich Anton von Heinitz, the Prussian minister of mines, he obtained a suitable post.

*Career as Prussian civil servant.* Stein began his career in the department of mines and factories, at first stationed for some years in Berlin, then for a long period in Prussian Westphalia. His work in the direction of mining enterprises and in the provincial administration of Westphalia made Stein an expert in the practical detail of local government. In 1796 he was appointed head of all the Rhenish and Westphalian administrative districts; and in 1802–03 he was entrusted with the administrative execution of the merging of the secularized bishoprics of Münster and Paderborn into the Prussian state. In his work as an administrator, Stein was content and highly successful: he improved the road network, made the rivers navigable, promoted textile production, and reformed the system of tax collection.

In 1793 he married the countess Wilhelmine Wallmoden. She was the daughter of a Hanoverian general and a granddaughter of England's king George II, through one of his mistresses, the Countess of Yarmouth. During the first years of their marriage, Stein felt that his wife did not appreciate his way of life and his goals. As the years passed, however, he became increasingly respectful of his wife's character and abilities. Together they devoted themselves to the education of their two daughters. During Stein's long periods of separation from his family in the years 1807–15, his wife took care of his estates, executed his commissions, and brought up the children. Stein outlived her by 12 years.

*Achievements as minister and prime minister.* On Oct. 27, 1804, Stein was summoned to Berlin to be minister for manufactures and excise (*i.e.*, for economic affairs). In this capacity he obtained an insight into the working of the central offices of the government, which moreover convinced him of the need for reform. Because of a momentary altercation with King Frederick William III, who rejected his demands for a ministerial system free of interference from the king's personal Cabinet, Stein was dismissed from office on Jan. 3, 1807, in the interval between the defeat of the Prussians by the French at Jena and Auerstädt (October 1806) and the Peace of Tilsit (July 1807).

Returning to his ancestral castle in March 1807, Stein used his enforced leisure to compose the now famous Nassau Memorandum (*Nassauer Denkschrift*). A comprehensive program for the reform of the Prussian state, this memorandum constitutes the best and most reliable account of Stein's ideas. His basic principle is that, for a healthy and efficient state, an organic relationship must be established between population and government and that citizens must be brought into responsible participation in the state's affairs. This perspective had long been developed, formulated, and modified in his mind through his preoccupation with the English system of self-government, and experience had further enriched and reinforced it. Seeking to give new life to the state from within, Stein hoped that the practice of self-government would generate "civic-mindedness" (*Bürgersinn*) and "community spirit" (*Gemeingeist*) in the populace, so that they would adopt the state's interests as their own.

Under the Peace of Tilsit, which mutilated the Prussian state, Frederick William III had to dismiss his minister Karl von Hardenberg at Napoleon's behest. He then invited Stein to be his chief minister, on Napoleon's recommendation. Stein arrived at Memel on Sept. 30, 1807, and after interviews with the King his new appointment was confirmed (October 4). Confronted with the extraordinary situation of Prussia, the single-minded, uncompromising, self-confident Stein saw the opportunity for fundamental reform. The old system of the state was quite obviously discredited; even the otherwise irresolute King could see that it was high time to put Prussia on a more up-to-date footing. Furthermore, Napoleon's demands on Prussia themselves necessitated incisive measures affecting the internal system. Last but not least, some of the liberally inclined members of the bureaucracy were ready to collaborate with Stein.

Thus, from the earliest days of his tenure of office, Stein could launch his reform. On Oct. 9, 1807, a law was published "concerning the Emancipated Possession and the Free Use of Landed Property as well as the Personal Relationships of the Inhabitants," which freed the peasants from servitude. Though it did not furnish a satisfactory solution to a number of problems (foremost among them being that of the gradual transfer of economically exploited land to peasant ownership), this October Edict was a decisive step in the conversion of Prussia to civil liberty and to equality before the law. No less revolutionary were the economic implications: land, which nobles had been forbidden to sell to nonnobles, could henceforth be bought and sold freely, and men were free to follow the vocation of their own choosing.

Stein's Municipal Ordinance (*Städteordnung*) of Nov. 19, 1808, was of lasting importance. It introduced self-government for the urban communes, created the distinction between the salaried executive officials (mayor and magistrate) and the town councils, and so enabled the towns to deal with their local affairs largely through their own citizenry. Even so, the greater towns were put under the supervision of a police president directly responsible to the minister of the interior. Stein's ordinance pointed the way to the development of municipal life throughout Germany.

Stein effectively modernized the structure of the Prussian government as a whole. The irresponsible advisers of the absolute king, namely the so-called Cabinet councillors, who had hitherto formed a sort of secret government behind the scenes, were discarded and so also was the "General Directory," which had been set up as the central authority in Frederick William I's reign. In its place Stein established departmental ministries (foreign affairs, internal affairs, finance, justice, and war) with unified competence for the whole Prussian territory. On the same principle he organized the activities of the intermediate administrations (*Regierungen*) and created the post of *Oberpräsident*, or official head of a whole province, directly responsible for it to the central government. Stein pursued his many-sided tasks with passionate determination, but much of his plan remained unexecuted. His schemes for agrarian and economic reform were taken up by Hardenberg from 1810 onward; but the latter applied them in a spirit more akin to that of the Enlightenment than to Stein's conservative sort of liberalism and without Stein's educative, ethicopolitical concern.

*Last years.* In August 1808 a letter in which Stein indiscreetly referred to the likelihood of war against France was intercepted by Napoleon's agents; and on November 24, yielding to French pressure, Frederick William dismissed him from office. Next, when Napoleon had declared him a public enemy (December 16), Stein had to take refuge on Austrian territory. In May 1812 he was summoned to the court of the Russian emperor Alexander I to be one of his political advisers. In the following winter, on the collapse of Napoleon's invasion of Russia, Stein urged the pursuit of the retreating French Army beyond the Russian frontiers; and early in 1813 he not only helped to organize the raising of troops in East Prussia but also negotiated the Russo-Prussian Treaty of Kalisz, the formal signal for Prussia's rising against Napoleon. He used his moral authority, during the War of Liberation and the Congress of Vienna, to work for a political union of the German states.

In 1816 Stein retired to his country property of Kappenberg in Westphalia. Even in his old age his energy did not desert him. German historical science, in fact, owes to Stein's efforts its most important enterprise of publishing. The Gesellschaft für ältere deutsche Geschichtskunde (Society for Earlier German History) was founded on Jan. 20, 1819, at his house in Frankfurt am Main, with him as its head and its coordinating force. The Gesellschaft has remained the most important organization for the publication of source materials on German medieval history. The

publication of the great documentary series *Monumenta Germaniae Historica,* which began in 1826, became the particular occupation of Stein's last years. As he himself said, he called the *Monumenta* into being "in order to give life to the savour of German history, to facilitate the study of its foundations, and thereby to contribute to the preservation of love of the common fatherland."

Stein was the greatest statesman concerned with Prussia's internal affairs since Frederick William I. He introduced liberal and constitutional elements into the absolutist state and, by his example and influence, made participation in public life a moral postulate.

(E.W.Z.)

**Stein, William H.,** in full WILLIAM HOWARD STEIN (b. June 25, 1911, New York, N.Y., U.S.—d. Feb. 2, 1980, New York), American biochemist who, along with Stanford Moore and Christian B. Anfinsen, was a cowinner of the Nobel Prize for Chemistry for 1972 for their studies of the composition and functioning of the pancreatic enzyme ribonuclease.

Stein received his Ph.D. degree from the Columbia College of Physicians and Surgeons, New York City, in 1938. In that year he joined the staff of the Rockefeller Institute for Medical Research (now Rockefeller University), also in New York City. He was promoted to a professorship there in 1954. With Moore, who was his colleague at the Rockefeller Institute, Stein between 1949 and 1963 deciphered how ribonuclease catalyzes the digestion of food. The two men developed methods for the analysis of amino acids and peptides obtained from proteins, and then they applied those procedures to determine the structure of ribonuclease. The same year they were awarded the Nobel Prize, Stein and Moore worked out the complete sequence of deoxyribonuclease, a molecule twice as complex as ribonuclease.

**Stein-Leventhal syndrome,** also called POLYCYSTIC OVARY SYNDROME, endocrine disorder in women that is characterized by an elevated level of male hormones (androgens) and an absence of ovulation (anovulation). It is one of the most common hormonal disorders and is responsible for a substantial proportion of cases of female infertility.

Additional symptoms include hirsutism and acne, which result from high androgen levels. Anovulation may manifest as irregular or absent menses, excessive bleeding, and infertility. Another common feature is obesity. Usually, but not always, the ovaries are enlarged and contain many follicular cysts. The disease usually begins in puberty, but because symptoms can be mild the disease is often not diagnosed until a woman is unable to conceive. Affected individuals exhibit a wide variety of signs and symptoms, and for this reason some authorities think the syndrome is not one but several different syndromes.

Excessive androgen secretion, which chronically stimulates estrogen production and disrupts the monthly menstrual cycle, is responsible for the development of the disease. The site of androgen overproduction may vary, but the ovaries are thought to be the main source of the hormones. The underlying cause of androgen overproduction by the ovaries is not fully understood.

Treatment of the disease attempts to curtail excess androgen production. Hirsutism in women who do not wish to become pregnant can be treated with oral contraceptives. Infertility usually is treated with clomiphene citrate, which induces ovulation, but laparoscopic surgery is sometimes used.

**Steinamanger** (Hungary): *see* Szombathely.

**Steinbeck, John,** in full JOHN ERNST STEINBECK (b. Feb. 27, 1902, Salinas, Calif., U.S.—d. Dec. 20, 1968, New York, N.Y.), American novelist, best known for *The Grapes of Wrath* (1939), which summed up the bitterness of the Great Depression decade and aroused widespread sympathy for the plight of migratory farm workers. He received the Nobel Prize for Literature for 1962.

Steinbeck attended Stanford University, Stanford, Calif., intermittently between 1920 and 1926 but did not take a degree. Before his books attained success, he spent considerable time supporting himself as a manual laborer while writing, and his experiences lent authenticity to his depictions of the lives of the workers in his stories. He spent much of his life in Monterey county, Calif., which later was the setting of some of his fiction.

Steinbeck's first novel, *Cup of Gold* (1929), was followed by *The Pastures of Heaven* (1932) and *To a God Unknown* (1933), none of which were successful. He first achieved popularity with *Tortilla Flat* (1935), an affectionately told story of Mexican-Americans. The mood of gentle humour turned to one of unrelenting grimness in his next novel, *In Dubious Battle* (1936), a classic account of a strike by agricultural labourers and a pair of Marxist labour organizers who engineer it. The novella *Of Mice and Men* (1937), which also appeared in play and film versions, is a tragic story about the strange, complex bond between two migrant labourers. *The Grapes of Wrath* won a Pulitzer Prize and a National Book Award and was made into a notable film in 1940. The novel is about the migration of a dispossessed family from the Oklahoma Dust Bowl to California and describes their subsequent exploitation by a ruthless system of agricultural economics.

After the best-selling success of *The Grapes of Wrath,* Steinbeck went to Mexico to collect marine life with the freelance biologist Edward F. Ricketts, and the two men collaborated in writing *Sea of Cortez* (1941), a study of the fauna of the Gulf of California. During World War II Steinbeck wrote some effective pieces of government propaganda,



Steinbeck
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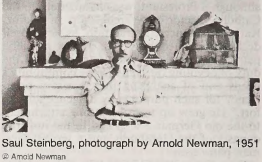
among them *The Moon Is Down* (1942), a novel of Norwegians under the Nazis, and he also served as a war correspondent. His immediate postwar work—*Cannery Row* (1945), *The Pearl* (1947), *The Wayward Bus* (1947)—contained the familiar elements of his social criticism but were more relaxed in approach and sentimental in tone.

Steinbeck's later writings were comparatively slight works of entertainment and journalism interspersed with three conscientious attempts to reassert his stature as a major novelist: *Burning Bright* (1950), *East of Eden* (1952), and *The Winter of Our Discontent* (1961). In critical opinion, none equaled his earlier achievement. *East of Eden,* an ambitious epic about the moral relations between a California farmer and his two sons, was made into a film in 1955. Steinbeck himself wrote the scripts for the film versions of his stories *The Pearl* (1948) and *The Red Pony* (1949). Outstanding among the scripts he wrote directly for motion pictures were *Forgotten Village* (1941) and *Viva Zapata!* (1952).

Steinbeck's reputation rests mostly on the naturalistic novels with proletarian themes he wrote in the 1930s; it is in these works that his building of rich symbolic structures and his attempts at conveying mythopoeic and archetypal qualities in his characters are most effective.

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**Steinberg, Saul,** original name SAUL JACOBSON (b. June 15, 1914, Râmnicu Sărat, Rom.—d. May 12, 1998, New York, N.Y., U.S.), Romanian-born American cartoonist and illustrator, best known for his line drawings that suggest elaborate, eclectic doodlings.



Saul Steinberg, photograph by Arnold Newman, 1951
© Arnold Newman

Steinberg studied sociology and psychology at the University of Bucharest and architecture in Milan. From 1936 to 1939 he published his cartoons in Italian magazines. Settling in New York City in 1942, Steinberg worked as a freelance artist, cartoonist, and illustrator, mainly for *The New Yorker* magazine, and exhibited his drawings in Paris, New York City, and other cities. Steinberg's subject matter ranges from the whimsical (*e.g.,* a wicker chair overtaken by its curlicues) to the satirical (sinister, overgrown gadgets) to the philosophical (a tiny figure perched on a giant question mark balanced at the edge of an abyss).

**Steinberg, William,** original name HANS WILHELM STEINBERG (b. Aug. 1, 1899, Cologne, Ger.—d. May 16, 1978, New York, N.Y., U.S.), German-born American conductor who directed the Pittsburgh Symphony from 1952 to 1976.

Steinberg worked as an apprentice under Otto Klemperer at the Cologne Opera and in 1924 became principal conductor there. He conducted opera at Prague (1925–29) and Frankfurt-am-Main (1929–33) before he founded, with Bronislaw Huberman, the Palestine Symphony (later the Israel Philharmonic) in 1936.

In 1938 Steinberg went to the United States. He became assistant to Arturo Toscanini at the NBC Symphony. In addition to conducting the Pittsburgh Symphony, Steinberg concurrently served as music director of the London Philharmonic (1958–60) and later of the Boston Symphony (1969–72). He retired as music director of the Pittsburgh Symphony in 1976 after building it into one of the strongest musical institutions in the United States.

**Steinberger, Jack** (b. May 25, 1921, Bad Kissingen, Ger.), German-born American physicist who, along with Leon M. Lederman and Melvin Schwartz, was awarded the Nobel Prize for Physics in 1988 for their joint discoveries concerning neutrinos.

Steinberger immigrated to the United States in 1934. He studied physics at the University of Chicago, receiving his Ph.D. there in 1948. He was a professor of physics at Columbia University, New York City, from 1950 to 1971, and from 1968 he was a physicist at the

European Organization for Nuclear Research (CERN) in Geneva, Switz.

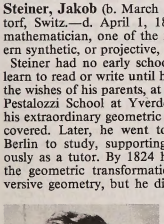
In the early 1960s Steinberger, along with his Columbia University colleagues Lederman and Schwartz, devised a landmark experiment in particle physics using the accelerator at the Brookhaven National Laboratory, N.Y. The three reseachers obtained the first laboratory-made stream of neutrinos—subatomic particles that have no electric charge and virtually no mass. In the process, they discovered a new type of neutrino called a muon neutrino. The high-energy neutrino beams that the three researchers produced became a basic research tool in the study of subatomic particles and nuclear forces. In particular, the use of such beams made possible the study of radioactive-decay processes involving the weak nuclear force, or weak interaction, one of the four fundamental forces in nature.

**Steinem, Gloria** (b. March 25, 1934, Toledo, Ohio, U.S.), American feminist, political activist, and editor, an articulate advocate of the women's liberation movement during the late 20th century.

Steinem graduated from Smith College in 1956 and began publishing freelance articles in newspapers while studying in India. In 1960 she began working as a writer and journalist in New York City, and she became deeply involved in the women's liberation movement in the late 1960s. In 1971 she was one of the founders of the National Women's Political Caucus, which encouraged women to run for political office, and in 1972 she founded and served as editor of *Ms.*, a trendsetting magazine that treated contemporary issues from the perspective of the feminist movement. In the 1970s and '80s she founded other politically active women's organizations. Her books include *Revolution from Within* (1992) and *Moving Beyond Words* (1994), and a collection of essays, *Outrageous Acts and Everyday Rebellions* (1983).

**Steiner, Jakob** (b. March 18, 1796, Utzenstorf, Switz.—d. April 1, 1863, Bern), Swiss mathematician, one of the founders of modern synthetic, or projective, geometry.

Steiner had no early schooling and did not learn to read or write until he was 14. Against the wishes of his parents, at 18 he went to the Pestalozzi School at Yverdon, Switz., where his extraordinary geometric intuition was discovered. Later, he went to Heidelberg and Berlin to study, supporting himself precariously as a tutor. By 1824 he had discovered the geometric transformation known as inversive geometry, but he did not publish his



Jakob Steiner, detail of a portrait after a painting by Niklaus Senn, *c.* 1850; in the University of Zürich

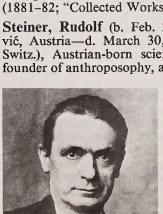
By courtesy of PRO HELVETIA, Zurich

work. The founding of August Crelle's *Journal* (1826) gave him an opportunity to publish some of his other geometric discoveries, and in 1832 he received an honorary doctorate from the University of Königsberg. Two years later he occupied the chair of geometry established for him at the University of Berlin, a post he held until his death.

Steiner's *Systematische Entwickelung der Abhängigkeit geometrischer Gestalten von Einander* (1832; "Systematic Development of the Dependency of Geometric Forms on One Another") includes a thorough discussion of the principle of duality, which states that, in projective geometry, if one of two dual theories is true, the other is also true. He had an extreme dislike for the use of algebra and analysis and often expressed the opinion that calculation replaces thinking, whereas pure geometry stimulates thinking. Using only synthetic methods, he proved that a surface of the third order contains only 27 lines, a theorem that would appear to depend on analysis for proof.

Steiner was considered the greatest geometer since Apollonius of Perga (*c.* 262–190 BC), and he produced works that are considered the classical authority on synthetic geometry. He contributed many basic concepts and results in projective geometry and discovered the Steiner surface (also known as the Roman surface), which has a double infinity of conic sections on it. He also developed the Steiner theorem, which holds that the two pencils (collections of geometric objects) by which a conic is projected from two of its points are projectively related, and the Poncelet-Steiner theorem, which demonstrates that only one given circle with its centre and a straightedge are needed for any Euclidean construction. His other work was primarily on the properties of algebraic curves and surfaces and maxima and minima. His collected writings were published as *Gesammelte Werke,* 2 vol. (1881–82; "Collected Works").

**Steiner, Rudolf** (b. Feb. 27, 1861, Kraljević, Austria—d. March 30, 1925, Dornach, Switz.), Austrian-born scientist, editor, and founder of anthroposophy, a movement based



Rudolf Steiner, 1916

By courtesy of the Bild-Archiv, Österreichische Nationalbibliothek, Vienna

on the notion that there is a spiritual world comprehensible to pure thought but accessible only to the highest faculties of mental knowledge.

Attracted in his youth to the works of Goethe, Steiner edited that poet's scientific works and from 1889 to 1896 worked on the standard edition of his complete works at Weimar. During this period he wrote his *Die Philosophie der Freiheit* (1894; "The Philosophy of Freedom"), then moved to Berlin to edit the literary journal *Magazin für Literatur* and to lecture. Coming gradually to believe in spiritual perception independent of the senses, he called the result of his research "anthroposophy," centring on "knowledge produced by the higher self in man." In 1912 he founded the Anthroposophical Society.

Steiner believed that man once participated more fully in spiritual processes of the world through a dreamlike consciousness but had since become restricted by his attachment to material things. The renewed perception of spiritual things required training the human consciousness to rise above attention to matter. The ability to achieve this goal by an exercise of the intellect is theoretically innate in everyone.

In 1913 at Dornach, near Basel, Switz., Steiner built his first Goetheanum, which he characterized as a "school of spiritual science." After a fire in 1922, it was replaced by another building. The Waldorf School movement, derived from his experiments with the Goetheanum, by 1969 had some 80 schools attended by more than 25,000 children in Europe and the United States. Among Steiner's varied writings are *The Philosophy of Spiritual Activity* (1894), *Occult Science: An Outline* (1913), and *Story of My Life* (1924).

**Steinert, Otto** (b. July 12, 1915, Saarbrücken, Ger.—d. March 3, 1978, Essen-Werden, W.Ger.), German photographer, teacher, and physician, who was the founder of the Fotoform (*q.v.*) movement of postwar German photographers.

Steinert studied medicine at various universities from 1934 to 1939, was a medical officer during World War II, and abandoned medicine for photography in about 1947, becoming a portrait photographer. He taught photography at various schools in Saarbrücken and Essen from 1952, training an entire generation of young German photographers in the process. He was best known as the founder, in 1949, and intellectual mentor of the Fotoform group of photographers, whose innovative images he displayed at the Photokina exhibition in Cologne the following year. He mounted three more highly influential photographic exhibitions (each called Subjektive Fotografie), in 1951, 1954, and 1958, which showcased the entire spectrum of West German photography since World War II. From the 1960s Steinert continued to photograph prominent people, to mount important exhibitions, and to write numerous articles on photography.

**Steingrímur Bjarnason Thorsteinsson:** *see* Thorsteinsson, Steingrímur Bjarnason.

**Steinhart Aquarium,** public aquarium in Golden Gate Park, San Francisco, noted for its innovative displays. The facility was opened in 1923 and is administered by the California Academy of Sciences. Besides having about 5,000 specimens of some 350 species of fish, the aquarium maintains a collection of more than 200 kinds of reptiles and amphibians, along with 3 species of marine mammals and 60 species of marine invertebrates. The facility was remodeled and modernized in 1963 and again in 1977. One innovation is the Fish Roundabout, an enormous circular glass tank that holds open-sea fish species. The viewer stands in an open area on the inside of the glass enclosure so that an illusion of being surrounded by water is achieved. The marine-mammal collection includes the rare Amazonian manatee.

**Steinitz, Wilhelm** (b. May 18, 1836, Prague, Bohemia, Austrian Empire [now in Czech Republic]—d. Aug. 12, 1900, Wards Island, N.Y., U.S.), Austrian chess master who is considered to have been the world champion longer than any other player, winning the championship in 1866 from Adolph Andersen and losing it in 1894 to Emanuel Lasker.

Steinitz learned to play chess from a schoolmate when he was about 12 years old. In 1858 he entered the Polytechnic Institute in Vienna but soon dropped out of school and occupied himself with chess full-time. In 1862 he represented Austria in his first National tournament. Later that year, he moved to England and in 1883 to the United States, where he was finally defeated by Lasker.

A superb defensive player, particularly in his later years, he sought to systematize chess and devoted much time and effort to arguing his theories. Following his defeat by Lasker, Steinitz suffered a nervous breakdown and was hospitalized in Moscow. He recovered for a time but fell ill again and died a pauper.

**Steinkjer,** town and seat of Nord-Trøndelag *fylke* (county), north-central Norway. Located at the head of Beitstad Fjord, an inlet of Trondheims Fjord and situated at the mouth of the By River, the port town was incorporated in 1857 as Steinker, a union of several neighbouring agricultural areas. More than 1,000 farms remain within its limits. It is located on the Nordland Railway, which connects northern Norway with Trondheim. Local industry includes tanneries and woollen mills as well as lumber production. The town was badly damaged during World War II but was rebuilt. Tourist attractions include ancient burial mounds west of the town and salmon fishing. Pop. (1986 est.) mun., 20,480.

**Steinman, David Barnard** (b. June 11, 1886, New York City—d. Aug. 21, 1960, New York City), American engineer whose studies of airflow and wind velocity helped make possible the design of aerodynamically stable bridges.

Steinman's thesis for his Ph.D. from Columbia University (1911) was published as *The Design of the Henry Hudson Memorial Bridge as a Steel Arch,* and more than 20 years later he built the bridge he had planned over the Harlem River. In 1914 he assisted Gustav Lindenthal in the design and construction of the Hell Gate Arch Bridge in New York City and the Sciotoville Bridge over the Ohio River between Ohio and Kentucky. Steinman joined Holton D. Robinson of the U.S. in constructing the Florianópolis Bridge in Brazil, the beginning of a long partnership. That bridge, then the largest in South America, incorporated a new type of stiffening truss and new cable construction.

In 1923 Steinman set up the consulting engineering firm in which he was active for 37 years. For much of the time he was a controversial figure in the engineering profession, notably in the debate following the failure of the Tacoma (Wash.) Narrows Bridge in 1940, which Steinman believed could have been averted.

Steinman designed more than 400 bridges, including the Mackinac Bridge connecting the two parts of Michigan, the Henry Hudson and Triborough bridges in New York City, and the Sydney Harbour Bridge in Australia. He also designed proposed bridges over the Tagus River in Lisbon, over the Straits of Messina to link Sicily with Italy, and over the Bosporus to link Asia with Europe at Istanbul. His books include *Suspension Bridges: The Aerodynamic Problem and Its Solution* (1954); *Miracle Bridge at Mackinac* (1957); and *Bridges and Their Builders,* with Sara Ruth Watson (1941; revised 1957).

**Steinmetz, Charles Proteus,** original name KARL AUGUST RUDOLF STEINMETZ (b. April 9, 1865, Breslau, Prussia—d. Oct. 26, 1923, Schenectady, N.Y., U.S.), German-born American electrical engineer whose ideas on alternating current systems helped inaugurate the electrical era in the United States.

At birth Steinmetz was afflicted with a physical deformity, hunchback, and as a youth he showed an unusual capability in mathematics, physics, and classical literature. On graduating from the gymnasium with honours, he entered the University of Breslau in 1883. There he joined a student socialist club, which was banned by the government after becoming affiliated with the German Social Democrats. When some of his fellow party members were arrested, Steinmetz took over the editorship of the party newspaper, "The People's Voice." One of the articles he wrote was considered inflammatory; the police began a crackdown on the paper, and Steinmetz had to flee Breslau (1888). After a short stay in Zürich he immigrated to the United States in 1889, traveling by steerage. He soon obtained a job with



Steinmetz
By courtesy of Union College, Schenectady, New York

a small electrical firm owned by Rudolf Eickemeyer in Yonkers, N.Y. At about the same time, Steinmetz Americanized his first name to Charles and substituted Proteus, a university nickname, for his two middle names.

Under the tutelage of his employer, Steinmetz became increasingly absorbed in the practical aspects of electrical engineering. He established a small laboratory at the factory, where he did much of his scientific research. Steinmetz' experiments on power losses in the magnetic materials used in electrical machinery led to his first important work, the law of hysteresis. This law deals with the power loss that occurs in all electrical devices when magnetic action is converted to unusable heat. Until that time the power losses in motors, generators, transformers, and other electrically powered machines could be known only after they were built. Once Steinmetz had found the law governing hysteresis loss, engineers could calculate and minimize losses of electric power due to magnetism in their designs before starting the construction of such machines.

In 1892 Steinmetz gave two papers before the American Institute of Electrical Engineers on his new law concerning hysteresis loss. His work was immediately recognized as a classic by the few who understood it, and the constant he calculated for this loss has remained a part of electrical engineering vocabulary. Thus, Steinmetz' reputation was assured at the age of 27.

His second contribution was a practical method for making calculations concerning alternating current circuits. This method was an example of using mathematical aids for engineering the design of machinery and power lines, so that the performance of the electrical system could be predicted in advance without the necessity of going through the expensive and uncertain process of building the system first and then testing it for its efficiency. Steinmetz developed a symbolic method of calculating alternating-current phenomena and in so doing simplified an extremely complicated and barely understood field so that the average engineer could work with alternating current. This accomplishment was largely responsible for the rapid progress made in the commercial introduction of alternating-current apparatus.

Steinmetz' method of calculation was presented to an uncomprehending audience at the International Electrical Congress in 1893. His book *Theory and Calculation of Alternating Current Phenomena* (coauthored with Ernst J. Berg in 1897) was read and understood by only a very few. The problem that Steinmetz faced was that electrical engineers were not taught enough mathematics to understand his new mathematical treatment of problems. To educate the electrical engineering profession, he published several textbooks, including *Engineering Mathematics* (1911), and expanded his original 1897 book into three separate volumes. Gradually, through his writing, lecturing, and teaching, his method of calculation was universally adopted in work with alternating currents.

In 1893 the newly formed General Electric Company purchased Eickemeyer's company, primarily for his patents, but Steinmetz was considered one of its major assets. At General Electric, Steinmetz gained an expanded opportunity for research and implementation of his ideas. He was assigned to the new calculating department, the first job of which was to work on the company's proposal for building the generators at the new Niagara Falls power station. In 1894 the General Electric Company transferred its operations to Schenectady, N.Y., and Steinmetz was made head of the calculating department. He at once began to indoctrinate the engineers with his method of calculating alternating-current circuits.

Steinmetz' third major scientific achievement was in the study and theory of electrical transients—that is, changes in electrical circuits of very short duration. A prime example of this phenomenon is lightning, and Steinmetz' investigation of lightning phenomena resulted in his theory of traveling waves and opened the way for his development of devices to protect high-power transmission lines from lightning bolts. In the course of this work he also designed a generator that produced a discharge of 10,000 amperes and more than 100,000 volts, equivalent to a power of more than 1,000,000 horsepower for 1/100,000 of a second. This was his last major project at the General Electric Company, where he had become head of the engineering consulting department.

In his later years Steinmetz also engaged in public affairs to a considerable degree, serving as president of the Board of Education of Schenectady, N.Y., and as president of the city council. He served as president of the American Institute of Electrical Engineers in 1901–02.

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**Steinway, Henry Engelhard,** original name HEINRICH ENGELHARDT STEINWEG (b. Feb. 15, 1797, Wolfshagen, Braunschweig—d. Feb. 7, 1871, New York City), German-born American piano builder and founder of a leading piano manufacturing firm, Steinway and Sons, which remained under family ownership until 1972.

Steinway fought in the Battle of Waterloo (1815) and in 1835 opened a piano business in the duchy of Brunswick; his oldest extant piano is dated 1836. In 1849 he migrated to New York with three sons; he opened his American shop in 1853 and won prizes for numerous innovations. Important among these were the overstrung scale, a design in which the bass strings cross over the higher ones, permitting longer bass strings and improved tone; and an improved cast-iron frame that bore the tension of the strings without twisting as wooden frames tend to do. Steinway's iron frame and overstrung scale were exhibited in a square piano in 1855; his first grand piano was produced in 1856 and the first upright model in 1862.

Henry's son Theodore joined the firm in

1865. The company opened a branch in London in 1875 and in Hamburg in 1880. Both branches and the New York company followed the custom of other piano manufacturers in maintaining small concert halls. The Steinways' further improvements in piano design included methods for improving the action, or key mechanism; redesigning the iron frame and case to allow increased string tension; and strengthening the soundboard.

**stela,** also spelled STELE (Greek: "shaft," or "pillar"), plural STELAE, standing stone slab used in the ancient world primarily as a grave marker but also for dedication, commemoration, and demarcation. Although the origin of



Stela to mark the grave of Theano, Greek, c. 370 BC; in the National Archaeological Museum, Athens

Hirmer Fotoarchiv, München

the stela is unknown, a stone slab, either decorated or undecorated, was commonly used as a tombstone, both in the East and in Grecian lands as early as Mycenae and the Geometric Period (c. 900–c. 700 BC). Dedicatory stelae can be traced through the Late Bronze Age Canaanite religion from miniature stelae at Hagar to immense numbers of stelae found in Carthaginian temples and sanctuaries. When Akhenaton, the heretical pharaoh of Egypt, founded his new capital, he had stelae carved in the cliffs at the edge of the desert to indicate the city limits.

The largest number of stelae were produced in Attica, where they were usually used as grave markers. These were tall and narrow rectangular shafts carved in relief, topped by a cavetto capital (a concave molding) and a sphinx, and usually having a rectangular base. About 530 BC a simpler form of gravestone was adopted, with a somewhat shorter shaft surmounted only by a palmette finial; a single figure was incised into the stone, which was then painted. By the 5th century the shaft was low and wide, with a more crowded composition of perhaps several figures carved in almost three-dimensional relief.

The dead were represented on the grave stelae as they were in life, the men as warriors or athletes, the women surrounded by their children, the children by their pets or toys. There are seldom signs of grief; instead, the figures assume rather static poses and thus emit a dreamlike pathos. The few stelae that do depict sorrow or even death are moving and attest to the Greek sculptors' skill at representing human emotion.

In several areas outside of Greece there exist single important examples of the stela form. From the Akkadian period there is a large stela immortalizing the king Naram-Sin and his victorious army. In the old Babylonian period, Hammurabi's famous law code was engraved on a tall diorite stela; at its top stands Hammurabi, who saw himself as the "good shepherd," facing the sun god Shamash. There is no ritual or action of any kind. Hammurabi simply stands, gesturing with his right arm as if explaining his code to the divine king.

Another famous stela is the Lhasa rdo-ring (Long Stone of Lhasa), which stands in front of the main entrance to the Jo-khang temple in Tibet, regarded as the holiest of holy places and the centre of Tibet. On the stela is inscribed the text of a bilingual Tibetan-Chinese peace treaty of AD 821–822 between the king of Tibet and the emperor of China.

Stelae were also used throughout the Mayan empire. The most celebrated are the massive, elaborate, and highly detailed figurative stelae found at the ancient city of Copán, in what is now Honduras.

**Stella, Frank,** in full FRANK PHILIP STELLA (b. May 12, 1936, Malden, Mass., U.S.), American painter, a leading figure in the Minimal art movement.

Stella studied painting at the Phillips Academy and history at Princeton University (B.A., 1958). He originally painted in an Abstract Expressionist style, but upon moving to New York City in the late 1950s, he began work on a series of innovative paintings marked by an austere and monumental simplicity of design. These "black paintings," which established his reputation, incorporated symmetrical series of thin white stripes that replicated the canvas shape when seen against their black backgrounds. In the early 1960s Stella painted a series of progressively more complex variations on the theme of the frame-determined design and used both metallic-coloured paints and irregularly shaped canvases to this purpose. In the mid-1960s Stella began using polychromy in an influential series of paintings marked by intersecting geometric and curvilinear shapes and plays of vivid and harmonious colours, some of which were fluorescent.

In the late 1970s Stella broke with the hard-edged style of his previous work and began to produce sensuously coloured mixed-media reliefs that featured arabesques, French curves, and other organic shapes.

**Stella, Maria:** *see* Maria Stella.

**stellar association,** a very large, loose grouping of stars that are of similar spectral type and relatively recent origin. Stellar associations are thought to be the birthplaces of most stars.

A brief treatment of stellar associations follows. For full treatment, *see* MACROPAEDIA: Stars and Star Clusters.

The stars in stellar associations are grouped together much more loosely than they are in star clusters of the open and globular types. A star cluster's members are bound together by gravity into a relatively tight configuration, whereas an association simply consists of young stars that have not yet had time to move very far from a common site of formation.

About 90 percent of all stars exist as members of associations. In the Milky Way Galaxy, the largest number of associations are found in the spiral arms of the galaxy and are located less than 10,000 light-years from the Sun. Stellar associations vary in size but tend to be large. Those near the Sun measure roughly 100 to 200 light-years in diameter, while those elsewhere in the galaxy typically extend about 700 light-years across. Stellar associations contain a relatively small number of stars (from about 10 to a few hundred in most cases), and so their total mass amounts to only several hundred or a few thousand solar masses.

Stellar associations are generally classified into three types on the basis of their most prominent components: OB, R, and T associations. OB associations consist largely of very young, massive stars (about 10 to 50 solar masses) of spectral types O and B, which have an absolute luminosity about 100,000 times that of the Sun. In many cases, one or more small open star clusters lie near the centre of such an association.

R associations consist of young, bright stars of intermediate mass (3 to 10 solar masses). Stars in this type of association are surrounded by patches of dust that reflect and absorb light from nebulae, and hence these associations are sometimes called reflection nebulae.

T associations contain mostly T Tauri stars. These are comparatively cool, newly formed stars of low mass (3 or less solar masses) that are still in the process of contraction. Associations of this kind are thought to be the primary source of low-luminosity stars in the vicinity of the Sun.

The stars in stellar associations are typically not more than 10 million years old. Certain stars consume their hydrogen fuel so rapidly that they exhaust it within a million years. The high luminosities of the stars in OB associations suggest that they have such short lifetimes, and according to current astrophysical theory, such stars had to have been created out of interstellar material a very short time ago. Some OB associations, moreover, give evidence of continuing star formation from interstellar clouds within them. A stellar association is thus, in effect, an extremely young group of stars, formed at essentially the same time in the same region of space from a single interstellar cloud. OB associations are places where the most massive stars have formed, while R associations are sites of the birth of intermediate-mass stars and T associations are the birth sites of low-mass stars. Ninety percent of all stars are believed to form in stellar associations, with the remaining 10 percent forming in clusters.

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*Where the same name may denote a person, place, or thing, the articles will be found in that order*

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**Stellarton,** town, Pictou county, northern Nova Scotia, Canada. It lies just south of New Glasgow, along the East River. Coal, discovered there in 1798, was mined continuously until the last mine closed in 1957. One of the world's thickest coal veins—the Foord seam (48 feet [15 m]) in part—was uncovered there. In 1839 *Samson,* the first steam locomotive to operate on steel rails in Canada, began hauling coal between the mines and the river. Another locomotive, *Albion,* put into service in 1854, may still be seen at the Miners' Museum. The town was named for its so-called stellar coal, which emits starlike sparks as it burns. The community was founded as Albion Mines and was incorporated as a town under its present name in 1889. Pop. (1991) 5,237.

**Stellenbosch,** town, Western Cape province, South Africa. It lies east of Cape Town, in the fertile Eerste River valley bordering mountains on the east. Founded in 1679 and named for Governor Simon van der Stel, it is South Africa's next oldest settlement after Cape Town. Stellenbosch is known for its restored Cape Dutch architecture dating from the 18th and 19th centuries and for its streets lined with majestic oaks. Its gardens and parks include the Braak, a square set aside in 1703 as a military parade ground. A centre of Afrikaans culture and learning, the town houses the University of Stellenbosch (incorporated 1918) and affiliated research institutes, libraries, and museums. It is a centre of the fertile vineyards and orchards of the western Cape, as well as of sawmilling. Pop. (1985) 38,602.

**Stelvio Pass,** Italian GIOGO DELLO STELVIO, German STILFSER JOCH, Alpine pass (9,042 feet [2,756 m]) at the northwest base of the Ortles mountain range in northern Italy near the Swiss border. One of the highest road



Trafoi Valley and the Stelvio Pass, Italy
Trus—C.I.R.I.

passes in Europe, it connects the Venosta valley of the upper Adige River to the northeast with the Tellina valley of the upper Adda River to the southwest. The winding road (built 1820–24) affords scenic views of nearby glaciers.

**stem,** in botany, the plant axis that bears buds and shoots with leaves and, at its basal end, roots. The stem is the stalk of a plant or the main trunk of a tree. The stem conducts water, minerals, and food to other parts of the plant; it may also store food, and green stems themselves produce food. In most plants the stem is the major vertical shoot, in some it is inconspicuous, and in others it is modified and resembles other plant parts (*e.g.,* underground stems may look like roots).

The first rudiment of the young stem, or shoot, of an embryonic plant appears from the seed after the root has first protruded. The growing portion at the apex of the shoot is the terminal bud of the plant, and by the continued development of this bud and its adjacent tissues, the stem increases in height. Lateral buds and leaves grow out of the stem at intervals called nodes; the intervals on the stem between the nodes are called internodes. The number of leaves that appear at a node depends on the species of plant; one leaf per node is common, but two or more leaves may grow at the nodes of some species. When a leaf drops off a stem at the end of a growing season, it leaves a scar on the stem because of the severing of the vascular (conducting) bundles that had connected stem and leaf. As the stem continues to grow, lateral buds are produced that develop into lateral shoots more or less resembling the parent stem, and these ultimately determine the branching of the plant. In trees the lateral shoots develop into branches, from which other lateral shoots, called branchlets, or twigs, arise. The point at which a leaf diverges in axis from a stem is called the axil. A bud formed in the axil of a previously formed leaf is called an axillary bud, and it, like the leaves, is produced from the tissues of the stem. During the development of such buds, vascular bundles are formed within them that are continuous with those of the stem.

The primary functions of the stem are to support the leaves; to conduct water and minerals to the leaves, where they can be converted into usable products by photosynthesis; and to transport these products from the leaves to other parts of the plant, including the roots. The stem conducts water and nutrient minerals from their site of absorption in the roots to the leaves by means of certain vascular tissues in the xylem (*q.v.*). The movement of synthesized foods from the leaves to other plant organs occurs chiefly through other vascular tissues in the stem called phloem (*q.v.*). Food and water are also frequently stored in the stem. Examples of food-storing stems include such specialized forms as tubers, rhizomes, and corms and the woody stems of trees and shrubs. Water storage is developed to a high degree in the stems of cacti.

In the stems of young dicotyledons and gymnosperms, the vascular bundles (xylem and phloem) are arranged in a circle around a central core of spongy ground tissue called the pith. Surrounding the vascular bundles is a layer that varies in thickness in different species and is called the cortex. Surrounding this and comprising the exterior surface of the stem is a layer called the epidermis. In plants with woody stems, a variety of secondary tissues are added to these primary tissues. Among the most important of these is a ring of meristematic cells that in turn give rise to the vascular cambium. This tissue arises between the primary xylem and phloem and gives rise to secondary phloem on the outside and secondary xylem on the inside; the latter tissue is the wood of trees.

All green stems carry on the photosynthetic work of the leaves, and in most cacti this function is performed to a predominant degree by the stem. Other plants in which food-making is carried on chiefly by the stem include the asparagus. In perennial plants the short stem may produce new shoots for many years. Plants producing woody stems are called trees and shrubs. The latter produce branches from or near the ground, while the former have conspicuous trunks.

In general, the habit of a stem is erect or ascending, but it may lie prostrate on the ground, as in the sweet potato and strawberry. A stem may climb on rocks or plants by means of rootlets, as in ivy; other vines have twining stems that twist around a supporting plant in a spiral manner, as in the morning-glory, honeysuckle, and hop. In other cases, climbing plants are supported by tendrils that may be specialized stems, as in the grape and passionflower. In tropical climates twining plants often form thick woody stems and are called lianas, while in temperate regions they are generally herbaceous vines. A stolon is a stem that curves toward the ground and, on reaching a moist spot, takes root and forms an upright stem and ultimately a separate plant. Among the subterranean stems are the rhizome, corm, and tuber (*qq.v.*). In some plants the stem does not elongate during its early development but instead forms a short conical structure from which a crown of leaves arises. These may form a bulb, a head, or a rosette.

**stem cell,** a plant or animal cell that is undifferentiated (unspecialized) and that can divide to produce either differentiated cells or new stem cells. In mammals there are two major types of stem cells: embryonic and tissue. Embryonic stem cells exist within the inner cell mass of an embryo early in its development. They are capable of becoming any type of cell in the body. Tissue stem cells (also known as adult stem cells) are present in small numbers in tissues that have a continuous turnover of cells, such as the epidermis of the skin, the epithelium of the small intestine, and bone marrow. Under normal conditions a tissue stem cell can produce cells only of a type found in the specific tissue in which the stem cell occurs.

Tissue stem cells called hematopoietic stem cells are used in bone marrow grafts. They help regenerate the bone marrow destroyed by the radiation therapy or chemotherapy used in treating leukemia, lymphoma, and certain blood disorders. Embryonic stem cells hold promise as a source of differentiated cells that could be used as grafts to treat human diseases such as Parkinson's disease and diabetes. However, because the extraction of stem cells from an embryo kills it, the use of embryonic stem cells is opposed by those who consider an embryo to be a human being.

**Stemann, Poul Christian** (b. April 14, 1764, Copenhagen—d. Nov. 25, 1855, Copenhagen), Danish premier who championed absolute monarchy against the rising tide of liberal reform.

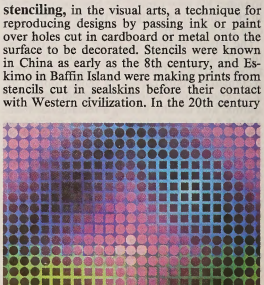
Trained as a lawyer, Stemann was a large landowner who entered government service in the late 1780s and held such posts as prefect of Sorø County. Earning a reputation as a highly competent administrator, he was appointed to the premiership and to other key positions in 1826 and remained an adamant opponent of reform for the next two decades. He was the closest adviser to the absolutist king Frederick VI and was still very influential with his successor, Christian VIII.

Hostile to any concession to the liberals, Stemann was, as a large landowner, particularly opposed to the agrarian and political demands of the peasants. He agreed with the nationalistic urban liberals only on the necessity of incorporating the affiliated Duchy of Schleswig into the Danish state. He resigned his premiership during the nationalistic demonstrations of March 1848, when the king capitulated to demands for a popular ministry.

**Sten gun,** in full STEN SUBMACHINE GUN, 9-millimetre submachine gun that became the standard such weapon in the British Commonwealth armed forces during World War II. Hundreds of thousands of Sten guns were provided to underground movements in Europe during that war. The gun was so ubiquitous that its name became all but a generic term for submachine gun. The Sten gun remained in service until the 1960s.

The most common version of the Sten gun was 30 inches (76.2 cm) long with a barrel of 7.5 inches (19 cm). It fired at a rate of 550 rounds per minute, and it had a 32-round box magazine but tended to jam if more than 30 rounds were loaded. The butt was a steel frame that, with the barrel, could be removed without difficulty so that the disassembled weapon could be easily hidden. Its weight was just over six pounds (2.7 kg) unloaded.

**stenciling,** in the visual arts, a technique for reproducing designs by passing ink or paint over holes cut in cardboard or metal onto the surface to be decorated. Stencils were known in China as early as the 8th century, and Eskimo in Baffin Island were making prints from stencils cut in sealskins before their contact with Western civilization. In the 20th century



Serigraph by Victor Vasarely, 1968, from a suite of eight entitled "Permutations"
By courtesy of Denise Rene, Paris

stencils are used for such diverse purposes as making mimeographs and fine paintings. The Pop-art paintings of the 20th-century American artist Roy Lichtenstein, for example, simulated the dots characteristic of the halftone process of comic-book illustrations by painting over evenly distributed perforations in a thin sheet of metal.

*Pochoir* (French: "stencil"), as distinguished from ordinary stenciling, is a highly refined technique of making fine limited editions of stencil prints. It is often called hand colouring, or hand illustration. The 20th-century artists Pablo Picasso and Joan Miró made prints in this technique for book illustrations.

The major disadvantage of the stencil method is that, although any open design can easily be cut in a stencil, a design enclosing another is impracticable because the middle design drops out. This can be dealt with by using two overlapping half designs. If all parts of the stencil are held together with a web of threads, however, greater freedom will result. A silk screen or a fine wire mesh that permits colour to pass except where the screen is coated, or "stopped," with glue or a similar substance is generally used for this purpose. When applied to mass-produced commercial products, such as fabrics, this process is called silk screen. When an artist designs, makes, and prints his own stencil to produce a fine print, it is called serigraphy and the product is called a serigraph.

Several methods may be used to obtain a stencil on a screen mesh. In the most popular method, called the blockout-, or glue-cutout-, stencil method, those parts of the screen that are to be stopped are filled with water-soluble glue. Lines can be reserved in these parts by drawing with lithographic tusche (a greasy ink) or crayon, which can later be washed out of the glue with turpentine. Another popular method, called the film-stencil method, employs stencils cut from a thin sheet of coloured lacquer laminated to a sheet of glassine paper. The design is cut only through the lacquer layer, and the finished stencil is fixed to the underside of the screen. The glassine paper is then removed from the stencil, and the design is printed. Photographic transfers both in line and halftone can also be fixed to the screen with a light-sensitive emulsion, which is exposed to light through a drawing or a film positive. This method is primarily a reproductive technique, because no original designing is actually done on the screen. Contemporary American painters, including Robert Rauschenberg, Andy Warhol, and Larry Rivers, however, have used photographic silk screen in their works.

Silk-screen printing is done with a liquid ink that is forced through the open screen by the sharp rubber blade of a squeegee. Since most of the inks used for this purpose are opaque, the reproduction of gouache (opaque watercolours) is almost perfect. Transparent colours can also be used, as can water-based colours through screens stopped with plastic.

Silk screens began to be used for noncommercial purposes in 1938, when a group of American artists working with the Federal Art Project experimented with the technique and subsequently formed the National Serigraph Society to promote its use. Serigraphy has been developed by a number of contemporary painters—in France by Victor Vasarely, in Great Britain by Eduardo Paolozzi and Bridget Riley, and in the United States by Jim Dine and Claes Oldenburg.

**Stendal,** city, Saxony-Anhalt *Land* (state), central Germany. It lies along the Uchte River, north of Magdeburg. Stendal was once the capital of the Altmark ("Old March") division of Brandenburg, and its early settlers were Lower Saxons, Wends, Netherlanders, and Rhinelanders. It was given market rights by Margrave Albert I the Bear in 1160 and was chartered in the same year. A residence, until 1309, of the elder line of the Ascanian margraves of Brandenburg, the city prospered from the 13th to the 15th century as a cloth-weaving centre. The 18th-century archaeologist and art critic Johann Winckelmann was born there, and the French novelist Marie-Henri Beyle may have taken his chief pseudonym, Stendhal, from the name of the city. Stendal's medieval and Renaissance buildings include the cathedral (1188), St. Mary's Church (1447), and the town hall. The medieval town gates also survive. Present-day Stendal is a rail junction, and its industries include sugar refining, food processing, and the manufacture of metal goods and chemicals. Pop. (1989 est.) 49,906.

**Stendhal,** pseudonym of MARIE-HENRI BEYLE (b. Jan. 23, 1783, Grenoble, Fr.—d. March 23, 1842, Paris), one of the most original and complex French writers of the first half of the 19th century, chiefly known for his works of fiction. His finest novels are *Le Rouge et le noir* (1830; *The Red and the Black*) and *La Chartreuse de Parme* (1839; *The Charterhouse of Parma*).



Stendhal, oil painting by Pierre-Joseph Dedreux-Dorcy; in the Bibliothèque Municipale de Grenoble, Fr.
By courtesy of the Bibliotheque Municipale de Grenoble, Fr.; photograph, Studio Piccardy

*Life.* Stendhal is only one of the many pseudonyms Henri Beyle adopted. His father, Chérubin Beyle, was a barrister in Grenoble's high court of justice. Henri's mother died when he was seven, and this loss, which he felt keenly, increased his sense of solitude and his resentment toward his father. But, though he tended throughout his life to stress the dreary and oppressive atmosphere of his home after his mother's death, there is no reason to believe that he was deprived of affection. As a student he grew interested in literature and mathematics. In 1799 he left for Paris, ostensibly to prepare for the entrance examination to the École Polytechnique, but in reality to escape from Grenoble and from paternal rule.

His secret ambition on arriving in Paris was to become a successful playwright. But some highly placed relatives of his, the Darus, obtained an appointment for him as second lieutenant in the French military forces stationed in Italy. This led him to discover Piedmont, Lombardy, and the delights of Milan. The culture and landscape of Italy were the revelation that was to play a psychologically and thematically determining role in his life and works.

In 1802 the 19-year-old Henri Beyle was back in Paris and at work on a number of literary projects, none of which he completed. He dreamed of becoming a modern Molière, enrolled in drama classes, worked at ridding himself of his provincial accent, and fell in love with a second-rate actress (Mélanie Louason) whom he followed to Marseille. By then he was keeping a diary (posthumously published as his *Journal*) and writing other texts dealing with his intimate thoughts.

The year 1806 proved to be a turning point. Count Pierre Daru, having been appointed intendant-general of Napoleon's army, had his young protégé sent as an adjunct military commissary to the German city of Brunswick. This was the beginning of an administrative career in the French army that allowed Henri Beyle to discover parts of Germany and Austria. His army appointment gave him a direct experience of the Napoleonic regime and of Europe at war. He watched Moscow go up in flames, took part in the French forces' retreat from Russia, and helped organize the military defense of the province of Daupbiné back in France. In 1814, when the French empire fell, he decided to settle in Italy.

From the moment he took up residence in Milan, his literary vocation became irreversible. He became friends with Milanese liberals and Carbonari patriots, discovered the *Edinburgh Review,* studied music and the visual arts, and published his first books: *Vies de Haydn, de Mozart et de Métastase* (1814; *Lives of Haydn, Mozart and Metastasio*) and *Histoire de la peinture en Italie* (1817; "History of Painting in Italy"). In these early works Henri Beyle was not always above plagiarism, which was seasoned, however, with brilliant and original insights. His travel book *Rome, Naples et Florence en 1817* also appeared (a later version was published in 1826), and this was the first time he used the pseudonym of Stendhal. Stendhal's stay in Milan ended in deep emotional disappointment: Métilde Dembowski, the woman whose memory was to haunt him for the rest of his life, rejected him as a lover. His political friendships had meanwhile compromised him in the eyes of the Austrian occupying authorities, which finally led him to leave Milan in 1821.

From 1821 to 1830, Stendhal's social and intellectual life in Paris was very active. He made a name for himself in the salons as a conversationalist and polemicist. His wit and unconventional views were much appreciated, and he had notable friendships and love affairs. In 1822 he published *De l'amour* (*On Love*), which claims to study the operations of love dispassionately and objectively, but which can be read as a hidden confession of Stendhal's emotional experiences and longings. His *Racine et Shakespeare* (1823, 1825) was one of the first Romantic manifestos to appear in France. In it Stendhal developed the central idea that each historical period has been "romantic" in its own time, that Romanticism is a vital aspect of every cultural period. Stendhal's literary production during this period was quite varied. In addition to his regular contributions to English journals, he published *Vie de Rossini* (1823; *Life of Rossini*); his first novel, *Armance* (1827); and the travel book *Promenades dans Rome* (1829). During this period he also wrote one of his two masterpieces, the novel *Le Rouge et le noir* (*The Red and the Black*), which appeared in 1830.

The year 1830, during which the July Revolution brought the constitutional monarch Louis-Philippe to the throne in France, marked a new turning point in Stendhal's life. He was appointed French consul in the port of Civitavecchia in the Papal States. In this small town, where he felt bored and isolated, Stendhal was occupied by endless administrative chores and found it difficult to write in a sustained manner. He sought distractions in nearby Rome, absenting himself frequently from his official duties. Lonely, aware of age and of failing health, he felt increasingly drawn to autobiography and began *Souvenirs d'egotisme* (1892; *Memoirs of an Egotist*) and *Vie de Henri Brulard* (1890; *The Life of Henri Brulard*), as well as a new and largely autobiographical novel entitled

*Lucien Leuwen* (1894). All these works remained uncompleted, though they were published posthumously, and are now considered among Stendhal's finest writings.

During his consulate, Stendhal discovered in Rome unpublished accounts of crimes of passion and grim executions set in the Renaissance. They became the inspiration for stories he later published under the title of *Chroniques italiennes* ("Italian Chronicles"). But it was only in Paris, where he took up residence again during a prolonged leave (1836-1839), that Stendhal could undertake new major literary work. He composed *Mémoires d'un touriste;* his second masterpiece, the novel *La Chartreuse de Parme* (1839; *The Charterhouse of Parma*); and began work on a new novel, *Lamiel* (1889), which he did not live long enough to complete. He died in 1842 after suffering a stroke while again on leave in Paris.

*Works.* During Stendhal's lifetime, his reputation was largely based on his books dealing with the arts and with tourism (a term he helped introduce in France), and on his political writings and conversational wit. His unconventional views, his hedonistic inclinations tempered by a capacity for moral and political indignation, his prankish nature and his hatred of boredom—all constituted for his contemporaries a blend of provocative contradictions. But the more authentic Stendhal is to be found elsewhere, and above all in a cluster of favourite ideas: the hostility to the concept of "ideal beauty," the notion of modernity, and the exaltation of energy, passion, and spontaneity. His personal philosophy, to which he himself gave the name of "Beylisme" (after his real family name, Beyle) stressed the importance of the "pursuit of happiness" by combining enthusiasm with rational skepticism, lucidity with willful surrender to lyric emotions. "Beylisme," as he understood it, meant cultivating a private sensibility while developing the art of hiding and protecting it.

It was in his novels above all, and in his autobiographical writings (the interchange between these two literary activities remains a constant feature in his case), that Stendhal's thoughts are expressed most fully. But even these texts remain baffling. Their prosaic and ironic style at first glance hides the intensity of Stendhal's vision and the profundity of his views.

*Armance* (1827) is a somewhat enigmatic novel in which the hero's sexual impotence is symbolic of France's conformist and oppressive society after the Restoration. The antagonism between the individual and society is the central subject of *The Red and the Black.* This realistic novel depicts the French social order under the Second Restoration (1815–30). The story centres on a carpenter's son, Julien Sorel, a sensitive and intelligent but extremely ambitious youth who, after seeing no road to power in the military after Napoleon's fall, endeavours to make his mark in the church. Viewing himself as an unsentimental opportunist, he employs seduction as a means to advancement, first with Madame de Rênal, whose children he is employed to tutor. After then spending some time in a seminary, he leaves the provinces and goes to Paris, where he seduces the aristocratic Mathilde, the daughter of his second employer. The book ends with Julien's execution for the attempted murder of Madame de Rênal after she had jeopardized his projected marriage to Mathilde.

The title of *The Red and the Black* apparently refers to both the tensions in Julien's character and to the conflicting choice he is faced with in his quest for success: the army (symbolized by the colour red) or the church (symbolized by the colour black). A variety of other polarities tempt the ambitious young hero as he sets out with fierce determination to rise above his lowly condition: the provinces or Paris, tender love or sexual conquest, happiness through ambition and achievement or happiness through reverie and the cultivation of selfhood. Careerism, political opportunism, the climate of fear and denunciation in Restoration France, a critique of bourgeois materialistic values—all these are dealt with in a subtle and incisive manner in a novel that is based on a newspaper account of a contemporary crime of passion. Julien Sorel, the central character, is a study in psychological complexity who both attracts and repels the reader. Timid and aggressive, sensitive and ruthless, vulnerable and supremely ambitious, Julien ultimately comes to realize, in prison, the vanity of worldly success and the superior value of love and a rich inner life. *The Red and the Black* also offers delicate portraits of two feminine figures, the maternal Madame de Renal and the romantic young aristocrat Mathilde de La Mole. At every point, the novel challenges conventions and denounces the sham of societal values. As a literary achievement, it is remarkable for its blend of comedy, satire, and ironic lyricism.

The uncompleted *Lucien Leuwen* (1894) is perhaps the most autobiographical of Stendhal's novels. The memory of Métilde Dembowski hovers over the relationship between the young hero of the title and Madame de Chasteller. This biting fictional assessment of French society and politics during the reign of Louis-Philippe also describes a basic father-son conflict that corresponds to the conflicting ethos of two distinct historical periods. As it stands, despite its imperfections and uncompleted form, *Lucien Leuwen* contains some of Stendhal's finest pages of psychological and social analysis, as well as delicate evocations of a young lover's emotional states.

*The Charterhouse of Parma* is Stendhal's other masterpiece. It fuses elements of Renaissance chronicles, fictional and historical sources, recent historical events (the Napoleonic regime in Italy, the Battle of Waterloo, the Austrian occupation of Milan), and an imaginative, almost dreamlike transposition of contemporary reality into fictional terms. The novel is set mainly in the court of Parma, Italy, in the early 19th century. Fabrice del Dongo, a young aristocrat and ardent admirer of Napoleon, goes to Paris to join the French army and is present at the Battle of Waterloo. He returns thereafter to Parma and enters the church for worldly advantage under the sponsorship of his aunt, the Duchess de Sanseverina, who is the mistress of the chief minister of Parma, Count Mosca. Following an affair with an actress, Fabrice kills a rival, is imprisoned, escapes, and is pardoned. In prison Fabrice falls in love with Clélia Conti, the daughter of the citadel's governor. He continues his affair with her after she marries, and he becomes a high-ranking ecclesiastic and an admired preacher. The death of their child and then of Clélia herself causes Fabrice to retire to the Carthusian monastery, or charterhouse, of Parma, where he dies.

The incongruous yet always harmonious combination of lyricism and high comedy, of realism and dreamlike atmosphere, of *The Charterhouse of Parma* allows the author to caricaturize the petty tyranny of post-Napoleonic Europe, to question public morality, and to assert the prerogatives of love's follies. There are subtly drawn portraits of the naive and idealistic young Fabrice del Dongo (notably at the Battle of Waterloo); of his courageous and passionate aunt, the Duchess de Sanseverina; of her lover, the benevolent Machiavellian statesman Count Mosca; and of the young and innocent Clélia Conti, the daughter of Fabrice's jailer, who falls in love with the handsome prisoner. Passion in all its forms is the novel's recurrent theme. And once again, the young hero learns the deeper lessons of spirituality, love, and freedom within the liberating confines of a prison cell.

Perhaps the most remarkable aspect of *The Charterhouse of Parma* is its highly sophisticated psychology. Rejecting traditional notions of a fixed and determined psychological makeup, Stendhal never defines his characters and instead depicts individuals in the process of becoming. His literary devices (his authorial comments, the improvisational tone of his narration) seem to grant his characters the freedom to discover themselves. Various forms of freedom are Stendhal's ultimate preoccupation, which probably explains why he repeatedly explores the ambiguities of the prison image. True freedom, in the world of Stendhal, reveals itself in the context of the cell, once confinement becomes the symbol of the inner world of dreams and longings. His novels thus illustrate metaphorically the fundamental conflict between the demands of society and those of the individual.

Stendhal's autobiographical writings, *Souvenirs d'egotisme* (1892; *Memoirs of an Egotist*) and *Vie de Henri Brulard* (1890; *The Life of Henri Brulard*), are among his most original achievements. Behind their vivacity and charming digressions, they reveal the uneasiness of a tender-hearted and fundamentally insecure human being wearing various masks. *The Life of Henri Brulard* in particular is a masterpiece of ironic self-searching and self-creation, in which the memories of childhood are closely interwoven with the liberating joy of writing.

Stendhal's writings and his personality were marked by a striking independence of mind. He was a romantic who kept his distance from Romanticism, an antiauthoritarian with a nostalgia for the pre-Revolutionary world, a dreamer and tender-hearted enthusiast who passed himself off as a cynic. His writings combine lyrical fervour with a rationalist's passion for analysis. Stendhal's contemporaries, however, found it difficult to appreciate his nimble and ironic sensibility. The novelist Honoré de Balzac, in a famous article on *The Charterhouse of Parma* published in *La Revue parisienne* in 1840, was the only one to recognize his genius as a novelist. Stendhal's literary fame came late in the 19th century, and this posthumous fame has steadily grown since then, largely because of the devotion of "Beylistes" or "Stendhalians" who have made of him a true cult. Stendhal has now come to be recognized as one of the great French masters of the novel in the 19th century.

(V.Br.)

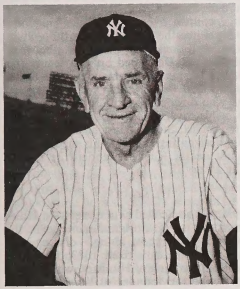
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**Steneosaurus,** extinct genus of early crocodiles found as fossils in Jurassic rocks (208 to 144 million years ago) of South America, Europe, and North Africa. Its skull was very light and narrow, with large openings and a long and narrow snout. The nostrils, at the tip of the snout, were connected to the throat by a long bony tube. Many sharp teeth were present; *Steneosaurus* probably subsisted on fish.

**Stengel, Casey,** byname of CHARLES DILLON STENGEL (b. July 30, 1891, Kansas City, Mo., U.S.—d. Sept. 29, 1975, Glendale, Calif.), American professional baseball player and manager who began his career in 1910 and retired in 1965.

Stengel was a left-handed outfielder for the National League Brooklyn Dodgers (1912–17) and later played for the Pittsburgh Pirates (1918–19), the Philadelphia Phillies (1920–21), the New York Giants (1921–23), and the Boston Braves (1924–25). In 1923 he hit .339 for the New York Giants and won two World Series games with two home runs, only to be overshadowed by the young Babe Ruth, who won the series with three for the New York Yankees.

In 1932 he became a coach and later a team manager with an undistinguished record, with the Brooklyn Dodgers (1934–36) and the



Stengel
AP/Wide World Photos

Boston Braves (1938–43), until his appointment as interim manager of the Yankees in 1949. During his 12 years with the Yankees, he led the team to 10 American League pennants (5 of them in consecutive years) and to 7 World Series championships (5 of them also in consecutive years). After a year of retirement, he joined the New York Mets until 1965. He became vice president of the Mets thereafter.

Stengel was also known for his showmanship and his misuse of the English language, called "Stengelese" (for example, "I've always heard it couldn't be done, but sometimes it don't always work"). He was inducted into the Baseball Hall of Fame in 1966.

**Stenmark, Ingemar** (b. March 18, 1956, Josesjö, Lapland, Sweden), Swedish alpine skier, a slalom specialist, who became the first Scandinavian to win the Alpine World Cup (1976), based on slalom, giant slalom, and downhill races. He repeated the victory in 1977–78. He also won 6 gold medals in international competition and 13 individual World Cup races (1979), a season record that broke the previous record of the French skier Jean-Claude Killy (12 in 1967). By 1984 he had won over 75 World Cup races, more than any other skier.

Stenmark began skiing at Tärnaby at the age of five and won his first national competition at the age of eight. He trained from the age of 13 with the Swedish junior national team. He won his first World Cup points late in 1973 and his first World Cup race late in 1974. In the 1976 Winter Olympic Games, he won the bronze medal for the giant slalom, and in the 1980 games he won the gold medals for slalom and giant slalom. Stenmark seldom skied in the downhill and, with the rules change in 1978 setting a maximum number of points for specialty skiers, he did not win the World Cup thereafter. In 1980, after winning more than 60 World Cup races, he turned professional and took up residence in Monaco.

**Stenness,** site of the Standing Stones of Stenness, a Neolithic stone circle on Mainland (Pomona), in the Orkney Islands, Scotland. Only four of the original stones (of which there were probably 12) remain; set in a rock foundation, some stand over 13 feet (4 m) in height. The circle, about 200 feet (61 m) across, is surrounded by a ditch cut through the rock. The larger Ring of Brodgar and the Maeshowe barrow are nearby.

**Steno, Nicolaus,** Danish NIELS STEENSEN, or STENSEN (b. Jan. 10, 1638, Copenhagen, Den.—d. Nov. 26, 1686, Schwerin [Germany]), geologist and anatomist whose early observations greatly advanced the development of geology.

In 1660 Steno went to Amsterdam to study human anatomy, and while there he discovered the parotid salivary duct, also called Stensen's duct. In 1665 he went to Florence, where he was appointed physician to the grand duke Ferdinand II.

Steno traveled extensively in Italy, and in 1669 he published his geological observations in *De solido intra solidum naturaliter contento dissertationis prodromus* (*The Prodromus of Nicolaus Steno's Dissertation Concerning a Solid Body Enclosed by Process of Nature Within a Solid*). In this work, a milestone in the literature of geology, he laid the foundations of the science of crystallography. He reported that, although quartz crystals differ greatly in physical appearance, they all have the same angles between corresponding faces. In addition he proposed the revolutionary idea that fossils are the remains of ancient living organisms and that many rocks are the result of sedimentation.

Steno was the first to realize that the Earth's crust contains a chronological history of geologic events and that the history may be deciphered by careful study of the strata and fossils. He rejected the idea that mountains grow like trees, proposing instead that they are formed by alterations of the Earth's crust. Hampered by religious intolerance and dogma, Steno was constrained to place all of geologic history within a 6,000-year span.

Upon becoming a Roman Catholic in 1667, Steno abandoned science for religion. He took holy orders in 1675, was made a bishop in 1677, and was appointed apostolic vicar of northern Germany and Scandinavia.

**stenography:** *see* shorthand.

**stenolaemate,** any member of the class Stenolaemata, a group of marine-living animals within the invertebrate phylum Bryozoa (moss animals). About 550 genera of stenolaemates have been described. Only one of the four orders that make up the class, the Cyclostomata, is represented by living species; all members of the other three orders (Cystoporata, Trepostomata, and Cryptostomata) are now extinct. The stenolaemates are the oldest of all the bryozoans and date from the Early Ordovician Epoch (505 to 478 million years ago) on. The individuals (zooids) that make up a stenolaemate colony have narrow, cylindrical, sometimes very elongated tubes with calcified walls.

*Crisia eburnea,* found in tide pools on both coasts of North America, grows on algae and seaweed and forms white bushy tufts about 1.25 to 2.5 cm (0.5 to 1 inch) high.

**Steno's law,** statement that the angles between two corresponding faces on the crystals of any solid chemical or mineral species are constant and are characteristic of the species; this angle is measured between lines drawn perpendicular to each face. The law, also called the law of constancy of interfacial angles, holds for any two crystals, regardless of size, locality of occurrence, or whether they are natural or man-made.

The relationship was discovered in 1669 by the Danish geologist Nicolaus Steno, who noted that, although quartz crystals differ in appearance from one to another, the angles between corresponding faces are always the same. In 1772 a French mineralogist, Jean-Baptiste L. Romé de l'Isle, confirmed Steno's findings and further noted that the angles are characteristic of the substance. A French crystallographer, René-Just Haüy, usually considered the father of crystallography, showed in 1774 that the known interfacial angles could be accounted for if the crystal were made up of minute building blocks that correspond to the present-day unit cells.

**stenosis:** *see* atresia and stenosis.

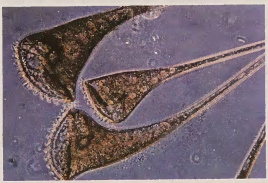
**Stenotaphrum,** genus of about six species of low, mat-forming perennial grasses of the family Poaceae, native to tropical and subtropical regions throughout the world. St. Augustine grass (*S. secundatum*), also known as buffalo grass, is native to the American South and to Central America but has become naturalized along many seacoasts of the world. It is cultivated as a coarse lawn grass in some areas of Australia and North America. A variety with white-striped leaves is grown as an ornamental.

**stenotypy,** a system of machine shorthand in which letters or groups of letters phonetically represent syllables, words, phrases, and punctuation marks. The machine—mainly the commercial Stenotype, or Stenograph—which is commonly used in court reporting, is virtually noiseless and can be operated at speeds of more than 250 words per minute. It consists of letter keys, a space key, a correction key, and a numeral bar that operates like the shift bar on a typewriter.

The machine is operated with both hands, and several keys may be struck simultaneously to print a complete word with one stroke. In contrast to the variety of handwritten shorthand systems, stenotype recordings can be read by anyone familiar with the system, because stenotypy does not lend itself to individual modification.

**Stensen, Niels:** *see* Steno, Nicolaus.

**Stentor,** genus of trumpet-shaped, contractile, uniformly ciliated protozoans of the order Heterotrichida. They are found in fresh water, either free-swimming or attached to sub-

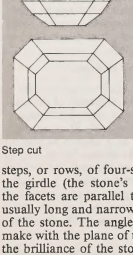


*Stentor coeruleus* (magnified)
Eric V. Grave

merged vegetation. *Stentor* assumes an oval or pear shape while swimming. At its larger end, *Stentor* has multiple ciliary membranelles spiraling around the region that leads to the mouth opening. It uses these cilia to sweep food particles into its cytostome. The species *S. coeruleus* is large (sometimes up to 2 mm [0.08 inch] long) and is predominantly blue from a blue pigment, stentorin, found in its ectoplasm. *Stentor* is remarkable for its regenerative powers; a small fragment less than

one-hundredth of the volume of an adult can grow back into a complete organism. This capability has made *Stentor* a favourite subject for studies of regeneration in protozoans.

**step cut,** also called TRAP CUT, or CUSHION CUT, method of faceting coloured gemstones in which the stone produced is rather flat with



Step cut

steps, or rows, of four-sided facets parallel to the girdle (the stone's widest part). Because the facets are parallel to the girdle, they are usually long and narrow, except at the corners of the stone. The angles that the main facets make with the plane of the girdle greatly affect the brilliance of the stone. Emerald, tourmaline, topaz, and amethyst are often cut in this fashion.

**Stepanakert** (city, Azerbaijan): *see* Xankändi.

**Stephan** (personal name): *see under* Stephen.

**stephanite,** a sulfosalt mineral, silver antimony sulfide ($Ag_5SbS_4$), that occurs as black, lustrous, orthorhombic crystals, fine particles, or masses in small amounts in many silver veins. At one time an important silver ore in the Comstock Lode, Nevada, it has been found in other parts of the western United States and in the Czech Republic, Germany, Norway, Bolivia, and Mexico. For detailed physical properties, *see* sulfosalt (table).

*To make the best use of the Britannica, consult the* INDEX *first*

**Stephanotis,** genus of the milkweed family (Asclepiadaceae) containing about 15 species of climbing plants native to Southeast Asia and Madagascar. Its members are hairless vines or shrubs that have opposite, undivided, leathery leaves. Their short-stalked flowers grow in clusters from the leaf axils and have a leafy, five-parted calyx and a tubular, five-lobed corolla that is swollen at its base. The best-known member of the genus, the Madagascar jasmine (*S. floribunda*), waxflower, or floradora, is a popular greenhouse plant. This woody, twining vine is native to Madagascar. It has leathery, oval leaves that grow up to 10 cm (4 inches) long and clusters of waxy, white flowers that grow to 5 cm and are exceedingly fragrant. Madagascar jasmine is grown out of doors in tropical or subtropical climates but is otherwise suitable only for tropical greenhouses.

**Stephansdom** (Vienna): *see* Saint Stephen's Cathedral.

**Stephansson, Stephan G.,** in full STEPHAN GUDMUNDARSON STEPHANSSON (b. Oct. 3, 1853, Kirkjuhóll, Skagafjördur, Ice.—d. Aug. 10, 1927, Markerville, Alta., Can.), Icelandic-born poet who wrote virtually all his poems in North America.

The son of an impoverished farmer, brought up on the Bible and the sagas, Stephansson emigrated to the United States at the age of 20. He worked as a labourer on farms and in railway construction camps and finally set up a small farm in Alberta when he was 36.

Stephansson was the literary leader of the emigrant Icelanders. He lived a hard life as a pioneer farmer with a large family, and most of his poems were written after a long day's work. His major collection, *Andvökur,* 6 vol. (1909–38; "Sleepless Nights"), was appropriately named.

Stephansson fought social regimentation, economic or clerical. He wrote nostalgically about Iceland but with equal fervour about his new country.

**Stephanus** (Latin personal name): *see under* Stephen.

**Stephen** (personal name): *see under* Stefan, except as below.

**Stephen,** name of rulers grouped below by country or papacy and indicated by the symbol •.

Foreign-language equivalents:

| | |
|---|---|
| Hungarian | István |
| Latin | Stephanus |
| Polish | Stefan |
| Romanian | Ştefan |
| Serbo-Croatian | Stefan |

ENGLAND

• **Stephen,** also called STEPHEN OF BLOIS (b. *c.* 1097—d. Oct. 25, 1154, Dover, Kent, Eng.), king of England from 1135 to 1154. He gained the throne by usurpation but failed to consolidate his power during the ensuing civil strife.



Stephen, the great seal showing the king on horseback and fully armed; in King's College, Cambridge
By courtesy of King's College, Cambridge; photograph, the Royal Academy of Arts

Stephen was the third son of Stephen, Count of Blois and Chartres, and Adela, daughter of King William I the Conqueror. He was reared by his uncle, King Henry I, and received vast lands in England, Normandy, and the county of Boulogne. With a number of other magnates he was pledged to support Henry's daughter, Matilda (*q.v.*), as successor to the throne. Nevertheless, many English nobles were reluctant to accept a woman ruler, and Henry's Norman subjects resented Matilda's marriage into an Angevin family. Consequently, after Henry I died in December 1135, the leading lords and bishops welcomed Stephen when he crossed the English Channel to claim the crown. In return for support from the pope, Stephen opened the way to increased papal influence in English political affairs.

Although Stephen was brave and energetic, his affable, mild-mannered nature prevented him from providing firm leadership. The lawlessness of his Flemish mercenaries and the desperate measures he took to build a party loyal to himself only alienated the barons. Hence, in 1138 Matilda's half brother, the powerful Robert, Earl of Gloucester, took up arms in support of Matilda's claim. At first Stephen scored several military triumphs, but he lost the support of the church when he arrested Bishop Roger of Salisbury and his relatives.

Seizing her opportunity, Matilda invaded England (September 1139). In an incredible display of chivalry, Stephen had Matilda escorted to Bristol, and she proceeded to bring most of western England under her control. Early in 1141 the Angevins captured Stephen in a battle at Lincoln. His cause might have been lost had not Matilda's arrogance provoked a rebellion of the citizens of London, where she had gone for her coronation. In November Stephen was exchanged for Gloucester, who had been captured by forces loyal to the king. Stephen gradually gained the upper hand, and in 1148 Matilda withdrew from England.

Although Stephen at this point exercised nominal control over most of the kingdom, he had neither the resources nor the will to suppress lawlessness and to mediate between warring nobles. He hoped only to secure the succession for his son, Eustace, but to do so he had to deal with Matilda's son, Henry of Anjou, who invaded England in January 1153 to claim his royal inheritance. When Eustace died in August, Stephen lost heart; he signed a treaty designating Henry as his successor. At Stephen's death, Henry ascended the throne as King Henry II.

HUNGARY

• **Stephen I,** also called SAINT STEPHEN, Hungarian SZENT ISTVÁN, original name VAJK (b. *c.* 970–975, Esztergom, Hung.—d. Aug. 15, 1038, Esztergom; canonized 1083; feast day August 16), first king of Hungary, who is considered to be the founder of the Hungarian state and one of the most renowned figures in Hungarian history.

Stephen was a member of the Árpád dynasty and son of the supreme Magyar chieftain Géza. He was born a pagan but was baptized and reared as a Christian, and in 996 he married Gisela, daughter of Duke Henry II of Bavaria. After the death of his father (997), Stephen combated an insurrection led by his older cousin, Koppány, who claimed the throne in accordance with Árpád succession rules. Stephen defeated Koppány at Veszprém (998) and had him executed as a pagan.

On Christmas Day, AD 1000, Stephen was anointed king of Hungary. According to tradition, he received from Pope Sylvester II a crown that is now held as a national treasure in Hungary (*see* Saint Stephen's Crown). His coronation signified Hungary's entry into the family of European Christian nations. With the exception of an invasion by the Holy Roman emperor Conrad II in 1030 and minor disputes with Poland and Bulgaria, Stephen's reign was peaceful.

Stephen organized his kingdom on German models. He founded bishoprics and abbeys, made the building of churches mandatory, and established the practice of tithing. He promoted agriculture, safeguarded private property with strict laws, and organized a standing army. While a ruling class was created, the institution of slavery was left virtually untouched. Stephen also opened the country to strong foreign influences, while saving it from German conquest. He treated the church as the principal pillar of his authority, dispatching missionaries throughout his realm.

Stephen is Hungary's patron saint. Although his feast day is August 16, Hungarians celebrate the translation of his relics to Buda on August 20.

• **Stephen V** (b. 1239—d. Aug. 6, 1272), king of Hungary (1270–72), the eldest son of Béla IV.

In 1262, as crown prince, he compelled his father, whom he had assisted in the Bohemian war, to surrender 29 counties to him, virtually dividing Hungary into two kingdoms; while afterward he seized the southern banate of Macso, which led to a fresh war between father and son in which the latter triumphed. In 1268 he invaded Bulgaria and assumed the title of king of Bulgaria.

During his father's lifetime Stephen had a double matrimonial alliance with the Neapolitan princes of the House of Anjou, the chief partisans of the pope. He certainly needed exterior support; for on his accession to the Hungarian throne he encountered almost universal hostility because of his alleged pagan leanings, due largely to the influence of his Cuman wife Elizabeth, to whom his father had married him for political reasons in 1255. The malcontents combined with Otakar II of Bohemia and invaded western Hungary; but Stephen routed Otakar at Mosony (1271) and was preparing to recover his infant son Ladislas (the future Ladislas IV), whom the rebels had kidnapped, when he died suddenly.

### Moldavia

**• Stephen,** byname STEPHEN THE GREAT, Romanian ŞTEFAN CEL MARE (b. 1435—d. July 2, 1504), *voivode* (prince) of Moldavia (1457–1504), who won European renown for his long resistance to the Ottoman Turks.

With the help of the Walachian prince Vlad IV the Impaler, Stephen secured the throne of Moldavia in 1457. Menaced by powerful neighbours, he successfully repulsed an invasion by Hungary in 1467, but in 1471 he invaded Walachia, which had by then succumbed to Turkish vassalage.

When the Ottoman sultan Mehmed II launched an attack on Moldavia, Stephen defeated the invaders near Vaslui (now in Romania; 1475) and again at Valea Albă (1476). His search for European assistance against the Turks had little success, but his determination "to cut off the pagan's right hand" won him the acclaim of Pope Sixtus IV as the "Athlete of Christ."

After 1484 Stephen had to contend not only with new Turkish onslaughts but also with Polish and Hungarian designs on Moldavian independence. Finally in 1503 he concluded with the sultan Bayezid II a treaty that preserved Moldavian independence but only at the cost of an annual tribute to the Turks. Though it was marked by continual strife, Stephen's long reign nonetheless brought considerable cultural development and was a period of great ecclesiastical building and endowment.

### Papacy

**• Stephen I,** SAINT (b. Rome—d. Aug. 2, 257; feast day August 2), pope from 254 to 257; he was a priest when consecrated, probably on May 12, 254, as the successor to Pope St. Lucius. Details of Stephen's papacy are known principally through three reports contained in the letters of his rival, Bishop St. Cyprian of Carthage.

Stephen I restored the two Spanish bishops Martial of Mérida and Basilides of León-Astorga, whose colleagues accused them of having apostatized by sacrificing to pagan gods during the persecution of Christians under the Roman emperor Decius. The Spanish episcopate, however, did not accept Stephen's restorations and appealed to the African bishops led by Cyprian, who cautioned the Spanish Church against the bishops' reinstatement. Concurrently, the Gallic bishops denounced Bishop Marcianus of Arles as a schismatic follower of Antipope Novatian. Despite a letter from Cyprian endorsing the Gallic position and asking for a successor to the see of Arles, Stephen apparently refused to depose Marcianus.



St. Stephen I, fresco painting attributed to Sandro Botticelli, c. 1481; in the Sistine Chapel, Vatican City

Rizzoli Photoarchive

The third conflict with Cyprian was the most serious. Stephen threatened to excommunicate bishops in Africa (including Cyprian) and in Asia Minor unless they discontinued the practice of rebaptizing heretics. Cyprian composed a defensive treatise that was given support by the Council of Carthage in 256; he vehemently attacked Stephen and dispatched envoys to Rome, threatening a schism between Carthage and Rome. Against Cyprian's argument that each bishop controlled his own see, Stephen staunchly asserted papal supremacy, and he regarded Cyprian's envoys as heretics. At that time the Roman emperor Valerian began his persecution of the Christians, during which Stephen died. It is doubtful, however, that he was martyred.

**• Stephen (II)** (b. Rome—d. March 25, 752, Rome), unconsecrated pope from March 23 to March 25, 752. He was a priest when he was elected on March 23, 752, to succeed Pope St. Zacharias, but he died of apoplexy two days later without having been consecrated. Because consecration is the act considered necessary to mark the official beginning of a pontificate, Stephen is listed neither in the catalog of the popes nor in the *Liber Pontificalis* ("Book of the Popes"). His successor, who also took the name Stephen, is called both Stephen II and Stephen III. Hence, the succession of Stephens is somewhat irregular.

**• Stephen II (or III)** (b. Rome—d. April 26, 757, Rome), pope from 752 to 757 and the first temporal sovereign of the newly founded Papal States.

He was a deacon when chosen on March 26, 752, as the second successor to Pope St. Zacharias (the first successor, Stephen II, had died on the previous day without being consecrated). The central act of his pontificate was to free the papacy from Byzantium and to ally it with the Franks against the Lombards, who, under the Lombardic king Aistulf (*q.v.*), were threatening Rome and attempting to conquer all of Italy.

Following unsuccessful negotiations with Aistulf at Pavia in the fall of 753, Stephen became the first pope to make the trip across the Alps to Gaul. There he met (Jan. 6, 754) the Frankish king Pepin the Short, who promised to restore to the church the lands taken by the Lombards. In July 754 at the abbey of Saint-Denis, Fr., Stephen anointed Pepin and his sons Charlemagne and Carloman, consecrating them kings of the Romans. Pepin then invaded Italy with his Frankish nobles, besieging Aistulf at Pavia; Stephen returned to Rome the following October. After Pepin's army returned to Gaul, however, Aistulf resumed his war on Italy. By January 756 the Lombards had surrounded Rome, which they planned to make their capital.

After receiving another appeal from Stephen, Pepin, Charlemagne, and Carloman returned to Italy in 756, subduing the Lombards and conferring on Stephen territory in the exarchate of Ravenna, the duchy of Rome, and the districts of Venetia and Istria, thereby founding the Papal States under Stephen's rule. Secured also was papal independence from the imperial regime at Constantinople, making the Frankish ruler protector of the papacy. Thus the pope became a sovereign prince.

**• Stephen III (or IV)** (b. 720?, Sicily—d. Jan. 24, 772, Rome), pope from August 768 to 772.

After the death in 767 of Pope St. Paul I, the papal throne was coveted by temporal rulers. Duke Toto of Nepi caused his brother Constantine (II), a layman, to be elected pope. The Lombard king Desiderius dispatched to Rome troops that killed Toto and dethroned Constantine. The Lombards then set up as pope a monk named Philip, who, in turn, was ejected. Stephen, a Benedictine priest, was elected pope on Aug. 1, 768, and was consecrated on the following August 7. He notified the Frankish rulers, Charlemagne and his brother Carloman, of his election.

Constantine had been blinded by order of the Frankish party, and Desiderius' legate Waldipert was subsequently assassinated. In April 769 Stephen summoned a Lateran council that formally deposed Constantine. He later tried to prevent an alliance between the Frankish and Lombard kingdoms. The alliance he did accept with the Lombards in 771 led to the murder of the leaders of the Frankish party in Rome, and Carloman died before he could avenge the wrong.

In ecclesiastical matters Stephen approbated the worship of icons for the Eastern Church and extended the rights of cardinal bishops for the Western Church.

**• Stephen IV (or V)** (b. Rome—d. Jan. 24, 817, Rome), pope from June 816 to January 817.

Of noble birth, he succeeded Pope St. Leo III in June 816. Immediately after his consecration he ordered the Romans to swear fidelity to the Carolingian emperor Louis I the Pious, whom he informed of his election and asked to meet in Gaul.

In Reims on the following October 18, he crowned Louis as Holy Roman emperor and Louis's consort, Ermengarde, as empress. The coronation, second after that of Louis's father, Charlemagne, which had been the first anointing of an emperor by a pope, solidified the alliance between the papacy and the Franks and created effects crucial to European history; the papacy became the agency that created emperors, symbolized by the coronation and anointing, and this became one of the papacy's most treasured prerogatives. Stephen died soon after returning to Rome.

**•Stephen V (or VI)** (b. Rome—d. Sept. 14, 891, Rome), pope from 885 to 891 whose pontificate witnessed the disintegration of the Carolingian Empire and intermittent struggles for the Italian crown.

Of noble birth, he was created cardinal by Pope Marinus I and was elected on May 17, 885, to succeed Pope St. Adrian III. Although consecrated on July 15, he was not accepted by the Holy Roman emperor Charles III the Fat, who dispatched a legate to depose him. Stephen's election was canonical, however, and Charles acquiesced, shortly thereafter being deposed (November 887) himself by the East Franks under King Arnulf.

Acting with utmost independence and authority, Stephen refused to recognize Photius as patriarch of Constantinople and encouraged the Byzantine emperor Basil I the Macedonian to depose him. Upon Basil's death, Stephen repeated his request to the succeeding Byzantine emperor Leo VI the Wise, who exiled Photius in 886. Concurrently, Stephen unsuccessfully begged Leo for aid against the Saracens, who were attacking the Italian mainland. To alleviate a famine he used his father's wealth, for the papal treasury was depleted. Against the Moravian Church, Stephen endorsed the prohibition of the Slavic liturgy that had been sanctioned by Pope John VIII.

At that time Italy was convulsed by invading attacks from the Saracens in the south, the Hungarians in the north, and by internal wars among various margraves fighting for the sole rule of Italy. The Pope appealed to Arnulf for order, but the eastern Frankish king was not to descend into Italy until a similar request from Stephen's successor Formosus in 894. In 888 Duke Guy of Spoleto had himself crowned as king of the French and in 889 as king of Italy. In 890 Stephen recognized Louis III the Blind as king of Provence. Although a partisan of Arnulf, Stephen, probably out of fear, crowned Guy as Holy Roman emperor on Feb. 21, 891.

**•Stephen VI (or VII)** (b. Rome—d. July/August 897, Rome), pope from May 896 to August 897.

The era in which he was elected as the successor to Pope Boniface VI was torn by factions led by Roman aristocrats and by rulers of Naples, Benevento, Tuscany, and Spoleto (of whose ruling family Stephen was a member). Guy, duke of Spoleto, had been reluctantly crowned (891) Holy Roman emperor by Pope Stephen V (VI), and Guy's son Lambert had been crowned co-emperor by Pope Formosus. Both of these preceding pontiffs had preferred the East Frankish king Arnulf, and in 896 Formosus abandoned the Spoletans and crowned Arnulf Holy Roman emperor, igniting a stormy conflict between the feuding factions. After Boniface's two-week pontificate, Stephen, then bishop of Anagni, was elected pope, and the Spoletan party gained control of Rome.

Stephen was a partisan of Lambert, who induced him to conduct one of the grisliest events in papal history—the "Cadaver Synod" (or Synodus Horrenda). The Spoletans were so driven by hate for Formosus that they effected an unprecedented council (897) at which Formosus' corpse was disinterred and arraigned for trial. Among the accusations against Formosus was that he had uncanonically transferred from the episcopal see of Porto to that of Rome (current church law forbade a bishop's transferring from one see to another). The true purpose of the trial, however, was the appeasement and satisfaction of political enmity; the Spoletans charged that as leader of the rival faction Formosus had crowned an illegitimate descendant of Charlemagne after he had already crowned Lambert. Inevitably, Stephen's party sought the destruction of the Formosan faction.

Stephen ordered the nine-month-old cadaver redressed in papal vestments and propped up in the papal throne. He then proceeded to annul Formosus' pontificate and to declare his acts (including the holy orders he had conferred) void. Since Formosus had appointed Stephen bishop of Anagni, the annulment freed Stephen from charges of irregularity in his transferral from the see of Anagni to Rome.

Stephen concluded the trial by ordering that the corpse be dragged through the streets and dumped into the Tiber River.

In a few months an insurrection removed Stephen from office. Deprived of papal insignia, he was imprisoned and strangled, but his party found another leader in the murderous pope Sergius III. Twelve years of blood, intrigue, and terror followed.

**•Stephen VII (or VIII)** (b. Rome—d. February 931, Rome), pope from 929 to 931. As cardinal priest of St. Anastasia, Rome, he was active in the administration of the Roman Church before his consecration in December 928 as Pope Leo VI's successor. His election was probably influenced by Marozia, *senatrix* of Rome, whose powerful family, the house of Theophylact, controlled the papacy. He extended privileges to Italian and French monasteries, but otherwise the history of his pontificate is practically unknown. He may have been assassinated.

**•Stephen VIII (or IX)** (b. Rome—d. October 942, Rome), pope from 939 to 942. Educated in Germany, he became cardinal priest of the Roman Church of SS. Silvester and Martin. He was elected pope on July 14, 939, to succeed Leo VII. Because Duke Alberic II of Spoleto, virtual dictator of Rome, dominated his pontificate, Stephen had little opportunity for independent action. His political efforts were directed toward supporting the last Carolingian, King Louis IV d'Outremer (from Overseas), Charles III the Simple's son. He formally recognized Louis, threatening to excommunicate those who rebelled against him. He also supported the important Cluniac reform of monasticism in Europe under the influence of Abbot St. Odo of Cluny, whom Stephen requested to visit Rome in 942 to negotiate peace between the feuding Alberic and Hugh of Provence, king of Italy.

**•Stephen IX (or X),** original name FREDERICK OF LORRAINE, French FRÉDÉRIC DE LORRAINE (b. *c.* 1000, Lorraine—d. March 29, 1058, Florence), pope from August 1057 to March 1058, one of the key pontiffs to begin the Gregorian reform.

The brother of Duke Godfrey of Lorraine, he studied at Liège, where he became archdeacon. Under his cousin Pope Leo IX he became a prime papal adviser and a member of the inner circle that led the movement for ecclesiastical reform. In 1054 he was papal legate to Constantinople, subsequently retiring to the important Benedictine abbey of Montecassino; he became abbot there in 1057. Pope Victor II, shortly before his death on July 28, 1057, made Frederick cardinal priest. He succeeded Victor as Pope Stephen IX on the following August 2 but was himself dying when elected.

During Stephen's brief pontificate the general church reform begun by Leo gained impetus. He convoked a Roman synod to denounce simony (*i.e.,* the buying or selling of a church office), zealously enforced clerical celibacy, and centralized the reform. Among the celebrated reforming ecclesiastics employed by Stephen were Cardinal Peter Damian, the powerful Roman cardinal Humbert of Silva Candida, and Cardinal Hildebrand (later Pope Gregory VII). He secured the cooperation of cardinals and Roman burghers to ensure the canonical and independent election of his successor, requesting them to await the return of Hildebrand, whom he had dispatched as legate in Germany. Stephen died in the midst of plans to halt the Norman advance in southern Italy and to negotiate an end to the Great Schism between the Eastern and Western churches. Buried in the church of S. Reparata, he is honoured as blessed by an unofficial popular cult commemorating him on March 29.

### POLAND

**•Stephen:** *see* Stephen Báthory.

### SERBIA

**•Stephen:** *see* Stefan Dušan.

**Stephen,** SAINT (d. *c.* AD 36, Jerusalem; feast day December 26), Christian deacon in Jerusalem; the first Christian martyr, whose apology before the Sanhedrin (Acts 7) points to a distinct strand of belief in primitive Christianity. His defense enraged his hearers, and he was taken out of the city and stoned to death.

The name Stephen is Greek, and Acts 6 tells us that he was a Hellenist; that is, a foreign-born Jew who spoke Greek. He lived in Jerusalem and had become a Christian. The Hellenists, who probably formed a minority in the Christian community, complained that the care of their elderly widows was neglected. The apostles presented the matter to the congregation and, pleading the press of responsibilities, instructed it to select seven deacons for this community service. They were chosen and ordained, and Stephen, who became the best known of the seven, was recognized as a man with special gifts as an evangelist. He engaged in religious discussions among the adherents of synagogues of Diaspora Jews in the capital. Growth in the number of Jewish converts, including "many of the priests," provoked a reaction; he was summoned before the Sanhedrin, the supreme rabbinic court in Jerusalem, and charged with speaking against "this holy place and the law." The charge is very general; the report of his defense before the Sanhedrin is the primary resource for learning what Stephen stood for.

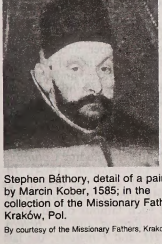
Stephen's response was Jewish in its concerns; in form it followed Hellenistic rhetorical conventions (*cf.* Josh. 24:2–14; Acts 3:12–26). Many scholars see a Samaritan connection to Stephen's community, postulating that it may have migrated there when Jerusalem was destroyed, AD 70. They assume that the speech may have been modified in its transmission through the years between its delivery and its incorporation in Luke's text which appears as Acts. In any event, what Stephen seems to say about temple and law would not have displeased Samaritan ears either, though it is probably Stephen's independent and original conviction.

Stephen was bitterly opposed to the Temples in Jerusalem and its sacrificial cult. He revered the Law of Moses but considered the temple cult an illegitimate part of it. An influential view in current exegesis proceeds from Stephen's position: Moses was "both ruler and deliverer" (Acts 7:35); he had delivered "living oracles," the true law; and he had promised that God would raise up another prophet (Jesus) as he had raised up Moses (7:37). Stephen seems to think of Jesus as the "restorer of Mosaic religion." He sets Aaron over against Moses, the temple over against the tent, and Solomon, who built the temple, over against David, who was persuaded not to. For Stephen the building of the temple was a bit of idolatry, comparable to Aaron's golden calf; "the Most High does not dwell in houses made with hands" (7:48).

Stephen's feelings about the Temple seem to have been more completely negative than those of the first Christians generally; the lat-

ter, including Paul, continued to frequent it. Its sacrificial rites served in many ways to shape the theological interpretation of salvation through the death of Jesus. There is no hint that Stephen assigned doctrinal significance to the death of Jesus. On the other hand, it has been suggested that he may have been the first to anticipate the return (Second Coming) of Jesus; in a moment of rapture, at the close of his apology, he saw the heavens opened and "the Son of Man standing at the right hand of God." The title "Son of Man," with its intensely eschatological-apocalyptic connotations, is used in the New Testament only by Jesus himself, with this single exception from the mouth of Stephen. For Paul, Jesus had brought deliverance from the "curse of the law" (Galatians 3:13). For Stephen, deliverance still awaits the rebirth of the Mosaic tradition in its purity. Though an intensely committed follower of Jesus, his faith may have rested as much on the old basis as on the new. Stephen, to whose fate Saul assented, spoke for a pre-Pauline Christian movement, overwhelmingly Jewish, the precise outlines of which are not easily recoverable because they have been covered by layers of great change. The discernible legacy of Stephen in the ancient church is slight.

**Stephen** BÁTHORY, Hungarian ISTVÁN BÁTHORY, Polish STEFAN BATORY (b. Sept. 27, 1533, Szilágysomlyó, Transylvania [now in Romania]—d. Dec. 12, 1586, near Grodno, Pol.), prince of Transylvania (1571–76) and



Stephen Báthory, detail of a painting by Marcin Kober, 1585; in the collection of the Missionary Fathers, Kraków, Pol.

By courtesy of the Missionary Fathers, Krakow, Pol.

king of Poland (1575–86) who successfully opposed the Habsburg candidate for the Polish throne, defended Poland's eastern Baltic provinces against Russian incursion, and attempted to form a great state from Poland, Muscovy, and Transylvania.

The son of another István Báthory, the governor of Transylvania for the Habsburg king of Hungary, Stephen entered the service of John Sigismund Zápolya, prince of the newly independent Transylvania, in 1556. He eventually became army commander in chief, and despite Habsburg objections the Hungarians elected him prince of Transylvania in succession to Zápolya on May 25, 1571.

Rejecting the candidature of the Habsburg emperor Maximilian II, the Polish nobility elected Stephen king of Poland in 1575 (Stephen being the son-in-law of the late Sigismund I). Having secured the Transylvanian succession for his brother Christopher, Stephen hurried to Kraków and was crowned on May 1, 1576, but could not totally pacify the country until the end of 1577, when he subdued Gdańsk. Thereafter he was able to face Poland's major enemy, Muscovy, which was attempting to seize an outlet on the Baltic Sea. Securing a truce with Turkey and strengthening the Polish army by enrolling Cossacks on a regular basis, Stephen attacked Tsar Ivan IV the Terrible in 1579 and, concluding the Livonian War (*q.v.*), forced the cession of Polotsk and Livonia to Poland under the truce of Yam Zapolsky (Jan. 15, 1582).

Though personally tolerant of differing religious views, Stephen, a strong-willed man and a Roman Catholic, encountered considerable resistance from his subjects in his attempts to promote the Counter-Reformation and to strengthen his royal power; but he did not allow his domestic difficulties to prevent his ambitious foreign adventures. His goal was to unite Poland, Muscovy, and Transylvania under his rule. He therefore prepared to renew his war against Russia and was planning to launch a crusade against the Ottoman Empire when he died. He was one of the most forceful and ambitious monarchs in the history of Poland.

**Stephen** DUSHAN (Serbian emperor): *see* Stefan Dušan.

**Stephen** HARDING, SAINT: *see* Harding, Saint Stephen.

**Stephen** NEMANJA (d. 1200), founder of the Serbian state.

Nemanja was grand *župan* (clan leader) of Raška under Byzantine suzerainty *c.* 1167. He subsequently sided with the Venetians and was eventually defeated by the avenging Byzantines, but he was pardoned. Nemanja later conquered Skopje, Prizren, and Tetovo. Though again defeated, he retained Kosovo, Peč, Prizren, Bar, Skadar (Shkodër), and Kotor. He abdicated in 1196 and joined his son, Sava, in a monastery.

**Stephen** OF BLOIS: *see* Stephen *under* Stephen (England).

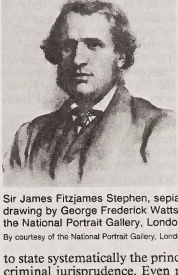
**Stephen** OF PERM, SAINT, Russian STEFAN PERMSKY (b. *c.* 1345, Veliky Ustyug, principality of Vladimir-Suzdal [now in Russia]—d. April 26, 1396, Moscow; canonized 16th century; feast day April 26), one of the most successful and dynamic missionaries of the Russian Orthodox Church.

During the 13th and 14th centuries, the Russian Orthodox Church expanded northward and eastward and succeeded in establishing monasteries at Sarai and at Lake Lagoda to begin the work of converting the Tatars and the Finns. Stephen of Perm's triumphant missions were in this tradition of Russian Orthodox evangelism. Having been a monk for 13 years at Rostov, Stephen traveled in 1379 to the territory of the Zyrians (now known as Komi), located in the frigid lands southeast of the White Sea between the Pechora and Vychegda rivers.

Stephen, who had been born among the Zyrians but was himself a Russian, translated the Bible and liturgy from Greek into the Zyrian language. He undertook these translations for two reasons: he was anxious to avoid forcing Russian ways on the Zyrian people, and he believed that each people should worship in its own tongue. He was so committed to these two principles that instead of using Russian Cyrillic characters as the script for the Zyrian language, he invented an alphabet based on the details and patterns of Zyrian embroidery and carving. Stephen also founded schools to teach the language, as well as seminaries for the training of priests. In 1383 he was named the first bishop of Perm.

**Stephen, Sir James Fitzjames,** 1ST BARONET (b. March 3, 1829, London—d. March 11, 1894, Ipswich, Suffolk, Eng.), British legal historian, Anglo-Indian administrator, judge, and author noted for his criminal-law reform proposals. His Indictable Offences Bill (late 1870s), though never enacted in Great Britain, has continued to influence attempts to recast the criminal law of Commonwealth nations and other English-speaking countries.

An older brother of the literary critic Sir Leslie Stephen, Sir James practiced law from 1854 and contributed articles on a wide range of topics to various periodicals, especially the *Pall Mall Gazette.* His *General View of the Criminal Law of England* (1863) was the first attempt after Sir William Blackstone's *Commentaries on the Laws of England* (1765–69)



Sir James Fitzjames Stephen, sepia drawing by George Frederick Watts; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

to state systematically the principles of English criminal jurisprudence. Even more ambitious was his *History of the Criminal Law of England* (1883), an impressive work despite his dogmatism and occasionally uncritical use of sources. *Liberty, Equality, Fraternity* (1873) elaborated his antidemocratic political philosophy in reply to John Stuart Mill's *On Liberty* (1859).

As the member of the British viceroy's council in India (1869–72) responsible for legal matters, Stephen devoted himself to the codification and reform of Indian law. Subsequently he prepared digests of the English law of evidence (1876) and criminal law (1877). Political opposition prevented the introduction of his Indictable Offences Bill (actually a comprehensive criminal code) in the House of Commons. From 1879 to 1891 he was a judge of the Queen's Bench Division of the English court system. In 1891 he was created a baronet.

**Stephen, Sir Leslie** (b. Nov. 28, 1832, London—d. Feb. 22, 1904, London), English critic, man of letters, and first editor of the *Dictionary of National Biography.*

A member of a distinguished intellectual family, Stephen was educated at Eton, at King's College, London, and at Trinity Hall, Cambridge, where he was elected to a fellowship in 1854 and became junior tutor in 1856. He was ordained in 1859, but his philosophical studies, combined probably with the controversy that followed the publication of Charles Darwin's *Origin of Species* (1859), caused him to lose his faith; in 1862 he resigned his tutorship and two years later left Cambridge to live in London.

Through his brother, James Fitzjames Stephen, a contributor to the *Saturday Review,* Stephen gained entry to the literary world, contributing to many periodicals. In 1871 George Smith offered him the editorship of *The Cornhill Magazine,* for which he wrote literary criticism later republished in the three series of *Hours in a Library* (1874–79). Stephen was one of the first serious critics of the novel, and his work still deserves consideration by historians of literary criticism. Thomas Hardy, Robert Louis Stevenson, Edmund Gosse, and Henry James were among those whom Stephen, as an editor, encouraged. After 11 years he resigned from the editorship of *Cornhill,* but he continued to write for periodicals.

His greatest learned work was his *History of English Thought in the Eighteenth Century* (1876). His philosophical study *The En-*

*glish Utilitarians* (1900) was somewhat less successful, though it is still a useful source. His philosophical contribution to the rationalist tradition, *Science of Ethics* (1882), attempted to wed evolutionary theory to ethics. Stephen's most enduring legacy, however, is the *Dictionary of National Biography*, which he edited from 1882 to 1891. He edited the first 26 volumes and contributed 378 biographies to that important reference work. In recognition of this service to letters he was created Knight Commander of the Bath in 1902 and received other honours. Stephen's *English Literature and Society in the Eighteenth Century* (1904) was a pioneer work in the sociological study of literature.

Stephen was shy and given to silence, the more so after the death in 1875 of his first wife, Harriet Marian, the second daughter of William Makepeace Thackeray. In 1878 he married Julia Jackson, the widow of Herbert Duckworth, and among their four children were the painter Vanessa Bell and the novelist Virginia Woolf. Noel G. Annan's *Leslie Stephen: His Thought and Character in Relation to His Time* (1952; reprinted, Walter P. Metzger, ed., 1977) is a notable study. *Sir Leslie Stephen's Mausoleum* (1978), edited by Alan Bell, is an autobiography written after the death of Stephen's wife Julia in 1895.

**Stephen Uroš IV** (Serbian emperor): *see* Stefan Dušan.

**Stephens, Alexander H(amilton)** (b. Feb. 11, 1812, Wilkes County, Ga., U.S.—d. March 4, 1883, Atlanta, Ga.), politician who served as vice president of the Confederate States of America during the American Civil War (1861–65).

Called "Little Ellick" by his colleagues because he weighed only about 100 pounds, Stephens was admitted to the bar in 1834. Though plagued by infirmities, he rose steadily in politics, serving in the Georgia House of Representatives (1837–41), the state Senate (1842–43), and the U.S. House of Representatives (1843–59). A Whig, he urged the annexation of Texas and supported the Compromise of 1850 and the Kansas–Nebraska Act (1854), both of which attempted to establish criteria for the extension of slavery to U.S. territories. He defended slavery but opposed the dissolution of the Union. When Georgia seceded, however (1861), he followed his state and was shortly elected vice president of the Confederacy.

Throughout the war Stephens opposed the exercise of extraconstitutional war powers by Confederate president Jefferson Davis lest the freedom for which the South was ostensibly fighting should be destroyed. The policy he advocated was to preserve constitutional government in the South and to strengthen the antiwar party in the North by convincing it that the Lincoln administration had abandoned such government; to the same end he urged, in 1864, the unconditional discharge of Federal prisoners. Stephens headed the Confederate commission to the abortive peace conference at Hampton Roads, Va., in February 1865.

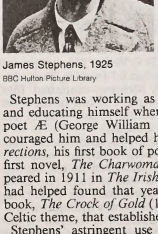


Alexander H. Stephens

By courtesy of the National Archives, Washington, D.C.

After the fall of the Confederacy (May 1865), Stephens was confined for five months at Fort Warren, Boston. In 1866 he was elected to the U.S. Senate but was denied his seat because his state had not been properly reconstructed according to the congressional guidelines. He did serve again in the U.S. House of Representatives (1873–82), however, and as governor of Georgia (1882–83). His book *A Constitutional View of the Late War Between the States,* 2 vol. (1868–70), is perhaps the best statement of the Southern position on state sovereignty and secession.

**Stephens, James** (b. Feb. 9, 1880?, Dublin—d. Dec. 26, 1950, London), Irish poet and storyteller whose pantheistic philosophy is revealed in his fairy tales set in the Dublin slums of his childhood and in his compassionate poems about animals.



James Stephens, 1925

BBC Hulton Picture Library

Stephens was working as a solicitor's clerk and educating himself when he met the Irish poet Æ (George William Russell), who encouraged him and helped him publish *Insurrections,* his first book of poetry, in 1909. His first novel, *The Charwoman's Daughter,* appeared in 1911 in *The Irish Review,* which he had helped found that year. It was his next book, *The Crock of Gold* (1912), with its rich Celtic theme, that established his fame.

Stephens' astringent use of irony suggests affinities with his friend James Joyce. He wrote *The Demi-Gods* (1914) in this vein, but *Deirdre* (1923) was constructed in a more formal, rhythmic prose. Short stories and lyric poems constitute the remainder of his work. Stephens was active in the Irish nationalist movement, but by 1940 he was living in London, where he made frequent radio broadcasts until his death in 1950.

His letters, edited by Richard J. Finneran, were published in 1975.

**Stephens, John Lloyd** (b. Nov. 28, 1805, Shrewsbury, N.J., U.S.—d. Oct. 12, 1852, New York City), American traveler and archaeologist whose exploration of Maya ruins in Central America and Mexico (1839–40 and 1841–42) generated the archaeology of Middle America.

Bored with the practice of law and advised to travel for reasons of health, in 1834 he set out on a journey that took him through eastern Europe and the Middle East, where he was particularly drawn to many of the archaeological sites. Two popular books resulted, *Incidents of Travel in Egypt, Arabia Petraea, and the Holy Land,* 2 vol. (1837), and *Incidents of Travel in Greece, Turkey, Russia, and Poland,* 2 vol. (1838), with drawings by the English illustrator and archaeologist Frederick Catherwood.

Reports of the existence of ancient ruins in Central America and Yucatán stirred Stephens' curiosity to locate and explore them. He obtained an appointment as U.S. chargé d'affaires to Central America through the influence of President Martin Van Buren, and in 1839, accompanied by Catherwood, he went to Central America, then torn by political upheaval and civil war. Their progress to Copán, Honduras, was imperiled first by local strife and then by the hazards and extreme hardships of travel through dense, dark jungle. At times they nearly despaired of finding what they sought, but their perseverance was vastly rewarded. After coming upon a wall of uncertain significance, they were stunned by the appearance of a magnificently carved stone stela (slab).

Other discoveries—more stelae, terraces, stairways, and walls with strange and fantastic ornamentation—came in quick succession. Stephens "purchased" the extensive site for $50, and work progressed in clearing away the jungle overgrowth. There and elsewhere, including Uxmal and Palenque in Mexico, Catherwood set about drawing the Maya remains. The report of the first expedition, *Incidents of Travel in Central America, Chiapas, and Yucatan,* 2 vol. (1841), and the subsequent publication of Catherwood's superb drawings caused a storm of popular and scholarly interest and precipitated much study of earlier, mostly forgotten accounts of the lands of the Maya by Spanish conquerors and explorers.

After their second expedition, Stephens and Catherwood published *Incidents of Travel in Yucatan,* 2 vol. (1843), containing accounts of visits to the remains of 44 ancient sites. Stephens' last years were devoted to directing the first American transatlantic steamship company and to developing a railroad across the Isthmus of Panama.

**Stephens, Olin James, II** (b. April 13, 1908, New York City), American naval architect who was designer, skipper, and navigator of the yacht *Dorade,* the winner of the 1931 Transatlantic and Fastnet races, and who was codesigner and relief helmsman of the J-class *Ranger,* the winner of the America's Cup in 1937.

The Sparkman & Stephens firm of which Stephens was a partner designed many famous America's Cup defenders, including *Columbia* (winner in 1958), *Constellation* (1964), *Intrepid* (1967 and 1970, after her design was somewhat modified), and *Courageous* (1974). Stephens designed such famous ocean racers as *Stormy Weather, Baruna, Blitzen, Bolero, Kialoa II, Kialoa III,* and *Finisterre,* the last a three-time winner of the Bermuda Race (1956, 1958, and 1960). Sparkman & Stephens also designed the Lightning and Blue Jay one-design classes.

**Stephens, Uriah Smith** (b. Aug. 3, 1821, Cape May, N.J., U.S.—d. Feb. 13, 1882, Philadelphia), American utopian reformer who was instrumental in founding the Knights of Labor, the first national labour union in the United States.

Stephens wanted to become a Baptist minister, but family financial reverses (largely brought about by the Panic of 1837) led him into an apprenticeship to a tailor. After working as a tailor in Philadelphia from 1845 to 1853, Stephens traveled to California by way of the West Indies, Central America, and Mexico. When he returned to Philadelphia in 1858 he became caught up in antebellum reform movements, advocating abolitionism and a utopian socialism that would later underlie his union-organizing efforts.

Those efforts began in 1862, when Stephens helped organize the Garment Cutters' Association of Philadelphia. When that union collapsed in 1869, Stephens joined with six others that same year to found the Noble Order of the Knights of Labor, with Stephens becoming the union's first grand master workman. Open to all working people (excluding bankers, lawyers, stockbrokers, gamblers, doctors, and liquor manufacturers and salespeople), the

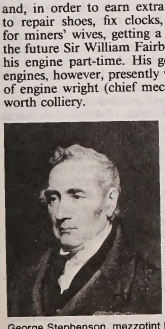
Knights were supposed to serve as a voluntary association of producers, brought together in a great fraternal body to replace the ugly materialism of the new industrial age with a cooperative economic order. In Stephens' view, the Knights constituted something akin to a secular church and thus required substantial secrecy and ritual to bind together its diverse membership. In an era that saw several brutal union-busting struggles, secrecy was also regarded as an essential survival strategy.

As the Knights grew into the most powerful labour organization of its day, Stephens found himself and his beliefs more and more the targets of attack. Secrecy and ritual became the central issues of controversy, and many members took exception to Stephens' opposition to strikes and other job actions. In 1878—after losing a congressional bid as a Greenback Party candidate—Stephens resigned as leader of the Knights.

His successor was Terence V. Powderly, and Stephens and Powderly clashed bitterly over the secrecy issue until in 1881 Powderly triumphed and the Knights repudiated the rule of secrecy and employed less ritual, stripping the union of the quasi-religious trappings in which Stephens believed so devoutly. Under Powderly the Knights of Labor went on to acquire almost 700,000 members by 1886—four years after Stephens' death. But by that time it was an entirely different organization from the cooperative commonwealth that Stephens had envisioned.

**Stephenson, George** (b. June 9, 1781, Wylam, Northumberland, Eng.—d. Aug. 12, 1848, Chesterfield, Derbyshire), English engineer and principal inventor of the railroad locomotive.

The son of a mechanic who operated a Newcomen atmospheric-steam engine that was used to pump out a coal mine at Newcastle upon Tyne, Stephenson went to work at an early age and without formal schooling; by the age of 19 he was operating a Newcomen engine. His curiosity aroused by the Napoleonic war news, he enrolled in night school and learned to read and write. He soon married and, in order to earn extra income, learned to repair shoes, fix clocks, and cut clothes for miners' wives, getting a mechanic friend, the future Sir William Fairbairn, to take over his engine part-time. His genius with steam engines, however, presently won him the post of engine wright (chief mechanic) at Killingworth colliery.



George Stephenson, mezzotint by C. Turner after H.P. Briggs
By courtesy of the Science Museum, London

Stephenson's first wife died, leaving him with a young son, Robert, whom he sent to a Newcastle school to learn mathematics; every night when the boy came home, father and son went over the homework together, both learning. In 1813 George Stephenson visited a neighbouring colliery to examine a "steam boiler on wheels" constructed by John Blenkinsop to haul coal out of the mines. In the belief that the heavy contraption could not gain traction on smooth wooden rails, Blenkinsop had given it a ratchet wheel running on a cogged third rail, an arrangement that created frequent breakdowns. Stephenson thought he could do better, and, after conferring with Lord Ravensworth, the principal owner of Killingworth, he built the *Blucher,* an engine that drew eight loaded wagons carrying 30 tons of coal at 4 miles (6 km) per hour. Not satisfied, he sought to improve his locomotive's power and introduced the "steam blast," by which exhaust steam was redirected up the chimney, pulling air after it and increasing the draft. The new design made the locomotive truly practical.

Over the next few years, Stephenson built several locomotives for Killingworth and other collieries and gained a measure of fame by inventing a mine-safety lamp. In 1821 he heard of a project for a railroad, employing draft horses, to be built from Stockton to Darlington to facilitate exploitation of a rich vein of coal. At Darlington he interviewed the promoter, Edward Pease, and so impressed him that Pease commissioned him to build a steam locomotive for the line. On Sept. 27, 1825, railroad transportation was born when the first public passenger train, pulled by Stephenson's *Active* (later renamed *Locomotion*), ran from Darlington to Stockton, carrying 450 persons at 15 miles (24 km) per hour. Liverpool and Manchester interests called him in to build a 40-mile (64-kilometre) railroad line to connect the two cities. To survey and construct the line, Stephenson had to outwit the violent hostility of farmers and landlords who feared, among other things, that the railroad would supplant horse-drawn transportation and shut off the market for oats.

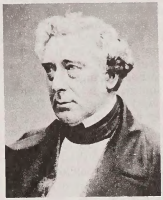
When the Liverpool-Manchester line was nearing completion in 1829, a competition was held for locomotives; Stephenson's new engine, the *Rocket,* won with a speed of 36 miles (58 km) per hour. Eight locomotives were used when the Liverpool-Manchester line opened on Sept. 15, 1830, and all of them had been built in Stephenson's Newcastle works. From this time on, railroad building spread rapidly throughout Britain, Europe, and North America, and George Stephenson continued as the chief guide of the revolutionary transportation medium, solving problems of roadway construction, bridge design, and locomotive and rolling-stock manufacture. He built many other railways in the Midlands, and he acted as consultant on many railroad projects at home and abroad.

**Stephenson, George Robert** (b. Oct. 20, 1819, Newcastle upon Tyne, Northumberland, Eng.—d. Oct. 26, 1905, Cheltenham, Gloucestershire), pioneer English railroad engineer who assisted his uncle George Stephenson and his cousin Robert Stephenson in their work.

Educated at King William College, Isle of Man, he entered his uncle's employ on the Manchester and Leeds Railway in 1837, later served as consultant on railroad construction in New Zealand, and returned to England to assist Sir John Hawkshaw in building the East London Railway. He helped Robert Stephenson build the Victoria tubular bridge across the St. Lawrence River in Canada and designed many railroad bridges in England and abroad. On Robert Stephenson's death, in 1859, he succeeded as director of the locomotive works at Newcastle.

**Stephenson, Robert** (b. Oct. 16, 1803, Willington Quay, Northumberland, Eng.—d. Oct. 12, 1859, London), outstanding English Victorian civil engineer and builder of many long-span railroad bridges, most notably the Britannia bridge over the Menai Strait, North Wales.

The only son of George Stephenson, inventor of the railroad locomotive, Robert was educated at Bruce's Academy, Newcastle upon Tyne, and at Edinburgh University. In 1821 he assisted his father in survey work for the Stockton and Darlington Railway and afterward on the Liverpool and Manchester Railway. After serving as a mining engineer in Colombia, he returned to England, where he made many improvements in locomotives and in 1833 was appointed chief engineer of the London and Birmingham Railway. In this position he directed several major engineering works, such as the cutting, or excavation, at Blisworth and the Kilsby Tunnel. Next undertaking a new railroad line from Newcastle to Berwick, he spanned the Tyne River with a six-arch iron bridge, using James Nasmyth's newly invented steam hammer to drive the bridge's foundations.



Robert Stephenson
By courtesy of the Science Museum, London

Called on to build a secure railroad bridge over the Menai Strait, between the Isle of Anglesey and the Welsh mainland, Stephenson conceived a unique tubular design, the success of which led to several other tubular bridges built by Stephenson in England and other countries.

**Stephenson, William (Samuel),** byname INTREPID (b. Jan. 11, 1896, Point Douglas, Man., Can.—d. Jan. 31, 1989, Paget, Bermuda), Canadian-born millionaire industrialist whose role as Britain's intelligence chief in the Western Hemisphere in World War II was chronicled in *A Man Called Intrepid* (1979).

The son of a lumber-mill owner, Stephenson dropped out of college to serve in the Royal Canadian Engineers (1914–15) and the British Royal Flying Corps (1915–18) in France. After the war he pursued various business ventures and inventions and launched himself on a career as an industrialist, manufacturing such diverse products as radios, phonographs, automobiles, and airplanes; he also moved into construction, real estate, and steel. Through his many business contacts, Stephenson gained valuable information in the 1930s about the buildup of German armaments and the development of the cipher machine Enigma. He conveyed this information to the British secret service. When Winston Churchill became prime minister in 1940, he sent Stephenson to New York City to direct the U.S.-based British Security Coordination (BSC). Stephenson coordinated all British overseas espionage activities in the Western Hemisphere, recruited agents, established a secret base in Canada to train agents for missions behind enemy lines, and functioned as liaison between the BSC and the U.S. government until the Office of Strategic Services (OSS) assumed responsibility for U.S. intelligence in 1942. Stephenson himself financed many of the BSC's operations. He was knighted in 1945.

After the war Stephenson returned to his business interests, operating mainly from Jamaica; he retired to Bermuda in 1968.

**Stepnoy** (Russia): *see* Elista.

**Steppe, the,** broad band of grassland, interrupted in some places by mountain ranges,

that begins in Hungary and extends eastward across the Ukraine and southern Russia into Central Asia and ultimately to Manchuria. It has served as an avenue for the spread of peoples and cultural patterns throughout recorded history.

A brief treatment of the Steppe follows. For full treatment, *see* MACROPAEDIA: Steppe, The History of the Eurasian.

The grassland zone may be divided into the Western Steppe, which extends 2,500 miles (4,000 km) from the Danubian plains eastward to the Altai Mountains, and the Eastern Steppe, which runs from the Altai eastward to the Greater Khingan Mountains, a distance of 1,500 miles (2,400 km). The western part, broken only by the low barrier of the Ural Mountains, is easily crossed by horse. The many rivers of the region tend generally to flow southward, providing access to warmer lands. The climate of the Western Steppe is one of definite seasonal changes, with cold winters and hot summers and with rainfall diminishing from west to east. The Eastern Steppe is subject to much more severe conditions. Its higher elevation makes it colder, and its infrequent rainfall provides sparser pasturage. The nomads of the Eastern Steppe have thus been motivated throughout history to seek better grazing lands either in northern China or in the Western Steppe.

In prehistoric times the Steppe people gradually abandoned their food-gathering way of life in favour of settled farming. With the domestication of the horse about 2000 BC, however, their way of life changed again, as stock raising on the grasslands was a migratory pursuit. They formed tribes and eventually tribal confederacies that chose paramount chieftains who could rapidly assemble formidable military forces. Such forces began to sweep into the Middle East after 1700 BC. Armies of nomad horsemen were formidable opponents because of their mobility and their ability to live off their animals. Shortly after 700 BC the peoples known to the Greeks as the Cimmerians and the Scythians began raiding Asia Minor from their base in the Ukraine; the Scythians helped to bring about the fall of the Assyrian empire with their sack of Nineveh in 612. In the following centuries nomad cavalry posed a constant threat to the Persian empire in the west and the Chinese empire in the east.

The Parthians, who were akin to the Scythians, began penetration of the Seleucid Empire in the 3rd century BC. Once having occupied agricultural land, the Parthians were able to defend it by virtue of their armoured cavalry and to deflect subsequent nomad invasions.

A period of stability ensued, during which the caravan routes across Asia carried goods and ideas back and forth from Rome to China. There ensued a period of ferment, beginning about AD 200. In the 4th century the Huns, a people perhaps of Turkish stock, invaded the Roman Empire. Their invasions displaced the Germanic tribes of Europe, forcing them into Roman territory and thereby setting in motion the dissolution of the western Roman realm. In the east, China was repeatedly attacked by nomads of Turkish-, Mongolian-, and other-language groups. In 550 the Avars, migrating from the Caucasus to Hungary, were the first wave of a succession of tribes driven west by the rise of a great Turkish confederacy based in the Altai and later in Central Asia. The Turks themselves looked south to Persia; gradually they adopted Islām and Middle Eastern culture. They served as a bridge to the nomads remaining in the Steppe, who also adopted Islām. In the Far East the influence of China and Buddhism was having an analogous effect on the Mongols, who adopted Chinese administrative techniques and created a nomad empire under Genghis Khan that united all the peoples of the Eurasian Steppe by the 13th century. The Turks in the west, Seljuqs at first and later Ottomans, completed the conquest of the Byzantine Empire and laid the foundation of the Ottoman Empire.

Trade and cultural exchange flourished, but unity eventually disintegrated as far-flung tribes were absorbed by conquered peoples. By the 16th century, Russia began to invade, conquer, and colonize much of the Steppe. By the 20th century, only a few Steppe nomads survived in the vast area that they once dominated.

**steppe cat:** *see* Pallas's cat.

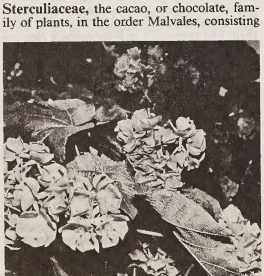
**steppe murrain** (cattle disease): *see* rinderpest.

**steptoe,** also called DAGALA, a hill or mountain that projects like an island above a surrounding lava field. This landform, a type of kipuka (*q.v.*), is named after Steptoe Butte, a quartzite protrusion above the Columbia Plateau lava flows near Colfax, Washington, U.S.

**steradian,** unit of solid-angle measure in the International System, defined as the solid angle of a sphere subtended by a portion of the surface whose area is equal to the square of the sphere's radius. The total solid angle about a point is equal to $4\pi$ steradians. Derived from the Greek for "solid" and "radian," a steradian is, in effect, a solid radian; the radian is an International System unit of plane-angle measurement defined as the angle of a circle subtended by an arc equal in length to the circle's radius.

**Stercorariidae,** bird family (order Charadriiformes) of medium- to large-sized oceanic, predatory birds. The family is composed of species of skua and jaeger (*qq.v.*).

**Sterculiaceae,** the cacao, or chocolate, family of plants, in the order Malvales, consisting



Dombeya (*Dombeya calantha*)
Walter Dawn

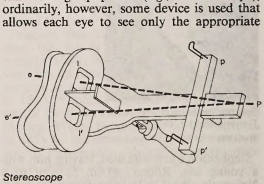
of about 12 genera of tropical or subtropical trees, shrubs, and herbs. The leaves of Sterculiaceae are alternate and simple or palmately compound (*i.e.*, divided into leaflets that radiate from a common point, fingerlike). The flowers, often unisexual, are solitary or clustered and have three to five sepals and five or no petals. The usually numerous stamens (male, pollen-producing structures) are separate or joined into a column, and the ovary is superior (positioned above the attachment point of the other flower parts) and has two to five cavities or separate parts. The fruit is fleshy or dry and is generally a capsule. Important plants of the family include cacao (*Theobroma cacao*), source of cocoa and chocolate; cola (*Cola nitida* and *C. acuminata*), which yields the flavouring and stimulant used in cola drinks; and a few *Sterculia* species (especially *Sterculia urens*), which yield karaya gum, an important substitute for gum tragacanth. Species of a few genera are cultivated as ornamentals, notably the bottle tree (*Brachychiton*), dombeya (*Dombeya*), Chinese parasol tree (*Firmiana*), flannelbush (*Fremontodendron*), and sterculia (*Sterculia*).

In geologic times the family was distributed far beyond the limits of the present tropics and subtropics—*e.g.*, into Alaska.

**stere,** metric unit of volume equal to one cubic metre, or 1,000 litres. The stere (from Greek *stereos*, "solid") was originally defined by law and used in France in 1793, primarily as a measure for firewood. It is thus the metric counterpart of the cord, one standard cord (128 cubic feet of stacked wood) being equal to 3.625 steres. In The Netherlands the term *wisse* is used in place of stere. A stere is made up of 10 decisteres, and 100 steres make up a hectostere. Very large volumes may be expressed in kilosteres, equal to 1,000 steres.

**stereophonic sound system,** equipment for sound recording and reproduction that utilizes two or more independent channels of information. Separate microphones are used in recording and separate speakers in reproduction; they are arranged to produce a sense of recording-hall acoustics and of the location of instruments within an orchestra. The effectiveness of stereophonic reproduction was demonstrated as early as 1933. Two-track stereophonic tape for the home became common in the 1950s and the stereophonic phonograph record, with two separate channels of information recorded in a single groove, in 1958. In the early 1970s, quadraphonic sound systems, employing four independent channels of information for even greater realism, became commercially available and later led to "surround-sound" systems.

**stereoscopy,** science and technology dealing with two-dimensional drawings or photographs that when viewed by both eyes appear to exist in three dimensions in space. A popular term for stereoscopy is 3-D. Stereoscopic pictures are produced in pairs, the members of a pair showing the same scene or object from slightly different angles that correspond to the angles of vision of the two eyes of a person looking at the object itself. Stereoscopy is possible only because of binocular vision, which requires that the left-eye view and the right-eye view of an object be perceived from different angles. In the brain the separate perceptions of the eyes are combined and interpreted in terms of depth, of different distances to points and objects seen. Stereoscopic pictures are viewed by some means that presents the right-eye image to the right eye and the left-eye image to the left. An experienced observer of stereopairs may be able to achieve the proper focus and convergence without special viewing equipment (*e.g.*, a stereoscope); ordinarily, however, some device is used that allows each eye to see only the appropriate




*Stereoscope*
Rays coming from corresponding points (p p') are deflected in the two lenses (l l') so as to strike the eyes (e e') as if coming from the point (P)
From *Webster's Third New International Dictionary* (1971); reproduced by permission from G. & C. Merriam Co.

picture of the pair. To produce a three-dimensional effect in motion pictures (*see* 3-D), various systems have been employed, all involving simultaneous projection on the screen

of left- and right-eye images distinguished by, for example, different colour or polarization and the use by the audience of binocular viewing filters to perceive the images properly. In holography the two eyes see two reconstructed images (light-interference patterns) as if viewing the imaged object normally, at slightly different angles.

**stereotype,** type of printing plate developed in the late 18th century and widely used in letterpress, newspaper, and other high-speed press runs. Stereotypes are made by locking the type columns, illustration plates, and advertising plates of a complete newspaper page in a form and molding a matrix, or mat, of papier-mâché or similar material to it; the dried mat is used as a mold to cast the stereotype from hot metal. A stereotype plate is much stronger and more durable under the press run than would be the composed page of type. It is gradually being replaced, however, by photopolymer (photosensitive plastic) and lithographic plates.

**sterilization,** in medicine, surgical procedure for the permanent prevention of conception by removing or interrupting the anatomical pathways through which gametes—*i.e.,* ova in the female and sperm cells in the male—travel.

The oldest form of surgical sterilization, tubal ligation, remains one of the most widely used; as originally performed, this consisted of tying the female's fallopian tubes closed with silk thread. Simple ligation has a high failure rate, however, and current procedure is usually combined with crushing or severing a section of the tubes, making the possibility of reopening the pathway remote. Tubal closure may also be achieved by electronic coagulation of a segment of the tubes or by chemical adhesives. Finally, occlusive devices—clips or bands of metal or some other material—may be used to close the tube. Techniques involving clips and bands are less destructive to the uterine tubes and generally have higher reversal rates than other methods. Tubal sterilization can be performed through an open incision or endoscopically.

Male sterilization (vasectomy) involves less risk to the subject and is simpler and less expensive than sterilization in women. In this procedure, each vas deferens, through which male sperm is transmitted, is severed through a small incision in the scrotum. This method has gained in use since the 1950s and is now the most common procedure for permanent sterilization in many countries. (*See* vasectomy.)

Because a sterilized individual may at some point desire restored fertility, the chief drawback of sterilization as a contraceptive means has been its irreversibility. Using microsurgical techniques developed in the 1970s, some tubal closures have been reversed, but the procedure is difficult and expensive. It has had only limited success at restoring fertility, because other damage associated with the original sterilization may prevent successful conception. Surgical reversal of vasectomy has been somewhat more successful, achieving success about 80 percent of the time, but the conception rate following such reversal remains low.

**Sterkfontein,** one of three neighbouring South African sites (the others being Swartkrans and Kromdraai) at which the remains of fossil hominids have been found. The region is one of dry, grassy, rolling hills near the Klip River, about 30 miles (50 km) west of Johannesburg. Sterkfontein is located on a kopje, or small hill, of limestone, pierced by caves. In the lime mined from this site, remains of the gracile australopithecine called *Australopithecus africanus* were found in 1936 and 1947–49. Kromdraai, 2 miles (3.2 km) east of Sterkfontein, yielded remains of another australopithecine, then designated *A. robustus,* in 1938. Swartkrans, 1 mile (1.6 km) west of Sterkfontein, produced many examples (1948–53) of *A. robustus* and fragments of two individuals later classified as *Homo erectus.* Early work at these three sites was largely carried out by R. Broom and J.T. Robinson.

**Sterling,** city, seat (1887) of Logan county, northeastern Colorado, U.S. It lies along the South Platte River at an elevation of 3,950 feet (1,204 m). Laid out after the arrival of the Union Pacific Railroad in 1881, it was named after a town in Illinois. Now an important railroad division point, it is a marketing and shipping centre for an irrigated area supporting cattle, sugar beets, grain (wheat and corn [maize]), and dairy products. In 1950 oil was discovered in the surrounding Denver-Julesburg Basin, and Sterling became the headquarters for much of the oil and natural-gas activities. The city's other industries include sugar refining, meat processing, and the manufacture of steel tanks, cinder blocks, and concrete. Sterling is the seat of Northeastern Junior College of Colorado (1941). The Pawnee National Grassland is northeast. Inc. 1884. Pop. (1993 est.) 10,433.

**sterling,** the standard of purity for silver. The term sterling silver denotes any silver alloy in which pure silver makes up at least 92.5 percent of the content.

One theory is that the word sterling comes from the name Easterlings—coiners from east German states brought to England during the reign of Henry II (1154–89) to improve the quality of the coinage. A more plausible derivation is from the Old English word *steorling* ("coin with a star"), for small stars occur on some Norman pennies.

In a monetary sense, the term sterling was formerly used to describe the standard weight or quality of English coinage. The basic monetary unit of the United Kingdom is still called the pound sterling. The pound sterling's origins go back to Anglo-Saxon times, when a pound weight of silver was coined into 240 pennies. These pennies were made from an alloy that was 925 parts silver and 75 parts copper. This proportion remained the standard in English coinage until 1920, when the proportion of silver in the coinage was reduced to 500 parts per 1,000. Britain stopped using any silver in its coins in 1946, replacing it entirely with copper and nickel. By this time the value of silver had long ceased to have any direct link to the British currency, Britain having adopted the gold standard in 1821.

**sterling area,** formerly, a group of countries that kept most of their exchange reserves at the Bank of England and, in return, had access to the London capital and money market. After the devaluation of the pound sterling in September 1931, the United Kingdom and other countries that continued to maintain parity with sterling and to hold their reserves in London became known as the sterling bloc.

When World War II brought exchange control and prospective exchange shortages, particularly of dollars, the countries with the closest ties to London adopted parallel policies of monetary collaboration. In the late 1950s sterling convertibility was gradually restored, but the United Kingdom maintained restrictions on all long-term foreign investment except in the overseas sterling area. Recurring financial crises in the 1960s caused these restrictions to be tightened, the overseas sterling-area countries still continuing to receive preferential treatment.

In the late 1960s, besides the United Kingdom and its few remaining dependencies and protectorates, the sterling area consisted mainly of countries then or formerly part of the Commonwealth. Canada was not a member, but Australia and New Zealand were, together with more than a score of other nations. After Britain joined the European Economic Community in 1973, however, the sterling area drastically contracted.

Sterling-area exchange guarantees were phased out in the following years, in the wake of the adoption of floating exchange rates by the United Kingdom and other leading trading nations. The last vestiges of sterling exchange controls were ended in 1980, and the sterling area ceased to exist.

**Sterlitamak,** city, Bashkortostan republic, western Russia. The city lies along the Belaya River at its confluence with the Sterlya. The small settlement of Ashkadarskaya Landing became the city of Sterlitamak in 1781, but it prospered only after 1940 with the development of the Volga-Urals oil field and local salt and limestone deposits. Sterlitamak's industries produce synthetic rubber, chemicals, soda ash, caustic soda, and cement. The city has a teacher-training institute. Pop. (1992 est.) 254,000.

**Stern, Elizabeth,** married name ELIZABETH STERN SHANKMAN (b. Sept. 19, 1915, Cobalt, Ont., Can.—d. Aug. 18, 1980, Los Angeles, Calif., U.S.), Canadian-born American pathologist, noted for her work on the stages of a cell's progression from a normal to a cancerous state.

Stern received her medical degree from the University of Toronto (1939) and the following year went to the United States, where she became a naturalized citizen in 1943. Stern was one of the first specialists in cytopathology, the study of diseased cells. From 1965 she was professor of epidemiology at the University of California at Los Angeles.

Stern published in 1963 what is believed to be the first case report linking a specific virus to a specific cancer—that of the herpes simplex virus to cervical cancer. She was also the first (1973) to report a definite link between the prolonged use of oral contraceptives and cervical cancer, connecting the use of the contraceptive pill with cervical dysplasia, often a precursor of cancer. In her most noted work in this field, Stern studied cells cast off from the lining of the cervix and discovered that a normal cell goes through 250 distinct stages of cell progression before reaching an advanced stage of cervical cancer. This prompted the development of diagnostic techniques to detect cervical cancer in its early stages, thus making it, with its slow rate of metastasis, one of the types of cancer that can be successfully treated by prophylactic measures (*i.e.,* excision of abnormal tissue).

**Stern, Isaac** (b. July 21, 1920, Kremenets, Russia), Russian-born American violinist.

Stern was taken by his parents to San Francisco as a one-year-old infant. He studied at the San Francisco Conservatory (1928–31) and with the Russian violinist Naoum Blinder (1932–39) and made his debut at the age of 11. After a highly successful New York concert in 1939 he rapidly gained recognition. He began to tour regularly after his European debut in 1948, appearing all over the world and at all the major festivals. He premiered works by Paul Hindemith, George Rochberg, and Krzysztof Penderecki. In addition to his concert performances, Stern appeared on radio and television and made numerous recordings. Stern was active in organizations promoting the arts. He helped save New York City's Carnegie Hall from demolition, and he helped to establish the National Endowment for the Arts in 1964.

**Stern, Otto** (b. Feb. 17, 1888, Sohrau, Ger. [now Zory, Poland]—d. Aug. 17, 1969, Berkeley, Calif., U.S.), German-born scientist and winner of the Nobel Prize for Physics in 1943 for his development of the molecular beam as a tool for studying the characteristics of

molecules and for his measurement of the magnetic moment of the proton.

Stern's early scientific work was theoretical studies of statistical thermodynamics. In 1914 he became a lecturer in theoretical physics at the University of Frankfurt and in 1923 a professor of physical chemistry at the University of Hamburg. Stern and Walther Gerlach had performed their historic molecular-beam experiment at Hamburg in the early 1920s. By shooting a beam of silver atoms through a nonuniform magnetic field onto a glass plate, they found that the beam split into two distinct beams instead of broadening into a continuous band. This experiment verified the space quantization theory, which stated that atoms can align themselves in a magnetic field only in a few directions (two for silver), instead of in any direction, as classical physics had suggested. (*See also* Stern-Gerlach experiment.) In 1933 Stern measured the magnetic moment (strength of a subatomic particle's magnetic property) of the proton by using a molecular beam and found that it was actually about 2½ times the theoretical value.

In 1933, when the Nazis rose to power, Stern was compelled to leave Germany. He went to the United States, where he became research professor of physics at the Carnegie Institute of Technology, Pittsburgh. He remained there until his retirement in 1945.

**Stern Gang,** also called STERN GROUP, or LEHI, formally LOḤAME ḤERUT YISRA'EL (Hebrew: "Fighters for the Freedom of Israel"), Zionist terrorist organization in Palestine, founded in 1940 by Avraham Stern (1907–42) after a split in the right-wing underground movement, Irgun Zvai Leumi.

Fanatically anti-British, the group repeatedly attacked British personnel in Palestine and even invited aid from the Axis powers. The British police retaliated by killing Stern in his apartment in February 1942; many of the gang's leaders were subsequently arrested. The group's terrorist activities extended beyond Palestine: two members assassinated Lord Moyne, British minister of state in the Middle East, at Cairo (November 1944). Later, the Stern Gang attacked airfields, railway yards, and other strategic installations in Palestine, usually with success, though at heavy loss in members killed or captured. After the creation of Israel (1948), the group, which had always been condemned by moderate leaders of the Jewish community in Palestine, was suppressed, some of its units being incorporated in the Israeli defense forces. Unlike the Irgun Zvai Leumi, a precursor of the Ḥerut ("Freedom") Party, the Stern Gang left no political party to carry on its political programs.

**Stern-Gerlach experiment,** demonstration of the restricted spatial orientation of atomic and subatomic particles with magnetic polarity, performed in the early 1920s by the German physicists Otto Stern and Walther Gerlach. In the experiment, a beam of neutral silver atoms was directed through a set of aligned slits, then through a nonuniform (nonhomogeneous) magnetic field, and onto a cold glass plate. An electrically neutral silver atom is actually an atomic magnet: the spin of an unpaired electron causes the atom to have a north and south pole like a tiny compass needle. In a uniform magnetic field, the atomic magnet, or magnetic dipole, only precesses as the atom moves in the external magnetic field. In a nonuniform magnetic field, the forces on the two poles are not equal, and the silver atom itself is deflected by a slight resultant force, the magnitude and direction of which vary in relation to the orientation of the dipole in the nonuniform field. A beam of neutral silver atoms directed through the apparatus in the absence of the nonuniform magnetic field produces a thin line, in the shape of the slit, on the plate. When the nonuniform magnetic field is applied, the thin line splits lengthwise into two distinct traces, corresponding to just two opposite orientations in space of the silver atoms. If the silver atoms were oriented randomly in space, the trace on the plate would have broadened into a wide area, corresponding to numerous different deflections of the silver atoms. This restricted orientation, called space quantization, is manifested by other atoms and subatomic particles that have nonzero spin (angular momentum), with its associated magnetic polarity, whenever they are subjected to an appropriate nonuniform magnetic field.

**Stern Magazin** (German: "Star Magazine"), weekly news and feature magazine published in Germany. First printed in 1948, it became the leading general-interest magazine in the country, known for its outstanding photography and its blend of light and serious material. *Stern* features issues-oriented reporting, celebrity profiles, articles on international affairs, and news analysis. It has also combined photographs of violence and sexual imagery with conventional pictures of current events. In the early 21st century, *Stern* took an influential stand against neo-Nazi activities by launching a campaign to prevent right-wing violence. *Stern*'s weekly circulation exceeds one million.

**Sternberg, Josef von,** original name JONAS, or JOSEF, STERN, or STERNBERG (b. May 29, 1894, Vienna, Austria—d. Dec. 22, 1969, Hollywood, Los Angeles, Calif., U.S.), motion-picture director whose films are characterized by pictorial richness and photographic craftsmanship.



Josef von Sternberg editing a film
Culver Pictures

Sternberg immigrated to the United States as a boy. He began working in films as early as 1911 for a film-servicing company, and by 1923 he was a scriptwriter and cameraman in Hollywood. *The Salvation Hunters* (1925), his first independent release, brought immediate recognition; it was a realistic portrait of waterfront life, almost entirely composed of motionless shots. Two years later he directed *Underworld* (1927), one of the outstanding pictures of the year. Marked by carefully created atmosphere, striking lighting effects, and colourful characterization, it initiated a series of pictures dealing with the criminal world that included *The Drag Net* (1928) and *The Docks of New York* (1928). *The Last Command* (1928), starring the German character actor Emil Jannings, furthered his reputation.

Sternberg's best-known motion picture was *Der blaue Engel* (1930; *The Blue Angel*). Starring Marlene Dietrich as the symbol of sultry post-World War I decadence, the film combined sensual elegance, realistic detail of background, smooth transition between scenes, and the effective integration of music and song into an artistic whole. Sternberg brought Dietrich to the United States, where he featured her in a succession of notable films: *Morocco* (1930), *Dishonored* (1931), *Blonde Venus* (1932), *Shanghai Express* (1932), *The Scarlet Empress* (1934), and *The Devil Is a Woman* (1935).

*An American Tragedy* (1931) and *Crime and Punishment* (1935) were the other important films he directed in the 1930s. Sternberg's popularity subsequently declined, and few pictures released after that were critically acclaimed.

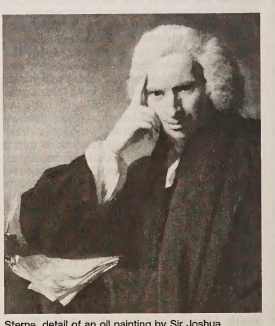
**Sterne, Laurence** (b. Nov. 24, 1713, Clonmel, County Tipperary, Ire.—d. March 18, 1768, London, Eng.), Irish-born English novelist and humorist, author of *Tristram Shandy* (1759–67), an early novel in which story is subordinate to the free associations and digressions of its narrator. He is also known for the novel *A Sentimental Journey* (1768).

*Life.* Sterne's father, Roger, though grandson of an archbishop of York, was an infantry officer of the lowest rank. Most of Laurence's early childhood was spent in poverty, following the troops about Ireland. Later, Sterne expressed his affection for soldiers through his portraits in *Tristram Shandy* of the gentle Uncle Toby and Corporal Trim.

At age 10, Sterne was sent to school at Hipperholme, near Halifax, where his uncle, Richard Sterne, could look out for him. He grew into a tall, thin man, with a long nose but likable face. Sterne attended Jesus College, Cambridge, on a scholarship. At college he suffered his first severe hemorrhage of the lungs. He had incurable tuberculosis.

After graduating he took holy orders and became vicar of Sutton-on-the-Forest, north of York. He soon became a prebendary (or canon) of York Minster and acquired the vicarage of Stillington. At first he was helped by another uncle, Jaques Sterne, precentor of York and archdeacon of Cleveland, a powerful clergyman but a mean-tempered man and a rabid politician. In 1741–42 Sterne wrote political articles supporting the administration of Sir Robert Walpole for a newspaper founded by his uncle but soon withdrew from politics in disgust. His uncle became his archenemy, thwarting his advancement whenever possible.

Sterne fell in love with Elizabeth Lumley, a



Sterne, detail of an oil painting by Sir Joshua Reynolds, 1760; in the National Portrait Gallery, London
National Portrait Gallery, London

cousin to Elizabeth Montagu, the bluestocking, and married her in 1741. Elizabeth soon showed a quarrelsome disposition, and Sterne grew restless. After their arguments, he would spend nights of debauchery in York.

As a clergyman Sterne worked hard but erratically. In two ecclesiastical courts he served as commissary (judge), and his frequent sermons at York Minster were popular. Externally, his

life was typical of the moderately successful clergy. But Elizabeth, who had several still-born children, was unhappy. Only one child, Lydia, lived.

In 1759, to support his dean in a church squabble, Sterne wrote *A Political Romance* (later called *The History of a Good Warm Watch-Coat*), a Swiftian satire of dignitaries of the spiritual courts. At the demands of embarrassed churchmen, the book was burned. Thus, Sterne lost his chances for clerical advancement but discovered his real talents. Turning over his parishes to a curate, he began *Tristram Shandy*. An initial, sharply satiric version was rejected by Robert Dodsley, the London printer, just when Sterne's personal life was upset. His mother and uncle both died. His wife had a nervous breakdown and threatened suicide. Sterne continued his comic novel, but every sentence, he said, was "written under the greatest heaviness of heart." In this mood, he softened the satire and told about Tristram's opinions, his eccentric family, and ill-fated childhood with a sympathetic humour, sometimes hilarious, sometimes sweetly melancholic—a comedy skirting tragedy.

Sterne himself published the first two volumes of *The Life and Opinions of Tristram Shandy, Gentleman* at York late in 1759, but he sent half of the imprint to Dodsley to sell in London. By March 1760, when he went to London, *Tristram Shandy* was the rage, and he was famous. Dodsley's brother James, the new proprietor, brought out a second edition of the novel, and two volumes of sermons followed. The witty, naughty "Tristram Shandy," or "Parson Yorick," as Sterne was called after characters in his novel, was the most sought-after man in town. Although the timing was coincidental, Lord Fauconberg, a Yorkshire neighbour, presented him with a third parish, Coxwold. Sterne returned north joyfully to settle at Coxwold in his beloved "Shandy Hall," a charming old house that is now a museum. He began to write at Shandy Hall during the summers, going to London in the winter to publish what he had written. James Dodsley brought out two more volumes of *Tristram Shandy;* thereafter, Sterne became his own publisher. In London he enjoyed the company of many great people, but his nights were sometimes wild. In 1762, after almost dying from lung hemorrhages, he fled the damp air of England into France, a journey he described as Tristram's flight from death. This and a later trip abroad gave him much material for his later *Sentimental Journey.* Elizabeth, now recovered, followed him to France, where she and their daughter settled permanently. Sterne returned to England virtually a single man.

In 1767 he published the final volume of *Tristram Shandy.* Soon thereafter he fell in love with Eliza Draper, who was half his age and unhappily married to an official of the East India Company. They carried on an open, sentimental flirtation, but Eliza was under a promise to return to her husband in Bombay. After she sailed, Sterne finished *A Sentimental Journey Through France and Italy, by Mr. Yorick,* published it early in 1768, and collapsed.

Lying in his London lodgings, he put up his arm as though to ward off a blow, saying, "Now it is come," and died. Soon after burial at London, Sterne's body was stolen by grave robbers, taken to Cambridge, and used for an anatomy lecture. Someone recognized the body, and the body was quietly returned to the grave. The story, only whispered at the time, was confirmed in 1969: Sterne's remains were exhumed and now rest in the churchyard at Coxwold, close to Shandy Hall.

*Works.* Sterne's *Tristram Shandy* was published in nine slim volumes from 1759 to 1767. In it the narrator, Tristram, sets out to do the impossible—to tell the story of his life. He begins with the story of his conception—an innocent remark of his mother upsetting his father's concentration and causing poor Tristram to be conceived a weakling. To understand that, Tristram must then explain John Locke's principle of the association of ideas. This, in turn, embroils him in a discussion of his parents' marriage contract, his Uncle Toby, Parson Yorick, the midwife, and Dr. Slop. He has so much to tell that he does not get himself born until the third volume. Finally reality dawns upon Tristram: it takes more time to tell the story of his life than it does to live it; he can never catch himself.

At one level *Tristram Shandy* is a satire upon intellectual pride. Walter Shandy thinks he can beget and rear the perfect child, yet Tristram is misconceived, misbaptized, miseducated, and circumcised by a falling window sash. He grows to manhood an impotent weakling whose only hope of transcending death is to tell the story of himself and his family. Finally, Tristram turns to the sweet, funny story of his Uncle Toby's amours with the Widow Wadman, concluding the novel at a point in time years before Tristram was born. A hilarious, often naughty novel, *Tristram Shandy* nevertheless makes a serious comment on the isolation of people from each other caused by the inadequacies of language and describes the breaking-through of isolation by impulsive gestures of sympathy and love. A second great theme of the novel is that of time—the discrepancy between clock time and time as sensed, the impinging of the past upon the present, the awareness that a joyous life inexorably leads to death. Modern commentators regard *Tristram Shandy* as the ancestor of psychological and stream-of-consciousness fiction.

Sterne's second and last novel, *A Sentimental Journey,* is the story of Yorick's travels through France; Sterne did not live to complete the part on Italy. He called it a "sentimental" journey because the point of travel was not to see sights or visit art collections, but to make meaningful contact with people. Yorick succeeds, but in every adventure, his ego or inappropriate desires and impulses get in the way of "sentimental commerce." The result is a light-hearted comedy of moral sentiments. *A Sentimental Journey* was translated into many languages, but the translations tended to lose the comedy and emphasize the sentiments. Abroad Sterne became the "high priest of sentimentalism," and as such had a profound impact upon continental letters in the second half of the 18th century.

(A.H.Ca.)

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**Sternheim, Carl,** in full WILLIAM ADOLF CARL STERNHEIM (b. April 1, 1878, Leipzig, Ger.—d. Nov. 3, 1942, Brussels, Belg.), German dramatist best known for plainly written satiric comedies about middle-class values and aspirations.

Sternheim, the son of a Jewish banker, grew up in Berlin. He studied philosophy, psychology, and law at the universities of Munich, Göteingen, Leipzig, and Berlin and performed his military service in a cavalry regiment. His family's money and that of his first two wives left him free to write, and he traveled most of his life.

He began writing plays at the age of 15, but his early plays were derivative. His best plays were produced from 1911 through 1916, being collectively titled *Aus dem bürgerlichen Heldenleben* ("From the Lives of Bourgeois Heroes"). The first play, *Die Hose* (*The Underpants*), was published and performed in 1911 under the title *Der Riese* ("The Giant") because the Berlin police had forbidden the original title on the grounds of gross immorality. It has as its main character Theobald Maske. He and others of the Maske family also appear in *Der Snob* (published and performed 1914), *1913* (published 1915 and performed 1919), and *Das Fossil* (published 1925 and performed 1923), the four plays forming the Maske Tetralogy. The plays portray the family as self-indulgent social climbers masked by bourgeois propriety. Sternheim's later plays were less successful. The telegram-like language used by Sternheim in the early plays is a kind of bridge between Frank Wedekind (whose daughter was his third wife) and Bertolt Brecht. Sternheim is frequently named among the Expressionist dramatists, but he straightfacedly maintained he was a realist. The petite bourgeoisie he attacked were, of course, represented by his own family. Sternheim's short and long fiction was in an avant-garde style that precluded success. His autobiography, *Vorkriegseuropa im Gleichnis meines Lebens* ("Prewar Europe in the Image of My Life"), appeared in 1936.

**sternum,** also called BREASTBONE, in the anatomy of tetrapods (four-limbed vertebrates), elongated bone in the centre of the chest that articulates with and provides support for the clavicles (collarbones) of the shoulder girdle and for the ribs. Its origin in evolution is unclear. A sternum appears in certain salamanders; it is present in most other tetrapods but lacking in legless lizards, snakes, and turtles (in which the shell provides needed support). In birds an enlarged keel develops, to which flight muscles are attached; the sternum of the bat is also keeled as an adaptation for flight.

In mammals the sternum is divided into three parts, from anterior to posterior: (1) the manubrium, which articulates with the clavicles and first ribs; (2) the mesosternum, often divided into a series of segments, the sternebrae, to which the remaining true ribs are attached; and (3) the posterior segment, called the xiphisternum. In humans the sternum is elongated and flat; it may be felt from the base of the neck to the pit of the abdomen. The manubrium is roughly trapezoidal, with depressions where the clavicles and the first pair of ribs join. The mesosternum, or body, consists of four sternebrae that fuse during childhood or early adulthood. The mesosternum is narrow and long, with articular facets for ribs along its sides. The xiphisternum is reduced to a small, usually cartilaginous xiphoid ("sword-shaped") process. The sternum ossifies from several centres. The xiphoid process may ossify and fuse to the body in middle age; the joint between manubrium and mesosternum remains open until old age.

**steroid,** any of a class of natural or synthetic organic chemical compounds characterized by a molecular structure of 17 carbon atoms arranged in four rings. In the parent structure (named gonane and referred to as the steroid nucleus), the carbon atoms are bonded to 28 hydrogen atoms. Steroids are important in biology, chemistry, and medicine. They include the sex hormones, adrenal cortical hormones, bile acids, sterols, anabolic agents, and oral contraceptives.

A brief treatment of steroids follows. For full treatment, *see* MACROPAEDIA: Chemical Compounds.

The steroid nucleus is three dimensional.

Steroids vary from one another not only in the nature of the attached groups but also in the configuration of the steroid nucleus and the position of the groups. Small modifications in the molecular structures of steroids can produce remarkable differences in their biological activities. Chemists have isolated hundreds of steroids from plants and animals. Thousands more have been made by treating natural steroids chemically or by synthesis.

Organic solvents are used to isolate steroids from natural sources. Sterols, the most abundant of the steroids, are treated with an alkali and then extracted by means of water-immiscible solvents, such as hexane or ether. Highly purified steroids can be obtained in the laboratory by these methods. Commercially large amounts of steroids are usually purified by repeated crystallization from solvents.

In plants and animals, steroids appear to be biosynthesized by similar reactions, beginning with acetic acid, assisted by a type of enzyme. The isoprenoid hydrocarbon called squalene, which occurs widely in nature, is thought to be the starting material from which all steroids are made. Enzymatic transformation of squalene produces lanosterol in animals and cycloartenol in plants, which yield cholesterol in both animals and plants. Cholesterol is then converted to bile acids and steroid hormones in animals and to steroids such as alkaloids in plants.

The commercial and laboratory synthesis of steroids usually begins with a one-ring starting material such as quinone, upon which other rings are built. Total synthesis of steroids has proved commercially feasible, but it is often more practical to prepare them by modifying other steroids that are naturally abundant. Certain microbes can transform parts of the steroid molecule, and industrial steroids are often made by a combination of chemical and microbiological techniques.

All the sex hormones and corticosteroids, which originate in the adrenal cortex, are derived from one of the most widely occuring steroids—namely, cholesterol. Corticosteroids play an essential role in maintaining life through a variety of hormonal functions that help to balance the ionic composition of the body fluids. Bile acids, a type of steroid found in mammals, play a role in emulsifying fats during digestion. Cholesterol, in addition to its role as a precursor of steroid hormones, is an important component of cell membrane. Unfortunately, in some persons excess serum cholesterol contributes to the formation of deposits on the arterial walls, which leads to atherosclerosis.

The first therapeutic use of steroids goes back to the 18th century when foxglove extracts were found to be beneficial for some heart conditions. The active ingredient in these preparations, digitalis, is still used today. It is a steroid glycoside, a molecule in which a steroid is linked to a sugar residue. Many plant steroids are cardiac glycosides, which in large doses can be fatal and may be used by the plant to ward off predatory insects. Some toads secrete steroid glycosides that may also act as a defense mechanism.

Corticosteroids and their synthetic analogues, such as prednisone and dexamethasone, are used therapeutically to control rheumatism and other inflammatory ailments. Anabolic steroids—which increase constructive metabolism—are sometimes administered to postoperative and geriatric patients to promote muscle growth and tissue regeneration. In recent years, a growing number of amateur and professional athletes have made use of synthetic analogues of testosterone to accelerate muscular development and to improve strength. Medical researchers have determined that anabolic steroids can have harmful effects, particularly in young people who are still developing physically.

The most widely employed steroid drugs, however, are undoubtedly the oral contraceptives, which were introduced in the early 1960s. These synthetic materials, which act by suppressing ovulation, are made chiefly from diosgenin, a plant steroid obtained from wild yams.

**steroid hormone,** any of a group of hormones that belong to the class of chemical compounds known as steroids; they are secreted by three "steroid glands"—the adrenal cortex, testes, and ovaries—and during pregnancy by the placenta. All steroid hormones are derived from cholesterol. They are transported through the bloodstream to the cells of various target organs where they carry out the regulation of a wide range of physiological functions.

These hormones often are classified according to the organs that synthesize them: the adrenal steroids are so called because they are secreted by the adrenal cortex, and the sex hormones are those produced by the ovaries and testes. This distinction is not exclusive, however, because the adrenal cortex also secretes sex hormones, albeit to a lesser extent than do the gonads, and the ovaries under abnormal conditions may produce adrenal steroids.

The adrenal cortex produces the adrenocortical hormones, which consist of the glucocorticoids and the mineralocorticoids. Glucocorticoids such as cortisol control or influence many metabolic processes, including the formation of glucose from amino acids and fatty acids and the deposition of glycogen in the liver. Glucocorticoids also help to maintain normal blood pressure, and their anti-inflammatory and immunosuppressive actions have rendered them useful in treating rheumatoid arthritis and preventing the rejection of transplanted organs. Mineralocorticoids such as aldosterone help maintain the balance between water and salts in the body, predominantly exerting their effects within the kidney.

The androgens are the male sex hormones. The principal androgen, testosterone, is produced primarily by the testes and in lesser amounts by the adrenal cortex and (in women) by the ovaries. Androgens are primarily responsible for the development and maintenance of reproductive function and stimulation of the secondary sex characteristics in the male. Androgens also have an anabolic (synthesizing and constructive, rather than degradative) function in stimulating the production of skeletal muscles and bone as well as red blood cells. To enhance the anabolic activity of androgens without increasing their masculinizing ability, anabolic steroids were developed. Though originally intended to combat diseases marked by wasting, these synthetic hormones have been abused by individuals desiring to increase their muscle mass, such as athletes seeking to gain a competitive advantage. Overdosing has been linked to serious side effects, including infertility and coronary heart disease.

Estrogens are one of the two types of female sex hormones. They are secreted mainly by the ovaries and in smaller amounts by the adrenal glands and (in men) by the testes. Estradiol is the most potent of the estrogens. Functioning similarly to androgens, the estrogens promote the development of the primary and secondary female sex characteristics; they also stimulate linear growth and skeletal maturation. In other mammals these hormones have been shown to precipitate estrus (heat). The ovarian production of estrogen plummets during menopause.

Progestins, the most important of which is progesterone, are the other type of female sex hormone and are named for their role in maintaining pregnancy (pro-gestation). Estrogens and progestins are secreted cyclically during menstruation. During the menstrual cycle, the ruptured ovarian follicle (the corpus luteum) of the ovary produces progesterone, which renders the uterine lining receptive to the implantation of a fertilized ovum. Should this occur, the placenta becomes the main source of progesterone, without which the pregnancy would terminate. As pregnancy progresses, placental production of progesterone increases, and these high doses suppress ovulation, preventing a second conception. The contraceptive quality of progesterone led to the development of structurally modified progestins and estrogens—the oral contraceptives known as birth-control pills, used by women to prevent unwanted pregnancy.

**Stesichorus** (b. 632/629 BC, Mataurus, Italy—d. 556/553 BC), Greek lyric poet credited with originating bucolic poetry in his *Daphnis* and with being the author of such forerunners of Hellenistic romantic poetry as *Calyce* and *Rhadine*.

Stesichorus' works were mainly narrative poems dealing with myths, and he wrote in the Doric dialect. The Latin writers Horace and Quintilian spoke of him as a serious poet, but hardly 100 lines of his work have survived, and it is not even certain that he used the triadic stanza (divided into strophe, antistrophe, and epode) supposed to be his invention. Stesichorus was active mainly at Himera in Sicily; Plato recounts in the *Phaedrus* that he was struck blind after censuring Helen of Troy's conduct in a poem but was cured after composing *Palinodia,* a recantation.

**Stessel, Anatoly Mikhaylovich,** Stessel also spelled STÖSSEL (b. June 28 [July 10, New Style], 1848, St. Petersburg, Russia—d. January 1915), Russian general who commanded the garrison at Port Arthur during the Russo-Japanese War.

Stessel graduated from the Pavlovskoye military academy in 1866. He took part in the Russo-Turkish War (1877–78) and commanded a brigade in the suppression of the Boxer Rebellion (1900–01). In August 1903 he assumed command of the Russian garrison at Port Arthur and (from January 1904) was the commander of the 3rd Siberian Corps stationed there. Shortly after the outbreak of the Russo-Japanese War, the Japanese blockaded the port (April 1904). After a 148-day siege Stessel surrendered the fortifications to the Japanese (December 1904) in disregard of the decisions taken by the other senior officers and of the adequate supply of men and materials.

He was suspended from active service in September 1906 and, in the wake of pressure from the press (which had initially portrayed him as the hero of the Port Arthur defense), court-martialed in 1907. He was sentenced to death, commuted to 10 years' imprisonment, but in May 1909 was pardoned by the tsar.

**stethoscope,** medical instrument used in listening to sounds produced within the body, chiefly in the heart or lungs. It was invented by the French physician R.T.H. Laënnec, who in 1819 described the use of a perforated wooden cylinder to transmit sounds from the patient's chest (Greek: *stēthos*) to the physician's ear. This monaural stethoscope was modified to more convenient forms, but it has been largely supplanted by the binaural type with two flexible rubber tubes attaching the chest piece to spring-connected metal tubes with earpieces. In listening to heart sounds, in particular, it is necessary to use both a bell-shaped, open-ended chest piece, which transmits low-pitched sounds well, and the flat chest piece covered with a semirigid disk (diaphragm type) that detects sounds of higher frequency. Instruments having both types of chest piece, arranged so that they can be rapidly interchanged by turning a valve, are widely used.

**Stettin** (Poland): *see* Szczecin.

**Stettinius, Edward Reilly, Jr.** (b. Oct. 22, 1900, Chicago—d. Oct. 31, 1949, Greenwich, Conn., U.S.), American industrialist who served as President Franklin D. Roosevelt's last secretary of state (1944–45) and figured prominently in the establishment of the United Nations (1945).



Stettinius

By courtesy of the Library of Congress, Washington, D.C.

Stettinius attended but did not graduate from the University of Virginia. He held several jobs before becoming, in 1926, an assistant to a vice president at General Motors; in five years he was himself a vice president of the company. In 1934 he joined U.S. Steel, where he became chairman of the board in 1938.

A year later, Stettinius left private industry to accept appointment as chairman of the War Resources Board. In 1940 he chaired the National Defense Advisory Commission, and in 1941 he assumed the directorship of priorities at the Office of Production Management. Later that year, Stettinius replaced Harry Hopkins in supervising the lend-lease program.

In 1943 Roosevelt appointed Stettinius undersecretary of state, and he succeeded Cordell Hull as full secretary of the department the following year. Stettinius dealt effectively with the administrative and personnel functions of his post and soundly implemented Roosevelt's foreign-policy decisions, but he played only a minor role in the formulation of that policy. He did, however, advise Roosevelt during the 1945 Yalta Conference.

A firm believer in a postwar international organization, Stettinius helped lay the groundwork for the United Nations and in 1945 led the U.S. delegation to the San Francisco Conference, which drafted the U.N. Charter.

Two months after Roosevelt's death, President Harry S. Truman appointed James F. Byrnes to replace Stettinius as secretary of state. Stettinius then became the first U.S. delegate to the UN, resigning in 1946. In 1949 he published *Roosevelt and the Russians: The Yalta Conference.*

**Steuart,** HOUSE OF: *see* Stuart, House of.

**Steuart, Sir James:** *see* Denham, Sir James Steuart.

**Steuben, Frederick William (Augustus), Freiherr von** (baron of), original name FRIEDRICH WILHELM LUDOLF GERHARD AUGUSTIN VON STEUBEN (b. Sept. 17, 1730, Magdeburg, Prussia [Germany]—d. Nov. 28, 1794, near Remsen, N.Y., U.S.), German officer who served the cause of U.S. independence by converting the revolutionary army into a disciplined fighting force.

Born into a military family, Steuben led a soldier's life from age 16. During the Seven Years' War (1756–63) he rose to the rank of captain in the Prussian army and was for a time attached to the general staff of Frederick II the Great. After the close of the war he was retired from the army and became court chamberlain for the prince of Hohenzollern-Hechingen, and at some unknown date he apparently was created a baron (*Freiherr*). In 1777 it was rumoured that he had been obliged to leave Hohenzollern-Hechingen for unsavoury conduct.

His availability came to the attention of Benjamin Franklin and Silas Deane—in France as agents of the newly formed U.S. government—and they composed a letter introducing him to General George Washington as a "Lieut. Genl. in the King of Prussia's Service," who was fired with "Zeal for our Cause." Thus armed, Steuben arrived in America in December 1777. Impressed by his fictitiously high rank, his pleasing personality, and Washington's favourable comments, Congress appointed him to train the Continental forces stationed at the winter encampment at Valley Forge, Pa.

The model drill company that Steuben formed and commanded was copied throughout the ranks. That winter he wrote *Regulations for the Order and Discipline of the Troops of the United States,* which soon became the "blue book" for the entire army and served as the country's official military guide until 1812. On Washington's recommendation, in May 1778, Steuben was appointed inspector general of the army with the rank of major general. In 1780 he was finally granted a field command; he served as a division commander in Virginia and participated in the siege of Yorktown (1781), where the British met final defeat.



Steuben, portrait by Charles Willson Peale; in Independence National Historical Park, Philadelphia

By courtesy of the Independence National Historical Park Collection, Philadelphia

After the war Steuben settled in New York City, where he lived so extravagantly that, despite large grants of money from Congress and the grant of 16,000 acres (6,000 hectares) of land by New York state, he fell into debt. Finally, after ceaseless importunity, in 1790 he was voted a life pension of $2,500, which sufficed to maintain him on his farm until he died.

**Steuben Glass Company,** glassworks founded in 1903 by T.G. Hawkes and Frederick Carder at Corning, N.Y. It was purchased by the Corning Glass Works in 1918 but continued to be directed by Carder until 1933. The company became known for fancy coloured glassware, particularly a type with an iridescent, translucent finish called Aurene. Another specialty was Intarsia glass, crystal glassware with soft, overlapping colour inlays. In the 1930s the firm began making glassware from a new colourless lead crystal developed by Corning. Steuben has since manufactured fine glass products of cut, engraved, and free-blown designs made almost exclusively of that type of crystal glass.

**Steubenville,** city, seat (1797) of Jefferson county, eastern Ohio, U.S. It lies along the Ohio River, there bridged to Weirton, W.Va., with which it forms a metropolitan area, 39 miles (63 km) west of Pittsburgh. Settled temporarily in 1765 by Jacob Walker, it later (1786) was the site of Fort Steuben (destroyed by fire, 1790), named for Baron Frederick William von Steuben, the Prussian soldier who drilled the colonial army during the American Revolutionary War. One of Ohio's oldest communities, it was permanently laid out in 1797. Its location on the river and nearby abundant supplies of coal and clay led to its development as a steel-making centre. The city's manufactures now also include tin, chemicals, ferroalloys, and paper products. The College of Steubenville was opened in 1946 and Jefferson Technical College in 1968. Edwin M. Stanton (1814–69), secretary of war under President Abraham Lincoln, was born in Steubenville. Inc. village, 1805; city, 1851. Pop. (1990) city, 22,125; Steubenville-Weirton MSA, 142,523.

**Steudner, Hermann** (b. 1832, Greiffenberg, Silesia [Germany]—d. April 10, 1863, Wāw, Sudan), German physician and explorer who investigated the Nile tributaries in the western Sudan and took part in the systematic exploration of Ethiopia.

In 1862 Steudner traveled across Ethiopia from Mitewa (on the Red Sea) to Lake Tana and across the highlands of Ethiopia north to Khartoum. The following year he went with a Dutch explorer, Alexandrine Tinné, on an expedition up the Baḥr al-Ghazāl, the chief western tributary of the White Nile, into the southwestern Sudan, where he died of fever.

**Stevenage,** district (borough) and new town in the county of Hertfordshire, England. It lies along the Great North Road (a major English transport artery) on the northern periphery of the London metropolitan complex. It was the first new town to be designated by British planners under the New Towns Act, 1946, with the aim of catering to the needs of London's overspill population. The old town, with its old coaching inns, 12th-century church, 16th-century grammar school, and market (granted 1281), forms one neighbourhood. The main shopping centre, from which vehicles are excluded, is in the new town, and modern industries, mainly the manufacture of electronic equipment, lie alongside the A1 motorway, which bypasses Stevenage. The district was created in 1974 with an area of 10 square miles (26 square km) to coincide roughly with the designated area of the new town. Pop. (1986 est.) district, 74,400.



Modern housing, Stevenage, Hertfordshire

J. Allen Cash—EB Inc.

**Stevens, Albert William** (b. March 13, 1886, Belfast, Md., U.S.—d. March 26, 1949, Redwood City, Calif.), U.S. Army officer, balloonist, and early aerial photographer who took the first photograph of the Earth's curvature (1930) and the first photographs of the Moon's shadow on the Earth during a solar eclipse (1932). On Nov. 11, 1935, Stevens made a record balloon ascent with Captain (later Lieutenant General) Orvil Anderson at Rapid City, S.D., attaining a height of 72,395 feet (22,066 m). This altitude record was unequaled until 1956.

**Stevens, Alzina Parsons,** *née* ALZINA ANN PARSONS (b. May 27, 1849, Parsonsfield, Maine, U.S.—d. June 3, 1900, Chicago), American labour leader and journalist known

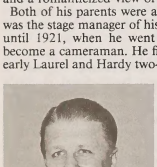
for her contributions to union organization and child-welfare reform.

Parsons was forced by family poverty to work in a textile factory at 13; by the age of 18, she had learned the printers' trade. In 1877 she organized the Working Woman's Union No. 1 in Chicago. Moving to Toledo, Ohio, in about 1882, she began working with the Knights of Labor, organizing a women's assembly and becoming, by 1890, the chief officer of 22 local Knights' assemblies.

Stevens returned to Chicago in 1892, and in 1893 she was named assistant factory inspector for the state of Illinois. Her work contributed to the passage of improved child-labour and compulsory school attendance laws in the state. Stevens subsequently lobbied for the passage of a state juvenile-court law that, when enacted in 1899, was the first such law in the nation.

**Stevens, George** (b. 1905, Oakland, Calif., U.S.—d. March 8, 1975, Lancaster, Calif.), American motion-picture director known for his films exhibiting brilliant camera techniques and a romanticized view of life.

Both of his parents were actors, and Stevens was the stage manager of his father's company until 1921, when he went to Hollywood to become a cameraman. He filmed many of the early Laurel and Hardy two-reel comedies and



George Stevens, 1957
AP/Wide World Photos

earned a reputation for meticulous craftsmanship. Six years after he directed his first picture, Stevens achieved fame with *Alice Adams* (1935) and *Annie Oakley* (1935). A series of comedies followed, including *Swing Time* (1936), a musical with Ginger Rogers and Fred Astaire; *Vivacious Lady* (1938); *Woman of the Year* (1942); *The Talk of the Town* (1942); and *The More the Merrier* (1943).

Stevens' later films were praised for effective camera work and overall visual composition, for the careful integration of music and visuals, and for the skillful handling of sentimental themes. Although *I Remember Mama* (1948), his first postwar picture, idealized the past, it is praised for its realistic background and emotional restraint. He won the Academy Award for best directing for *A Place in the Sun* (1951), a screen adaptation of Theodore Dreiser's novel *An American Tragedy*, and again in 1956 for *Giant*. He is also remembered for *Shane* (1953), a western now considered a classic; *The Diary of Anne Frank* (1959); and *The Greatest Story Ever Told* (1965). His last film was *The Only Game in Town* (1969).

**Stevens, J(ohn) P(eters)** (b. Feb. 2, 1868, North Andover, Mass., U.S.—d. Oct. 29, 1929, Plainfield, N.J.), merchant who founded J.P. Stevens, one of the biggest firms in the American textile industry.

John Stevens' grandfather, Nathaniel Stevens, started in the textile industry during the War of 1812. Nathaniel's son (John's uncle) Moses took over the textile company and made it one of the largest in the country.

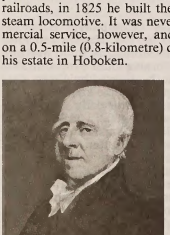
John Stevens started his career working for a Boston dry-goods commission house, Faulkner Page & Co., and by 1899 he had enough money to establish his own dry-goods commission house in New York City, named J.P. Stevens & Co. His commission house prospered by selling the products of his uncle's company. He also purchased interests in many textile firms in New England and was one of the first textile industrialists to invest heavily in mills in the South. He served as director of six textile mills.

**Stevens, John** (b. 1749, New York City—d. March 6, 1838, Hoboken, N.J., U.S.), American lawyer, inventor, and promoter of the development of steam power for transportation. His petition to the U.S. Congress resulted in the Patent Law of 1790, the foundation of the present U.S. patent system.

In 1776 Stevens became a captain in the American Revolutionary army and later was promoted to colonel. Afterward, he became interested in the exploits of the American steamboat pioneers James Rumsey and John Fitch, and he developed a number of designs of his own for boilers and engines. It was with the view of protecting his inventions that he submitted to Congress his outline for a patent law. In 1802 he built a screw-driven steamboat, the first example of a powered screw applied to ship propulsion. His steamboat also incorporated a multitubular boiler, for which he was awarded a patent in 1803. The following year, Stevens completed an improved twin-screw steamboat that was successful in navigating the Hudson River.

Because of the inherent danger in using the high-pressure steam engines in his previous vessels, he began the design of a low-pressure engine to be used in a paddle-wheeled boat. Although the American inventor Robert Fulton successfully launched his own paddle wheeler, the *Clermont*, in 1807 before Stevens could finish, he persisted and launched the 100-foot (30-metre) *Phoenix* in 1809. Since Fulton had a monopoly grant of navigation rights on the Hudson, Stevens sent the *Phoenix* to Philadelphia by sea, the first time a steamship ever navigated ocean waters. In 1811, at Philadelphia, he inaugurated the world's first steamferry service.

In 1812 Stevens submitted plans to Congress for an armoured warship, but they were ignored. In that same year he published a pamphlet entitled *Documents Tending to Prove the Superior Advantages of Rail-Ways and Steam-Carriages over Canal Navigation*, in which he outlined many phases of railway transportation. To demonstrate the feasibility of railroads, in 1825 he built the first American steam locomotive. It was never put into commercial service, however, and was run only on a 0.5-mile (0.8-kilometre) circular track on his estate in Hoboken.



John Stevens, oil on panel, attributed to John Trumbull; in the collection of the Stevens Institute of Technology
By courtesy of Stevens Institute of Technology, Hoboken, N.J.; photograph, Frick Art Reference Library

In 1815 Stevens obtained from the New Jersey legislature the first charter ever granted in the United States for a railroad, and the Camden and Amboy Railroad and Transportation Company was formed in 1830.

**Stevens, John Frank** (b. April 25, 1853, near West Gardiner, Maine, U.S.—d. June 2, 1943, Southern Pines, N.C.), American civil engineer and railroad executive who, as chief engineer of the Panama Canal from late 1905 to April 1907, laid the basis for that project's successful completion.

Stevens became an engineer and in 1875 began working for various railroads. By 1895 he had become chief engineer for the Great Northern Railway and had overseen the laying of thousands of miles of track over difficult terrain. In 1905 he was appointed chief engineer of the Isthmian Canal Commission and thus became responsible for both the engineering and construction of the Panama Canal.

At the time of Stevens' appointment, the canal-building project was a shambles. Stevens quickly created orderly planning, began a program to eradicate the yellow-fever mosquito in the area, greatly expanded the network of railways serving the project, improved the food supply, and generally made the Canal Zone livable for the American work force. Most importantly, he was instrumental in persuading President Theodore Roosevelt of the feasibility of a canal using a combination of locks and a dammed lake instead of the sea-level canal favoured by a majority of the Isthmian Canal Commission's members. Roosevelt's approval of the locked-canal plan ensured the successful building of the Panama Canal (the alternative, sea-level design would have entailed the moving of much greater quantities of soil and rock than were technically feasible).

Stevens had laid the canal project on a firm basis, but he grew frustrated by his strenuous and demanding post and resigned it in April 1907. He was succeeded by George W. Goethals. Stevens subsequently served as an executive for several American railroads and was an engineering consultant for them.

**Stevens, John Paul** (b. April 20, 1920, Chicago), associate justice of the U.S. Supreme Court (from 1975).

Stevens was admitted to the bar in 1947 and served as a clerk for Justice Wiley B. Rutledge before joining a Chicago law firm to specialize in antitrust law. He also taught and served on various public commissions. In 1970 he was appointed circuit judge of the Court of Appeals of the seventh circuit by President Richard M. Nixon and gained a reputation for his legal attainments. He was appointed to the U.S. Supreme Court by President Gerald R. Ford in 1975 to fill the seat of William O. Douglas. Stevens was an independently minded justice who occupied a centrist position on the Court.

**Stevens, Nettie Maria** (b. July 7, 1861, Cavendish, Vt., U.S.—d. May 4, 1912, Baltimore, Md.), American biologist and geneticist who was one of the first scientists to find that sex is determined by a particular chromosome.

Stevens earned a B.A. (1899) and M.A. (1900) from Stanford University. In 1903 she received a Ph.D from Bryn Mawr College (Pa.). She stayed on at Bryn Mawr as a research fellow and associate in experimental morphology from 1903 to 1912.

Stevens investigated in the field of cytology, particularly the analysis of germ cells and the histology of regenerative processes in planarians and hydroids. She is best known for her contributions to the theory of sex determination. In 1906 Stevens and Edmund Beecher Wilson independently discovered that sex was determined by the X and Y chromosomes. This was a finding of great significance to the

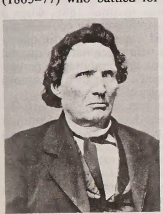
science of genetics, for it established the relationship of cytology to heredity. Stevens subsequently investigated the sex determination of beetles, flies, plant life, and aphids, discovering supernumerary chromosomes in certain insects and the paired state of chromosomes in flies and mosquitoes.

**Stevens, Robert Livingston** (b. Oct. 18, 1787, Hoboken, N.J., U.S.—d. April 20, 1856, Hoboken), U.S. engineer and ship designer who invented the widely used inverted-T railroad rail and the railroad spike. He tested the first steamboat to use screw propellers, built by his father, the noted inventor John Stevens. He also assisted his father in the construction of the "Phoenix," on which he served during the steamboat's historic ocean voyage from New York to Philadelphia in 1809.

Stevens became a prominent figure in naval design. He developed a "false bow" for the steamboat "New Philadelphia," which increased its speed so that it was able to leave Albany, N.Y., in the morning and reach New York City before nightfall. In 1822 he built the ferryboat "Hoboken."

Stevens designed the inverted-T rail in 1830; he found that rails laid on wooden ties, with crushed stone or gravel beneath, provided a roadbed superior to any known before. His rail and roadbed came into universal use in the United States. He also added the pilot, or cowcatcher, to the locomotive and increased the number of drive wheels to eight for better traction. In 1846 Stevens, an ardent yachtsman, designed the "Maria," for 20 years one of the fastest yachts in the world.

**Stevens, Thaddeus** (b. April 4, 1792, Danville, Vt., U.S.—d. Aug. 11, 1868, Washington, D.C.), U.S. Radical Republican congressional leader during Reconstruction (1865–77) who battled for freedmen's rights



Thaddeus Stevens

By courtesy of the National Archives, Washington, D.C.

and insisted on stern requirements for readmission of Southern states into the Union after the Civil War (1861–65).

Admitted to the Maryland bar, he moved to Pennsylvania to practice law in 1816. Having witnessed the oppressive slave system at close range, he early developed a fierce hatred of bondage and defended numbers of fugitives without fee. An anti-Masonic member of the state legislature (1833–41), he proved himself a friend of banks, internal improvements, and public schools and a foe of Freemasons, Jacksonian Democrats, and slaveholders. Serving as a Whig in the U.S. House of Representatives (1849–53), he advocated tariff increases and opposed the fugitive slave provision of the Compromise of 1850.

In the middle of the decade he joined the newly formed Republican Party, which opposed extension of slavery into the western territories; again he was elected to Congress (1859–68), where he became, in the words of a fellow member, the "natural leader, who assumed his place by common consent." He exerted this leadership by means of his sarcastic eloquence, his parliamentary skills, and his privileges as chairman of the Ways and Means Committee and later of the Appropriations Committee.

After the war Stevens emerged as one of the most militant of the Radical Republicans, consistently striving for justice for the black masses. Alert to the return to power of traditional white Southern leadership, he argued that the seceded states were in the condition of "conquered provinces" to which restraints of the Constitution did not apply.

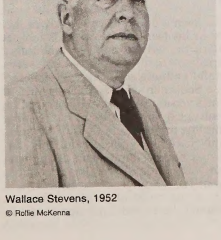
When Congress met in December 1865, Stevens took the lead in excluding the traditional senators and representatives from the South. As a member of the joint Committee on Reconstruction, he played an important part in the preparation of the Fourteenth (due process) Amendment to the Constitution and the military reconstruction acts of 1867. Viewing Pres. Andrew Johnson as "soft" toward the South, he introduced the resolution for his impeachment (1868) and served as chairman of the committee appointed to draft impeachment articles. Throughout this period Stevens urged that Southern plantations be taken from their owners and that part of the land be divided among freedmen, with proceeds of the balance to be used toward paying off the national war debt; this confiscation plan failed, however, to gain congressional support.

In failing health, Stevens requested that he be buried among Negroes resting in a cemetery in Lancaster, Pa. On his tombstone were carved the words he had composed, explaining that he had chosen this place so that he might "illustrate in death" the principle he had "advocated throughout a long life"; namely, "Equality of man before his Creator."

**Stevens, Wallace** (b. Oct. 2, 1879, Reading, Pa., U.S.—d. Aug. 2, 1955, Hartford, Conn.), U.S. poet whose work explores the interaction of reality and what man can make of reality in his mind. It was not until late in life that Stevens was read at all widely or recognized as a major poet by more than a few.

Stevens attended Harvard for three years, worked briefly for the New York *Herald Tribune,* and then won a degree (1904) at the New York Law School and practiced law in New York City. His first published poems, aside from college verse, appeared in 1914 in *Poetry,* and thereafter he was a frequent contributor to the literary magazines. In 1916 he joined an insurance firm in Hartford, Conn., rising in 1934 to vice president, a position he held until his death.

*Harmonium* (1923), his first book, sold fewer than 100 copies but received some favourable critical notices; it was reissued in 1931 and in 1947. In it he introduced the imagination–reality theme that occupied his creative lifetime, making his work so unified that he considered three decades later calling his collected poems "The Whole of Harmonium."



Wallace Stevens, 1952

© Rollie McKenna

He displayed his most dazzling verbal brilliance in his first book; he later tended to relinquish surface lustre for philosophical rigour. In *Harmonium* appeared such poems as "Le Monocle de Mon Oncle," "Sunday Morning," "Peter Quince at the Clavier," and Stevens' own favourites, "Domination of Black" and "The Emperor of Ice-Cream"; all were frequently republished in anthologies. *Harmonium* also contained "Sea Surface Full of Clouds," in which waves are described in terms of such unlikely equivalents as umbrellas, French phrases, and varieties of chocolate, and "The Comedian as the Letter C," in which he examines the relation of the poet, or man of imagination, to society.

In the 1930s and early '40s, this theme was to reappear, although not to the exclusion of others, in Stevens' *Ideas of Order* (1935), *The Man with the Blue Guitar* (1937), and *Parts of a World* (1942). *Transport to Summer* (1947) incorporated two long sequences that had appeared earlier: "Notes Towards a Supreme Fiction" and "Esthétique du Mal" ("Aesthetic of Evil"), in which he argues that beauty is inextricably linked with evil. *The Auroras of Autumn* (1950) was followed by his *Collected Poems* (1954), which earned him the Pulitzer Prize for Poetry. A volume of critical essays, *The Necessary Angel,* appeared in 1951.

After Stevens' death, Samuel French Morse edited *Opus Posthumous* (1957), including poems, plays, and prose omitted from the earlier collection. Robert Buttel, in *Wallace Stevens: The Making of Harmonium* (1967), included some of Stevens' juvenilia. Holly Stevens, the poet's daughter, published *Souvenirs and Prophecies: The Young Wallace Stevens* (1977), which included the complete juvenilia and journals. A late critical commentary is provided by Harold Bloom in *Wallace Stevens: The Poems of Our Climate* (1977).

**Stevens Point,** city, seat (1867) of Portage County, central Wisconsin, U.S., on the Wisconsin River, 68 mi (109 km) west-northwest of Appleton. Settled in 1839 by George Stevens, it became the service centre for a lumbering community and grew in the 1870s after the arrival of the Wisconsin Central Railroad (the Soo Line). Polish immigrants influenced its cultural development. Diversified manufacturing includes paper products, furniture, fishing equipment, and beer. The Sentry Insurance Company is headquartered there. The University of Wisconsin—Stevens Point was founded as a teacher's college in 1894. Inc. 1858. Pop. (1990) 23,006.

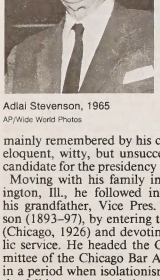
**Stevenson, Adlai E(wing)** (b. Oct. 23, 1835, Christian County, Ky., U.S.—d. June 14, 1914, Chicago), Democratic lawyer and legislator who rose to be vice president of the United States (1893–97).

Beginning his practice of law in Metamora, Ill., Stevenson was stimulated by the famous Lincoln–Douglas debates, which took place during the Illinois senatorial campaign of 1858. He soon became involved in local and national politics and was appointed to his first public office as a master in chancery in 1860. In 1865 he was elected state's attorney. Chosen twice for the U.S. House of Representatives (1875–76, 1879–80), he stood for low tariffs and a soft money policy; he also took a conspicuous part in the congressional debate protesting the manner of settlement in the disputed presidential election of 1876.

When Grover Cleveland was elected president (1885–89) on the Democratic ticket, Stevenson served as first assistant postmaster general. Upon Cleveland's renomination four years later, Stevenson was selected as the vice presidential candidate who could best unite all factions of the party. At the end of his term in office, he was appointed by Pres. William

McKinley to serve as chairman of a commission sent to Europe to work for international bimetallism. Twice afterward he ran unsuccessfully—for vice president (1900) and for governor of Illinois (1908). His grandson and namesake was a governor of Illinois and twice an unsuccessful candidate for president.

**Stevenson, Adlai E(wing)** (b. Feb. 5, 1900, Los Angeles—d. July 14, 1965, London), U.S. political leader and diplomat who helped found the United Nations (UN), where he served as chief U.S. delegate (1961–65); he is



Adlai Stevenson, 1965
AP/Wide World Photos

mainly remembered by his countrymen as the eloquent, witty, but unsuccessful Democratic candidate for the presidency in 1952 and 1956.

Moving with his family in 1906 to Bloomington, Ill., he followed in the footsteps of his grandfather, Vice Pres. Adlai E. Stevenson (1893–97), by entering the practice of law (Chicago, 1926) and devoting himself to public service. He headed the Civil Rights Committee of the Chicago Bar Association, and—in a period when isolationism was rampant in the Midwest—was chairman of the Chicago chapter of the Committee to Defend America by Aiding the Allies. From 1941 to 1944 he was special assistant to the U.S. secretary of the navy, and in 1943 he headed a Foreign Economic Administration mission to Italy to develop a U.S. relief program. Two years later he became assistant to the secretary of state and served as an adviser to the U.S. delegation to the San Francisco Conference that founded the UN. He was named senior adviser to the U.S. delegation at the first meeting of the UN General Assembly in London (1946) and was a U.S. delegate at Assembly meetings in New York (1946–47).

In 1948 Stevenson was elected governor of Illinois by a larger majority than any other candidate had received in the history of the state. His administration was characterized by far-reaching reforms: establishment of a merit system for state police, improved care and treatment of patients in state mental hospitals, greater state aid for schools, and a revitalized civil service.

In spite of his refusal to seek the presidential nomination in 1952, he was drafted by the Democratic National Convention in Chicago. He waged a vigorous campaign, but the popular appeal of wartime hero Gen. Dwight D. Eisenhower proved irresistible. Stevenson was defeated a second time four years later, again by Eisenhower.

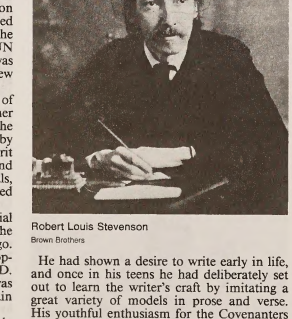
With the election of Pres. John F. Kennedy in 1960, Stevenson was appointed chief U.S. representative to the UN, holding Cabinet rank and the title of ambassador. He served until his death, helping to assuage some of the worst international tensions—brought on by the financial difficulties of the parent organization, by the Cold War, and by the sensitivity of emerging African and Asian nations to traditional Western leadership. Stevenson's published works include *Call to Greatness* (1954); *What I Think* (1956); *Friends and Enemies* (1958); *Looking Outward: Years of Crisis at the United Nations* (1963); and *The Papers of Adlai E. Stevenson* (1972– ).

His eldest son, Adlai E. Stevenson III, was elected to the U.S. Senate from Illinois in 1970 and again in 1974 (retiring in 1981), after serving in the state legislature (1965–67) and as state treasurer (1967–70).

**Stevenson, Robert** (b. June 8, 1772, Glasgow—d. July 12, 1850, Edinburgh), civil engineer who in 1797 succeeded his stepfather, Thomas Smith, as a member of the Scottish Lighthouse Board. In that capacity until 1843, he designed and built lighthouses (1797–1843) and invented intermittent and flashing lights as well as the hydrophore (an instrument for obtaining specimens from water). He wrote *Account of the Bell Rock Lighthouse* (1824), the famous lighthouse that he built (1807–12) in collaboration with John Rennie on an isolated site, the first such in Scotland. Three of Stevenson's sons, Alan, David, and Thomas, were associated with him in the practice of engineering; Thomas was the father of the writer Robert Louis Stevenson.

**Stevenson, Robert Louis (Balfour)** (b. Nov. 13, 1850, Edinburgh—d. Dec. 3, 1894, Vailima, Samoa), Scottish essayist, poet, and author of fiction and travel books, best known for his novels *Treasure Island* (1881), *Kidnapped* (1886), *Strange Case of Dr. Jekyll and Mr. Hyde* (1886), and *The Master of Ballantrae* (1889).

*Early life.* Stevenson was the only son of Thomas Stevenson, a prosperous civil engineer, and his wife, Margaret Isabella Balfour. His poor health made regular schooling difficult, but he attended Edinburgh Academy and other schools before, at 17, entering Edinburgh University, where he was expected to prepare himself for the family profession of lighthouse engineering. But Stevenson had no desire to be an engineer, and he eventually agreed with his father, as a compromise, to prepare instead for the Scottish bar.



Robert Louis Stevenson
Brown Brothers

He had shown a desire to write early in life, and once in his teens he had deliberately set out to learn the writer's craft by imitating a great variety of models in prose and verse. His youthful enthusiasm for the Covenanters (*i.e.,* those Scotsmen who banded together to defend their version of Presbyterianism in the 17th century) led to his writing *The Pentland Rising,* his first printed work. During his years at the university he rebelled against his parents' religion and set himself up as a liberal bohemian who abhorred the alleged cruelties and hypocrisies of bourgeois respectability.

In 1873, in the midst of painful differences with his father, he visited a married cousin in Suffolk, England, where he met Sidney Colvin, the English scholar, who became a lifelong friend, and Fanny Sitwell (who later married Colvin). Sitwell, an older woman of charm and talent, drew the young man out and won his confidence. Soon Stevenson was deeply in love, and on his return to Edinburgh he wrote her a series of letters in which he played the part first of lover, then of worshipper, then of son. One of the several names by which Stevenson addressed her in these letters was "Claire," a fact that many years after his death was to give rise to the erroneous notion that Stevenson had had an affair with a humbly born Edinburgh girl of that name. Eventually the passion turned into a lasting friendship.

Later in 1873 Stevenson suffered severe respiratory illness and was sent to the French Riviera, where Colvin later joined him. He returned home the following spring. In July 1875 he was called to the Scottish bar, but he never practiced. Stevenson was frequently abroad, most often in France. Two of his journeys produced *An Inland Voyage* (1878) and *Travels with a Donkey in the Cévennes* (1879). His career as a writer developed slowly. His essay "Roads" appeared in the *Portfolio* in 1873, and in 1874 "Ordered South" appeared in *Macmillan's Magazine,* a review of Lord Lytton's *Fables in Song* appeared in the *Fortnightly,* and his first contribution (on Victor Hugo) appeared in *The Cornhill Magazine,* then edited by Leslie Stephen, a critic and biographer. It was these early essays, carefully wrought, quizzically meditative in tone, and unusual in sensibility, that first drew attention to Stevenson as a writer.

Stephen brought Stevenson into contact with Edmund Gosse, the poet and critic, who became a good friend. Later, when in Edinburgh, Stephen introduced Stevenson to the writer W.E. Henley. The two became warm friends and were to remain so until 1888, when a letter from Henley to Stevenson containing a deliberately implied accusation of dishonesty against the latter's wife precipitated a quarrel that Henley, jealous and embittered, perpetuated after his friend's death in a venomous review of a biography of Stevenson.

In 1876 Stevenson met Fanny Vandegrift Osbourne, an American lady separated from her husband, and the two fell in love. Stevenson's parents' horror at their son's involvement with a married woman subsided somewhat when she returned to California in 1878, but it revived with greater force when Stevenson decided to join her in August 1879. Stevenson reached California ill and penniless (the record of his arduous journey appeared later in *The Amateur Emigrant,* 1895, and *Across the Plains,* 1892). His adventures, which included coming very near death and eking out a precarious living in Monterey and San Francisco, culminated in marriage to Fanny Osbourne (who was by then divorced from her first husband) early in 1880. About the same time a telegram from his relenting father offered much-needed financial support, and after a honeymoon by an abandoned silver mine (recorded in *The Silverado Squatters,* 1883) the couple sailed for Scotland to achieve reconciliation with the Thomas Stevensons.

*Romantic novels.* Soon after his return, Stevenson, accompanied by his wife and his stepson, Lloyd Osbourne, went, on medical advice (he had tuberculosis), to Davos, Switz. The family left there in April 1881 and spent the summer in Pitlochry and then in Braemar, Scot. There, in spite of bouts of illness, Stevenson embarked on *Treasure Island* (begun as a game with Lloyd), which started as a serial in *Young Folks,* under the title *The Sea-Cook,* in October 1881. Stevenson finished the story in Davos, to which he had returned in the autumn, and then started on *Prince Otto* (1885), a more complex but less successful work. *Treasure Island* is an adventure presented with consummate skill, with

atmosphere, character, and action superbly geared to one another. The book is at once a gripping adventure tale and a wry comment on the ambiguity of human motives.

In 1881 Stevenson published *Virginibus Puerisque,* his first collection of essays, most of which had appeared in *The Cornhill.* The winter of 1881 he spent at a chalet in Davos. In April 1882 he left Davos; but a stay in the Scottish Highlands, while it resulted in two of his finest short stories, "Thrawn Janet" and "The Merry Men," produced lung hemorrhages, and in September he went to the south of France. There the Stevensons finally settled at a house in Hyères, where, in spite of intermittent illness, Stevenson was happy and worked well. He revised *Prince Otto,* worked on *A Child's Garden of Verses* (first called *Penny Whistles*), and began *The Black Arrow: A Tale of the Two Roses* (1888), a historical adventure tale deliberately written in anachronistic language.

The threat of a cholera epidemic drove the Stevensons from Hyères back to England. They lived at Bournemouth from September 1884 until July 1887, but his frequent bouts of dangerous illness proved conclusively that the British climate, even in the south of England, was not for him. The Bournemouth years were fruitful, however. There he got to know and love the American novelist Henry James. There he revised *A Child's Garden* (first published in 1885) and wrote "Markheim," *Kidnapped,* and *Strange Case of Dr. Jekyll and Mr. Hyde.* The poems in *A Child's Garden* represent with extraordinary fidelity an adult's recapturing of the emotions and sensations of childhood; there is nothing quite like them in English literature. In *Kidnapped* the fruit of his researches into 18th-century Scottish history and of his feeling for Scottish landscape, history, character, and local atmosphere mutually illuminate one another. But it was *Dr. Jekyll*—both moral allegory and thriller—that established his reputation with the ordinary reader.

In August 1887, still in search of health, Stevenson set out for America with his wife, mother, and stepson. On arriving in New York, he found himself famous, with editors and publishers offering lucrative contracts. He stayed for a while in the Adirondack Mountains, where he wrote essays for *Scribner's* and began *The Master of Ballantrae.* This novel, another exploration of moral ambiguities, contains some of his most impressive writing, although marred by its contrived conclusion.

*Life in the South Seas.* In June 1888 Stevenson, accompanied by his family, sailed from San Francisco in the schooner yacht *Casco,* which he had chartered, on what was intended to be an excursion for health and pleasure. In fact, he was to spend the rest of his life in the South Seas. They went first to the Marquesas Islands, then to Fakarava Atoll, then to Tahiti, then to Honolulu, where they stayed nearly six months, leaving in June 1889 for the Gilbert Islands, and then to Samoa, where he spent six weeks.

During his months of wandering around the South Sea islands, Stevenson made intensive efforts to understand the local scene and the inhabitants. As a result, his writings on the South Seas (*In the South Seas,* 1896; *A Footnote to History,* 1892) are admirably pungent and perceptive. He was writing first-rate journalism, deepened by the awareness of landscape and atmosphere, such as that so notably rendered in his description of the first landfall at Nuku Hiva in the Marquesas.

In October 1890 he returned to Samoa from a voyage to Sydney and established himself and his family in patriarchal status at Vailima, his house in Samoa. The climate suited him; he led an industrious and active life; and, when he died suddenly, it was of a cerebral hemorrhage, not of the long-feared tuberculosis. His work during those years was moving toward a new maturity. While *Catriona* (U.S. title, *David Balfour,* 1893) marked no advance in technique or imaginative scope on *Kidnapped,* to which it is a sequel, *The Ebb-Tide* (1894), a grim and powerful tale written in a dispassionate style (it was a complete reworking of a first draft by Lloyd Osbourne), showed that Stevenson had reached an important transition in his literary career. The next phase was demonstrated triumphantly in *Weir of Hermiston* (1896), the unfinished masterpiece on which he was working on the day of his death. "The Beach of Falesá" (first published 1892; included in *Island Night's Entertainments,* 1893), a story with a finely wrought tragic texture, as well as the first part of *The Master of Ballantrae,* pointed in this direction, but neither approaches *Weir.* Stevenson achieved in this work a remarkable richness of tragic texture in a style stripped of all superfluities. The dialogue contains some of the best Scots prose in modern literature. Fragment though it is, *Weir of Hermiston* stands as a great work and Stevenson's masterpiece.

*Assessment.* Stevenson was an indefatigable letter writer, and his letters (edited by Sidney Colvin in 1899) provide a lively and enchanting picture of the man and his life. But Colvin omitted many of the most interesting letters and compressed and dovetailed others, with the result that many important facts about Stevenson's emotional life remained unknown until the true text of all the letters was available. Colvin presented Stevenson's letters to Fanny Sitwell to what is now the National Library of Scotland with the proviso that they were not to be opened until 1949; the revealing and often fascinating letters to Charles Baxter, a friend, were deposited in the Yale University Library. Stevenson's biography suffered from his being early canonized; later writers built up a counterpicture of an immoral swaggerer restrained into reluctant respectability by a jealous wife. Access to the crucial letters yielded a picture of a Stevenson who was neither the "seraph in chocolate" against whom Henley protested nor a low-living rake nor an optimistic escapist nor the happy invalid but a sensitive and intelligent writer who had no illusions about life and wryly made the best of a world to which he did not profess to have the key.

Stevenson's literary reputation has also fluctuated. The reaction against him set in soon after his death: he was considered a mannered and imitative essayist or only a writer of children's books. But eventually the pendulum began to swing the other way, and by the 1950s his reputation was established among the more discerning as a writer of originality and power; whose essays at their best are cogent and perceptive renderings of aspects of the human condition; whose novels are either brilliant adventure stories with subtle moral overtones or original and impressive presentations of human action in terms of history and topography as well as psychology; whose short stories produce some new and effective permutations in the relation between romance and irony or manage to combine horror and suspense with moral diagnosis; whose poems, though not showing the highest poetic genius, are often skillful, occasionally (in his use of Scots, for example) interesting and original, and sometimes (in *A Child's Garden*) valuable for their exhibition of a special kind of sensibility. (D.Da.)

MAJOR WORKS. *Tales and novels. New Arabian Nights,* 2 vol. (1882; the stories in vol. 1 appeared as *Latter-Day Arabian Nights,* 1878; those in vol. 2 had appeared in *The Cornhill* and other magazines); *Treasure Island* (1883; serialized in a slightly different form in *Young Folks,* 1881–82); *More New Arabian Nights,* with Fanny Van de Grift Stevenson (1885); *Prince Otto* (1885); *Strange Case of Dr. Jekyll and Mr. Hyde* (1886); *Kidnapped* (1886; in *Young Folks,* 1886); *The Merry Men and Other Tales and Fables* (1887), including "Thrawn Janet" and "Olalla"; *The Black Arrow: A Tale of the Two Roses* (1888; in *Young Folks,* 1883); *The Master of Ballantrae* (1889; serialized in *Scribner's Magazine,* 1888–89); *Catriona* (1893), a sequel to *Kidnapped; The Ebb-Tide,* with Lloyd Osbourne (1894; serialized in *To-Day,* 1893–94); *Weir of Hermiston* (unfinished 1896); *St. Ives,* completed by Sir Arthur Quiller-Couch, pseudonym "Q" (1897).

*Essays and miscellaneous. An Inland Voyage* (1878); *Travels with a Donkey in the Cévennes* (1879); *Virginibus Puerisque* (1881), collected essays, mainly from *The Cornhill Magazine; Familiar Studies of Men and Books* (1882); *Memories and Portraits* (1887), 16 essays; *Across the Plains* (1892), 12 essays; *Vailima Letters,* to Sidney Colvin (1895); *From Scotland to Silverado,* ed. by J.D. Hart (1966), brings together all Stevenson's previously published and unpublished writings about his trip to California in 1879–80.

*Poetry. A Child's Garden of Verses* (1885); *Underwoods* (1887), 38 poems in English, 16 in Scots; *Ballads* (1890); *Songs of Travel and Other Verses* (1896). *Collected Poems,* ed. by J. Adam Smith, 2nd ed. (1971), is the standard edition of Stevenson's poetry.

BIBLIOGRAPHY. Bibliographies of works by and about Stevenson include William F. Prideaux, *A Bibliography of the Works of Robert Louis Stevenson,* rev. by F.V. Livingston (1917, reprinted 1968); and George L. McKay (comp.), *A Stevenson Library . . . , Formed by Edwin J. Beinecke,* 6 vol. (1951–64).

Of the many collected editions of Stevenson's works the following are notable: Pentland edition, ed. by Edmund Gosse, 20 vol. (1906–07); Swanston edition, 25 vol. (1911–12); Vailima edition, ed. by Lloyd Osbourne, with prefatory notes by Fanny Van de Grift Stevenson, 26 vol. (1922–23, reprinted 1974); Skerryvore edition, 30 vol. (1924–26); Tusitala edition, 35 vol. (1923–24); South Seas edition, 32 vol. (1925). James D. Hart (ed.), *From Scotland to Silverado* (1966), brings together all of Stevenson's previously published and unpublished writings about his trip to California in 1879–80, with a biographical introduction.

*The Letters of Robert Louis Stevenson to His Family and Friends* were edited by Sidney Colvin (2 vol., 1899; 4 vol., 1911, reprinted 1969). but these are far from complete, and the text has sometimes been tampered with. Stevenson's lively and important correspondence with his lifelong friend Charles Baxter, *RLS: Stevenson's Letters to Charles Baer,* was edited by De Lancey Ferguson and Marshall Waingrow (1956).

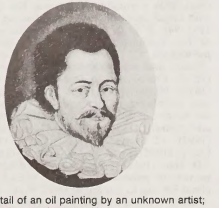
The official biography of Stevenson is by his cousin Graham Balfour, *The Life of Robert Louis Stevenson,* 2 vol. (1901, reprinted 1968). This is valuable, but there are serious omissions and evasions. The standard modern biography is Joseph C. Furnas, *Voyage to Windward: The Life of Robert Louis Stevenson* (1951, reprinted 1980). Malcolm Elwin, *The Strange Case of Robert Louis Stevenson* (1950, reprinted 1971); Richard Aldington, *Portrait of a Rebel* (1957); and David Daiches, *Robert Louis Stevenson and His World* (1974), are lively retellings of the life. Jenni Calder, *Robert Louis Stevenson: A Life Study* (1980), explores and explains a man and a writer. *Henry James and Robert Louis Stevenson: A Record of Friendship and Criticism,* ed. by J. Adam Smith (1948), gives an account of the relationship between the two writers and prints both their criticisms of each other's work and their letters to each other.

Critical works on Stevenson are David Daiches, *Robert Louis Stevenson* (1946); Lettice Cooper, *Robert Louis Stevenson* (1947); Robert Kiely, *Robert Louis Stevenson and the Fiction of Adventure* (1964); and Edwin M. Eigner, *Robert Louis Stevenson and Romantic Tradition* (1966). Paul Maixner (ed.), *Robert Louis Stevenson: The Critical Heritage* (1981), presents reviews and critical assessments from 1878 to 1924 that represent the debate on Stevenson's reputation.

**Stevin, Simon** (b. 1548, Bruges—d. 1620, The Hague or Leiden, Neth.), Flemish mathematician who helped standardize the use of decimal fractions and aided in refuting Ar-

istotle's doctrine that heavy bodies fall faster than light ones.

Stevin was a merchant's clerk in Antwerp for a time and eventually rose to become commissioner of public works and quartermaster general of the army under Prince Maurice of Nassau. He engineered a system of sluices to flood certain areas and drive off any enemy, an important defense of Holland. He also invented a 26-passenger carriage with sails for use along the seashore.



Stevin, detail of an oil painting by an unknown artist; University Library of Leiden, Neth.
By courtesy of the University Library of Leiden, Neth.

In *De Beghinselen der Weeghconst* (1586; "Statics and Hydrostatics") Stevin published the theorem of the triangle of forces. The knowledge of this triangle of forces, equivalent to the parallelogram diagram of forces, gave a new impetus to the study of statics, which had previously been founded on the theory of the lever. He also discovered that the downward pressure of a liquid is independent of the shape of its vessel and depends only on its height and base.

In 1585 Stevin published a small pamphlet, *La Thiende* ("The Tenth"), in which he presented an elementary and thorough account of decimal fractions and their daily use. Although he did not invent decimal fractions and his notation was rather unwieldy, he established their use in day-to-day mathematics. He declared that the universal introduction of decimal coinage, measures, and weights would be only a question of time. The same year he wrote *La Disme* ("The Decimal") on the same subject.

Stevin published a report in 1586 on his experiment in which two lead spheres, one 10 times as heavy as the other, fell a distance of 30 feet in the same time. His report received little attention, though it preceded by three years Galileo's first treatise concerning gravity and by 18 years Galileo's theoretical work on falling bodies.

**stew,** dish of meat, poultry, or fish, usually with vegetables, cooked in liquid in a closed vessel over low heat. Prepared properly, the stew never boils, but simmers at about 190° F (88° C), a process that tenderizes tougher foods and mingles flavours. Meats to be stewed are cut in cubes, fowls are jointed, and fish is cut in steaks or chunks. For brown stews, the meat pieces (and sometimes a portion of the vegetables) are seared in hot fat before the liquid is added. Poultry is often cooked *à blanc,* without browning, as are delicate veal and lamb stews. Root vegetables (carrots, onions, turnips, parsnips, and potatoes), tomatoes, and celery are commonly added to stews. The sauce that develops as the dish cooks may be thickened by pureeing the vegetables or by incorporating flour or egg yolks.

The French *ragout à brun* is a brown stew that is flavoured with garlic, tomato, and herbs. A navarin is a *ragout à brun* made with lamb or mutton; *navarin à la printanière* has been garnished with new potatoes, carrots, peas, onions, and turnips. Fricassees and blanquettes are "white" stews of poultry (in the case of fricassee), veal, or lamb. They are delicately flavoured with mushrooms, mild vegetables, and herbs; the sauce is thickened with egg yolks and cream.

Stews are found in virtually all of the world's cuisines. *Gulyás* (goulash, *q.v.*), *pörkölt, paprikás,* and *tokany* are four stews that have been called the four pillars of Hungarian cooking. *Bigos,* a hunter's stew of Poland, combines a variety of fresh and cured meats, game, cabbage or sauerkraut, and aromatic vegetables. Irish stew is a simple "white" dish of mutton, onions, and potatoes. A Greek *stifado* of beef is flavoured with red wine, onions, tomatoes, bay leaf, and garlic, and it may contain cubes of feta cheese. Two American stews deserve mention: Brunswick stew (originating in Brunswick County, Virginia) combines squirrel, rabbit—more commonly today, chicken—sweet corn, lima beans, tomatoes, okra, and onions; Kentucky's burgoo is similar, adding beef and potatoes, carrots, turnips, and other vegetables.

Fish stews may be made with freshwater or ocean fish; often a variety is used, with shellfish. Notable are the French *meurette,* matelote, *cotriade,* and bouillabaisse (*q.v.*); the Spanish *zarzuela;* the Italian *cacciucco;* the Belgian *waterzooi;* and the cioppino of the United States.

**Steward, Julian H(aynes)** (b. Jan. 31, 1902, Washington, D.C.—d. Feb. 6, 1972, Urbana, Ill., U.S.), American anthropologist best known as one of the leading neoevolutionists of the mid-20th century and as the founder of the theory of cultural ecology. He also did studies of the social organization of peasant villages, conducted ethnographic research among the North American Shoshoni Indians and various South American Indians, and was an early proponent of area studies.

Steward received his B.A. from Cornell University in 1925 and his Ph.D. from the University of California, Berkeley, in 1929. He was affiliated with several universities before joining the American Bureau of Ethnology of the Smithsonian Institution in 1935. He became successively the senior anthropologist (1938) and director of the Institute of Social Anthropology (1943–46).

Steward's work drew on several disciplines, including anthropology, archaeology, history, ecology, and ethnography. He was editor of the massive ethnographic study *Handbook of South American Indians,* 7 vol. (1946–59), a survey of cultures published by the Bureau of American Ethnology in cooperation with the U.S. Department of State.

Steward's chief theoretical work was anthologized in *Theory of Culture Change: The Methodology of Multilinear Evolution* (1955), in which he attempted to show that social systems arise out of labour patterns which, in turn, are determined by the technological adaptation of a people to their natural environment. Although there are cross-cultural similarities of social change, the exigencies of differing physical and historical settings produce different social manifestations in each case, resulting in what Steward called "multilinear evolution." Similarly, his book *Irrigation Civilizations* (1955) illustrates how the collective labour and centralized authority required for irrigation in an arid climate resulted in increased social stratification and, ultimately, in the development of the state in various areas of the world.

After teaching at Columbia University (1946–52), Steward joined the faculty of the University of Illinois and became professor emeritus in 1967.

**steward, lord:** *see* lord steward.

**steward, lord high:** *see* lord high steward.

**Stewart,** HOUSE OF: *see* Stuart, House of.

**Stewart, Alexander:** *see* Albany, Alexander Stewart, duke of.

**Stewart, Alexander Turney** (b. Oct. 12, 1803, Lisburn, County Antrim, Ire.—d. April 10, 1876, New York City), American textile merchant whose dry-goods store grew into a giant wholesale and retail business.

Stewart came to New York City from Ireland as an adolescent. He returned to Ireland a few years later to collect an inheritance, which he used to purchase $3,000 in Irish laces. With this stock he returned to New York and opened a small dry-goods store in 1823. His business expanded steadily until, in 1846, he built a huge marble building for his retail and wholesale operations.

Instead of haggling over prices with each individual customer, Stewart set standard prices on all his goods, which was an innovation in his time. He was also systematic in his relations with his employees, paying a low wage and imposing a system of fines for failings. With the outbreak of the American Civil War, Stewart won huge government contracts to supply the Union Army and Navy with uniforms. In 1862 he built the largest retail store in the world to house his burgeoning business. He also acquired a controlling interest in many of the mills that manufactured his cloth, and he established offices and warehouses in six European countries. Stewart invested heavily in New York real estate, which added considerably to his fortune.

Stewart's charitable activities included sending a shipload of provisions to Belfast during the famine in 1847 and bringing the ship back full of immigrants, for whom he then found jobs. He also built a model town, Garden City, Long Island, with homes for working-class families.

**Stewart, Arabella:** *see* Stuart, Arabella.

**Stewart, Balfour** (b. Nov. 1, 1828, Edinburgh—d. Dec. 19, 1887, Drogheda, Ire.), Scottish meteorologist and geophysicist noted for his studies of terrestrial magnetism and radiant heat.

Stewart pursued a mercantile career for 10 years before becoming an assistant at Kew Observatory and later an assistant to James Forbes at Edinburgh University, where Stewart conducted his research on radiant heat. In 1859 he became director of Kew Observatory, and in 1870 he became professor of natural philosophy at Owens College, Manchester.

In his work on radiant heat, Stewart was the first to discover that bodies radiate and absorb energy of the same wavelength; his work in this field was soon surpassed, however, by that of the German physicist Gustav Kirchhoff. In his studies of terrestrial magnetism, Stewart discovered that daily variation in the magnetic field could be explained by air currents in the upper atmosphere, which act as conductors and generate electrical currents as they pass through the Earth's magnetic field.

Stewart wrote *The Unseen Universe* (with Peter Tait, 1875) and many other popular accounts of scientific discoveries of the day.

**Stewart, Donald Ogden** (b. Nov. 30, 1894, Columbus, Ohio, U.S.—d. Aug. 2, 1980, London), American humorist, actor, playwright, and screenwriter who won a 1940 Academy Award for his screenplay adaptation of *The Philadelphia Story.*

After graduation from Yale University (1916) Stewart served as chief quartermaster in the U.S. Naval Reserve Force during World War I and worked briefly in private business before taking up humorous writing in 1921. His *A Parody Outline of History* (1921) achieved instant success, and he quickly won entrée into the literary circle known as the Algonquin Round Table, famous for the witty repartee of its members, Dorothy Parker, Robert Benchley, and others. In 1928 he made his New York City acting debut as Nick Potter in

*Holiday* and subsequently wrote his first play, *Rebound,* in which he also appeared (1930).

Nonetheless, Stewart remains best known for his screenplays (mostly adaptations), which were notable for witty dialogue and were always faithful to the original work. In addition to *The Philadelphia Story,* he either wrote or collaborated on *The Barretts of Wimpole Street* (1934), *Holiday* (1938), *That Uncertain Feeling* (1941), and *Life with Father* and *Cass Timberlaine* (1947), among others. An outspoken socialist, he was one of many Hollywood figures to be blacklisted in 1950, and he emigrated from the United States to England in 1951. His autobiography, *By a Stroke of Luck,* was published in 1975.

**Stewart, Douglas,** in full DOUGLAS ALEXANDER STEWART (b. May 6, 1913, Eltham, N.Z.—d. Feb. 14, 1985, Sydney, Austl.), poet, playwright, and critic who helped establish an Australian national tradition through mythical re-creation of the past in his plays.

Stewart studied at Victoria University College but left to take up journalism. He later traveled to London to find work in journalism, but without success. Returning to Australia in 1938, he was editor of the "Red Page" literary section in *The Bulletin,* Sydney's influential newspaper, from 1940 to 1961. Thereafter he worked as a literary adviser to Angus and Robertson publishers of Sydney.

Stewart's greatest successes as a playwright were in radio rather than stage plays. *The Fire on the Snow,* broadcast in 1941, describes the British explorer Robert Falcon Scott's expedition to Antarctica in 1912. This was followed by *The Golden Lover* (1944; published with *The Fire on the Snow*), the retelling of a Maori legend. Among his dramas for the stage are *Ned Kelly* (1943) and *Fisher's Ghost* (1960). He also wrote poetry (*Collected Poems, 1936–1967* [1967]), short stories (*A Girl with Red Hair and Other Stories* [1944]), and works of criticism (*The Broad Stream: Aspects of Australian Literature* [1975]).

**Stewart, Dugald** (b. Nov. 22, 1753, Edinburgh, Scot.—d. June 11, 1828, Edinburgh), philosopher and major exponent of the Scottish "common sense" school of philosophy.

Educated at the University of Edinburgh, where his father was professor of mathematics, Stewart began teaching there when he was 19. In 1775 he took over his father's chair and 10 years later was appointed professor of moral philosophy, a position he held until 1820.

As a student, Stewart had come under the influence of the works of the Scottish realist Thomas Reid, particularly *An Inquiry into the Human Mind on the Principles of Common Sense* (1764). Stewart, like Reid, held that philosophy should be a scientific discipline unfettered by metaphysical speculations and categories, though he objected to some of Reid's formulations of his new science of mind. Stewart's affinity for the scientific approach to philosophical problems is reflected in his mathematics career, and he often made analogies between the axioms of mathematics and the laws that govern human thinking.

Stewart's major work is *Elements of the Philosophy of the Human Mind,* 3 vol. (1792, 1814, and 1827). His other works, which fill an 11-volume edition (1854–58), include *Outlines of Moral Philosophy* (1793), *Philosophical Essays* (1810), and *Philosophy of the Active and Moral Powers of Man* (1828).

**Stewart, Henry:** *see* Darnley, Henry Stewart, Lord.

**Stewart, James:** *see* Moray, James Stewart, 1st Earl of; Moray, James Stewart, 2nd Earl of.

**Stewart, James,** in full JAMES MAITLAND STEWART, byname JIMMY STEWART (b. May 20, 1908, Indiana, Pa., U.S.—d. July 2, 1997, Beverly Hills, Calif.), major American motion-picture star known for his portrayals of diffident but morally resolute characters.

Stewart was a graduate of Princeton University in the field of architecture and became part of the University Players at Falmouth, Mass., joining such future film actors as Henry Fonda and Margaret Sullavan. He moved to Hollywood in the mid-1930s, but his slow speaking pattern and angular features puzzled directors as to how best to cast him. His naive, engaging manner, however, led to quick acceptance by the movie-going public. Stewart's first film was *Murder Man* (1935). In the late 1930s, he appeared in such hit comedies as director Frank Capra's *You Can't Take It with You* (1938) and *Mr. Smith Goes to Washington* (1939). In 1940 his role in *The Philadelphia Story* earned him an Academy Award.

During World War II, Stewart rose from private to colonel in the U.S. Army Air Corps and, as a bomber pilot, flew missions over Germany. The first film he made after the war,




James Stewart in *It's a Wonderful Life,* 1946
Culver Pictures

Capra's *It's a Wonderful Life* (1946), became an annual Christmas classic.

As he approached age 40, Stewart had outgrown the "young innocent" persona of his prewar films. His collaborations with directors Alfred Hitchcock and Anthony Mann helped toughen his image and broaden his appeal. Of Stewart's Hitchcock films, *Rear Window* (1954) and *Vertigo* (1958) rank as masterpieces. For Hitchcock, Stewart was an American Everyman, albeit one whose private quirks and obsessions threatened a tragic outcome. The films Stewart made for Mann proved the actor capable of rugged western roles, especially in the classics *Winchester '73* (1950) and *The Man from Laramie* (1955). Stewart and Mann also collaborated on the sentimental biography *The Glenn Miller Story* (1954). Stewart worked in films only sparingly after 1960, most memorably in *The Man Who Shot Liberty Valance* (1962) and *The Shootist* (1976). In 1985 he received the Presidential Medal of Freedom, the nation's highest civilian honour.

**Stewart, J.I.M.,** in full JOHN INNES MACKINTOSH STEWART, pseudonym MICHAEL INNES (b. Sept. 30, 1906, Edinburgh, Scot.—d. Nov. 12, 1994, Coulsdon, Surrey, Eng.), British novelist, literary critic, and educator who created the character of Inspector John Appleby, a British detective known for his suave humour and literary finesse.

Stewart was educated at Oriel College, Oxford, and lectured in English at the University of Leeds from 1930 to 1935. While making a sea voyage from England to serve as professor of English at the University of Adelaide (1935–45), Stewart began to write a detective novel, *Death at the President's Lodging,* which was published in 1936. It was the first of almost 50 novels he was to write under the pseudonym Michael Innes. Stewart was unique among fellow mystery writers of the day for his stylish wit and for allowing his character to age over the years; Inspector Appleby rises through the police ranks to become commissioner of the Metropolitan Police and holder of a knighthood before retiring. Among the best known of these books are *Appleby's End* (1945) and *The Journeying Boy* (1949).

Stewart wrote other works of fiction under his own name and held various teaching posts. He wrote works of literary criticism on William Shakespeare, Thomas Hardy, and Rudyard Kipling. His autobiography, *Myself and Michael Innes,* was published in 1987.

**Stewart, John:** *see* Albany, John Stewart, 2nd Duke of; Atholl, John Stewart, 4th Earl of.

**Stewart, Martha,** *née* MARTHA HELEN KOSTYRA (b. Aug. 3, 1941, Jersey City, N.J., U.S.), American entrepreneur and domestic lifestyle innovator who built a catering business into an international media and home-furnishing company, Martha Stewart Living Omnimedia, Inc.

She worked as a model while studying at Barnard College (B.A., 1963) and was employed as a stockbroker at a Wall Street firm from 1965 to 1972. She launched a catering business with a partner in 1976, and in 1982 Stewart published the first of many books on entertaining, cooking, and gardening. She founded the monthly magazine *Martha Stewart Living* in 1990 and started a television show by the same name in 1993. Through her signature style, borne of intense creativity and perfectionism that was at times parodied, Stewart showed millions how to rewire lamps, design gardens, cook innovative meals, or decorate their homes. She became a billionaire, however briefly, with the public launch of her company in 1999. In 2003 Stewart faced charges of obstructing justice and lying about a stock transaction. Convicted in 2004 and sentenced to prison and home confinement, Stewart urged her fans to continue supporting her company.

**Stewart, Mary:** *see* Mary *under* Mary (Scotland).

**Stewart, Potter** (b. Jan. 23, 1915, Jackson, Mich., U.S.—d. Dec. 7, 1985, Hanover, N.H.), associate justice of the United States Supreme Court (1958–81).

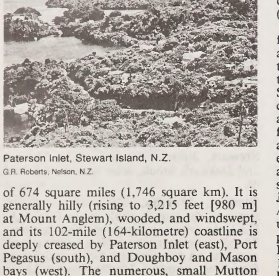
Stewart was admitted to the bar in New York and Ohio in 1941 and after World War II settled in Cincinnati. He served on the city council and as vice mayor before his appointment to the Court of Appeals for the sixth district in 1954. In 1958 President Dwight D. Eisenhower appointed him to the U.S. Supreme Court.

Voting generally with the conservative bloc, Stewart was often described during the 1960s as the "swing man" on close court decisions involving the exercise of government powers. In *Shelton* v. *Tucker* he wrote the majority opinion holding unconstitutional a requirement that teachers list all their associations. Stewart also wrote a number of dissents in cases involving individual freedoms, including *Engel* v. *Vitale, Griswold* v. *Connecticut,* and *Miranda* v. *Arizona.* In his dissents, as in his opinions, Stewart sought to define rather than deny the exercise of governmental powers. He retired from the court in 1981.

**Stewart, Robert:** *see* Albany, Robert Stewart, 1st Duke of; Castlereagh, Robert Stewart, Viscount; Robert II *under* Robert (Scotland).

**Stewart Island,** third largest island of New Zealand, in the southwest Pacific Ocean off

the southern tip of South Island. Roughly triangular and measuring 45 by 25 miles (70 by 40 km), the island has a total land area



Paterson Inlet, Stewart Island, N.Z.
G.R. Roberts, Nelson, N.Z.

of 674 square miles (1,746 square km). It is generally hilly (rising to 3,215 feet [980 m] at Mount Anglem), wooded, and windswept, and its 102-mile (164-kilometre) coastline is deeply creased by Paterson Inlet (east), Port Pegasus (south), and Doughboy and Mason bays (west). The numerous, small Mutton Bird Islands lie close offshore. Stewart Island was seen (1770) by Captain James Cook, who thought it was a peninsula of South Island. This initial description was disproved in 1809 by a survey conducted by Captain William Stewart, one of the many whalers and sealers who visited the island at that time.

Stewart Island is sparsely populated and depends on summer tourists and fishing for oysters and crayfish for its livelihood. It is connected to Bluff, on South Island, by a ferry, which crosses Foveaux Strait, approximately 17 miles (27 km) wide. The ferry lands on Stewart Island at Halfmoon Bay (formerly Oban), which is the most southerly permanently inhabited place in New Zealand. Pop. (1987 est.) 540.

**stewartia,** any member of a genus (*Stewartia*) of about 8 species of shrubs and small trees, in the tea family (Theaceae), native to East Asia and eastern North America. They are planted as ornamentals in warm areas for their showy camellia-like flowers and their strikingly coloured, peeling bark.

Especially attractive is the Japanese stewartia (*S. pseudocamellia*), a tree that grows to a height of 15 m (50 feet) and has reddish, peeling bark and large white flowers with conspicuous orange stamens in the centre. Silky camellia, or Virginia stewartia (*S. malacodendron*), a shrub up to 3.5 m high, has white flowers with purple stamens. Another American species is the mountain stewartia, sometimes called mountain camellia (*S. ovata*), which is also shrubby; it is mostly confined to the southern Appalachians. *S. monadelpha, S. serrata,* and *S. sinensis* are Asian trees with somewhat smaller flowers.

**Stewartry,** district, Dumfries and Galloway region, southwestern Scotland. Formed by the reorganization of 1975, it is the central part of the former county of Kirkcudbright.

The district's steep but rounded hills, which exceed 2,500 feet (750 m) in the north and have a heavy rainfall, are drained south to the Solway Firth; and the lower ground is mantled with glacial soils on which pastoral farming prevails, the mild, damp climate favouring grass growth. Large quantities of milk are sent to urban markets, both in central Scotland and in northern England. There has been extensive forestation, at the expense of rough grazing for sheep, on the northern hills. There is little manufacturing other than that which is directly related to farming, and the district remains rural, with small service centres that benefit also from growing tourism. Kirkcudbright, situated on the River Dee estuary, is the seat of the district authority. Area 645 square miles (1,671 square km). Pop. (1991 prelim.) 23,600.

**Steyn, Marthinus Theunis** (b. Oct. 2, 1857, Rietfontein, Orange Free State [now in South Africa]—d. Nov. 28, 1916, Bloemfontein), leader of the Orange Free State and its president before and during the South African War (1899–1902).

Steyn, educated at Grey College in Bloemfontein and at Deventer, Neth., became state attorney and was appointed to the high court of the Orange Free State in 1889. After winning the presidential election of February 1896, Steyn pursued a policy of economic independence and of protecting the Dutch language against immigrant influences. In foreign affairs he worked toward a Free State–Transvaal alliance, which was concluded in 1897. In an effort to prevent a conflict between Britain and the Transvaal, Steyn was host to the unsuccessful Bloemfontein Conference in May–June 1899 between President Paul Kruger and Alfred Milner, the British commissioner. Not until September did he give his ally full support and join in the South African War. When British troops took Bloemfontein in March 1900, Steyn fought on as a guerrilla leader. Poor health prevented his signing the formal surrender at Pretoria on May 31, 1902 (Peace of Vereeniging).

The war so shattered Steyn's health that he never held office again. Idolized by the people, the former president became a behind-the-scenes power and resisted the program of conciliation put forth by Louis Botha, premier of the Transvaal.

**Steyr,** city, Oberösterreich *Bundesland* (federal state), northeast-central Austria. The city is situated at the confluence of the Enns and Steyr rivers, southeast of Linz. Originating in the 10th century around the castle of the Traungau family, it was the centre of Austria's iron industry in medieval times.

In the old town centre are the parish church (1443–1522), the Rococo town hall (1765–78), and several medieval houses with picturesque courtyards, notably the Bummerlhaus. The castle was last restored in 1727. A hospital dating from 1305 is in the suburb of Steyrdorf, and the magnificent Baroque churches of the abbeys of Gleink and Garsten are nearby. Still an iron and steel centre, Steyr has a number of additional manufactures, including trucks, automobiles, tractors, ball bearings, sporting guns, and machinery. Pop. (1991) 39,337.

**Sthānakavāsī,** a modern subsect of the Śvetāmbara Jainas of India. The Sthānakavāsī differs from the parent group in its rejection of image worship and temple services. The Sthānakavāsī was founded in the 18th century under the leadership of Lava of Surat, who was a member of an earlier nonidolatrous sect called the Lumpāka, or Lonkā. Both groups based their belief on the argument that the Jaina canon makes no mention of idol worship.

The name Sthānakavāsī ("*sthānaka*-dweller") refers to the subsect's preference for performing religious duties at a secular place such as a monks' meetinghouse (*sthānaka*) rather than at a temple. The group is also sometimes called the Dhuṇḍhiā ("searchers").

The Sthānakavāsī has itself divided into smaller groups, such as the Terāpanthī ("those who follow the path of the 13"), founded in the early 19th century.

**stibnite,** antimony sulfide ($Sb_2S_3$), the principal ore of antimony. This mineral has a brilliant metallic lustre, is lead- to steel-gray in colour, and fuses readily (at about 525° C [977° F]). Stibnite occurs in massive forms in gneiss and granite. It is also found in limestone, presumably deposited by hot springs. Significant deposits of stibnite have been located in Hunan province, China; on the island of Shikoku, Japan; and in the western United States (Idaho, California, and Nevada).

Stibnite and the analogous sulfides of arsenic and bismuth (orpiment and bismuthinite, respectively) form a group of minerals that have similar physical properties (*see* sulfide mineral [table]). Stibnite is used in the manufacture of matches, fireworks, and percussion caps and was used by the ancients as a cosmetic to increase the apparent size of the eye. Its crystals belong to the orthorhombic system.

**stichomythia,** also spelled STICHOMYTHY, plural STICHOMYTHIAS, or STICHOMYTHIES, dialogue in alternate lines, a form sometimes used in Classical Greek drama in which two characters alternate speaking single epigrammatic lines of verse. This device, which is found in such plays as Aeschylus' *Agamemnon* and Sophocles' *Oedipus Rex,* is often used as a means to show characters in vigorous contention or to heighten the emotional intensity of a scene. Characters may take turns voicing antithetical positions, or they may take up one another's words, suggesting other meanings or punning upon them.

Repartee in the form of polished aphorisms was a stylistic feature of the Roman tragedies of Seneca, which were intended for private readings rather than performance. Through the influence of Seneca, stichomythia was adapted to the drama of Elizabethan England, most notably by William Shakespeare in comedies such as *Love's Labour's Lost* and in the memorable exchange between Richard and Queen Elizabeth in *Richard III* (IV, iv). A similar type of "cut-and-thrust," or "cut-and-parry," dialogue figures in the clipped, epigrammatical speech of the prose plays of the 1920s, such as those of Noel Coward.

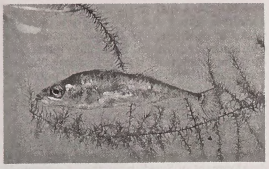
**stick insect:** *see* walkingstick.

**stickball,** game played on a street or other restricted area, with a stick, such as a mop handle or broomstick, and a hard rubber ball. Stickball developed in the late 18th century from such English games as old cat, rounders, and town ball. Stickball also relates to a game played in southern England and colonial Boston in North America called stoolball. All of these games were played on a field with bases, a ball, and one or more sticks.

The modern game is played especially in New York City on the street, where such fixtures as a fire hydrant or an abandoned car serve as bases. These fixtures also provide targets off of which to carom a stickball. Manhole covers frequently serve as bases, and the length of hits is measured in terms of sewers. Players may wrap adhesive tape around one end of the stick for better grip. Stickball can be played with two teams or with one batter and several fielders. The rules are as diversified as the teams, neighbourhoods, or sections of the country playing the game. The central feature of the game is that the batter hits the ball as far as he can and then tries to get to the first base or farther before the fielder recovers the ball. The batter is put out either by the fielder hitting him with the ball, tagging him, or outrunning him to home base.

Modern stickball is usually played like baseball, except for the lack of a standard ball and bat.

**stickleback,** any of about 12 species of fishes of the family Gasterosteidae (order Gasterosteiformes), found in temperate regions of the Northern Hemisphere. Sticklebacks are small, elongated fishes reaching a maximum length of about 15 cm (6 inches). Some species live in freshwater, some in the sea, and some in both. The members of the family are characterized by a row of spines on the back, in front of a soft-rayed dorsal fin. They also have a sharp spine in each of the pelvic fins; a slender tail base (caudal peduncle); and



Stickleback (*Gasterosteus aculeatus*)
G.E. Hyde from Natural History Photographic Agency—EB Inc.

a squared tail. The scaleless skin is generally protected by a variable number of hard armour plates on the sides.

Sticklebacks are noted for their reproductive behaviour. Breeding usually takes place in spring, at which time the male becomes suffused with bright red. After building a nest of plant materials glued together with a thread-like, mucous secretion from his kidneys, he coaxes and drives a female into the nest to lay her eggs and follows her to fertilize them. More than one female may be chosen. When the nest is full, the male becomes its guard and caretaker, aerating the eggs until they hatch and aggressively defending eggs and young from intruders.

Several stickleback species are familiar and abundant fishes. The three-spined stickleback (*Gasterosteus aculeatus*) is found almost everywhere in the Northern Hemisphere, in freshwater and salt water. A small fish, 5 to 10 centimetres long, it has three dorsal spines. The nine-spined stickleback (*Pungitius pungitius*), also small but with more dorsal spines, is another widely distributed form. Other species include the brook stickleback (*Culaea inconstans*) of North American freshwaters; the four-spined stickleback (*Apeltes quadracus*), also North American but primarily marine; and the sea, or 15-spined, stickleback (*Spinachia spinachia*), a slim, many-spined fish of European coasts.

**Stickley, Gustav** (b. March 9, 1858, Osceola, Wis., U.S.—d. April 21, 1942, Syracuse, N.Y.), U.S. furniture designer and maker who largely created what came to be known as the Mission style.

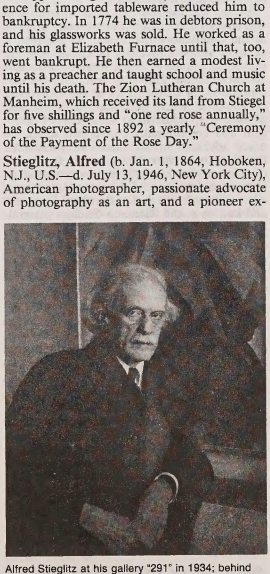
Stickley learned basic furniture-making skills in a Pennsylvania chair factory owned by an uncle. After a time he took over the factory and in 1884 moved it to Binghamton, N.Y. He experimented briefly with designs in the fashionable Art Nouveau mode before introducing, about 1900, a new line of sturdy oak furniture whose virtues of simplicity, functionality, and soundness of construction were for Stickley an expression of democratic values. He established the Craftsman Workshops in Syracuse in 1901 and began publishing the monthly magazine *The Craftsman* to carry his ideas and designs to a wider audience. Although he owed something to the British Arts and Crafts movement, Stickley was a highly original designer who applied his ideas not only to furniture but to decorative accessories of all kinds. One of the most popular features of *The Craftsman* was a series of house designs intended to suit modest incomes.

The popularity of Craftsman furniture waned after a decade and a half, and in 1916 Stickley ceased publishing his magazine and gave up his bankrupt workshops to two younger brothers, who continued for a time to produce furniture from his designs. Two other brothers had for some time produced similar furniture under the name L. and J.G. Stickley, and numerous other imitators had capitalized on his work as well.

**Stiegel, Henry William,** German HEINRICH WILHELM STIEGEL (b. May 13, 1729, near Cologne—d. Jan. 10, 1785, Charming Forge, Pa., U.S.), ironmaster, glassmaker, and town builder whose spectacular rise and fall in early American industry is now remembered because of the high-quality blue, purple, green, and crystal-clear glassware that he produced.

Stiegel arrived in Philadelphia in 1750, and by 1760 he was one of the most prosperous ironmasters in the country, having built the forge Elizabeth Furnace, in Lancaster County, Pa., and a second ironworks, Charming Forge, in Berks County. In 1762 he purchased a huge tract in Lancaster County, where he laid out and built a town, Manheim. Encouraged by the patriotic adoption of a boycott of British imports and having already made window glass and bottles at Elizabeth Furnace, Stiegel built a glassworks, later called the American Flint Glassworks, at Manheim; work began in 1768. He imported Venetian, German, and English glassworkers, to make utilitarian vessels and fine tableware. Nicknamed "Baron" for his lavish style of living, Stiegel maintained three mansions staffed with servants; the one at Manheim, of imported English brick, included a chapel, where he preached the gospel to his workers, and a roof platform, where concerts were given. His comings and goings in a coach-and-four with liveried retainers were announced by a cannon salute and rooftop band music. These princely expenditures and the adverse economic conditions caused by the approaching war and by colonial preference for imported tableware reduced him to bankruptcy. In 1774 he was in debtors prison, and his glassworks was sold. He worked as a foreman at Elizabeth Furnace until that, too, went bankrupt. He then earned a modest living as a preacher and taught school and music until his death. The Zion Lutheran Church at Manheim, which received its land from Stiegel for five shillings and "one red rose annually," has observed since 1892 a yearly "Ceremony of the Payment of the Rose Day."

**Stieglitz, Alfred** (b. Jan. 1, 1864, Hoboken, N.J., U.S.—d. July 13, 1946, New York City), American photographer, passionate advocate of photography as an art, and a pioneer exhibitor of modern art in the United States. In 1902 he founded the seminal Photo-Secession Group as a protest against the conventional photography of the time. Stieglitz' own best photographs are the 400-print series of his wife, Georgia O'Keeffe, and his studies of cloud patterns suggesting emotions.



Alfred Stieglitz at his gallery "291" in 1934; behind him is a painting by his wife, Georgia O'Keeffe.
Imogen Cunningham

Stieglitz was the oldest son of Edward Stieglitz, a retired woollen merchant. After his early schooling in New York, the Stieglitz family moved to Europe in 1881 to further their children's education. Stieglitz eventually registered for studies in mechanical engineering at the Berlin Polytechnic in 1883. A few months later, the purchase of a small camera led him to abandon engineering for photo-chemistry and to begin his photographic career.

While still a student at Berlin, where many of his friends were painters, Stieglitz decided to fight for the recognition of photography as a creative art medium equal to that of painting. The best way to gain this acceptance, he innocently believed, was to become a photographic authority, and to become such an authority he believed he had only to set the highest standards for his own prints and to win all possible prizes and medals.

Both in Europe and the United States, where he returned to live in 1890, his early work (*c.* 1883–1910) reflects these aims. It was characterized by constant technical innovations, which at the time were believed impossible to achieve. Before the turn of the century, for example, Stieglitz had made the first successful photographs in snow, in rain, and at night and had undertaken the first serious use of a small, hand-held camera. By 1910 these photographs had won many important prizes.

Realizing that his own early fame could not alone bring about the recognition of photography as an art, Stieglitz believed that the work of a group might be more effective than that of an individual. After several ventures with established photographic organizations, in which Stieglitz usually led dissident factions, in 1902 he founded a new group of his own, the Photo-Secession, a title adapted from the German Secessionist painters who at that time also were in revolt against the traditional art world. As its leader, Stieglitz gathered around him a group of talented American photographers dedicated to his ideals.

Until 1905, however, the Photo-Secession had not had a centre to exhibit its work in. That year, largely at the urging of Edward Steichen, a close friend and associate, Stieglitz finally agreed that the group should have its own space. Initially called the Little Galleries of the Photo-Secession, located in New York City, the group soon became known by the gallery's street number ("291"); and Stieglitz himself was so closely identified with its work that he often signed his personal correspondence "291."

Soon after its establishment Stieglitz turned his energies to the cause of modern art. At first he did not claim to understand the modern movements, but he did consider them to be fascinating new ways of expressing reality.

The famous Armory Show of 1913 is often considered to have introduced modern art to the United States. Stieglitz in 1908, however, had already held the first showings of work by the sculptor Auguste Rodin and the painter Henri Matisse, and he continued to hold exhibitions of the painters Toulouse-Lautrec, Henri Rousseau, Paul Cézanne, and Pablo Picasso during the five years before the Armory Show. Even more revolutionary was Stieglitz' fervent belief that living American artists were of equal importance and could create significant works of art in their own lifetime. Thus, during the same years that he was bringing modern European art to the United States, he also was holding exhibitions of the work of the American painters John Marin, Marsden Hartley, Arthur Dove, Alfred Maurer, and Max Weber. By the time "291" closed in 1917, Stieglitz also had given Americans their first shows of works by the sculptors Constantin Brancusi and Elie Nadelman and the painters Francis Picabia, Gino Severini, Stanton Macdonald-Wright, and Georgia O'Keeffe, who was to become his wife in 1924. For the most part these exhibitions were viewed by a hostile and derisive public. The

history of these stormy years is documented in *Camera Work* (1903–17), the radical and beautiful magazine edited and published by Stieglitz.

Neither "291" nor *Camera Work* survived the difficulties of the World War I years, both coming to an end in 1917. With the closing of the gallery, Stieglitz once more had time for his own photography, neglected during the years of "291." His interests turned from his youthful preoccupation with technique and a wide subject matter to an intense preoccupation with what he saw and lived with daily—either at his summer home in Lake George, N.Y., or at his New York City residence. Two series of this period (1917–37), each consisting of more than 400 prints, are often considered his greatest photographs; the portraits of Georgia O'Keeffe, and the equivalents—photographs of abstract cloud shapes corresponding to all possible emotional experiences. In both he continued to extend the frontiers of photography.

Stieglitz' preoccupation with his photography did not deter him from continuing to hold shows of American painters, thus helping to provide them a living and the freedom to work as they wished. Since by that time the once-ridiculed European artists had become a commercial success, he ceased working for them. (He was not a dealer and never profited financially from his activities for artists.) Fanatic until the end in his belief that significant art existed in the United States, his steadfast interest encouraged a group of American artists (principally Charles Demuth, Dove, Hartley, Marin, and O'Keeffe) to achieve this vision. His faith was demonstrated in more than 175 exhibitions held in his three galleries (1905–46), first at "291" (1905–17), then at the Intimate Gallery (1925–29), and finally at An American Place (1929–46). By the end of his life he had changed the climate for all American painting, gaining for it a truly independent status and acceptance.

Stieglitz broke down the barriers against photography in American art museums. His prints were the first photographs accepted as art and received as such by major museums in Boston, New York City, and Washington, D.C. In those museums his photographs were hung and exhibited in the same manner as other notable achievements in the graphic arts.

A born leader, Stieglitz had an infallible eye, a flexible, inquiring mind, and a temperament conducive to battling for his revolutionary beliefs. Almost single-handedly, he launched his country into the 20th-century art world, not only in the field of photography but in painting and sculpture as well. He awakened the public by exposing it, for the first time, to the best of modern art. With camera and pen, with fiery harangues in his own galleries, he goaded Americans away from their complacent artistic tradition, which largely had been confined to the imitation of European academicians since the 19th century, and worked for the recognition of the contemporary artist in the United States as a force in the international art world. (D.Br.)

BIBLIOGRAPHY. The most complete set of Stieglitz photographs is held by the National Gallery of Art, Washington, D.C. Other important collections are those of the Metropolitan Museum of Art and the Museum of Modern Art in New York City; the Museum of Fine Arts, Boston; the Art Institute of Chicago; and the San Francisco Museum of Art. The main portions of the Alfred Stieglitz collection of paintings are at the Metropolitan Museum of Art and the Art Institute of Chicago. Weston J. Naef (ed.), *Collection of Alfred Stieglitz* (1978), contains reproductions of most of the approximately 600 photographs in the collection donated by Stieglitz to the Metropolitan Museum of Art. The text of this first major book on the Stieglitz collection provides much useful background and bibliographical information. Other significant works include Doris Bry, *Alfred Stieglitz: Photographer* (1965); Herbert J. Seligmann, *Alfred Stieglitz Talking* (1966); and Dorothy Norman, *Alfred Stieglitz; an American Seer* (1973), a comprehensive survey of his work and influence.

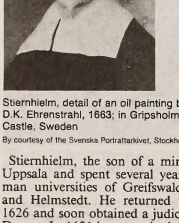
**Stieglitz, Julius** (b. May 26, 1867, Hoboken, N.J., U.S.—d. Jan. 10, 1937, Chicago), U.S. chemist who interpreted the behaviour and structure of organic compounds in the light of valence theory and applied the methods of physical chemistry to organic chemistry.

Stieglitz received his Ph.D. from the University of Berlin (1889) and later was associated with the University of Chicago, where he headed the chemistry department (1915–33). He studied molecular rearrangements, catalysis, the theory of chemical indicators, and the structure of organic nitrogen compounds. Stieglitz introduced theories of ionization and chemical equilibrium in *Elements of Quantitative Chemical Analysis*, 2 vol. (1911–12).

**Stieltjes, Thomas Jan** (b. 1856, Zwolle, Neth.—d. 1894, Toulouse, Fr.), Dutch-born French mathematician who made notable contributions to the theory of series. He is remembered as "the father of the analytic theory of continued fractions."

Stieltjes was the son of a civil engineer and was educated at Delft. After six years of work at the observatory in Leiden, he accepted a position at the University of Groningen. He moved to France in 1885, received a doctorate there in the following year, and became a professor of mathematics at the University of Toulouse, where he remained for the rest of his life. In addition to his studies of divergent and conditionally convergent series, he made advances in the theory of Riemann's function, in number theory, and in the theory of spherical harmonics. He also proposed an important definition of the integral now usually combined with that of Bernhard Riemann and known as the Riemann–Stieltjes integral.

**Stiernhielm, Georg,** original name JÖRAN OLOFSSON, also called GEORGIUS OLAI, or GÖRAN LILIA (b. Aug. 7, 1598, Vika, Swed.—d. April 22, 1672, Stockholm), poet and scholar, often called "the father of Swedish poetry."



Stiernhielm, detail of an oil painting by D.K. Ehrenstrahl, 1663; in Gripsholm Castle, Sweden

By courtesy of the Svenska Portrattarkivet, Stockholm

Stiernhielm, the son of a miner, studied at Uppsala and spent several years at the German universities of Greifswald, Wittenberg, and Helmstedt. He returned to Sweden in 1626 and soon obtained a judicial position in Dorpat. In 1631 he was raised to the nobility. From *c.* 1640 he was occasionally in Stockholm as poet in attendance at the court of Queen Christina, although his home was in Estonia until 1656, when he fled before the Russian invaders. Thereafter he lived in Stockholm in straitened circumstances. In 1661 he was appointed councillor of war and in 1667 director of the college of antiquities.

Stiernhielm's first poetic works in Swedish appeared during the 1640s. They included verses in celebration of the queen and three court masques adapted from the French. His most important work is the allegorical, didactic epic, *Hercules* (written about 1647; published 1658), a fine example of late Renaissance classicism. It is a sermon on virtue and honour and is imbued with the spirit of humanism. The theme is developed with power and originality; the imagery is exuberant; the construction, faultless. It had great influence on the development of Swedish poetry. Stiernhielm's poems were collected in *Musae Suethizantes* (1668).

Stiernhielm's scholarship was encyclopaedic, and in numerous writings, many unpublished, he dealt with philological, historical, and philosophical problems. An earnest patriot, he claimed that Swedish was man's original language. He sought to purify it by eliminating words borrowed from other languages and enlarging its stock from the popular dialect and from Swedish words that had become obsolete. In his fragmentary works of natural philosophy, he expounded a cosmogony based on the platonic, mystical tradition of such thinkers as Paracelsus, Robert Fludd, and Comenius.

**Stif** (Algeria): *see* Sétif.

**stiff neck** (congenital disorder): *see* torticollis.

**stifftail,** any of several small, round ducks with short wings and long, spiky tail feathers, of the tribe Oxyurini, family Anatidae (order Anseriformes). A common and typical stifftail is the ruddy duck (*Oxyura jamaicensis*) of North America. In most species the drake has shiny reddish plumage and a bright-blue bill in breeding season; at other times he is drab. Hens are plainly coloured birds with a line or two crossing the face. A stifftail uses its specialized tail feathers for steering underwater in search of food. Stifftails can scarcely get about on land; like most waterfowl, they sleep on the water. The drake has an expansible esophagus and an air sac in the neck that he inflates (and, in some species, beats upon with his bill) during his noisy, elaborate courtship display. Stifftails usually build substantial nests of reeds in marshes. The eggs, averaging four or five to a clutch, are rough-surfaced and relatively the largest laid by waterfowl. The drake helps rear the young—a rare trait among ducks.

Most stifftail species live in warm regions of the Southern Hemisphere, and most are freshwater birds. The only European form is the white-headed duck (*O. leucocephala*), of the Mediterranean region to Turkistan; the drake is brown with an entirely white face, and his blue bill is humped at the base. Drakes of the maccoa duck (*O. maccoa*), of eastern Africa, and the Australian blue-billed duck (*O. australis*) have reddish bodies and black heads. In the masked duck (*O. dominica*), of the West Indies and tropical America, the drake is white-bellied and entirely reddish above, with a black face. Other stifftails are the musk duck (*Biziura lobata*), of southern Australia and Tasmania, and the parasitic black-headed duck (*Heteronetta atricapilla*), of southern South America.

**Stifter, Adalbert** (b. Oct. 23, 1805, Oberplan, Austria—d. Jan. 28, 1868, Linz), Austrian narrative writer whose novels of almost classical purity exalt the humble virtues of a simple life. He was the son of a linen weaver and flax merchant, and his childhood experiences in the country, surrounded by peasant craftsmen, provided the setting for his work.

Stifter was educated at the Kremsmünster abbey school. He enrolled as a law student in Vienna, but for the most part he attended scientific lectures and took no degree. After many years of precarious living as a tutor, artist, and writer, in 1840 he began to publish



Stifter, portrait by Ernst Hader, second half of the 19th century

By courtesy of Bild-Archiv, Osterreichische Nationalbibliothek, Vienna

stories, including *Der Condor* (1840), *Feldblumen* (1841; "Wildflowers"), and *Die Mappe meines Urgrossvaters* (1841–42; "My Great-grandfather's Portfolio"). In *Brigitta* (1844) the basic structure of his major work began to emerge: he saw that an inner unity of the landscape and people—a crucial part of life for him—must also determine the shape of his story. Collections of revised stories, *Studien,* 6 vol. (1844–50; "Studies") and *Bunte Steine* (1853; "Colourful Stones"), brought him fame. In the important preface to the latter book, he expounded his doctrine of the "law of gentleness" as the enduring principle.

During the political turmoil of 1848–50, Stifter was deeply involved in the debate over the role of education; in 1850 he moved from Vienna to Linz, becoming an inspector of schools. The novel *Der Nachsommer* (1857; "Indian Summer"), his greatest work, depicts a young man learning and growing; the work radiates a still beauty and a restrained idealism, set against the landscape Stifter loved. His epic *Witiko* (1865–67) uses medieval Bohemian history as a symbol for the human struggle for a just, peaceful order. Other stories followed, but he was too ill to finish his project of expanding *Die Mappe meines Urgrossvaters* into a novel: only the first volume was completed.

**Stigand** (d. Feb. 22, 1072), archbishop of Canterbury, probably the English king Canute's priest of this name whom he placed over the minster of Ashingdon in 1020.

Stigand was consecrated bishop of Elmham in 1043 but was deposed later in the year when Queen Emma, whom Stigand advised, fell into disgrace. He was reinstated in 1044. In 1047 he became bishop of Winchester, and Elmham was given to his brother Aethelmaer. Stigand mediated the peace between King Edward and Earl Godwine in 1052 and was made archbishop of Canterbury in place of the Norman Robert of Jumièges, who had fled. He did not, however, relinquish Winchester. As he had been intruded into Canterbury while his predecessor was alive, his position was regarded as uncanonical; hence he did not receive the pallium (a cloth band that is symbolic of episcopal authority) until 1058, and then only from the antipope Benedict X, after whose deposition (1059) Stigand was excommunicated by Pope Nicholas II. His continuance as archbishop was one of the reasons for the papal support given to William I the Conqueror's invasion in 1066. Yet he was too powerful for William to remove him at once, and he was not deposed until 1070. Domesday Book shows him to have had extensive lands and many men commended to him.

**Stigler, George J.,** in full GEORGE JOSEPH STIGLER (b. Jan. 17, 1911, Renton, Wash., U.S.—d. Dec. 1, 1991, Chicago, Ill.), American economist whose incisive and unorthodox studies of marketplace behaviour and the effects of government regulation won him the 1982 Nobel Prize for Economics.

After graduating from the University of Washington in 1931, Stigler took a business degree at Northwestern University in 1932 and a Ph.D. in economics at the University of Chicago in 1938. He taught at Iowa State College in 1936–38, the University of Minnesota in 1938–46, Brown University in 1946–47, Columbia University in 1947–58, and the University of Chicago from 1958, becoming emeritus in 1981. At Chicago he founded in 1977 the Center for the Study of the Economy and the State.

Among Stigler's notable contributions to economics were his study of the economics of information, an important elaboration of the traditional understanding of how efficient markets operate, and his studies of public regulation, in which he concluded that at best it has little influence and that it is usually detrimental to consumer interests. Stigler's publications include *The Theory of Price* (1946), a textbook of microeconomics; *The Intellectual and the Market Place* (1964); *Essays in the History of Economic Thought* (1965); *The Citizen and the State* (1975); and *The Economist as Preacher, and Other Essays* (1982).

**Stiglitz, Joseph E.** (b. Feb. 9, 1943, Gary, Ind., U.S.), American economist who, with A. Michael Spence and George A. Akerlof, won the Nobel Prize for Economics in 2001 for laying the foundations for the theory of markets with asymmetric information.

After studying at Amherst College (B.A., 1964) in Massachusetts and the Massachusetts Institute of Technology (Ph.D., 1967), Stiglitz taught at several universities, including Yale, Harvard, and Stanford. He was an active member of President Bill Clinton's economic policy team; a member of the U.S. Council of Economic Advisers (1993–97), of which he became chairman in 1995; and senior vice president and chief economist of the World Bank (1997–2000). In 2001 he became a professor at Columbia University in New York.

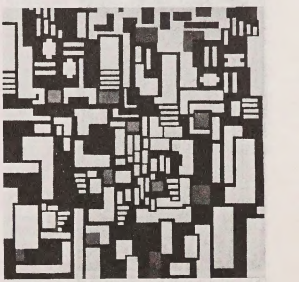
Stiglitz's research concentrated on what could be done by ill-informed individuals and operators to improve their position in a market with asymmetric information. He found that they could extract information through screening and self-selection. This point was illustrated through his study of the insurance market, in which the (uninformed) companies lacked information on the individual risk situation of their (informed) customers. By offering incentives to policyholders to disclose information, insurance companies were able to divide policyholders into different risk classes, which enabled the companies to issue a choice of policy contracts in which lower premiums could be exchanged for higher deductibles.

**stigmata,** singular STIGMA, in Christian mysticism, bodily marks, scars, or pains corresponding to those of the crucified Jesus Christ—that is, on the hands or feet, near the heart, and sometimes on the head (from the crown of thorns) or shoulders and back (from carrying the Cross and scourging).

In St. Francis of Assisi there occurred the first example of the alleged miraculous infliction of stigmata. While in his cell on Mount Alverno in 1224, pondering on the sufferings of Christ, he was purportedly visited by a seraph who produced upon his body the five wounds of Christ. Pope Alexander IV and others attested that they had seen these marks both before and after Francis' death. The divinely attested sanctity of its founder gave to the newly established order of Franciscans a powerful impulse. In the next century the same alleged wonder occurred to a Dominican sister, Catherine Benincasa, better known as St. Catherine of Siena. Her biographer implied that she was subject to hystero-epileptic attacks, during one of which, at the age of 23, she received her first stigma. From the 14th to the 20th century, more than 330 persons were identified as having been stigmatized; 60 were declared saints or the blessed in the Roman Catholic church.

**Stijl, De** (Dutch: "The Style"), group of Dutch artists in Amsterdam in 1917, including the painters Piet Mondrian, Theo van Doesburg, and Vilmos Huszár, the architect Jacobus Johannes Pieter Oud, and the poet A. Kok; other early associates of De Stijl were Bart van der Leck, Georges Vantongerloo, Jan Wils, and Robert van't Hoff. Its members, working in an abstract style, were seeking laws of equilibrium and harmony applicable both to art and to life.

De Stijl's most outstanding painter was Mondrian, whose art was rooted in the mystical ideas of Theosophy. Although influenced by his contact with Analytical Cubism in Paris



"Card Players," oil painting by De Stijl artist Theo van Doesburg, 1917; in the collection of the Haags Gemeentemuseum, The Hague

By courtesy of the Haags Gemeentemuseum, The Hague

before 1914, Mondrian thought that it had fallen short of its goal by not having developed toward pure abstraction, or, as he put it, "the expression of pure plastics" (which he later called Neoplasticism). In his search for an art of clarity and order that would also express his religious and philosophical beliefs, Mondrian eliminated all representational components, reducing painting to its elements: straight lines, plane surfaces, rectangles, and the primary colours (red, yellow, and blue) combined with neutrals (black, gray, and white). Van Doesburg, who shared Mondrian's austere principles, launched the group's periodical, *De Stijl* (1917–32), which set forth the theories of its members.

As a movement, De Stijl influenced painting, decorative arts (including furniture design), typography, and architecture, but it was principally architecture that realized both De Stijl's stylistic aims and its goal of close collaboration among the arts. The Worker's Housing Estate in Hoek van Holland (1924–27), designed by Oud, expresses the same clarity, austerity, and order found in a Mondrian painting. Gerrit Rietveld, another architect associated with De Stijl, also applied its stylistic principles in his work; the Schröder House in Utrecht (1924), for example, resembles a Mondrian painting in the severe purity of its facade and in its interior plan. Beyond The Netherlands, the De Stijl aesthetic found expression at the Bauhaus in Germany during the 1920s and in the International Style.

**stiletto fly,** any insect of the family Therevidae (order Diptera), composed of about 670 species. The hairy or bristly, slender adults are usually found in open areas, such as pastures.

The larvae, which occur in soil and decaying matter, are usually predatory, as are the adults. The larvae move with a wiggly motion and are often confused with worms.

**Stilfser Joch** (Italy): *see* Stelvio Pass.

**Stilicho, Flavius** (b. *c.* AD 365—d. Aug. 22, 408), regent (394–408) for the Roman emperor Honorius and one of the last great Roman military commanders in the West. He fought in several campaigns against the barbarians, opposing the invading Visigoths under Alaric in the Balkans and Italy and repelling an Ostrogothic invasion of Italy in 406.



Ebony relief thought to be a portrait of Stilicho, panel of a diptych, *c.* 400; in the Cathedral Treasury, Monza, Italy
Alinari—Art Resource/EB inc.

Stilicho was half-Roman, half-Vandal by birth. Making the army his career, in 383 he served on an embassy to the Persian king Shāpūr III, afterward marrying Serena, the favourite niece of the emperor Theodosius. He was appointed count of the domestics (commanding the Emperor's household troops) *c.* 385 and then, in or before 393, master of both services (*i.e.*, commander in chief of the army), an office he held until his death.

Little is known of Stilicho's military exploits before 395. He became the enemy of Flavius Rufinus, because of a difference of opinion about the treatment of some barbarian invaders in 389. Before his death Theodosius appointed Stilicho to be the guardian of his son Honorius in the West and Rufinus to be the guardian of his son Arcadius in the East. Stilicho had a great military advantage over his rival, for the army Theodosius had assembled to crush the usurper Eugenius was still concentrated in the West under Stilicho's command when Theodosius died.

Before either Stilicho or Rufinus could attack the other, the Visigoths, a Germanic tribe living in Lower Moesia who had suffered severe losses in the campaign against Eugenius, rebelled under the leadership of their chieftain Alaric and began to devastate Thrace and Macedonia. Stilicho, who claimed for the Western government the prefecture of Illyricum, which was disputed between the emperors, went with his army to Thessaly. About to engage Alaric there, however, he was ordered by Arcadius, acting on Rufinus' advice, to send a number of his troops to Constantinople. Stilicho obeyed and thus enabled Alaric to penetrate into Greece, but the troops sent to Constantinople murdered Rufinus there on Nov. 27, 395. The gifted poet Claudian began to publish his poems in praise of Stilicho, an important source of information about the politics of the time until 404, when the poet apparently died.

In 397 Stilicho took another army to Greece but failed again to bring Alaric to battle and withdrew to Italy. In that same year, Gildo, the count of Africa, rebelled against the Roman government and refused to allow African grain ships to sail to Rome. Stilicho promptly imported grain from Gaul and Spain. In the following year he sent Gildo's brother, Mascezel, to Africa with an army, and he easily overthrew Gildo and put him to death; but Mascezel died soon afterward, and Stilicho was suspected of having had him murdered so that he might not become a rival. In 398 Stilicho's daughter Maria was married to the emperor Honorius, and Stilicho himself became consul in 400.

In 401 when Alaric and the Visigoths invaded Italy and threatened Milan, where Honorius was living, Stilicho summoned troops from the Rhine frontier and from Britain to strengthen his army, and in 402 he engaged the Goths at Pollentia (Pollenzo, near modern Bra). The battle, fought on Easter Sunday, April 6, resulted in an incomplete victory for Stilicho, but he captured the Gothic camp. Alaric then marched toward Etruria, but after negotiations he agreed to withdraw from Italy. In 403, however, he reentered Italy and attacked Verona. Stilicho once more engaged him successfully and pursued him northward. Again an understanding was reached, and Alaric, though his army was in bad condition, was allowed to escape.

Late in 405 Italy was menaced by new invaders, a vast host of Germans, mainly Ostrogoths, led by a pagan called Radagaisus. Contemporary accounts numbered them in the hundreds of thousands, though any such figure is impossible. They attacked Florence, but Stilicho compelled their withdrawal to Fiesole, where he cut off their supplies and massacred them. Radagaisus was executed on Aug. 23, 406, and, in celebration, a triumphal arch was erected at Rome.

Stilicho had never abandoned his plans to annex Illyricum, and in 407 he put them into operation. He closed the ports of Italy to all Eastern ships, instructed Alaric to hold Epirus for Honorius, and himself prepared to cross the Adriatic. But a false report reached him that Alaric was dead, and then he heard of the revolt of Constantine in Britain. Once more his plans had to be abandoned. Alaric then marched to the province of Noricum (roughly central Austria) and demanded compensation for the trouble he had been put to. His price was high—4,000 pounds (in weight) of gold—but despite considerable opposition Stilicho persuaded the Roman Senate to pay it.

By this time the empress Maria had died, but early in 408 Honorius married another daughter of Stilicho, Thermantia. Stilicho's influence, however, had declined. It was rumoured that he wished to have his son Eucherius elevated to the throne. Reports reached him early in 408 that his army was disaffected. Then came news of the death of the Eastern emperor, Arcadius, and Stilicho proposed to go to Constantinople. A certain Olympius, a palace official, spread the rumour that Stilicho was preparing to put his own son on the Eastern throne, and so the troops in Tictinum (Pavia) killed nearly all of the officials present on August 13. Stilicho went to Ravenna but was imprisoned by Honorius' orders. He was beheaded on August 22; Eucherius was put to death shortly thereafter. (E.A.T.)

BIBLIOGRAPHY. The most important ancient source is the poet Claudian; Alan Cameron, *Claudian: Poetry and Propaganda at the Court of Honorius* (1970), is fundamental on Stilicho as well as Claudian. J.B. Bury, *A History of the Later Roman Empire*, vol. 1 (1923), is an adequate source of information on Stilicho.

**Still, Andrew Taylor** (b. Aug. 6, 1828, Jonesboro, Va., U.S.—d. Dec. 12, 1917, Kirksville, Mo.), U.S. founder of osteopathy, who believed that remedies for disease are available in the correctly adjusted body, obtained through manipulative techniques and concomitant medical and surgical therapy.

Still acquired some medical training from his father and a college in Kansas City. About 1849 he began to practice medicine in Kansas and in Missouri. He was an active Abolitionist and was elected to the Kansas territorial legislature in 1857. He also saw service in the Civil War.

Motivated by the deaths of three of his children in an epidemic, he formulated his principles of osteopathy in 1874. After a period of opposition he founded the American School of Osteopathy at Kirksville in 1892. In 1924 it was absorbed by the Andrew Taylor Still School of Osteopathy and Surgery, founded by George Laughlin in 1922, which was renamed the Kirksville College of Osteopathic Medicine in 1971. Still established the *Journal of Osteopathy* in 1894.

**Still, William Grant** (b. May 11, 1895, Woodville, Miss., U.S.—d. Dec. 3, 1978, Los Angeles), U.S. composer and conductor, and the first black to conduct a professional symphony orchestra in the United States. Though a prolific composer of operas, ballets, symphonies, and other works, he was best known for his *Afro-American Symphony* (1931).

Still was brought up by his mother and grandmother in Little Rock, Ark., and studied medicine at Wilberforce University, Ohio, before turning to music. He first studied composition at Oberlin Conservatory of Music in Oberlin, Ohio, then under the conservative George W. Chadwick at the New England Conservatory of Music, Boston, and later under Edgard Varèse during the latter's most radical avant-garde period. The diversity of Still's musical education was extended when, in the 1920s, he worked as an arranger for the dance-band leader Paul Whiteman and for the blues composer W.C. Handy. In 1939 he married and settled in Los Angeles. Early orchestral works include *Darker America* (1924) and *From the Black Belt* (1926) for chamber orchestra.

Still's concern with the position of the blacks in U.S. society is reflected in many of his works, notably the *Afro-American Symphony*; the ballets *Sahdji* (1930), set in Africa and composed after extensive study of African music, and *Lenox Avenue* (1937); and the operas *The Troubled Island* (1938; produced 1949), with a libretto by Langston Hughes, and *Highway No. 1, U.S.A.* (produced 1963 and 1977).

Still's compositions from the mid-1930s show the jazz band as a major influence on his eclectic musical style. He made considerable use of material in the Negro style—though rarely borrowing actual melodies—and preferred simple, commercial harmonies and orchestration, the use of which, however, was characterized by the highest professionalism and seriousness of purpose.

**still-life painting,** depiction of inanimate objects for the sake of their qualities of form, colour, texture, and composition. Although decorative fresco murals and mosaics with still-life subjects occasionally appeared in antiquity, it was not until the Renaissance that still life emerged as an independent painting genre, rather than existing primarily as a subsidiary element in a composition. Early Netherlandish still-life paintings depicted skulls, candles, and hourglasses as allegories of mortality, or combined flowers and fruits of all seasons to symbolize nature's cycle (*see* vanitas). An interest in observing and then realistically representing the material details of the environment, the rise of a wealthy middle



"Still Life," painting on wood by Jan Fyt; in the Prado, Madrid
By courtesy of the Museo del Prado, Madrid

class who desired art works to decorate their homes, and an increasing demand for secular subjects in painting other than portraiture as a result of the prolonged effects of the Reformation—all were factors that contributed to the rise of still-life painting in the 16th and 17th centuries. The painting generally considered to be the first still life is a work by the Italian painter Jacopo de'Barbari painted 1504. The "golden age" of still-life painting occurred in the Lowlands during the 17th century.

Among the most famous Dutch and Flemish painters who specialized in still-life subjects were Willem Heda, Willem Kalf, Jan Fyt, Frans Snyders, Jan Weenix, Melchior d'Hondecoeter, Jan van Huysum, and the de Heem family. From the 18th century until the rise of Nonobjective painting after World War II, France became the centre of still-life painting. Most major artists who at some time resided there during this 250-year period executed still lifes—*e.g.*, J.-B.-S. Chardin, Eugène Delacroix, Gustave Courbet, Édouard Manet, Claude Monet, Paul Cézanne, Vincent van Gogh, Pablo Picasso, Georges Braque, Henri Matisse, and Pierre Bonnard.

**still rings** (gymnastics): *see* rings.

**Stillbay industry,** assemblage of Late Paleolithic stone tools, found first in Cape Province, S.Af., and dating from about 30,000 to 50,000 years ago. The stone flake culture reached from Ethiopia in the north to South Africa along the eastern coast and produced a variety of stone tools that are likened to the Mousterian industry of North Africa and Europe, which lay midway between the earliest stone tools and the highly complex ones of Cro-Magnon man.

Tools were made generally by the Levallois stone-flaking technique, that is, by shaping a prepared core in order to produce pointed flakes probably used as lance heads or skinning knives. In addition, the Stillbay industry contains leaf-shaped bifacial points.

**Stiller, Mauritz** (b. 1883, Helsinki—d. Nov. 8, 1928, Stockholm), motion-picture director who during the early 1920s was a leader in the internationally preeminent Swedish cinema. He was influenced by D.W. Griffith's epic style and Thomas Harper Ince's integral use of landscape but most of all by the typically Swedish mysticism and passionate love of nature reflected in the novels of Selma Lagerlöf, many of which he adapted to the screen.

Trained as a stage actor, Stiller acted in and directed his first film, *Mor och dotter* ("Mother and Daughter"), in 1912. The film made from the Lagerlöf novel *Herr Arnes penningar* (1919; *Sir Arne's Treasure*), with its pictorial beauty and intense characterizations, won worldwide acclaim as one of the finest Swedish silent films. It was followed by *Erotikon* (1920), a lighter, more cosmopolitan film, then by another screen version of a Lagerlöf novel, *Gunnar Hedes saga* (1922; *Gunnar Hede's Saga*), in which Stiller treated nature lyrically, as in the scenes of reindeer being driven into the mountains, a treatment repeated in *Gösta Berlings saga* (1923; *The Atonement of Gösta Berling*), from another Lagerlöf novel, his best known film.

Because of the success of *Gösta Berlings saga,* he was invited to Hollywood in 1925, and the star of the picture, his young protégée, Greta Garbo, was also offered a contract. Stiller directed the films *Hotel Imperial* (1927), *Woman on Trial* (1927), and *The Street of Sin* (1927), before returning to Sweden in 1928.

**Stilling, Heinrich** (German writer): *see* Jung-Stilling, Johann Heinrich.

**Stillman, James** (b. June 9, 1850, Brownsville, Texas, U.S.—d. Mar. 15, 1918, New York City), U.S. financier and banker whose presidency of New York's National City Bank (now Citibank) made it one of the most powerful financial institutions in the United States.

Beginning his career in a New York City mercantile house, Stillman became a protégé of Moses Taylor, then a wealthy merchant and banker. In 1891, having participated in a number of Taylor's projects, Stillman succeeded Taylor's son-in-law as president of the National City Bank, shortly after a controlling interest in the bank was purchased by the Rockefeller family.

By maintaining large cash reserves and drawing on powerful connections, Stillman's bank prospered during the panic of 1893, more than doubling deposits and rising to a commanding position among U.S. banks. In 1897 National City was the only bank capable of financing the reorganization of the Union Pacific Railroad. The bank later expanded into international markets, establishing a preeminence that it has retained since.

Deposits mushroomed during Stillman's tenure from about $12,000,000 in 1891 to $638,000,000 at the time of his death. He left a personal fortune estimated at more than $100,000,000.

**Still's disease,** rheumatoid arthritis in children. The major difference between this illness and rheumatoid arthritis in adults is its effect on the rate of bone growth. Deformities of the spine are typical in Still's disease. Medication and physical therapy coupled with rest and orthopedic appliances often prevent crippling defects in the bone structure.

**Stillwater,** city, seat (1840) of Washington County, eastern Minnesota, U.S., on the St. Croix River, at the head of Lake St. Croix, 20 mi (32 km) northeast of St. Paul. Founded in 1839 (in Wisconsin Territory) as a logging town, it was the scene of a convention (Aug. 26, 1848) that undertook the organization of Minnesota Territory and was the first townsite of the state. The Minnesota State Prison was established there in 1851. Principal industries are dairy processing, shoemaking, and the manufacture of ventilating fans. A fossilized face of sandstone is exposed nearby along the St. Croix. Inc. town, 1844; city, 1854. Pop. (1990) 13,882.

**Stillwater,** city, seat (1907) of Payne County, north central Oklahoma, U.S. It was first recorded in 1884 as a colony of "boomers" (illegal homesteaders from Kansas) on Still Water Creek, near its confluence with the Cimarron River. A permanent settlement was begun in April 1889 in the first great Oklahoma land run. Growth was stimulated by the establishment there in 1891 of the Oklahoma Agricultural and Mechanical College, rechartered as Oklahoma State University in 1957. The university continues to dominate the city's economic and social development.

Local resources include cattle, wheat, and gas. Nearby, Lake Carl Blackwell (3,200 ac [1,300 ha]) is the focus of the Central Oklahoma Land Utilization Project. Inc. village, 1890; town, 1891; city, 1895. Pop. (1990) 36,676.

**Stilo Praeconinus, Lucius Aelius,** also called AELIUS STILO (b. *c.* 154 BC, Lanuvium, near Rome—d. 74 BC, Rome?), first systematic student, critic, and teacher of Latin philology and literature and of the antiquities of Rome and Italy.

A member of a distinguished family of the equestrian order, Stilo taught Varro and Cicero, who later thought poorly of his skill as an orator. According to Cicero he was a Stoic. His aristocratic sympathies and interest in the law were so strong that he voluntarily shared the exile of Quintus Caecilius Metellus Numidicus (consul 109 BC) in protest against a new agrarian law.

Only a few fragments of Stilo's works remain. He wrote commentaries on the hymns of the Salii (minor priests who sang their Carmen Saliare at various public meeting places at the beginning and end of the growing season). He probably wrote commentaries on the Twelve Tables, the earliest collected body of Roman law, and also a general glossographical work dealing with literary, historical, and antiquarian questions. His most important work was his investigation of the authenticity of the comedies of Plautus, of which he recognized 25. His devotion to Plautus is reflected in his remark that if the Muses spoke Latin, it would be the Latin of Plautus.

**Stilpōn,** also spelled STILPO (fl. *c.* 380–300 BC), Greek philosopher of the Megarian school founded by Euclid (fl. about 300 BC) of Megara, Greece. Most of the Megarian philosophers are better known for the high value they placed on dialectical skill and for their influence on Stoic logic than for positive ethical assertions of their own.

Unfortunately, nothing of Stilpōn's dialogues has survived, except for a few fragments that were quoted by other authors. Among Stilpōn's best known pupils was Zeno of Citium, founder of Stoicism.

**stilt,** any of certain species of shorebirds belonging to the family Recurvirostridae (order Charadriiformes), characterized by long thin legs and a long slender bill. Stilts are about 35 to 45 centimetres (14 to 18 inches) in length.

They live in warm regions, around ponds, where they probe in mud and weedy shallows for crustaceans and other small aquatic animals.

The common stilt (*Himantopus himantopus*) is variably black and white with pink legs and red eyes. Among its races are the black-winged



Black-necked stilt (*Himantopus himantopus mexicanus*)
G.W. Robinson—Root Resources

stilt (*H. h. himantopus*), of the Old World, and the black-necked stilt (*H. h. mexicanus*), of the New World; and very dark birds occur in New Zealand.

The banded, or red-breasted, stilt (*Cladorhynchus leucocephala*), of Australia, is white with brown wings, reddish breast band, and yellowish legs.

**stilt,** one of a pair of poles with footrests, used for walking. Stilts were originally designed for use in crossing rivers and marshes. As a means of amusement, they have been used by all peoples of all ages, as well as by the inhabitants of marshy or flooded districts. The city of Namur, in Belgium, which formerly suffered from the overflowing of the Sambre and Meuse rivers, has been celebrated for its stilt walkers for many centuries. Not only the townspeople but also the soldiers used stilts. The Governor of Namur, having promised the archduke Albert (about 1600) a company of soldiers that should neither ride nor walk, sent a detachment on stilts, which so pleased the Archduke that he conferred upon the city perpetual exemption from the beer tax—no small privilege.

Stilts used by children are usually long, the upper half being held under the arms. They are not strapped to the leg.

**stilt bug,** any fragile, long-legged, slender insect of the family Berytidae (or Neididae, order Heteroptera), which contains more than 100 species. These sluggish, brown, plant-feeding insects are 5 to 9 millimetres (0.2 to 0.4 inch) long and are usually found in dense vegetation throughout the world.

*Jalysus spinosis* of the eastern United States damages corn, peach, and tomato crops. *J. wickhami* is found in the central United States.

**Stilton,** classic English blue cheese made from cow's milk, named for the village in Huntingdonshire where, according to tradition, it was first sold in the late 18th century at a stagecoach stop called the Bell Inn. Stilton cheese has apparently never been produced in its namesake village; in modern times the designation is restricted to certain cheeses produced in the counties of Leicestershire, Derbyshire, and Nottinghamshire.

Originally made exclusively from the milk of Shorthorn cows, as some still is, Stilton has a rich, intense flavour that is less salty than that of Roquefort. The texture is semisoft and moist or creamy, since the cheese is not pressed, and ivory yellow in colour, streaked with bluish-green veins of *Penicillium glaucum* mold. It is formed in cylinders nine inches (23 centimetres) in height and about 8 in. in diameter. The beige rind is wrinkled and crusty. Stilton is aged for four to eight months, sometimes longer. In England it is traditionally served with biscuits, port wine, and fruit.

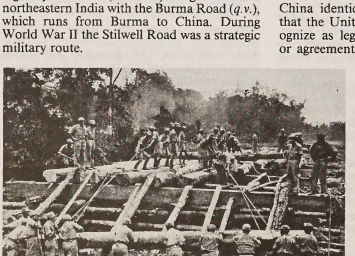
**Stilwell, Joseph W(arren)** (b. March 19, 1883, Palatka, Fla., U.S.—d. Oct. 12, 1946, San Francisco), World War II army officer who headed both U.S. and Chinese Nationalist resistance to the Japanese advance on the Far Eastern mainland.

A 1904 graduate of the U.S. Military Academy, West Point, N.Y., Stilwell rose to the rank of general in 1944, having served in the Philippines, with the American Expeditionary Force in Europe during World War I, and as an instructor at West Point. In addition, he studied the Chinese language and later served in Tientsin (1926–29) and as a military attaché in Peking (1935–39).

At the outbreak of World War II, Gen. Chiang Kai-shek asked Stilwell to be his chief of staff, and he was placed in command of the Chinese 5th and 6th armies in Burma. In 1942 he was routed by Japanese troops—superior in numbers and equipment—and arrived in India on foot with the remains of his command after an agonizing 140-mile jungle trek. Through the war he served as commanding general of all U.S. forces in China, Burma, and India, and early in 1945 the Ledo Road, an Allied supply route linked to the Burma Road (*q.v.*), was renamed the Stilwell Road in his honour. He was appointed commander of the U.S. 10th Army in the Pacific theatre, and in August 1945 he received the surrender of more than 100,000 Japanese troops in the Ryukyu Islands.

After March 1946 Stilwell served as 6th Army commander in San Francisco until his death.

**Stilwell Road,** original name LEDO ROAD, highway 478 mi (769 km) long that links northeastern India with the Burma Road (*q.v.*), which runs from Burma to China. During World War II the Stilwell Road was a strategic military route.



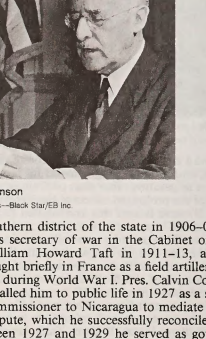
Chinese troops building a bridge along the Stilwell Road in Burma, 1943
Bernard Hoffman—Time-LIFE Picture Agency

U.S. Army engineers began construction of the highway in December 1942 to link the railheads of Ledo (Assam, now in Arunachal Pradesh, India) and Mogaung (Burma), and Chinese troops later aided in the project.

The highway crossed into Burma through the difficult Pangsau Pass of the Patkai Range and was known as the Ledo Road until January 1945, when a connection via Myitkyinā and Bhamo was completed to the Burma Road at Mu-se. Chiang Kai-shek then renamed the highway in honour of the U.S. general Joseph W. Stilwell. It was officially abandoned by the United States in October 1945, but it remains a major internal route.

**Stimson, Henry L(ewis)** (b. Sept. 21, 1867, New York City—d. Oct. 20, 1950, Huntington, N.Y., U.S.), statesman who exercised a strong influence on U.S. foreign policy in the 1930s and 1940s. He served in the administrations of five presidents between 1911 and 1945.

Stimson was admitted to the New York bar in 1891, and he served as U.S. attorney for the



Stimson
Giles—Black Star/EB Inc

southern district of the state in 1906–09. He was secretary of war in the Cabinet of Pres. William Howard Taft in 1911–13, and he fought briefly in France as a field artillery officer during World War I. Pres. Calvin Coolidge recalled him to public life in 1927 as a special commissioner to Nicaragua to mediate a civil dispute, which he successfully reconciled. Between 1927 and 1929 he served as governor general of the Philippine Islands.

Appointed secretary of state under Pres. Herbert Hoover (1929–33), Stimson led the U.S. delegation to the London Naval Conference in 1930. Following the Japanese occupation of Manchuria in 1931, he sent to Japan and China identical notes (Jan. 7, 1932) stating that the United States did not intend to recognize as legally valid any situation, treaty, or agreement impairing U.S. treaty rights or brought about by means contrary to the Pact of Paris (1919). This policy afterward became known as the Stimson Doctrine.

By the beginning of World War II, Stimson was known as an outspoken interventionist and a leading member of the Committee to Defend America by Aiding the Allies. Although a lifelong Republican, he was appointed secretary of war by Pres. Franklin D. Roosevelt in 1940, to strengthen bipartisan support of foreign policy. In this capacity he guided the expansion and training of the U.S. Army throughout the war. He also acted as chief adviser on atomic policy to President Roosevelt and, later, to Pres. Harry S. Tru-

man. To President Truman he recommended that atom bombs be dropped on Japanese cities of military importance. He later justified the bombing of Hiroshima and Nagasaki on humanitarian grounds, arguing that use of the bomb accelerated the surrender of Japan and thus saved more lives than it cost.

Stimson left office in September 1945. His publications include *American Policy in Nicaragua* (1927), *Democracy and Nationalism in Europe* (1934), and *The Far East Crisis* (1936). With McGeorge Bundy he wrote an autobiography entitled *On Active Service in Peace and War* (1948).

**stimulant,** any drug that excites any bodily function, but more specifically those that stimulate the brain and central nervous system. Stimulants induce alertness, elevated mood, wakefulness, increased speech and motor activity and decrease appetite. Their therapeutic use is limited, but their mood-elevating effects make some of them potent drugs of abuse.

The major stimulant drugs are amphetamines and related compounds, methylxanthines (methylated purines), cocaine, and nicotine. Amphetamines achieve their effect by increasing the amount and activity of the neurotransmitter norepinephrine (noradrenaline) within the brain. They facilitate the release of norepinephrine by nerve cells and interfere with the cells' reuptake and breakdown of the chemical, thereby increasing its availability within the brain. The most commonly used amphetamines are methamphetamine (Methedrine), amphetamine sulfate (Benzedrine), and dextroamphetamine sulfate (Dexedrine). Amphetamines were first used in the 1930s to treat narcolepsy and subsequently became prescribed for obesity and fatigue. Their heavy or prolonged use causes irritability, restlessness, hyperactivity, anxiety, excessive speech, and rapid mood swings. Still higher doses or chronic use can cause agitation, tremor, confusion, and, in the most serious cases, a state resembling paranoid schizophrenia. Moreover, letdown effects of deep depression and physical exhaustion may occur after only a single dose of moderate strength wears off. With repeated use, tolerance develops, so that a user needs to take larger doses, but the accompanying dependence is not strong enough to be termed a physical addiction. Amphetamines are widely abused, in some cases by workers or students seeking enhanced physical energy and mental acuity to fulfill demanding tasks.

Certain drugs related to the amphetamines have the same mode of action but are somewhat milder stimulants. Among them are phenmetrazine (Preludin) and methylphenidate (Ritalin). The latter drug is widely used to "slow down" hyperactive children and improve their ability to concentrate.

The methylxanthines are even milder stimulants. Unlike amphetamines and methylphenidate, which are synthetically manufactured, these compounds occur naturally in various plants and have been used by humans for many centuries. The most important of them are caffeine, theophylline, and theobromine. The strongest is caffeine, which is the active ingredient of coffee, tea, cola beverages, and maté. Theobromine is the active ingredient in cocoa. Caffeine constricts blood vessels of the brain; for this reason it is often a component of headache remedies. Theophylline is used in the treatment of severe asthma because of its capacity for relaxing the bronchioles in the lungs.

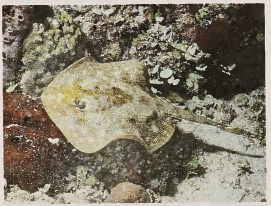
Cocaine is one of the strongest and shortest-acting stimulants and has a high potential for abuse owing to its euphoric and habit-forming effects. Nicotine, the active ingredient in cigarettes and other tobacco products, may also be regarded as a stimulant.

**stimulated emission,** in laser action, the release of energy from an excited atom by artificial means. According to Albert Einstein, when more atoms occupy a higher energy state than a lower one under normal temperature equilibrium (*see* population inversion), it is possible to force atoms to return to an unexcited state by stimulating them with the same energy as would be emitted naturally.

In stimulated emission the emitted light wave will be coherent (*i.e.,* in phase; *see* coherence) with the incoming wave. In laser action the stimulating emission triggers a chain reaction in which the radiation from one atom stimulates another in succession until all the excited atoms in the system have returned to normalcy. In doing so, coherent monochromatic light (light of a single wavelength) is emitted.

**stinging coral:** *see* millepore.

**stingray,** any of a number of flat-bodied rays noted for the long, sharp spines on their tails. They are sometimes placed in a single family, Dasyatidae, but often separated into two families, Dasyatidae and Urolophidae. Stingrays are disk-shaped and have flexible, tapering tails armed, in most species, with one or more saw-edged, venomous spines.



Yellow stingray (*Urolophus jamaicensis*), one of the round stingrays
© Mickey Gibson/Animals Animals

The dasyatid stingrays, also called whiptailed rays and stingarees, inhabit all oceans and certain South American rivers. They have slim, often very long, whiplike tails. They vary in size: *Dasyatis sabina,* a small western North Atlantic species, is mature at a width of about 25 cm (10 inches), but the Australian *D. brevicaudata* reportedly attains a width of about 2 m (7 feet) and a length of 4 m. The urolophid, or round stingrays, are considerably smaller, the largest attaining a length of about 75 cm. Round stingrays have relatively short tails and well-developed tail fins. They are found in the Pacific and western Atlantic.

Stingrays inhabit warm temperate and tropical waters, sometimes in great abundance. They are bottom dwellers and often lie partially buried in the shallows. Stingrays eat worms, mollusks, and other invertebrates, sometimes badly damaging valuable shellfish beds. They lash their tails when stepped on, and large stingrays can exert enough force to drive their tail spines into a wooden boat. The spines cause serious, extremely painful wounds that, if abdominal, may result in death.

Certain other rays may also possess tail spines. Some of the devil rays and eagle rays are so armed. The latter, forming the family Myliobatidae, comprise several genera found in warm and temperate coastal waters. They have very long, slim tails and, unlike other rays, have heads that project beyond the body disk. Notable members of this family include the spotted duckbilled ray (*Aetobatus narinari*), a large Atlantic and Pacific species that can cause deep wounds with its tail spines, and the bat stingray (*Myliobatis californicus*), a Pacific form noted for its depredations on the shellfish of San Francisco Bay.

Two other families, the butterfly rays (Gymnuridae) and cow-nosed rays (Rhinopteridae), are found in shallow coastal waters of tropical and warm temperate seas and reach widths of about 2 m.

The possible existence of another stingray family, consisting of deepwater species, was indicated in 1981 with the identification of *Hexatrygon bickelli.* The specimen, found on the coast of South Africa, showed unique adaptations to deepwater life and was classified by its discoverers in a separate family and suborder.

**stinkbug,** any member of the insect family Pentatomidae (order Heteroptera), which has more than 5,000 species. Stinkbugs are characterized by their foul-smelling secretions, which may be transferred to the resting place of the insect—*e.g.,* on plant, fruit, or leaf—giving it a disagreeable or nauseating taste.

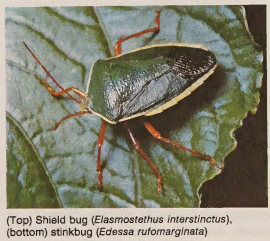
Their combination of colour (brown, green, or metallic) and shape (oval, broad, and slightly convex) camouflages many of these insects as they sit on bark and foliage. The head and prothorax form a triangle that points forward. In some species the triangular-shaped area on the back is enlarged to form a prominent shield that may cover the entire abdomen.

Stinkbugs generally range between 5 and 12 mm (0.2 to 0.5 inch) in length. One exception is *Oncomeris flavicornis,* which occurs throughout the world. It is more than 50 mm long and is brightly coloured with red, blue, black, and orange. Sexual dimorphism, a condition in which the appearance of the male and female differs, exists in some species.

In cooler climates the adults hibernate during the winter; in the winters of warmer climates they simply become less active. The female deposits about 100 or more ornate, barrel-shaped eggs in rows or clusters; females of some species remain close to the eggs and newly hatched larvae.

Some species (*e.g., Tessaratoma papillosa* of the Orient) have sound-producing organs and make loud, noisy sounds if disturbed. *T. papillosa* also has the ability to "spit" foul-smelling secretions 15 to 30 cm (6 to 12 inches).





(Top) Shield bug (*Elasmostethus interstinctus*), (bottom) stinkbug (*Edessa rufomarginata*)
(Top) Sven Samelius, (bottom) E.S. Ross

Stinkbugs may feed on plants, causing discoloration or spotting of the fruit, or they may prey on other insects. One of the most important plant pests is the harlequin cabbage bug (*Murgantia histrionica*). The southern green stinkbug, or green vegetable bug (*Nezara viridula*), which occurs worldwide, damages beans, berries, tomatoes, and other garden crops. The rice stinkbug (*Oebalus pugneax*) causes severe losses to the rice crop in North America.

The stinkbug family Pentatomidae is so diverse that some authorities divide its members into separate families. The members of the family of shield bugs, or shield-backed bugs (Scutelleridae), are between 8 and 10 mm long, and their shield-shaped thorax covers almost the entire abdomen. An important member of this family is the senn bug (*Eurygaster* species), a grain pest in Middle Eastern and Central Asia.

Control measures include the use of pesticides and the elimination of hibernating spots and alternate hosts. Not all stinkbugs are destructive. The genus *Podisus* feeds on the Colorado potato beetle larvae and other plant pests. *Zicrona caerulea,* a species that occurs in China, preys on beetle larvae and adult beetles. In some areas of Mexico, Africa, and India, stinkbugs are eaten by humans.

**stinkdamp,** colourless, poisonous, gaseous compound of sulfur responsible for the characteristic odour of rotten eggs (*see* sulfur).

**stinkhorn,** any fungus of the order Phallales (division Mycota), typified by a phalluslike, ill-smelling fruiting body. Stinkhorns produce odours that attract the flies and other insects



Stinkhorn (*Phallus impudicus*)
Franklin K. Anderson

that assist in dispersing the reproductive bodies (spores). Their appearance is often sudden; the spore-forming tissue (gleba) can erupt from an underground "egg" and burst open within an hour, becoming slimy and fetid at maturity. Genera widespread in the temperate zone include *Phallus, Mutinus, Dictyophora, Simblum,* and *Clathrus.*

**stinking nutmeg** (tree): *see* California nutmeg.

**stinking smut** (plant disease): *see* bunt.

**Stinnes, Hugo** (b. Feb. 22, 1870, Mülheim, Ger.—d. Apr. 10, 1924, Berlin), German industrialist who emerged after World War I as Germany's "business kaiser," controlling coal mines, steel mills, hotels, electrical factories, newspapers, shipping lines, and banks.

At age 20 Stinnes inherited his father's interest in the family business. Since 1808 the Stinnes family had been operating coal mines, a shipping line to carry the coal up the Rhine River, and a trading house to sell the goods that were carried back. In 1893 Stinnes founded Hugo Stinnes GmbH, which was to become the centre of operations for the Stinnes Konzern (trust) established by his grandfather, Mathias Stinnes. Hugo established the company to consolidate his interests in shipping and mining.

With the profits from distributing coal, he began to acquire interests in the steel industry and in the Ruhr's power, gas, and water utilities. By a process of acquiring and consolidating industries, he was able to control the complete industrial cycle, from raw materials to distribution. From cutting lumber to publishing newspapers, from mining coal and iron ore to shipping automobiles, tools, and machinery all over the world, Stinnes companies handled every phase.

During World War I, Stinnes was a leading supplier of Germany's war materials. After the war, he began acquiring newspapers. By 1922 he owned more than 60 papers and had interests in many more. He was a member of the economic council and used the newspapers to combat the policies of the Weimar coalition and promote his own political ideas. He was a member of the Reichstag (parliament) for the German People's Party (Deutschenationale Volkspartei) from 1920 to 1924.

Influential in starting Germany's industrial recovery after the war, Stinnes pushed to abolish the eight-hour workday in order to increase productivity and resisted the socialization of industry. He eventually operated industries in Germany, Switzerland, Austria, the Balkans, Russia, and Argentina.

**stipulatio,** in Roman law, a form of contract based upon a simple question and answer. It had no parallel in other legal systems. *Stipulatio* developed, at first, with very strict rules. Although no witnesses were required, both parties had to be present during the entire proceedings, which had to be one continuous act. The contract was oral and had to be made in Latin. The stipulator asked, "Spondes?" ("Do you promise?") and the promisor answered, "Spondeo" ("I promise"). The form could be used only by citizens; other forms were open to noncitizens.

The rules later were relaxed. Other forms were added, and Latin was no longer required; only a basic factual agreement between question and answer was necessary. In the 4th century AD a written document began to supersede the oral contract.

**Stirling,** council area, central Scotland. The area south of Loch Katrine and the River Forth lies within the historic county of Stirlingshire, and the area to the north belongs to the historic county of Perthshire. Stirling borders Loch Lomond to the west and spans the Highland Boundary Fault, which separates the Highlands in the north and west from the Lowlands. Towering above the Lowlands, with abrupt slopes of about 1,000 feet (300 metres) in places, are the intrusive volcanic Campsie Fells. The Lowlands, which drain into the River Forth, are thickly mantled with glacial deposits, and raised beaches flank the alluvial flats along the Forth. Annual rainfall decreases from 100 inches (2,500 mm) in the northwestern Highlands to 30 inches along the Forth.

In the wetter north and west, pastoralism predominates; cattle are fattened, and dairying is important. In the southeast, particularly on the alluvial carse (fertile riverine lands), farmers raise crops as well as livestock. The coalfield in the southeast, which underlay the growth of heavy industry in the 19th century, is now largely exhausted, and coal mining has virtually ceased. However, most of the population still lives in the southeast. Services are now the most important economic sector. Financial services are important in Stirling town, and tourism is the most important economic sector in the scenic Highlands. The council area is a centre for electronics manufacture. There are also papermaking, malting, brewing, and distilling industries. Stirling is the council area's administrative centre and largest town. Area 848 square miles (2,196 square km). Pop. (1999 est.) 84,700.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Stirling,** royal burgh (town), Stirling council area, historic county of Stirlingshire, south-central Scotland, on the right bank of the River Forth. The precipitous 250-foot- (75-metre-) high volcanic plug on which the present castle stands was probably occupied by the early British Picts. The settlement had developed sufficiently for it to be made a royal burgh about 1130. Alexander II of Scotland granted another charter in 1226 and made the castle a royal residence.

Two famous battles were fought near Stirling. In the Battle of Stirling Bridge (1297), Sir William Wallace, the Scottish national leader, routed the English, and in 1314 at the Battle of Bannockburn, 2.5 miles (4 km) south, the English under Edward II were defeated and the Scots regained their independence. From then until the mid-16th century, Stirling flourished and shared with Edinburgh the rank and privileges of a capital city. The castle became a regular residence for the Stuart kings, but, after the union of the Scottish and English crowns in 1603, Stirling ceased to play an important national role.

The old town was built on higher levels and on the steep approaches to the castle, where many fine examples of 16th- and 17th-century domestic buildings still survive. Remains of a town wall still exist, as does the "auld brig" over the Forth, a 14th-century structure of pointed arches that is now used only by pedestrians but was once the "key to the Highlands." Stirling grew rapidly in the 19th century, especially after the coming of the railways, when it became the commercial centre for an extensive and prosperous agricultural region. During this period much of the new town was laid out, mainly on level land to the south.

Services are Stirling's most important economic sector, notably financial services. Other industries include electronics manufacture and food processing. The town's position in central Scotland at a natural focus of major roads and railways has favoured its development as a tourist centre. Stirling is the historic county town (seat) of Stirlingshire and the administrative centre of the Stirling council area. Pop. (1991) 30,515.

**Stirling, James,** byname STIRLING THE VENETIAN (b. 1692, Garden, Stirling, Scot.—d. Dec. 5, 1770, Edinburgh), Scottish mathematician who contributed important advances to the theory of infinite series and infinitesimal calculus.

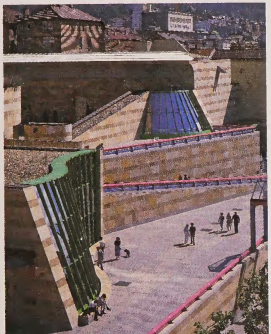
Expelled from the University of Oxford for corresponding with the Jacobites (supporters of Stuart claims to the throne), Stirling in 1715 went to Venice to study. There he uncovered the trade secrets of the Venetian glassmakers and later published *A Description of a Machine to Blow Fire by Fall of Water* (1745).

Stirling returned to London in 1725 and the following year was elected a fellow of the Royal Society of London. In 1735 he became manager of the Scots Mining Company, Leadhills. He published a supplement to Sir Isaac Newton's enumeration of 72 forms of the cubic curve, entitled *Lineae Tertii Ordines Newtonianae,* 8 vol. (1717; "Newtonian

Third Order Curves"). His other publications include *Methodus Differentialis sive Tractatus de Summatione et Interpolatione Serierum Infinitarum* (1730; "Differential Method with a Tract on Summation and Interpolation of Infinite Series") and *On the Figure of the Earth, and On the Variation of the Force of Gravity at Its Surface* (1735). A series expansion called Stirling's formula is named after him, though it was first derived by his countryman Abraham De Moivre.

**Stirling, Sir James (Frazer)** (b. April 22, 1926, Glasgow, Scot.—d. June 25, 1992, London, Eng.), British architect known for his unorthodox, sometimes controversial, designs of multiunit housing and public buildings.

Stirling received his architectural training at the University of Liverpool's School of Architecture (1945–50). He began practice in the



New State Gallery, Stuttgart, Ger., by James Stirling and Michael Wilford, 1977–84
Richard Bryant/ARCAID

early 1950s in London and from 1956 to 1963 was in partnership with James Gowan. From 1971 he worked with Michael Wilford. His early work was mainly low-rise-housing projects in the New Brutalist style, which emphasized exposures of raw steel and brick and the conscious avoidance of polish and elegance. Stirling's Engineering Department building for the University of Leicester (1959–63) is perhaps his most important work in this idiom.

After his breakup with Gowan in 1963, Stirling evolved a rather playful variant of Postmodernism making use of unconventional building axes, complex geometric shapes, and brightly coloured decorative elements. His New State Gallery, or Neue Staatsgalerie (1977–84), in Stuttgart, Ger., a combination of classicism and geometric abstraction, is considered by many to be his finest achievement. Among his other works are a new building for the Fogg Museum (1979–84) and the Arthur M. Sackler Museum (1985), both at Harvard University. In 1981 Stirling was awarded the Pritzker Architectural Prize. He was knighted shortly before his death.

**Stirling, Robert** (b. 1790, Perthshire, Scot.—d. June 6, 1878, Galston, Ayrshire), Scottish clergyman, best known as the inventor of the Stirling engine, a type of external-combustion engine. He also invented optical devices and other instruments.

Stirling's first patent was granted in 1816, and his engines were manufactured from 1818 to 1922, during which time they were used to pump water on farms and to generate electricity. Later attempts to develop the Stirling engine for commercial use proved largely unsuccessful, though its potential for quiet operation, multiple fuel sources, high efficiency, low pollution, and high power density continues to hold considerable attraction for researchers.

**Stirling, William Alexander, 1st Earl of,** Viscount of Canada, Viscount of Stirling, Lord Alexander of Tullibody, also called (1608/09–1630) Sir William Alexander (b. *c.* 1576, Menstrie, Clackmannan, Scot.—d. Feb. 12, 1640, London, Eng.), Scottish courtier, statesman, and poet who founded and colonized the region of Nova Scotia in Canada.

When King James VI of Scotland ascended the English throne as James I in 1603, Alexander attended his court in London. He there wrote, in 1604, his best-known work, *Aurora,* a sonnet sequence that outlived his subsequent didactic tragedies. In 1608 Stirling became agent, in partnership with his cousin, for collecting debts owed to the crown in Scotland during the period 1547–88, retaining a 50 percent reward. He was knighted that same year. His last important poetical work, *Doomes-day, or, The Great Day of the Lords Judgement* (1614), caused King James to choose him to collaborate in translating the Psalms.

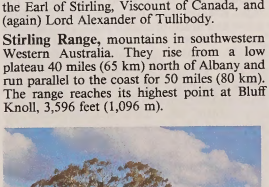
Alexander's career advanced within the Scottish realm, and he became determined to bring Scotland into colonial affairs. In 1621 he obtained a grant of northwestern Newfoundland. He abandoned that territory the same year, however, and was given a much larger tract north of the Sainte-Croix River. He thus became the proprietor of New Scotland (Nova Scotia), despite rival French claims to part of the territory. Although exploratory parties set out in 1622 and 1623, the first settlement was not established until 1629.

In 1625 the charter of 1621 was renewed, but despite expensive and sincere efforts, including an offer of hereditary baronetcies to Scotsmen who established six or more settlers, by 1626 Alexander had failed to colonize the region, and there were only 28 baronets (the total reached 85 by 1631).

The French challenged Scottish rights to Nova Scotia in 1627, and war broke out. Alexander's son led reinforcements to Nova Scotia in 1629. By the Treaty of Susa that year, however, England and France agreed to a mutual restoration of territory and shipping, and Alexander was compelled to surrender Nova Scotia. The Scottish settlers were ordered to withdraw in 1631, leaving Alexander deeply in debt.

In 1630 he was created Viscount of Stirling and Lord Alexander of Tullibody and in 1633 the Earl of Stirling, Viscount of Canada, and (again) Lord Alexander of Tullibody.

**Stirling Range,** mountains in southwestern Western Australia. They rise from a low plateau 40 miles (65 km) north of Albany and run parallel to the coast for 50 miles (80 km). The range reaches its highest point at Bluff Knoll, 3,596 feet (1,096 m).



Bluff Knoll area in the Stirling Range, Western Australia
Photographic Library of Australia

Sighted in 1802 by Matthew Flinders, the range was named after Sir James Stirling, who was the first governor of the state. In 1957 the whole of the range and part of the adjoining plains became the Stirling Range National Park, with an area of 447 square miles (1,157 square km). The park has steep rocky peaks, excellent coastal views, and a wide variety of vegetation.

**Stirlingshire,** also called Stirling, historical region and former midland county, central Scotland. In the reorganization of 1975 most of it became part of Stirling district, in Central region.

The Antonine Wall, which is locally known as Graham's Dyke, was constructed by the Romans in AD 142; it connects the Rivers Forth and Clyde and passes through the southeast of the region. Many Roman relics have been found at Castlecary and Camelon. After the withdrawal of the Romans, the native Picts gradually retired before the advance of the Saxons and Scots. By the time of Malcolm Canmore (d. 1093), the lowland area had become settled. Stirling received a royal charter from David I (*c.* 1130) and became a trading centre.

The Stuart kings ruled from Stirling Castle until the union of the English and Scottish crowns. The region played a conspicuous part in the struggle for Scottish independence, being particularly associated with a number of the exploits of Sir William Wallace and Robert I the Bruce. The three great battles for independence were fought in the region—Stirling Bridge (1297), Falkirk (1298), and Bannockburn (1314). James III was stabbed to death in a cottage in the village of Milton following the Battle of Sauchieburn (1488); however, apart from the disastrous defeat of the Covenanters at Kilsyth (1645) and the transitory triumph of Prince Charles Edward the Young Pretender at Falkirk (1746), the history of the district practically centres in that of the royal burgh.

**Stirner, Max,** pseudonym of Johann Kaspar Schmidt (b. Oct. 25, 1806, Bayreuth, Bavaria [Germany]—d. June 26, 1856, Berlin, Prussia), German anti-statist philosopher in whose writings many anarchists of the late 19th and the 20th centuries found ideological inspiration. His thought is sometimes regarded as a source of 20th-century existentialism.

After teaching in a girls' preparatory school in Berlin, Stirner made a scanty living as a translator, preparing what became a standard German version of Adam Smith's *Wealth of Nations.* He contributed articles to the liberal periodical *Rheinische Zeitung,* which was in part edited by Karl Marx. Later, Marx tried to refute Stirner's ideas, ironically calling him "Sankt Max" ("Saint Max"). His most influential work is *Der Einzige und sein Eigentum* (1845; *The Ego and His Own*).

Stirner believed that there was no objective social reality independent of the individual; social classes, the state, the masses, and humanity are abstractions and therefore need not be considered seriously. He wrote of a finite, empirical ego, which he saw as the motive force of every human action. Writing chiefly for working-class readers, he taught that all persons are capable of the self-awareness that would make them "egoists," or true individuals.

**stirrup,** either of a pair of light frames hung from the saddle attached to the back of an animal—usually a horse or pony. Stirrups are used to support a rider's feet in riding and to aid in mounting. Stirrups probably originated in the Asian steppes about the 2nd century BC. They enormously increased the military value of the horse.

When the spur reached western Europe in the 8th century, it was combined with the use of the lance and armour to produce a new type of warfare, the shock combat of the mounted knight, in which stirrups helped the rider keep



Stirrups on Western saddle

his seat at the moment of impact. Modern stirrups differ little from those of the European Middle Ages. *See also* saddle.

**stirrup cup,** originally a drink offered to a man mounted on horseback and about to depart for the hunt; now, the drinking vessel itself. Commonly connected with hunting, many of the cups are made of silver and engraved with mottoes taken from the chase. They are usually in the form of a fox's head or, more rarely, the head of a greyhound or hare.


English silver-gilt stirrup cup in the shape of a fox's head, probably by Thomas Pitts, 1771
By courtesy of Christie, Manson, and Woods

Many stirrup cups survive from the late 18th and early 19th centuries, and their popularity as collector's items has led to their continued production by modern silversmiths. In glass the stirrup cup took the form of a footless wineglass.

**stishovite,** high-pressure, metastable polymorph of silica ($SiO_2$), having a rutile-type tetragonal structure; silicon is in six-fold coordination with oxygen while each oxygen atom is shared with three silicon atoms. Stishovite was first discovered in sandstone that had been converted to glass at Meteor Crater, Ariz., and its occurrence with coesite in many other craters is evidence that it was formed by kinetic energy imparted by large-scale impact on the surrounding rock.

**stoa,** plural STOAE, in Greek architecture, a freestanding colonnade or covered walkway; also, a long open building, its roof supported by one or more rows of columns parallel to the rear wall. The Stoa of Attalus at Athens is a prime example.

Stoae surrounded marketplaces and sanctuaries and formed places of business and public promenade. Rooms might back onto the colonnade, and a second story was sometimes added.

**stoat,** type of weasel more commonly known as ermine (*q.v.*).

**stochastic process,** in probability theory, a family of random variables indexed by some other set and having the property that for each finite subset of the index set, the collection of random variables thus indexed has a joint probability distribution; it is one of the most general objects of study in probability. These distributions are compatible with each other, a property that ensures that there exists some probability space and some family of random variables defined on the space that realizes the original stochastic process. Examples of stochastic processes include Markov processes, Poisson processes, and time series, with the index family originally thought of as referring to time. This indexing is either discrete or continuous, the interest being in the nature of changes of the variables with respect to time.

**stock,** in botany, any of about 50 species of plants constituting the genus *Matthiola* of the mustard family (Brassicaceae), native to Eurasia and southern Africa and well known for the spicy fragrance of some species. Biennial natives to southwestern Europe and western Asia, stocks, or gillyflowers (*M. incana*), are known in Great Britain as sea stocks for their frequent growth on seaside cliffs. They produce 60- to 80-centimetre (25- to 30-inch) spikes of lilac to white, four-petaled flowers rising from narrowly oval, deep green leaves.


Stock (*Matthiola tricuspidata*)
A.J. Huxley

Garden varieties are red, crimson, yellow, and deep purple; some have double flowers. *M. sinuata,* hardier, shorter, and deeper coloured, also is native to southwestern Europe. Evening stock (*M. longipetala bicornis*), a low and much-branched annual from southeastern Europe and Asia, produces pink to purple, intensely fragrant flowers that open only at night.

**stock,** in finance, the subscribed capital of a corporation or limited-liability company, usually divided into shares and represented by transferable certificates. The certificates may detail the contractual relationship between the company and its stockholders, or shareholders, and set forth the division of the risk, income, and control of the business.

*Common stock, or ordinary shares.* Many companies have only one class of stock, often called common stock, or ordinary shares. This class of stock carries residual ownership of the company, entitling the holder to unlimited interest in the earnings and assets of the company after limited claims are paid. Common stockholders have the right to control the company through their voting rights, unless such rights are specifically withheld, as in special classes of "nonvoting" shares. The common stockholders' legal rights may also include preemptive rights to maintain their proportion of equity when new stock is issued. Dividends paid on common stock are usually unstable because they tend to vary with earnings; they are also usually less than earnings, the difference being used by management to expand the firm and allow the stockholders' equity to grow. The market price of common stock is often subject to wide fluctuations, because it depends largely upon investors' expectations of future earnings.

*Preferred stock, or preference shares.* To appeal to investors who wish to be sure of receiving dividends regularly, many companies issue what is called preferred stock, or preference shares. This class of stock has a prior claim to dividends paid by the company and, usually, to the assets of the company in the event of its dissolution. Dividends are usually set at a fixed annual rate that must be paid before dividends are distributed to the common stockholders. Preferred stock may be participating, meaning that its holders share with common stockholders in any company earnings over and above the stated dividends on the preferred stock. Preferred stock may be cumulative or noncumulative: if cumulative, dividends not paid in one year must be paid in addition to dividends earned in the following year, before any dividend payments are made on the common stock.

**stock-car racing,** form of automobile racing, popular in the United States, in which cars that conform externally to standard U.S. commercial types are raced, usually on oval, paved tracks. Stock-car racing is said to have originated during the U.S. Prohibition period (1919–33), when illegal still operators, needing private cars capable of more than ordinary speed to evade the law while transporting liquor, tuned and altered ordinary passenger automobiles to make them faster. Subsequently, these cars were raced for pleasure, particularly in the southeastern states, where the sport remained most popular.

Organized stock-car racing began at Langhorne, Pa., in 1939. The National Association for Stock Car Auto Racing (NASCAR) was founded in 1947 at Daytona Beach, Fla. The sport had become popular at Daytona Beach from the 1930s, but the first organized racing there was in 1948. By the 1970s several other organizations, including the United States Auto Club (USAC), also sponsored stock-car races. Automotive companies often sponsor racing teams in order to test performance and safety equipment.

**stock company,** troupe of actors performing regularly in a particular theatre, presenting a different play nightly from its repertory of prepared productions. Stock companies were usually composed of players who specialized in dramatic types such as the tragedian, or leading man; the leading lady; the heavy lead, who played villains; the old woman; the juvenile lead, who played the young lover or heroic roles; the soubrette, or female second lead; and the low comedian.

The stock system was used in England from the Elizabethan period. The major cities of the United States, such as New York City, Philadelphia, and Boston, had them from the early 1800s, though the term stock company did not come into use until the mid-19th century, distinguishing the permanent troupes from their competitors, the touring companies. By the end of the 19th century, most of the big-city stock companies had been forced out of business by long-running plays, which proved to be more economical and profitable in the theatres of the large cities. Regional stock companies were unable to compete with touring companies, which brought long-run plays from the capitals to outlying districts. *See also* repertory theatre.

**stock exchange,** also called STOCK MARKET, or (in continental Europe) BOURSE, organized

market for the sale and purchase of securities such as shares, stocks, and bonds.

A brief treatment of stock exchanges follows. For full treatment, *see* MACROPAEDIA: Markets: *Financial markets.*

In most countries, the stock exchange functions as a ready market for securities that encourages investors to direct savings toward the financing of businesses. A stock exchange also serves as a pricing mechanism, because the allocation of capital among firms helps determine prices that reflect the true investment value of a company's stock. (Ideally, this price represents the present value of the stream of expected income per share).

Membership requirements of stock exchanges vary among countries, mainly with respect to the number of members, the degree of bank participation, the rigour of the eligibility requirements, and the level of government involvement. The exchanges also differ in their corporate structure. In North America, the New York Stock Exchange (NYSE) is a not-for-profit corporation, while the National Association of Securities Dealers Automated Quotation (NASDAQ) and the Toronto Stock Exchange (TSE) are shareholder-owned, for-profit companies.

Trading is done in various ways: it may occur on a continuous auction basis, it may involve brokers buying from and selling to dealers in certain types of stock, or it may be conducted through specialists in a particular stock.

By the 21st century, increased access to the Internet and the proliferation of electronic communications networks (ECNs) allowed electronic trading, or e-trading, to alter the investment world. These computerized ECNs made it possible to match the orders of buyers and sellers of securities without the intervention of specialists or market makers. In a traditional full-service or discount brokerage, a customer places an order with a broker member of a stock exchange, who in turn passes it on to a specialist on the floor of the exchange who actually concludes the transaction.

The traditional specialist makes a market for a stock on the exchange by matching buy and sell orders in his exclusive "book" and establishing a price for the trade. In the over-the-counter market, market makers establish prices by setting "bid" and "asked" spreads with a commitment to complete trades in a given security. In e-trading, the customer enters an order directly on-line, and specialized software automatically matches orders to achieve the best price available. In effect, the ECN is a stock exchange for off-the-floor trading. As a result, the operations of some stock exchanges need not be centralized in one location but can be coordinated electronically from a number of locations.

**Stock Market Crash of 1929,** also called THE GREAT CRASH, American economic disaster that precipitated the Great Depression, a nearly 10-year economic slump affecting all the Western industrialized countries.

During the mid-to-late 1920s, the stock market in the United States underwent rapid expansion, reaching a peak at the end of August 1929. Prices began to decline in September and early October, but speculation continued. On October 18 the stock market began to fall precipitately. The first day of real panic, October 24, is known as "Black Thursday"; on that day a record 12,894,650 shares were traded. Though a number of major banks and investment companies bought up great blocks of stock in a successful effort to stem the panic that day, their attempts soon proved to be in vain. The panic began again on "Black Monday"; on "Black Tuesday" (October 29) 16,000,000 shares were traded, and prices on the stock market collapsed completely.

The reasons for the collapse of the stock market are many and complicated. Among the more obvious indications are a period of rampant speculation, the proliferation of holding companies and investment trusts (which, by nature, create debt), and a multitude of large bank loans that could not be liquidated. *See also* Great Depression.

**stock option,** contractual agreement enabling the holder to buy or sell a security at a designated price for a specified period of time, unaffected by movements in its market price during the period. Put and call options, purchased both for speculative and hedging reasons, are made by persons anticipating changes in stock prices. A put gives its holder an option to sell, or put, shares to the other party at a fixed put price even though the market price declines; a call, on the other hand, gives the holder an option to buy, or call for, shares at a fixed price.

Another form of option, a stock purchase warrant, entitles its owner to buy shares of a common stock at a specified price (the exercise price of the warrant). Warrants are often issued with senior securities (preferred stocks and bonds) as "sweeteners" to increase their salability. They may also be issued directly as part of the compensation for underwriters of new issues and other promoters in the establishment of a new business.

The stock rights option gives a stockholder the choice of (1) buying additional stock at a price below the current market price for a specified period of time, usually briefer than the life span of stock purchase warrants, or (2) selling the rights on the market. They are the customary way of implementing the stockholder's preemptive right to subscribe to whatever additional stock is issued in order to maintain his proportionate equity in the corporation and its control.

American corporations frequently issue employee stock options as a form of incentive compensation for their executives. The underlying theory is that an option constitutes an incentive to do what will improve the company's fortunes and thus raise the value of its stock. The employee stock option was widely used as a means of supplementing the compensation of high-salaried employees after 1950, when federal income-tax provisions permitted the "spread" between high market price and the lower option price to be treated, upon sale of the stock, as capital gain, taxable at a 25 percent ceiling rather than the higher personal income-tax rates. In 1976, however, such profit was designated as ordinary income.

**Stockbridge,** town (township), Berkshire county, western Massachusetts, U.S. It lies along the Housatonic River in the Berkshire Hills, 12 miles (19 km) south of Pittsfield. In 1737 John Sergeant and Timothy Woodbridge chartered a Christian mission on the site, which became known as Indian Town. Incorporated in 1739 and named for Stockbridge, Hampshire, Eng., it remained essentially a Native American settlement until 1785. The theologian Jonathan Edwards was pastor and missionary there in 1751–57.

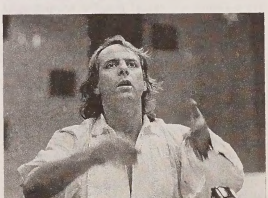


Mission House, John Sergeant's home, built 1739 (now a museum), Stockbridge, Mass.
© Kindra Clineff/THE PICTURE CUBE

From the early 19th century the town's economy depended on manufacturing, but in the 20th century tourism gained prominence. The artist-illustrator Norman Rockwell lived the last 25 years of his life in Stockbridge, and an expanded museum containing his studio and a large collection of his works opened in the town in 1993. Chesterwood, the studio and barn gallery of the sculptor Daniel Chester French (who died in 1931 in Stockbridge), displays his plaster casts, tools, and other belongings. Historic houses include Naumkeag, designed by Stanford White in 1885; Mission House (1739), occupied by the missionary John Sergeant; and Merwin House ("Tranquility"; built *c.* 1825). Pop. (2000) 2,408.

**Stöcker, Adolf:** *see* Stoecker, Adolf.

**Stockhausen, Karlheinz** (b. Aug. 22, 1928, Mödrath, near Cologne, Ger.), German composer, an important creator and theoretician of electronic and serial music who strongly influenced avant-garde composers from the 1950s through the '80s.



Stockhausen, 1972
Clive Barda/P.A.L.

Stockhausen studied at the State Academy for Music (Cologne) and the University of Cologne from 1947 to 1951. In 1952 he went to Paris, where he studied with the composers Olivier Messiaen and, for a time, Darius Milhaud. Returning to Cologne in 1953, Stockhausen joined its celebrated electronic-music studio West German Broadcasting (Westdeutscher Rundfunk), where he served as artistic director from 1963 to 1977. His *Elektronische Studie I* (1953; "Electronic Study") was the first musical piece composed from sine-wave sounds, while *Elektronische Studie II* (1954) was the first work of electronic music to be notated and published. From 1954 to 1956, at the University of Bonn, Stockhausen studied phonetics, acoustics, and information theory, all of which influenced his musical composition. Having lectured at summer courses on new music in Darmstadt since 1953, he began teaching composition there in 1957 and established a similar series of workshops at Cologne in 1963. Stockhausen lectured and gave concerts of his music throughout Europe and North America. From 1971 to 1977 he was professor of composition at the State Academy for Music in Cologne.

Stockhausen's explorations of fundamental psychological and acoustical aspects of music were highly independent and remarkably free of outside influences. Serialism (music based on a series of tones in an ordered arrangement without regard for traditional tonality) was a guiding principle for him. But whereas

composers such as Anton Webern and Arnold Schoenberg had confined the serial principle to pitch, Stockhausen, beginning with his composition *Kreuzspiel* (1951), set about extending serialism to other musical elements. Thus, instrumentation, pitch register and intensity, melodic form, and time duration are deployed in musical pieces that assume an almost geometric level of organization. Stockhausen also began using tape recorders and other machines in the 1950s to analyze and investigate sounds through the electronic manipulation of their fundamental elements, sine waves. From this point he set out to create a new, radically serial approach to the basic elements of music and their organization. He used both electronic and traditional instrumental means and buttressed his approach with rigorous theoretical speculations and radical innovations in musical notation.

In general, Stockhausen's works are composed of a series of small, individually characterized units, either "points" (individual notes), "groups" of notes, or "moments" (discrete musical sections), each of which can be enjoyed by the listener without forming part of a larger dramatic line or scheme of musical development. A typical example of this "open form" is *Momente* (1962), a piece for soprano, 4 choruses, and 13 players. In some such works, such as *Klavierstück XI* (1956; *Piano Piece XI*), Stockhausen gives performers a choice of several possible sequences in which to play a given collection of individual moments, since they are equally interesting regardless of their order of occurrence. Chance decisions thus play an important role in many of the compositions.

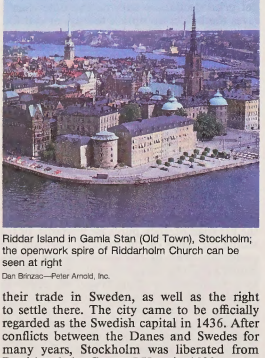
Certain elements are played off against one another, simultaneously and successively. In *Kontrapunkte* (*Counterpoints;* first performed 1953, for 10 instruments), pairs of instruments and extremes of note values confront one another in a series of dramatic encounters; in *Gruppen* (*Groups;* 1958, for three orchestras), fanfares and passages of varying speed are flung from one orchestra to another, giving the impression of movement in space; while in *Zeitmasze* (*Measures;* 1956, for five woodwinds) various rates of acceleration and deceleration oppose one another.

In Stockhausen's electronic music these juxtapositions are taken still further. In the early work *Gesang der Jünglinge* (1956; *Song of the Youths*), a recording of a boy's voice is mixed with highly sophisticated electronic sounds. *Kontakte* (1960) is an encounter between electronic sounds and instrumental music, with an emphasis on their similarities of timbre. In *Mikrophonie I* (1964), performers produce an enormous variety of sounds on a large gong with the aid of highly amplified microphones and electronic filters.

Stockhausen's *Stimmung* (1968; "Tuning"), composed for six vocalists with microphones, contains text consisting of names, words, days of the week in German and English, and excerpts from German and Japanese poetry. *Hymnen* (1964–66; "Hymns") was written for electronic sounds and is a recomposition of several national anthems into a single universal anthem. Stockhausen began to reincorporate more conventional melodic forms in such works as *Mantra* (1970) and *Zodiac* (1975–76). Virtually all of his works from 1977 formed part of the grandiose seven-part operatic cycle *LICHT* ("Light"), a work steeped in spirituality and mysticism that he intended to be his masterpiece.

**Stockholm,** capital and largest city of Sweden. Stockholm is located at the junction of Lake Mälar (Mälaren) and Salt Bay (Saltsjön), an arm of the Baltic Sea, opposite the Gulf of Finland. The city is built upon numerous islands as well as the mainland of Uppland and Södermanland. By virtue of its location, Stockholm is regarded as one of the most beautiful capital cities in the world.

Stockholm was first mentioned as a town in 1252 and was largely built by the Swedish ruler Birger Jarl. It grew rapidly as a result of a trade agreement made with the German city of Lübeck. This agreement ensured Lübeck merchants freedom from customs charges for



Riddar Island in Gamla Stan (Old Town), Stockholm; the openwork spire of Riddarholm Church can be seen at right

Dan Brinzac—Peter Arnold, Inc.

their trade in Sweden, as well as the right to settle there. The city came to be officially regarded as the Swedish capital in 1436. After conflicts between the Danes and Swedes for many years, Stockholm was liberated from Danish rule by Gustav I Vasa in 1523.

Stockholm developed rapidly in the mid-17th century as Sweden temporarily became a great power. The central government departments were then placed there, and the city became an independent administrative unit. The old city walls were torn down, and new districts grew up north and south of the "city between the bridges." In the 18th century, fires destroyed large parts of the city, and stone buildings were constructed to replace the old wooden houses. Stockholm had by then become the cultural centre of Sweden; many of its literary societies and scientific academies date from this time.

A new period of development began with industrialization in the 19th century, and the introduction of municipally organized cleaning (1859) and sanitation (1861) contributed to a rapid increase in population. During this time redevelopment took place in the medieval city nucleus, buildings were reconstructed, boulevards, avenues, and parks were laid out, and many of the city's present-day schools, museums, libraries, and hospitals were built. Many suburbs and satellite towns have subsequently developed.

The original nucleus of the city is the "city between the bridges"—Gamla Stan (Old Town), consisting of Stads Island, Helgeands Island, and Riddar Island. The buildings in this area are mainly from the 16th and 17th centuries. This well-preserved city nucleus, with the original network of streets and many of its buildings dating from the Middle Ages, is legally protected from change. Stads Island contains the Royal Palace; Storkyrkan, also called the Cathedral, or Church, of St. Nicolas; the German Church; the House of Lords; the government offices; the Stock Exchange; and a number of other notable buildings. Riddar Island is dominated by the Riddarholm Church. The House of Parliament and the National Bank are on Helgeands Island.

These islands are connected by old bridges and modern overpasses to city districts occupying the mainland of Uppland to the north and that of Södermanland to the south. The chief northern districts are Norrmalm, Vasastaden, Östermalm, Kungs Island, and Stadshagen. Of these, Norrmalm is a modern shopping, business, and financial centre, while Kungs Island has the City Hall and other municipal buildings. East of Gamla Stan lies the island of Djurgården, a cultural-recreational area that has several museums, including the Vasa Museum, which houses a salvaged Swedish warship dating from 1628.

Stockholm is Sweden's leading industrial area. Its major industries include metal and machine manufacturing, paper and printing, foodstuffs, and chemicals. It is also the country's chief wholesale and retail centre and serves as the headquarters of many banks and insurance companies. Stockholm is also the second largest port in Sweden (Göteborg being the first). The national government's many offices are a major employer in the city, as are various educational, scientific, and cultural institutions.

Public transportation is provided by buses and an extensive subway system. Traffic to neighbouring areas is chiefly handled by trains, and there are railway lines to Malmö, Göteborg, Ange, and Västerås. Arlanda Airport, to the north of the city, has international services. Domestic and charter flights are based at Bromma Airport to the west.

Stockholm is the chief educational centre in Sweden and is home to Stockholm University (1877), the Royal Institute of Technology (1827), and the Caroline Medical Institute. The city's leading cultural institutions include the Royal Theatre (the opera), the Concert Association (Stockholm Philharmonic Orchestra), and the Royal Dramatic Theatre. Pop. (2001 est.) 754,948.

**Stockholm,** *län* (county) of east-central Sweden. It lies along the Baltic Sea and surrounds Stockholm, the national capital and seat of the *län*'s governor, yet is administratively separate from that city. The *län* includes parts of the traditional *landskap* (provinces) of Södermanland (south) and Uppland (north). Stockholm *län* is a fertile lowland dotted with many lakes, and off the deeply indented coastline are numerous skerries (islands). Iron is mined in the northeastern region. Industries include metalworking, papermaking, and the manufacture of machinery and electrical equipment. Area 2,505 square miles (6,488 square km). Pop. (2001 est.) 1,838,882.

**Stockholm Bloodbath,** Swedish STOCKHOLMS BLODBAD (Nov. 8–9, 1520), the mass execution of Swedish nobles by the Danish king Christian II (reigned 1513–23), which led to the final phase of the Swedish war of secession from the Kalmar Union of the three Scandinavian kingdoms under Danish paramountcy.

With the support of the pope, Christian invaded Sweden in 1519 at the head of a large mercenary army after an antiunion Swedish faction led by Sten Sture the Younger had imprisoned the unionist archbishop Gustav Trolle. After defeating the Sture forces and taking Stockholm (September 1520), Christian, at the instigation of Trolle, had more than 80 Swedish nobles executed for heresy on November 8 and 9. Further executions followed, spreading throughout Sweden and Finland. The Kalmar Union seemed secured, but the outrage of the bloodbath alienated virtually all Swedish factions from support of the union. By 1522 Gustav I Vasa (reigned 1523–60) was able, with the help of the peasants of the Dalarna region and the Hanseatic League, to drive the Danes out of Sweden and finally to dissolve the Kalmar Union.

**stockinette stitch** (knitting): *see* plain stitch.

**Stockmar, Christian Friedrich, Baron** (Freiherr) **von** (b. Aug. 22, 1787, Coburg, Saxe-Coburg-Gotha [Germany]—d. July 9, 1863, Coburg), German physician who became influential in Belgian and then in British politics, as secretary to King Leopold I of the Belgians and as adviser to Queen Victoria and Albert, the prince consort, of Great Britain. His ardent constitutionalism helped to form Victoria's determination to act with strict constitutionality.

Stockmar was physician and secretary to Prince Leopold of Saxe-Coburg and was active in the abortive negotiations (1829–30) to place Leopold on the throne of Greece and in promoting his successful candidacy for the throne of Belgium (1830–31). Between 1831 and 1837 Stockmar acted mainly as Leopold's agent in England, where he helped to arrange the marriage (1836) between the widowed queen of Portugal and a Coburg prince.

Stockmar was made adviser to Prince Albert of Saxe-Coburg-Gotha and was employed to arrange his marriage to Queen Victoria, Leopold's niece (Feb. 10, 1840). Stockmar remained at the English court until his retirement to Germany in 1857. He attended the German diets of Frankfurt (1848) and Erfurt (1850) and favoured the extension of Prussian influence.

**Stockport,** borough and district, on the southeastern periphery of the metropolitan area of Greater Manchester, England. Granted a charter in 1220, the original settlement stood on the southern slope of a narrow gorge where the Rivers Tame and Goyt meet to form the Mersey; the modern borough has spread over the more level higher ground.

Cotton spinning was Stockport's staple industry in the 19th century, and hat making dates from the 18th century. Diversification has brought industries ranging from clothing and electronics to heavy engineering. Modern Stockport is also a residential area for Manchester commuters, with large tracts of new housing. Area 49 square miles (126 square km). Pop. (1992 est.) 288,900.

**Stockton,** city, seat (1850) of San Joaquin county, central California, U.S. It lies along the San Joaquin River. Connected westward with San Francisco Bay by the river's 78-mile (126-kilometre) channel, Stockton is, with Sacramento, one of the state's two inland ports. Part of a Mexican land grant (1843) to Captain Charles Weber, it was founded as Tuleburg in 1847. As the head of navigation on the river, it grew rapidly as a miners' supply point during the 1849 gold rush. After a disastrous fire in 1850, it was laid out, incorporated, and renamed to honour Commodore Robert F. Stockton, who in 1846 had claimed California for the United States.

Stockton's growth as a market for mixed farm produce and wines of the Central Valley was assured by the introduction of irrigation and the arrival of the Central Pacific Railroad (1869). The river's deepwater channel (completed 1933) made it a major port as well as a supply depot for U.S. Pacific military operations. An agricultural economic base prevails, strongly augmented by diversified industry.

The University of the Pacific (founded 1851 in San Jose) was moved to Stockton in 1924. Humphreys College dates from 1896, and San Joaquin Delta (junior) College was opened in 1935. Pop. (1993 est.) city, 221,867; Stockton-Lodi MSA, 509,244.

**Stockton, Frank Richard,** byname of FRANCIS RICHARD STOCKTON (b. April 5, 1834, Philadelphia, Pa., U.S.—d. April 20, 1902, Washington, D.C.), American popular novelist and short-story writer of mainly humorous fiction, best known as the author of the title story of a collection called *The Lady, or the Tiger?* (1884).

Stockton refused to study medicine as his father wished and became a wood engraver. He contributed to and was on the staff of *Hearth and Home* and in 1873 became assistant editor of the *St. Nicholas Magazine.* His earliest fiction was written for children. Among his most popular children's stories were those collected in *Ting-a-Ling Tales* (1870) and *The Floating Prince, and Other Fairy Tales* (1881).

His adult novel *Rudder Grange* (1879), originally serialized in *Scribner's Monthly,* recounted the whimsically fantastic and amusing adventures of a family living on a canal boat. Its success encouraged two sequels, *Rudder Grangers Abroad* (1891) and *Pomona's Travels* (1894). *The Casting Away of Mrs. Lecks and Mrs. Aleshine* (1886) told of two middle-aged women on a sea voyage to Japan who become castaways on a deserted island. A sequel appeared in 1888 as *The Dusantes.*

Though he continued to write some juvenile fiction, Stockton wrote mostly for adults after 1887. He also wrote a book of history, *Buccaneers and Pirates of Our Coast* (1898).

**Stockton, Robert F.,** in full ROBERT FIELD STOCKTON (b. Aug. 20, 1795, Princeton, N.J., U.S.—d. Oct. 7, 1866, Princeton), U.S. naval officer and public leader who helped conquer California in the Mexican War (1846–48).

Joining the navy as a midshipman, Stockton saw action in the War of 1812 and in the war against the Barbary pirates (1815). At home, he was active (1828–38) in the American Colonization Society, for which he had journeyed to Africa in 1821 to obtain the land that later became Liberia. In 1838 he went to sea again as commander of the flagship of the Mediterranean fleet. With the naval designer John Ericsson, he drew up the plans for the *Princeton,* the first warship to be driven with a screw propeller.

Late in 1845 he was chosen to command the *Congress* on its voyage from Norfolk, Va., to the Pacific Coast, where he had been ordered to take charge of the fleet. When war with Mexico erupted while he was en route, Stockton immediately took command of U.S. land and sea forces and proceeded to capture Los Angeles—a Mexican stronghold—on Aug. 13, 1846. Four days later, he set up a civil government and formally annexed California to the United States, first naming himself, and later the soldier-explorer John C. Frémont, as governor. In September, however, the two men again had to fight to subdue rebellious native Mexicans; this time they were assisted by Colonel Stephen Watts Kearny of the U.S. Army. The entire province was then ceded to the United States.

After resigning from the navy (1850), Stockton returned to New Jersey. He served as a U.S. senator (1851–53) and finally as president of the Delaware and Raritan Canal Company, which he had helped to form some 20 years earlier.

**Stockton & Darlington Railway,** in England, first railway in the world to operate freight and passenger service with steam traction. In 1821 George Stephenson, who had built several steam engines to work in the Killingworth colliery, heard of Edward Pease's intention of building an 8-mile (12.9-kilometre) line from Stockton on the coast to Darlington to exploit a rich vein of coal. Pease intended to use horse traction; Stephenson told Pease that a steam engine could pull 50 times the load that horses could draw on iron rails. Impressed, Pease agreed to let Stephenson equip his line.

On Sept. 27, 1825, the first engine ran from Darlington to Stockton, preceded by a man on horse carrying a flag reading *Periculum privatum utilitas publica* ("The private danger is the public good"). When the horseman was out of the way, Stephenson opened the throttle and pulled his train of wagons carrying 450 persons at a speed of 15 miles (24 km) per hour.

**Stockton-on-Tees,** borough and district, county of Cleveland, England. It lies on the left bank of the River Tees, 12 miles (19 km) from the river's North Sea mouth. Stockton grew up as a market town around the manor house and later castle of the bishops of Durham, who granted its charter in 1310. Its importance as a port was enhanced by the construction of a stone bridge across the Tees in 1769 and a railway to the Durham coalfield in 1825. This Stockton and Darlington Railway, built by George Stephenson, was the world's first public railway.

The modern district includes both agriculture and industry. There are petrochemical and fertilizer plants at Billingham, ironworks at Stockton town, and heavy-engineering works at Thornaby-on-Tees. Area 77 square miles (200 square km). Pop. (1992 est.) 176,600.

**Stoddard, Richard Henry** (b. July 2, 1825, Hingham, Mass., U.S.—d. May 12, 1903, New York, N.Y.), American poet, critic, and editor, more important as a figure in New York literary circles in the late 19th century than for his own verse. *Abraham Lincoln, An Horatian Ode* (1865) and parts of *Songs of Summer* (1857) and *The Book of the East* (1867) can still be read with interest.

Stoddard spent most of his boyhood in New York City, where he became a blacksmith and later an iron molder, but in 1849 he gave up his trade and began writing for a living. He served as a literary reviewer and editor for a number of New York newspapers and magazines. His wife Elizabeth was a novelist and poet, and their house was a leading gathering place for writers and artists in the last 30 years of the 19th century. Stoddard's autobiography, *Recollections Personal and Literary,* was published in 1903.

**Stoecker, Adolf,** Stoecker also spelled STÖCKER (b. Dec. 11, 1835, Halberstadt, Prussia [Germany]—d. Feb. 2, 1909, Bozen Gries, Ger.), cleric, conservative politician, and reformer who founded the German Christian Social Party and promoted political anti-Semitism in Germany.

An army chaplain during the Franco-German War (1870–71), Stoecker secured appointment as a court preacher at the cathedral in Berlin in 1874. Hoping to win the working classes back to Christianity and away from the liberal secularism of the Social Democratic movement, he founded his Christian Social Workers' Party (1878)—later renamed the Christian Social Party (1881). Though failing in its appeal to the workers, the party attracted a considerable following among the Berlin lower-middle classes because of its founder's espousal of anti-Semitism. As a member of the Reichstag (national parliament) in 1881–93 and 1898–1908, he sought to revive the fortunes of conservative politics by opening the parties of the right to mass support. In 1890—having abandoned his official clerical duties for politics—he founded two Christian social-political associations, the Lutheran Social Congress and the United Lutheran Workers' League of Germany. In 1892 he was influential in fashioning a new political program for the Conservative Party that, among other activities, officially committed that party to an anti-Semitic course. By 1896, however, he had left the party, and thereafter his political role was insignificant.

**stoichiometry,** in chemistry, the determination of the proportions in which elements or compounds react with one another. The rules followed in the determination of stoichiometric relationships are based on the laws of conservation of mass and energy and the law of combining weights or volumes. *See also* equivalent weight.

**Stoicism,** a school of philosophy in Greco-Roman antiquity that stressed duty and held that, through reason, man can come to regard the universe (both physical and moral) as governed by fate and, despite appearances, as fundamentally rational; that, in the regulation of his life, he can thus emulate the grandeur of the calm and order of the universe by learning to accept events with a stern and tranquil mind (apathy) and to achieve a lofty moral worth; and that, in contrast to the Epicurean view, man, as a world citizen, is obliged to play an active role in public affairs.

A brief treatent of Stoicism follows. For full treatment, *see* MACROPAEDIA: Philosophical Schools and Doctrines.

The Stoic movement was founded at Athens by Zeno of Citium (Cyprus) *c.* 300 BC and was influential throughout the Greco-Roman world up to at least AD 200. The name derives from the Stoa Poikile (Painted Colonnade), adjacent to the Athenian agora, where Zeno gave public lectures. Inspired by the teaching of Socrates and the Cynic Diogenes, Zeno's philosophy began as a radical criticism of conventional moral attitudes. The good for man, he argued, is not health, wealth, or any set of values that identify happiness with worldly success. Strictly speaking, only virtue and vice are good and bad, respectively; virtue alone (a wholesome state of mind) is always beneficial, and vice alone (an unwholesome state of mind) is always harmful. Everything else is "indifferent" for happiness, since wealth or health (for instance) can be used well or badly. A virtuous man has all that he needs for happiness. A morally weak man is completely unhappy, no matter what conventional advantages he possesses. Thus happiness and unhappiness are not dependent upon the chances of birth, upbringing, and the other contingencies of life. Every person, through his reasoning faculty, has the natural resources for living well. Emotional disturbance is an indication of mistaken values: fear, passionate desire, grief, etc., are the states of an unhealthy mind, since a virtuous man is in full possession of every good at every moment. His virtue is impregnable to all the ordinarily distressing vicissitudes of fortune. In acting virtuously, the good man seeks to improve the material conditions of other people and of himself, but the worth of his actions consists in their virtuous intention and not in their successful execution, as viewed from outside.

This ethical doctrine accounts for the appeal of Stoicism in antiquity. It transcended the traditional boundaries of race, status, and sex. By internalizing the foundations of happiness, and by identifying these with the virtues of wisdom, courage, justice, and moderation, Stoicism helped to promote the ideal of a common humanity, bonded together through acts of mutual benefit. In the diverse communities of the Hellenistic world and the Roman Empire, Stoicism offered an ethical system that could support the individual in adversity; at the same time it gave positive encouragement to a "natural law" for society, based upon the essential moral nature of all its members.

Ethical doctrine was the core of Stoicism. It is this aspect of the philosophy that has been made most familiar to Western civilization through the surviving books of Cicero (not a Stoic himself), and the Roman Stoics, Seneca, Epictetus, and Marcus Aurelius. These men, however, were writing long after the time of Zeno. The early development of Stoicism into an elaborate system was accomplished by Zeno's associates and successors at Athens—other Greek speakers of eastern origin, including Cleanthes, Chrysippus, Panaetius, and Poseidonius. Their work made important and original contributions to cosmology, physics, logic, and psychology. The trenchant criticism of Stoic views on these subjects and on ethics by the Academic Skeptics (Plato's successors at Athens) prompted many important refinements of the philosophy.

While much that was written by the early Stoics has been lost, a coherent outline of their system may be drawn from the works remaining. In the classic Stoic view, the world consists of a divinely determined sequence of events, whereby God, as all-pervading, rational agent, gives energy and form to unshaped matter. All particular bodies are composites of "God in matter," but the human mind is a "fragment" of God in God's identity as divine mind. In advocating "life in accordance with nature," the Stoics supposed that a person who perfects his own reason is living in harmony with cosmic nature. Acceptance of everything with equanimity was grounded, as a doctrine, in the assumption that all happens for the best, since the world that exists is the best of all worlds possible. Nature can be securely understood by attending to those sense-impressions that are indubitable.

The wise man (a paradigm of virtue invoked by the Stoics) is infallible in his empirical and moral judgments. His mental disposition can be described as "truth," a microcosm of the harmonious order that characterizes nature at large. The wise man is also a master of argument. Under Chrysippus, Stoicism came to be noted for technical discoveries in propositional logic, and it also developed theories of language, which became the foundations of traditional grammar. These activities went well beyond the philosophy's primary concerns with ethics; yet they were justified as consistent with the cultivation of rationality, man's specific function.

By the time of Cicero, Stoicism was the most widely diffused intellectual movement in the Mediterranean world. Its creative impulses were largely over, but it persisted as a powerful moral doctrine, acknowledged in life and literature. In writers such as Philo of Alexandria (early Roman Empire), Stoicism and popular Platonism are curiously blended. This amalgam of both philosophies, together with that of Aristotle, is reflected in much of the writings of the Christian Fathers. Reformulations of Stoic doctrines have appeared periodically into modern times.

**Stojadinović, Milan,** Stojadinović also spelled STOYADINOVITCH (b. July 23, 1888, Čačak, Serbia—d. Oct. 24, 1961, Buenos Aires), Serbian politician, Yugoslav minister of finance from 1922 to 1926, and premier and foreign minister of Yugoslavia from 1935 to 1939.

After graduation from the University of Belgrade in 1910, Stojadnović studied in Germany, England, and France and then served in the Serbian ministry of finance during World War I. Resigning in 1919, he became professor of economics at the University of Belgrade and then (1922) minister of finance.

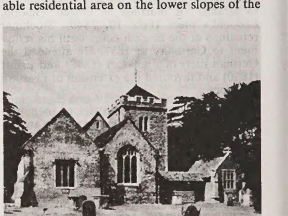
On June 23, 1935, he became premier and, in foreign affairs, abandoned Yugoslavia's principal allies, Czechoslovakia and France, in favour of Nazi Germany. In 1937, with German support, he negotiated treaties with Italy and Bulgaria, both traditional enemies of his country. As head of the Yugoslav Radical Union, a party of Serbs, Bosnian Muslims, and Slovenes, he was mistrusted by Croat leaders.

The regent prince Paul, seeking national unity as World War II approached, accepted Stojadinović's early resignation in 1939. Fear that he was trying to set himself up as the head of a puppet regime with Axis backing led to his arrest in 1940. He was smuggled out of Yugoslavia in 1941 and moved to Argentina in 1949, where he became editor and publisher of an economics magazine. His memoirs, *Ni rat ni pakt* ("Neither War nor Pact"), were published in 1963.

**Stoke-on-Trent,** city and unitary authority, geographic and historic county of Staffordshire, England, consisting of the industrial ceramic-producing area known as the Potteries. Ceramics is the chief industry, although metalworking, glass, and rubber are also important. The city of Stoke-on-Trent combines the former towns of Burslem, Fenton, Hanley, Longton, Stoke-upon-Trent, and Tunstall. The British Ceramic Research Association's laboratories were opened in 1951, and Staffordshire University (founded 1970) has programs in ceramic technology.

Josiah Wedgwood, the great English potter of the 18th century, lived and worked in Stoke-upon-Trent for a time. The novelist Arnold Bennett, born in Hanley, used the area as the setting for many of his works in the early 20th century. Pop. (1998 est.) 251,500.

**Stoke Poges,** town ("parish"), South Bucks district, county of Buckinghamshire, England, just north of Slough. It has become a fashionable residential area on the lower slopes of the



Church of Stoke Poges, Buckinghamshire
A.F. Kersting

Chiltern Hills, with a famous golf club on the site of a manor house built by William Penn, the founder of Pennsylvania. Thomas Gray, the poet, is buried in the churchyard, reputedly the setting for his "Elegy Written in a Country Church Yard" (published 1751). Pop. (1991) 4,851.

**stoker,** machine for feeding coal or other solid fuel into a furnace, usually supporting the fuel during combustion. A good stoker also supplies air for combustion and regulates the rate of burning and, in large installations, disposes of the ashes. Use of stokers affords substantial fuel savings over hand firing. Fuel may be fed into the furnace on a moving chain grate or, for small units (even some for home heating), by a moving screw. Power for running a stoker is usually furnished by an electric motor, and control of combustion is achieved by variable speed or intermittent drive.

The term stoker was originally applied to the man who performed the operation by hand—*e.g.,* aboard ship.

**Stoker, Bram** (b. 1847, Dublin—d. April 20, 1912, London), author of the popular horror tale *Dracula.* Although an invalid in early childhood—he could not stand or walk until he was seven—he outgrew his weakness to become an outstanding athlete and football player at the University of Dublin. After 10 years in the civil service at Dublin Castle, during which he was also an unpaid drama critic for the Dublin *Mail,* he made the acquaintance of his idol, the actor Sir Henry Irving, and from 1878 until Irving's death 27 years later, he acted as his manager, writing as many as 50 letters a day for him and accompanying him on his American tours. Turning to fiction late in life, he published *The Snake's Pass* in 1890, and in 1897 his masterpiece, *Dracula,* appeared. Written chiefly in the form of diaries

and journals kept by the principal characters—Jonathan Harker, who made the first contact with the vampire Count Dracula; Mina, Jonathan's wife; Dr. Seward; and Lucy Westenra, a victim who herself became a vampire—the story is that of a Transylvanian vampire who, using supernatural powers, makes his way to England and there victimizes innocent people to gain the blood on which he lives. Led by Dr. Van Helsing, Harker and his friends, after many hair-raising adventures, are at last able to overpower and destroy Dracula. The immensely popular novel enjoyed equal success in several versions as a play and as a film.

Stoker wrote several other novels—among them *The Mystery of the Sea* (1902), *The Jewel of Seven Stars* (1904), and *The Lady of the Shroud* (1909)—but none of them approached the popularity, or, indeed, the quality, of *Dracula*. *The Man Who Wrote Dracula*, a biography by Daniel Farson, was published in 1975.

**Stokes (of Leyland), Donald Gresham Stokes, Baron** (b. March 22, 1914, London), British automobile executive who presided over the merger that resulted in British Leyland Motor Corporation, Ltd., the largest automaker in England. Although Stokes had done well as managing director of Leyland Motors Ltd., one of the partners in the merger, the consolidated company was not a success and was nationalized by the British government in 1975.

Stokes joined Leyland Motors in 1930 as a student engineer, eventually rising to the post of managing director in 1963. Well known for his sales trips abroad during the 1960s, he was credited with transforming Leyland from a small-lorry (small-truck) and bus manufacturer into the world's leading heavy-lorry exporter. During his five years as head of Leyland the company doubled its sales.

In 1968 Leyland merged with the much larger British Motor Holdings Company at the urging of then prime minister Harold Wilson, who was concerned that the British auto industry would be swamped by its huge foreign competitors. The new company was beset with numerous problems, among them too many models, obsolete plants, uncoordinated management, and poor labour relations. Stokes proved unequal to the formidable task before him, and stockholders urged his removal. When the British government purchased most of the shares of British Leyland, Stokes was elevated to the largely honorary post of president (1975–79). He was knighted in 1965 and made a life peer in 1969.

**Stokes, Sir George Gabriel,** 1ST BARONET (b. Aug. 13, 1819, Skreen, County Sligo, Ire.—d. Feb. 1, 1903, Cambridge, Cambridgeshire, Eng.), British physicist and mathematician noted for his studies of the behaviour of viscous fluids, particularly for his law of viscosity, which describes the motion of a solid sphere in a fluid, and for Stokes's theorem, a basic theorem of vector analysis.

Stokes, who was appointed Lucasian Professor of Mathematics at Cambridge University in 1849, earlier had published his first papers on fluid motion and the steady motion of incompressible fluids (1842 and 1843) and his work on the friction of fluids in motion and the equilibrium and motion of elastic solids (1845). He worked on fluorescence (he originated the term), used it in the study of ultraviolet light, and demonstrated that quartz, unlike ordinary glass, is transparent to ultraviolet light. He was an advocate of the wave theory of light and the concept of an ether in which the waves of light supposedly must travel. In an attempt to explain the apparently contradictory properties of the ether, he suggested that it behaved much like wax and that it was rigid but would flow under a slow but steady force, such as that applied by the orbiting planets. In addition, he hypothesized that the planets dragged part of the ether along with them by virtue of friction.

A pioneer in the science of geodesy (the study of the size and shape of the Earth and its gravitational field), he published a paper in 1849 on the variation of gravity at the surface of the Earth. In 1851 Stokes was elected to the Royal Society (London) and three years later became its secretary, a post he held for 30 years until he was elected president. He thus became the first man since Sir Isaac Newton to hold the three positions of Lucasian Professor, secretary, and then president of the Royal Society.

In 1854 Stokes suggested that the Fraunhofer lines might be caused by atoms in the outer layers of the Sun that absorb light of certain wavelengths. He failed to pursue the possibility, however, and later disclaimed any prior discovery when the German physicist Gustav R. Kirchhoff published his explanation of the Fraunhofer lines. Stokes was created a baronet in 1889.

Stokes's mathematical and physical papers were published in five volumes; the first three under his own editorship in 1880, 1883, and 1901 and the last two under that of Sir Joseph Larmor. Stokes also wrote *On Light* (1887) and *Natural Theology* (1891).

**Stokes, William** (b. Oct. 1, 1804, Dublin—d. Jan. 10, 1878, Howth, near Dublin), physician and the leading representative of the Irish, or Dublin, school of anatomical diagnosis, which emphasized clinical examination of patients in forming a diagnosis. He was also the author of two important works in the emerging field of cardiac and pulmonary diseases. The leading Irish physician of his time, he has been described as the greatest contemporary physician in all of Europe.

Son of Whitley Stokes, regius professor of medicine at Dublin University, William Stokes received his M.D. from the University of Edinburgh in 1825. Upon his return to Dublin he became a clinical instructor, then physician to the Meath Hospital, succeeding his father in this position. He continued the educational reforms introduced at Meath by Robert James Graves a few years earlier. Stokes encouraged students to gain clinical experience by working, under faculty supervision, in hospital wards; he also urged them to acquire a general as well as a medical education to provide a basis for independent judgment. Stokes was a pioneer in the new methods of clinical diagnosis popularized by the Parisian school of anatomical diagnosis and was leader of the movement in Dublin. Upon the death of his father in 1845, he was confirmed as regius professor of medicine at Dublin University.

Stokes published more than a hundred scientific works, but the two most important were *A Treatise on the Diagnosis and Treatment of Diseases of the Chest*, published in 1837, and *The Diseases of the Heart and Aorta*, published in 1854. He was also the author of one of the first works in English on the use of the stethoscope. Stokes also gave his name to a type of breathing characteristic of advanced myocardial degeneration, called Cheyne-Stokes respiration (Cheyne, a Scottish physician practicing in Dublin, had published observations on rhythmic respiration), and to a combination of slow pulse and cerebral attacks known as the Adams-Stokes syndrome (described earlier by Robert Adams, a regius professor of surgery at the University of Dublin).

**Stokes lines,** radiation of particular wavelengths present in the line spectra associated with fluorescence and the Raman effect (*q.v.*), named after Sir George Gabriel Stokes, a 19th-century British physicist. Stokes lines are of longer wavelength than that of the exciting radiation responsible for the fluorescence or Raman effect.

Anti-Stokes lines are found in fluorescence and in Raman spectra when the atoms or molecules of the material are already in an excited state (as when at high temperature). In this case the radiated line energy is the sum of the pre-excitation energy and the energy absorbed from the exciting radiation. Thus, anti-Stokes lines are always of shorter wavelength than that of the light that produces them. The difference between frequency or wavelength of the emitted and absorbed light is called the Stokes shift.

**Stokesay,** parish in South Shropshire district, county of Shropshire (formerly Salop), England, best known for its castle (1240), one of the most notable fortified manor houses of England. It was fortified against Welsh marauders, and the south tower was added by the Ludlows, a landowning family who purchased the castle in 1291. In the 16th century a half-timbered gatehouse replaced the ancient entrance tower.

**Stokes's law,** mathematical equation that expresses the settling velocities of small spherical particles in a fluid medium. The law, first set forth by the British scientist Sir George G. Stokes in 1851, is derived by consideration of the forces acting on a particular particle as it sinks through a liquid column under the influence of gravity. The force acting in resistance to the fall is equal to $6\pi r\eta v$, in which $r$ is the radius of the sphere, $\eta$ is the viscosity of the liquid, and $v$ is the velocity of fall. The force acting downward is equal to $\frac{4}{3}\pi r^3 (d_1 - d_2)g$, in which $d_1$ is the density of the sphere, $d_2$ is the density of the liquid, and $g$ is the gravitational constant. At a constant velocity of fall the upward and downward forces are in balance. Equating the two expressions given above and solving for $v$ therefore yields the required velocity, expressed by Stokes's law as $v = \frac{2}{9}(d_1 - d_2)gr^2/\eta$.

Stokes's law finds application in several areas, particularly with regard to the settling of sediment in fresh water and in measurements of the viscosity of fluids. Because its validity is limited to conditions in which the motion of the particle does not produce turbulence in the fluid, however, various modifications have been set forth.

**Stokowski, Leopold (Antoni Stanislaw Boleslawawicz)** (b. April 18, 1882, London—d. Sept. 13, 1977, Nether Wallop, Hampshire, Eng.), virtuoso British-born U.S. conductor known for his flamboyant showmanship and the rich sonorities of his orches-



Stokowski
EB Inc.

tras and for his influence as a popularizer of classical music.

Stokowski was trained at the Royal College of Music, London, and Queen's College, Oxford, and held positions as an organist before becoming conductor of the Cincinnati (Ohio) Symphony (1909–12). He gained an international reputation as musical director of the Philadelphia Orchestra from 1912 to 1936,

and he frequently conducted concerts with them until 1941. He introduced youth concerts and performed contemporary works by Mahler, Edgard Varèse, and Stravinsky and conducted the world premiere of Charles Ives's *Fourth Symphony*. He also experimented with the placement of various sections of the orchestra and occasionally changed the written orchestration of the music he performed.

Organizer of the All-American Youth Orchestra, he conducted the NBC Symphony (1941–44) with Toscanini and founded low-priced concerts at the New York City Center (1944–45). He directed the New York Philharmonic (1946–50) and the Houston (Texas) Symphony (1955–62) and in 1962 formed the American Symphony Orchestra in New York City.

Stokowski made three films with the Philadelphia Orchestra, including Walt Disney's *Fantasia* (1940), and wrote a book, *Music for All of Us* (1943). He also made symphonic transcriptions of Bach's works.

**Stolberg-Stolberg, Friedrich Leopold, Graf zu** (count of) (b. Nov. 7, 1750, Bramstedt, Holstein—d. Dec. 5, 1819, Schloss Sondermühlen, near Osnabrück, Hanover), German lyric poet of the Sturm und Drang (Storm and Stress) and early Romantic periods.

Stolberg and his brother Christian, noblemen who were actually Danish subjects, studied law at Halle and at Göttingen, where both became members of the Göttinger Hainbund, a group that met to discuss their poems and to further the ideals of friendship, virtue, freedom, love of fatherland, and interest in Germanic history, in 1772. The two were caught up in the revolutionary mood of the times and wrote stirring odes to freedom and fatherland. A book of poems by the brothers, *Gedichte,* appeared in 1779. But Friedrich's verse also has a pastoral, idyllic quality that ties his work to the Romantics. The combination of revolutionary and pacifist sentiments in Stolberg's poems is striking.

Stolberg entered the diplomatic service in 1777 and lived in Copenhagen and Berlin. After several years of increasing religiosity, he converted to Catholicism in 1800. He was active in a group of Westphalian Catholics working to develop Romanticism. In addition to poetry, Stolberg wrote travel books and theoretical literary essays and translated Homer's *Iliad* (1778) and tragedies by Aeschylus (1802). His final work was the immense *Geschichte der Religion Jesu Christi,* 15 vol. (1806–18; "History of the Religion of Jesus Christ"), which covered the development of Christianity up until the year 430. It was continued (53 vol., 1825–64) by F. von Kerz and J.N. Brischar.

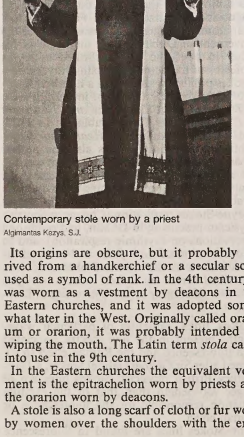
**Stolbovo, Treaty of** (1617), peace settlement concluded between Sweden and Russia ending Sweden's intervention in Russia's internal political affairs and blocking Russia from the Baltic Sea. In 1610 Muscovite leaders, faced with a succession crisis, a war with Poland, and peasant uprisings (Time of Troubles, 1606–13), offered the Russian throne to Władysław, the son of the Polish king Sigismund III. This action provoked Sweden, then at war with Poland, to declare war on Russia and claim the Russian throne for the Swedish prince Philip.

Hoping to recover territory along the Gulf of Finland that they had lost to Russia during an earlier Russo-Swedish war (1590–95; Treaty of Täysinä), the Swedes invaded northern Russia (autumn 1610) and in July 1611 captured Novgorod. When the Russian domestic crises had been brought under control, the forces of the new tsar Michael Romanov actively resumed the war against the Swedes in northern Russia, expelling them from the Novgorod region. But the Swedes besieged Pskov, and peace was restored only after the mediation of Holland and England brought about the Treaty of Stolbovo.

The provisions of the treaty called for Sweden to return Novgorod and its other acquisitions in northern Russia to the Muscovite government but allowed Sweden to retain Karelia and Ingria, between Estonia and Finland, thus cutting off Russia's access to the Baltic Sea. Also, Russia had to pay Sweden an indemnity of 20,000 rubles, and Sweden's Prince Philip renounced his claim to the Russian throne.

This settlement was observed until 1656, when the Swedish king Charles X invaded Poland and declared himself the new Polish king. Russia also was at war with Poland, and, objecting to Swedish control of that country as well as hoping to regain some territory in the Baltic region, it turned its forces against Sweden. But the resulting peace settlement, concluded at Valiesar (1658) and confirmed at Cardis (1661), made no territorial changes.

**stole,** ecclesiastical vestment worn by Roman Catholic deacons, priests, and bishops and by some Anglican, Lutheran, and other Protestant clergy. A band of silk 2 to 4 inches (5 to 10 centimetres) wide and about 8 feet (240 centimetres) long, it is the same colour as the major vestments worn for the occasion. The Roman Catholic deacon wears it over the left shoulder with ends joined under the right arm; priests and bishops wear it around the neck with ends hanging vertically, except that priests cross the ends in front when wearing an alb. In the Roman Catholic Church it is a symbol of immortality. It is generally considered the unique badge of the ordained ministry and is conferred at ordination.



Contemporary stole worn by a priest
Algimantas Kezys, S.J.

Its origins are obscure, but it probably derived from a handkerchief or a secular scarf used as a symbol of rank. In the 4th century it was worn as a vestment by deacons in the Eastern churches, and it was adopted somewhat later in the West. Originally called orarium or orarion, it was probably intended for wiping the mouth. The Latin term *stola* came into use in the 9th century.

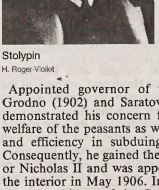
In the Eastern churches the equivalent vestment is the epitrachelion worn by priests and the orarion worn by deacons.

A stole is also a long scarf of cloth or fur worn by women over the shoulders with the ends hanging down in front. It probably developed from a long, robe-like outer garment worn by matrons in ancient Rome.

**stolon,** in biology, a special slender horizontal branch serving to propagate the organism. In botany a stolon—also called a runner—is a slender stem that grows horizontally along the ground, giving rise to roots and aerial (vertical) branches at specialized points called nodes. In zoology, stolons of certain invertebrate animals are horizontal extensions that produce new individuals by budding. Fungi spread by means of horizontal filaments (hyphae) that are also called stolons.

**Stolp** (Poland): *see* Słupsk.

**Stolypin, Pyotr Arkadyevich** (b. April 14 [April 2, old style], 1862, Dresden, Saxony—d. Sept. 18 [Sept. 5, O.S.], 1911, Kiev), conservative statesman who, after the Russian Revolution of 1905, initiated far-reaching agrarian reforms to improve the legal and economic status of the peasantry as well as the general economy and political stability of imperial Russia.



Stolypin
H. Roger-Viollet

Appointed governor of the provinces of Grodno (1902) and Saratov (1903), Stolypin demonstrated his concern for improving the welfare of the peasants as well as his firmness and efficiency in subduing their rebellions. Consequently, he gained the favour of Emperor Nicholas II and was appointed minister of the interior in May 1906. In July he was also named president of the Council of Ministers (*i.e.,* prime minister).

Dismissing the first Duma (the elected legislative body created after the 1905 Revolution) on July 22 (July 9, O.S.), 1906, because it demanded a determining voice in the formulation of an agrarian reform program, Stolypin, by executive decree, introduced his own reforms. These gave the peasantry greater freedom in the selection of their representatives to the *zemstvo* (local government) councils, removed restrictions that had excluded the peasantry from participating in normal judicial procedures, and, most importantly, provided them with an opportunity to leave their communes, acquire private ownership of consolidated plots of land, and transform themselves, according to Stolypin's wish, into a prosperous, stable, and loyally conservative class of farmers (October and November 1906).

Stolypin, however, also instituted a network of courts-martial, which were authorized to try accused rebels and terrorists; within the few months of their existence they used "Stolypin's necktie" (the noose) to execute several thousand defendants; the prime minister gained the enmity of the left wing and much of the centre. He also provoked the opposition of the moderate left when he swiftly dismissed the second Duma (which met from March to June 1907) because it refused to endorse his agrarian reform proposals and when, on the day of its dissolution (June 16 [June 3, O.S.], 1907), he issued—in complete disregard for the recently adopted constitution—a new

electoral law reflecting his personal conservatism and Russian nationalism and restricting the franchise of the peasant and worker electorate as well as that of the national minorities.

Although he had earlier also alienated the extreme right by partially accepting the constitutional framework, Stolypin did obtain the cooperation of the party of the moderate right (the Octobrists), which dominated the third Duma (convened November 1907). With the Octobrists' aid he passed legislation confirming and elaborating his 1906 agrarian reforms (June 1910 and June 1911). He was also able to reimpose harsh Russification policies on Finland. When he convinced the Emperor to temporarily suspend both the Duma and the upper legislative house (the State Council) in order to bypass them and enact legislation on the extension of the *zemstvo* system into the Polish regions of the empire (March 1911), he also alienated the moderate right, which condemned him for once again abusing the constitutional system of government.

It is probable that Nicholas was considering his dismissal when Stolypin, while attending an operatic performance with the Emperor, was fatally shot (Sept. 14 [Sept. 1, O.S.], 1911) by Dmitry Bogrov, a revolutionary who had used his police connections to gain admittance to the theatre.

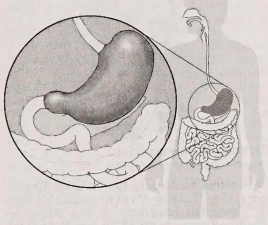
**Stolypin land reform** (1906–17), measures undertaken by the Russian government to allow peasants to own land individually. Its aim was to encourage industrious peasants to acquire their own land, and ultimately to create a class of prosperous, conservative, small farmers that would be a stabilizing influence in the countryside and would support the autocracy. After the government emancipated the serfs in 1861 it allotted land to each peasant household, but the land was collectively owned by the village communes. The communes traditionally divided the land into strips, which were distributed among the households for cultivation.

The lack of economic success in agriculture following emancipation, as well as the violent peasant uprisings that occurred during the Revolution of 1905, suggested the need to abandon communal land tenure and to replace it with individual land ownership. On Nov. 22 (Nov. 9, old style), 1906, while the Duma (the formal legislative body) was not in session, the prime minister Pyotr Arkadyevich Stolypin issued a decree that enabled each peasant household to claim individual ownership of its land allotment and to withdraw from the commune. The household could also demand that the commune provide it with a consolidated plot equivalent to the scattered strips it had been cultivating. Furthermore, the decree abolished joint household ownership and made the head of each household the sole property owner. In 1910 the decree was finally confirmed by the Duma, which passed laws expanding it in 1910 and 1911.

The reform was only a moderate success. By the end of 1916 no more than 20 percent of the peasant households had title to their land, although fewer (some 10 percent) had received consolidated plots. The reform did not transform the peasantry into the bulwark of support that the autocracy needed; and during 1917 peasants everywhere participated in the revolutions, seizing properties belonging to the Stolypin farmers.

**stomach,** saclike expansion of the animal digestive system, between the esophagus and the small intestine; it is located in the anterior portion of the abdominal cavity in most vertebrates. The stomach serves as a temporary receptacle for storage and mechanical distribution of food before it is passed into the intestines. In animals whose stomachs contain digestive glands, some of the chemical processes of digestion also occur in the stomach.

*Humans.* The human stomach is subdivided into four regions: the cardia (so named because it is nearest to the heart), an opening leading down from the esophagus; the fundus, an expanded area curving up above the cardiac opening; the body, or intermediate, region, the central and largest portion; and the pylorus (*q.v.*), a narrowing where the stomach joins the small intestine. Each of the openings, the cardiac and the pyloric, has a sphincter muscle that keeps the neighbouring region closed, except when food is passing through. In this manner, food is enclosed by the stomach until ready for digestion.



Stomach

The stomach has the ability to expand or contract depending upon the amount of food contained within it. When contracted, the interior walls form numerous folds (rugae), which disappear when the walls are distended. The thick mucous-membrane lining of the walls is densely packed with small gastric glands (*q.v.*) that secrete a mixture of enzymes and hydrochloric acid to partly digest proteins and fats.

Human stomach muscles are rarely inactive. Upon entry of food they relax briefly, then begin to contract. Periodic contractions churn and knead food into a semifluid mixture called chyme; rhythmical pumping (peristaltic) waves move food toward the pylorus and small intestine. Peristaltic contractions persist after the stomach empties and, increasing with time, may become painful. Such hunger pangs may also be related to the amount of sugar in the blood. If the level of sugar decreases significantly, hunger can be experienced without the stomach's intervention. The absorption of food, water, and electrolytes by the stomach is practically negligible, but iron and highly fat-soluble substances such as alcohol and some drugs are absorbed directly. Secretions and movements of the stomach are controlled by the vagus nerve and the sympathetic nervous system; emotional stress can alter normal stomach functions. Common stomach disorders include peptic ulcer, cancer, and gastritis.

For a depiction of the stomach in human anatomy, shown in relation to other parts of the body, see the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

*Other animals.* The stomachs of some other animals differ considerably from that of humans; many have multiple-chambered organs or special adaptations. The stomachs of cows and most cud-chewing animals are divided into four separate parts. Food is received first in the rumen, where mucus is added and cellulose is broken down. Next, it goes back to the mouth to be thoroughly rechewed. When swallowed again, it is passed to the second and third chambers, the reticulum and omasum, where water is extracted and absorbed. The food then goes to a final chamber, the abomasum, to receive the digestive enzymes.

Birds have a three-chambered stomach: the first chamber, the crop, receives the food initially and either stores or begins to moisten and soften (macerate) it; the true stomach area adds digestive juices; and the gizzard, with its stones, or toothlike structures, grinds the food.

Rodents have only one stomach area, and many must eat their food twice before absorption takes place. Food is eaten and passed through the lower digestive tract, where it is coated with metabolites to help break it down. The fecal material is then re-eaten and mixed with additional food. Enzymes and water are removed from the once-passed material by the stomach and used to help digest new nutritional substances. Dry fecal pellets are finally excreted.

The starfish can turn its stomach inside out and extrude it partly from the body to eat the soft contents of shelled animals such as clams. Camels and llamas can regurgitate their stomach contents and spit this material at approaching enemies. Crayfish produce stones of calcium salts in their stomach. These are stored until the animal sheds its external shell, when the stones are reabsorbed by the stomach and used in forming a new shell.

**stomach cancer,** also called GASTRIC CANCER, abnormal growth of cells in the stomach. The incidence of stomach cancer is significantly lower in countries where refrigeration has replaced other methods of food preservation such as salting, smoking, and pickling. Stomach cancer rates remain high in countries where these processes are still used extensively.

Multiple risk factors have been identified that increase a person's probability of developing this cancer. These include a diet high in salted, smoked, or pickled foods, infection by the bacterium *Helicobacter pylori,* tobacco and alcohol use, or a family history of stomach cancer. Other factors that may increase the risk of stomach cancer to varying degrees are previous stomach surgery, blood type A, advanced age (60–70 years), or chronic stomach inflammation. Males develop stomach cancer at approximately twice the rate of females. Rare disorders such as pernicious anemia or Menetrier's disease and congenital disorders that lead to increased risk for colorectal cancer may also increase stomach cancer risk.

The symptoms of stomach cancer are prevalent in many other illnesses and may include abdominal pain or discomfort, unexplained weight loss, vomiting, poor digestion, or visible swelling in the abdomen. Stomach cancer is usually diagnosed through a combination of visual means. A physician can inspect the lining of the stomach with a flexible, lens-containing tube called an endoscope. A biopsy may be performed. X rays are also employed, usually after the patient has swallowed a barium compound that provides better image contrast. Other imaging techniques such as computed tomography (CT) scans and magnetic resonance imaging (MRI) are also used, especially when the cancer is believed to have spread.

Once stomach cancer has been diagnosed, its stage is determined. The stage is an indicator of how far the cancer has progressed. Advanced cancers may have spread into the connective tissue or muscle layers that underlie the epithelial cells, nearby lymph nodes, and distant tissues.

A very high percentage of individuals survive stomach cancer for at least 5 years if the cancer is diagnosed very early, and many of them go on to live long, healthy lives. Unfortunately, only a small percentage of stomach cancers are identified and treated at such an early stage. At the time when most lower-stomach cancers are diagnosed, roughly half the pa-

tients survive for at least five years. Cancers of the upper stomach have a lower patient survival rate, and if the cancer has spread to distant tissues in the body, the survival rate is extremely low.

Surgery is the only method available for curing stomach cancer, although radiation or chemotherapy may be used in conjunction with surgery or to relieve symptoms. If the cancer is localized, the cancerous portions of the stomach are removed in a procedure called a partial gastrectomy. In some cases, the entire stomach must be removed along with the spleen and nearby lymph nodes. If the cancer cannot be cured, surgery may still be used to relieve symptoms or digestive discomfort. When stomach cancer has spread to distant organs, chemotherapy may be required.

Stomach cancer cannot be completely prevented, but people can decrease their risk of disease by adopting a diet that is low in salted, smoked, and pickled foods and high in fruits and vegetables. Elimination of tobacco use and reduction in alcohol consumption also help lower stomach cancer risk.

**stomate,** also called STOMA, plural STOMATA, or STOMAS, any of the microscopic openings or pores in the epidermis of leaves and young stems. Stomates are generally more numerous on the underside of leaves. They provide for the exchange of gases between the outside air and the branched system of interconnecting air canals within the leaf.

A stomate opens and closes in response to the internal pressure of two sausage-shaped guard cells that surround it. The inner wall of a guard cell is thicker than the outer wall. When the guard cell is filled with water and it becomes turgid, the outer wall balloons outward, drawing the inner wall with it and causing the stomate to enlarge.

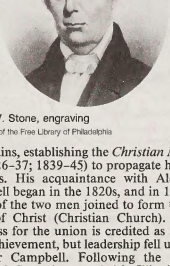
Guard cells work to control excessive water loss, closing on hot, dry, or windy days and opening when conditions are more favourable for gas exchange. At dawn a sudden increase in stomatal opening, reaching maximum near noon, is followed by a decline because of water loss. Recovery and reopening are then followed by another decline as darkness approaches.

The concentration of carbon dioxide in the air is another regulator of stomatal opening in many plants. When carbon dioxide levels fall below normal (about 0.03 percent), the guard cells become turgid and the stomata enlarge.

**stone,** British unit of weight equivalent to 14 pounds avoirdupois (6.35 kg). Originally any good-sized rock chosen as a local standard, the stone came to be widely used as a unit of weight in trade, although its value fluctuated with the commodity and region. In the 14th century England's exportation of raw wool to Florence necessitated a fixed standard. In 1389 a royal statute fixed the stone of wool at 14 pounds and the sack of wool at 26 stones. Trade stones of variant weights persist, such as the glass stone of 5 pounds. The stone is now commonly used to designate the weights of people and large animals.

**Stone, Barton W(arren)** (b. Dec. 24, 1772, Charles county, Maryland [U.S.]—d. Nov. 9, 1844, Hannibal, Mo., U.S.), Protestant clergyman and a founder of the Disciples of Christ, a major U.S. religious denomination.

Stone was ordained a Presbyterian minister in 1798, though he was more Arminian than Calvinist in his views and stressed primitive Christian thought and practice. He was preacher at Cane Ridge Church, near Paris, Ky., when it became the centre of the Great Revival (1801–03) and an immense camp meeting. In 1803 Stone and five colleagues left the Synod of Kentucky and formed the Springfield Presbytery. In 1804, after biblical study, they signed "The Last Will and Testament of the Springfield Presbytery," dissolving that body that it might "sink into union with the Body of Christ at large." This act on behalf of Christian unity furthered among churches of the Carolinas and Kentucky a movement toward congregational polity and the use of only the term "Christian" in the names of their churches. Stone gradually became the leader of this movement west of the Allegheny



Barton W. Stone, engraving
By courtesy of the Free Library of Philadelphia

Mountains, establishing the *Christian Messenger* (1826–37; 1839–45) to propagate his liberal views. His acquaintance with Alexander Campbell began in the 1820s, and in 1832 followers of the two men joined to form the Disciples of Christ (Christian Church). Stone's eagerness for the union is credited as decisive in its achievement, but leadership fell upon the younger Campbell. Following the frontier westward, Stone later settled in Illinois. He is buried at Cane Ridge, where his original log church is enshrined.

**Stone, Edward Durell** (b. March 9, 1902, Fayetteville, Ark., U.S.—d. Aug. 6, 1978, New York City), American architect who directed the design of a number of significant modern buildings.

Stone studied art at the University of Arkansas, Fayetteville, in 1920–23 and architecture at Harvard University and the Massachusetts Institute of Technology. In 1927 he won a two-year scholarship that enabled him to study and travel in Europe, and during that period he was exposed to the modern movement in architecture there. In 1930 Stone joined the New York firm responsible for the design of Radio City Music Hall. He organized his own architectural firm in 1936. He participated in the design of the Museum of Modern Art (1937), the first building in New York City in the International Style. After World War II, in which he served as chief of planning and design for the U.S. Army Air Corps, he became an associate professor of architecture at Yale University (1946–52).



New York Cultural Center (formerly the Gallery of Modern Art), New York City, by Edward Durell Stone, 1959
By courtesy of the New York Cultural Center, in association with Fairleigh Dickinson University; photograph, Arnold Eagle

Among Stone's best-known buildings outside the United States are El Panama Hotel, Panama City, Panama (1946), notable for its pioneering use of cantilevered balconies in the construction of a resort hotel; the U.S. Embassy in New Delhi (1954); and the Nuclear Research Center, near Islāmābād, Pak. (1966). The embassy in New Delhi, with its lacy grilles and an inner water garden, fountains, and islands of plantings, was well received and led to many foreign commissions. His design for the American Pavilion for the Brussels World's Fair of 1958, a circular structure 340 feet (104 m) in diameter with a free-span translucent roof, also attracted attention.

Examples of Stone's work in the United States include the Fine Arts Center, University of Arkansas (1948); the Gallery of Modern Art, formerly housing the Huntington Hartford collection (1959; now the New York Cultural Center) in New York City; the National Geographic Society headquarters (design completion 1961) in Washington, D.C.; and the John F. Kennedy Center for the Performing Arts (1971), also in Washington, D.C. His skyscrapers include the 50-story General Motors Tower in New York City (design completion 1964) and the 80-story Standard Oil (Indiana) Tower in Chicago (1974; now the Amoco Building).

Stone's autobiography, *The Evolution of an Architect,* was published in 1962.

**Stone, Fred (Andrew)** (b. Aug. 19, 1873, Valmont, near Denver, Colo., U.S.—d. March 5, 1959, Hollywood, Calif.), popular American stage actor and dancer.

Stone was raised in Topeka, Kan., making his stage debut there at age 11, and soon joined his brother on tour with a number of small circuses. In the 1890s he teamed up with Dave Montgomery and together they toured in vaudeville and minstrel shows before appearing in their first Broadway show, *The Girl from Up There* (1901). The pair scored a major success in 1903 in *The Wizard of Oz* with Stone as the Scarecrow, and they went on to perform in other Broadway hits. After Montgomery's death in 1917, Stone continued on his own as a top attraction, displaying his eccentric acrobatic dancing and engaging personality in such vehicles as *Jack o' Lantern* (1917), *Stepping Stones* (1923), *Criss Cross* (1926), and *Smiling Faces* (1932). His last New York City appearance was as Granpa Vanderhof in the 1945 revival of *You Can't Take It with You.* Long active in attempts to unionize stage performers, early in his career Stone was blacklisted from vaudeville for his leadership role in the White Rats of America, a forerunner of Actors' Equity Association, and he served for a time as president of National Vaudeville Artists. His wife, Allene Crater Stone, and his daughters, Carol, Dorothy, and Paula Stone, appeared in several stage and film productions with him.

**Stone, Harlan Fiske** (b. Oct. 11, 1872, Chesterfield, N.H., U.S.—d. April 22, 1946, Washington, D.C.), associate justice of the U.S. Supreme Court (1925–41) and 12th chief justice of the United States (1941–46). Sometimes considered a liberal and occasionally



Harlan Fiske Stone, 1929
By courtesy of the Library of Congress, Washington, D.C.

espousing libertarian ideas, he believed primarily in judicial self-restraint: the efforts of government to meet changing 20th-century social and political conditions should be restricted only on the basis of unconstitutionality rather than undesirability.

Stone graduated from Amherst College in 1894 and received his law degree in 1898 from the law school of Columbia University. He then taught at Columbia from 1899 and served as the dean of its law school from 1910, while also conducting a private law practice in New York City. President Calvin Coolidge appointed him attorney general of the United States (1924), in which post he reorganized the Federal Bureau of Investigation after its reputation had been tarnished by the Teapot Dome and other scandals of President Warren G. Harding's administration. Stone's effectiveness prompted Coolidge to appoint him an associate justice of the Supreme Court (1925), and President Franklin D. Roosevelt promoted him to chief justice in succession to Charles Evans Hughes (1941).

In his early years on the court, Stone was bracketed with Justices Louis Brandeis and Oliver Wendell Holmes (and later with Benjamin Nathan Cardozo, who replaced Holmes in 1932) as one of the "three great dissenters" against a conservative majority that disliked legislative regulation of business. During Roosevelt's presidency (1933–45), Stone generally affirmed the legislative reforms of the New Deal, upholding, for instance, the Social Security Act of 1935 and the enactment of a national minimum-wage law in 1938. In a leading case involving federal New Deal legislation, *United States* v. *Butler*, 297 U.S. 1 (1936), he opposed the court majority's invalidation of the Agricultural Adjustment Act.

Besides advocating a new tolerance for state regulation of economic activity, Stone was instrumental in asserting the court's concern for protecting individual civil liberties from governmental coercion. He was the lone dissenter when, in *Minersville School District* v. *Gobitis,* 310 U.S. 586 (1940), the court upheld a state ruling that children who were Jehovah's Witnesses must join in saluting the American flag in public schools. This decision was overruled (1943) while Stone was chief justice. In *Girouard* v. *United States,* 328 U.S. 61, 76 (1946), the court followed Stone's dissent in a similar case, *United States* v. *Macintosh,* 283 U.S. 605 (1931), in which he had argued that religious pacifists who refused to take the statutory oath to bear arms could nonetheless be naturalized as citizens.

Stone was renowned for the judicial impartiality and objectivity that he displayed in his more than 600 opinions, many of them on important constitutional questions. He was often less successful, however, in building a consensus among his associate justices, with the result that the Supreme Court during his chief justiceship was often a bitterly divided body.

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**Stone, I(sidor) F(einstein),** original name ISIDOR FEINSTEIN (b. Dec. 24, 1907, Philadelphia—d. June 18, 1989, Boston), spirited and unconventional American journalist whose newsletter, *I.F. Stone's Weekly* (later *I.F. Stone's Bi-Weekly*), captivated readers by the author's unique blend of wit, erudition, humanitarianism, and pointed political commentary.

Feinstein worked on newspapers while still in high school. After studying at the University of Pennsylvania (1924–27), he worked for the *Philadelphia Inquirer*. Feinstein moved to New York City and worked for both the *New York Post* (1933–39) and the *Philadelphia Record*. He changed his name to I.F. Stone in 1937. In 1938 Stone became an associate editor of the liberal weekly *The Nation*, eventually becoming its editor (1940–46). During this period he also worked as a reporter for *PM*, an experimental liberal daily. When *PM* folded in 1948, Stone worked for the New York *Star*, then went back to the *Post*, and then to the New York *Daily Compass*. When this paper folded in 1952, Stone decided to start his own weekly.

From the outset *I.F. Stone's Weekly* (1953–67; *I.F. Stone's Bi-Weekly,* 1967–71) had an influence far greater than the size of its readership. Among early subscribers were Albert Einstein, Bertrand Russell, and Eleanor Roosevelt. The newsletter, staffed only by Stone and his wife, was researched, written, and edited by Stone. It set high journalistic standards and could be found in the homes of some of the most prominent politicians, academicians, and journalists in the nation.

Stone became known for his espousal of unpopular causes long before they became popular with the liberal establishment. He was an early supporter of civil rights and an early opponent of President Harry S. Truman's Cold War policies and of McCarthyism. He was also an early opponent of the United States' involvement in the Vietnam War.

Stone also wrote numerous books, including *The Court Disposes* (1937), about the U.S. Supreme Court; *Business as Usual: The First Year of Defense* (1941), an indictment of the U.S. military's unpreparedness for World War II; and *Underground to Palestine* (1946), detailing his involvement with the struggle of Jewish refugees to reach a homeland. Collections of Stone's columns were published in *The Haunted Fifties* (1963), *In a Time of Torment* (1967), and *Polemics and Prophecies, 1967–1970* (1971).

**Stone, Irving,** original name IRVING TENNENBAUM (b. July 14, 1903, San Francisco—d. Aug. 26, 1989, Los Angeles), American writer of popular historical biographies. Stone first came to prominence with the publication of *Lust for Life* (1934), a vivid fictionalized biography of the painter Vincent Van Gogh.

After receiving his B.A. in 1923 at the University of California, Berkeley, and his master's degree in 1924 from the University of Southern California, he wrote plays and supported himself by writing detective stories. In 1934—after being rejected by 17 publishers—*Lust for Life* was finally accepted and published.

Stone termed his work "bio-history." Through meticulous and exhaustive research, he verified and expanded his preconception of a selected historical character. Then, by immersing himself in the subject's native environment and reading all available original documents, from letters and diaries to research notes and household accounts, he acquired the basis for imaginary or reconstructed dialogue.

In addition to *Lust for Life,* Stone's many popular works include *Clarence Darrow for the Defense* (1941); *They Also Ran* (1943), biographies of 19 defeated presidential candidates; *Immortal Wife* (1944), the story of Jesse Benton Frémont, wife of the explorer John Frémont; *President's Lady* (1951), based on the life of Rachel Jackson, wife of the seventh U.S. president; *Love Is Eternal* (1954), a fictionalized account of the marriage of Mary Todd and Abraham Lincoln; *The Agony and the Ecstasy* (1961), a life of the Renaissance artist Michelangelo; *The Passions of the Mind* (1971), about Sigmund Freud; and *The Origin* (1980), a life of Charles Darwin centred on the voyage of the *Beagle* and its aftermath.

Stone founded the Academy of American Poets in 1962, in addition to founding several other literary societies. He married Jean Factor, his editor from 1933, in 1934.

**Stone, Lucy** (b. Aug. 13, 1818, West Brookfield, Mass., U.S.—d. Oct. 18, 1893, Dorchester, Mass.), American pioneer in the women's-rights movement.

After graduating from Oberlin (Ohio) College in 1847, Stone became a lecturer for the Massachusetts Anti-Slavery Society, which soon granted her permission to devote part of



Lucy Stone
By courtesy of the Library of Congress, Washington, D.C.

each week to speaking on her own for women's rights. She was instrumental in organizing women's-rights conventions in the 1850s.

In 1855, when she married Henry B. Blackwell, an Ohio Abolitionist, she retained her own name (as a protest against the unequal laws applicable to married women) and became known as Mrs. Stone. After more than a decade of working for woman suffrage as New Jersey residents, she and her husband moved to Boston. There they helped establish the American Woman Suffrage Association (1869), a nationwide organization that worked for woman suffrage by state legislation, while the rival National Woman Suffrage Association urged a federal constitutional amendment. The couple also helped found the *Woman's Journal,* a woman suffrage weekly. From 1870 until 1917 that publication and *Woman Suffrage Leaflets,* both under Blackwell's editorship in Boston, were major influences in extending the suffrage movement and in paving the way for the work of the woman-suffrage leader Carrie Chapman Catt.

**Stone, Nicholas** (b. 1586, Woodbury, Devon, Eng.—d. Aug. 24, 1647, Winchester, Hampshire?), the most important English mason-sculptor of the early 17th century.

He studied under Hendrick de Keyser in Amsterdam (1606–13) and was the master mason under Inigo Jones in the construction of the Banqueting House at Whitehall (1619–22). As a tomb sculptor, Stone was well established in London by 1622, and he became master mason to the crown in 1632.

His style evolved from a naturalistic approach to a more classical one, as in the "Francis Holles Monument" (1622, Westmin-

ster Abbey), which also demonstrates the influence on Stone of Michelangelo's tomb of Giuliano de Medici. Stone was an innovator, and his use of the circular base was unusual in the early 17th century. The North Gate of the Botanical Garden (1632) at Oxford reflects Renaissance ideas of garden architecture. He executed some of the sculptural decoration on the work, but additions were made at a later time. The "Sir Charles Morison Monument" (1619) at St. Mary's Church in Watford, Hertfordshire, exemplifies his naturalistic style. Another classical work is the "Lyttelton Monument" (1634) at Magdalen College, Oxford.

Stone's more than 80 commissions were primarily executed in alabaster, marble, or stone. He produced some of the most significant monuments and sculptures of the entire 17th century in England.

**Stone, Sir Richard,** in full SIR JOHN RICHARD NICHOLAS STONE (b. Aug. 30, 1913, London, Eng.—d. Dec. 6, 1991, Cambridge, Cambridgeshire), British economist who in 1984 received the Nobel Prize in Economic Science for developing an accounting model that could be used to track economic activities on a national and, later, an international scale. He is sometimes known as the father of national income accounting.

Stone initially studied law at the University of Cambridge, but, under the influence of economist John Maynard Keynes, he took a degree in economics in 1935 (Sc.D., 1957). He worked for a brokerage firm in London (1936–40), and in 1940, at the invitation of Keynes, he entered the British government's Central Statistical Office. After World War II he was appointed director of the new department of applied economics at Cambridge. He retained that position until 1955, when he became P.D. Leake professor of finance and accounting at Cambridge (1955–80; professor emeritus from 1980). He was knighted in 1978.

The first official estimates of British national income and expenditures were made according to Stone's method in 1941. The greater part of Stone's work, however, was done in the 1950s, when he offered the first concrete statistical means by which to measure investment, government spending, and consumption; these models resulted in what was, in essence, a national bookkeeping system. He went on to adapt his models for such international organizations as the United Nations. He was coauthor (with J.E. Meade) of *National Income and Expenditure* (1944; 10th ed., with Giovanna Stone, 1977) and author of several other works, including *Input–Output and National Accounts* (1961), *Mathematics in the Social Sciences and Other Essays* (1966), and *Mathematical Models of the Economy and Other Essays* (1970). He was also general editor and part author of the series *A Programme for Growth 1962–74*.

**Stone Age,** prehistoric cultural stage or level of human development, characterized by the creation and use of stone tools. The Stone Age is usually divided into three separate periods, based on the degree of sophistication in the fashioning and use of tools. *See* Paleolithic Period; Mesolithic Period; Neolithic Period.

**stone bass:** *see* wreckfish.

**stone chest** (coffin): *see* cist.

**stone chimes,** also called LITHOPHONE, a set of struck sonorous stones (individually called phonoliths). Such instruments can be found from the South Seas and South America to Africa and the Far East. Stones are used in Ethiopian and Coptic churches, for example, as bells (*dowel*) as well as in sets of chimes.

Large stones are used in some Vietnamese



*Pien ch'ing,* Chinese stone chimes
By courtesy of the Chinese Classical Music Association, Taipei, Taiwan

religious temples, and one of the oldest surviving lithophones was discovered there in 1949. Remains of other ancient stones come from Chinese archaeological diggings, and such instruments are mentioned in sources as early as the Chou dynasty (*c.* 1122–256/255 BC). Chinese stones (*ch'ing*) are commonly found in an obtuse L shape. They are made of many materials, including marble, nephrite, and jade. Sets of 16 stones (*pien ch'ing*) were used in Confucian ritual orchestras and survive today in such groups in Korea, where they are called *teuk kyeng.* A lithophone was built by an English stonemason in 1841 and enjoyed a brief concert life under the name rock harmonicon.

**stone curlew** (bird): *see* thickknee.

**Stone of Scone,** also called STONE OF DESTINY: *see* Scone, Stone of.

**stone-tool industry,** any of several assemblages of artifacts displaying man's earliest technology, beginning more than 2 million years ago. These stone tools have survived in great quantities and now serve as the major means to determine the activities of hominids. Archaeologists have classified distinct stone-tool industries on the basis of style and use.

The earliest stone industry was found by paleoanthropologists L.S.B. Leakey and Mary Douglas Leakey in the Olduvai Gorge in what is now Tanzania in the 1930s. Called the Oldowan Industry, it dates from about 1.8 to 1.2 million years ago in the Lower Pleistocene Epoch and consisted of what the Leakeys called choppers, shaped by hitting one stone against another until a sharpened edge was achieved. This could be used for cutting or sawing, while the unflaked end could be used for smashing or crushing. The variety and numbers of choppers found at the site led the Leakeys to identify the people who lived there as *Homo habilis,* implying "able man." Remains of the Oldowan Industry were also found in North Africa and Europe.

Many early sites unearthed by paleoanthropologists show a more advanced tool industry, beginning with the Acheulian, which is dated from as early as 1.4 million years ago at Olduvai Gorge. The technique for making tools in the Acheulian Industry was a development of the earlier technique, namely striking one stone against another, but the choice of stone was refined. Where flint, which was the ideal tool-making material, was not available, quartz, quartzite, and other rocks were used.

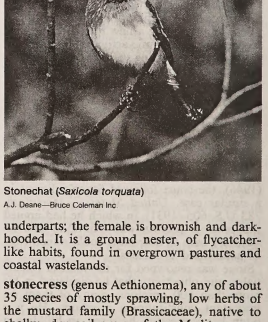
As the Acheulian Industry progressed, so did the skill with which tools were made. A bifacial cutting implement emerged, called a handaxe, that had longer, straighter, sharper edges than the earlier chopper. The earliest handaxes were made with a hard hammer. More advanced techniques, however, began about 1 million years ago; rather than simply smashing the rock against a boulder, a soft hammer (usually antler) began to be used. In all, 18 different types of implements have been discovered for the Acheulian Industry—including chisels, awls, anvils, scrapers, hammer-stones, and round balls. The evidence indicates that the industry was sufficiently developed to enable early man to adapt to local conditions and seasonality, as in the temperate forest, temperate grasslands, or subtropics.

The Acheulian Industry was followed by the Mousterian, a flake- rather than a core-tool industry associated with Neanderthal peoples and others living north of the Sahara and eastward to Asia. In addition to the Mousterian Industry two other distinct industries were found in Africa south of the Sahara—the Fauresmith and the Sangoan. In these the flake tool was improved to become a blade, which is at least two times as long as it is wide.

In the Late Paleolithic Period, tools became even more sophisticated. As many as 80 different types of implements have been unearthed for what are called the Perigordian and Aurignacian industries in Europe. It is believed that these tools were used for hunting and butchering, clothesmaking, and a great variety of other tasks that moved early man closer to modern life. In all, hundreds of highly complex tools have been found, some of which are the prototypes for modern tools.

By 40,000 years ago man created tools with bone and antler handles that gave them much more leverage. Still later, Cro-Magnon man created bone tools with engravings that were probably used only for artistic or ritualistic purposes. The Solutrean Period produced laurel leaf and willow leaf knives that are today valued as works of art.

**stonechat** (species *Saxicola torquata*), Eurasian and African thrush (family Turdidae, order Passeriformes) named for its voice, which is said to sound like pebbles clicked together. In this species, 13 cm (5 inches) long, the male is black above, with white neck patch and a smudge of reddish colour on the white



Stonechat (*Saxicola torquata*)
A.J. Deane—Bruce Coleman Inc

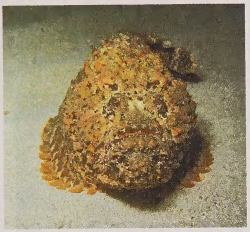
underparts; the female is brownish and darkhooded. It is a ground nester, of flycatcher-like habits, found in overgrown pastures and coastal wastelands.

**stonecress** (genus Aethionema), any of about 35 species of mostly sprawling, low herbs of the mustard family (Brassicaceae), native to chalky, dry soil areas of the Mediterranean region, with a few species in eastern Asia. Stonecresses are grown as rock garden or border plants for their narrow leaves and fourpetaled pink, lilac, or white flowers. Persian stonecress (*A. grandiflorum*), a perennial with rosy-lavender flowers, grows to over 30 cm (1

foot). Lebanon stonecress (*A. cordifolium*) has rose-pink flowers on 10- to 25-centimetre plants.

**stonecrop** (plant): *see* sedum.

**stonefish,** any of certain species of venomous marine fish of the genus *Synanceja* and the family Synancejidae, found in shallow waters of the tropical Indo-Pacific. Stonefish are sluggish, bottom-dwelling fish that live among



Stonefish (*Synanceja verrucosa*)
Douglas Faulkner/Sally Faulkner Collection

rocks or coral and in mud flats and estuaries. Thickset fish with large heads and mouths, small eyes, and bumpy skins covered with wartlike lumps and, sometimes, fleshy flaps, they rest on the bottom, unmoving, blending almost exactly with their surroundings in form and colour. They are dangerous fish. Difficult to see, they can, when stepped on, inject quantities of venom through grooves in their dorsal-fin spines. Wounds produced by these fish are intensely painful and sometimes fatal. A representative species is *Synanceja verrucosa,* which may grow about 33 cm (13 inches) long.

The family Synancejidae includes a few other species of robust, warty fish. They are also venomous, though not as notorious as the stonefish.

Certain scorpionfish of the family Scorpaenidae (order Scorpaeniformes) are also referred to as rockfish or stonefish.

**stonefly** (order Plecoptera), any of about 1,550 species of insects, the adults of which



Stonefly (Plecoptera)
William E. Ferguson

have long antennae, weak, chewing mouthparts, and two pairs of membranous wings. The stonefly ranges in size from 6 to more than 60 mm (0.25 to 2.5 inches). The hindwings are generally larger and shorter than the forewings and fold like a fan when not in use. Even though its wings are well developed, the stonefly is a poor flier. Many species are gray, black, or brown and blend into their surroundings.

The life history of the stonefly is not well known. Each female may produce as many as about 6,000 eggs, which are dropped in masses into a stream. The stonefly nymph resembles the adult but lacks wings and may have external gills on various parts of its body. The nymph feeds on plants, decaying organic matter, and other insects. The nymphal stage lasts from one to four years, and the adults live several weeks.

*Consult the* INDEX *first*

**Stonehenge,** monumental circular setting of large standing stones surrounded by a circular earthwork, built in prehistoric times beginning about 3100 BC and located about 13 km (8 miles) north of Salisbury, Wiltshire, Eng. The modern interpretation of the monument is based chiefly on excavations carried out since 1919 and especially since 1950.

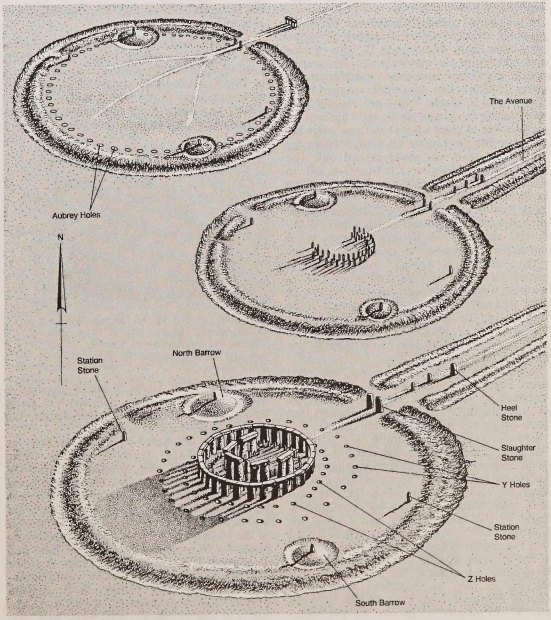
The Stonehenge that visitors see today is considerably ruined, many of its stones having been pilfered by medieval and early modern builders (there is no natural building stone within 21 km [13 miles] of Stonehenge); its general architecture has also been subjected to centuries of weathering and depredation. The monument consists of a number of structural elements, mostly circular in plan. On the outside is a circular ditch, with a bank immediately within it, all interrupted by an entrance gap on the northeast, leading to the Avenue. At the centre of the circle is a stone setting consisting of a horseshoe of tall uprights of sarsen (Tertiary sandstone) encircled by a ring of tall sarsen uprights, all originally capped by horizontal sarsen lintels. Within the sarsen stone circle were also configurations of smaller and lighter bluestones (igneous rock of diabase, rhyolite, and volcanic ash), but most of these bluestones have disappeared. Additional stones include the so-called Altar Stone, the Slaughter Stone, two Station stones, and the Heel Stone, the last standing on the Avenue outside the entrance. Small circular ditches enclose two flat areas on the inner edge of the bank, known as the North and South barrows, with empty stone holes at their centres.

Archaeological excavations since 1950 suggest three main periods of building—Stonehenge I, II, and III, the last divided into phases.

In Stonehenge I, about 3100 BC, the native Neolithic people, using deer antlers for picks, excavated a roughly circular ditch about 98 m (320 feet) in diameter; the ditch was about 6 m (20 feet) wide and 1.4 to 2 m (4.5 to 7 feet) deep, and the excavated chalky rubble was used to build the high bank within the circular ditch. They also erected two parallel entry stones on the northeast of the circle (one of which, the Slaughter Stone, still survives). Just inside the circular bank they also dug—and seemingly almost immediately refilled—a circle of 56 shallow holes, named the Aubrey Holes (after their discoverer, the 17th-century antiquarian John Aubrey). The Station stones also probably belong to this period, but the evidence is inconclusive.

Stonehenge I was used for about 500 years and then reverted to scrubland.

During Stonehenge II, about 2100 BC, the complex was radically remodeled. About 80 bluestone pillars, weighing up to 4 tons each, were erected in the centre of the site to form what was to be two concentric circles, though the circles were never completed. (The blue-




Stonehenge (from top) *c.* 3100 BC, *c.* 2100 BC, and *c.* 1550 BC
English Heritage

stones came from the Preseli Mountains in southwestern Wales and were either transported directly by sea, river, and overland—a distance of some 385 km [240 miles]—or were brought in two stages widely separated in time.) The entranceway of this earliest setting of bluestones was aligned approximately upon the sunrise at the summer solstice, the alignment being continued by a newly built and widened approach, called the Avenue, together with a pair of Heel stones. The double circle of bluestones was dismantled in the following period.

The initial phase of Stonehenge III, starting about 2000 BC, saw the erection of the linteled circle and horseshoe of large sarsen stones whose remains can still be seen today. The sarsen stones were transported from the Marlborough Downs 30 km (20 miles) north and were erected in a circle of 30 uprights capped by a continuous ring of stone lintels. Within this ring was erected a horseshoe formation of five trilithons, each of which consisted of a pair of large stone uprights supporting a stone lintel. The sarsen stones are of exceptional size, up to 9 m (30 feet) long and 50 tons in weight. Their visible surfaces were laboriously dressed smooth by pounding with stone hammers; the same technique was used to form the mortise-and-tenon joints by which the lintels are held on their uprights, and it was used to form the tongue-and-groove joints by which the lintels of the circle fit together. The lintels are not rectangular; they were curved to produce all together a circle. The pillars are tapered upward. The jointing of the stones is probably an imitation of contemporary woodworking.

In the second phase of Stonehenge III, which probably followed within a century, about 20 bluestones from Stonehenge II were dressed and erected in an approximate oval setting within the sarsen horseshoe. Sometime later, about 1550 BC, two concentric rings of holes (the Y and Z Holes, today not visible) were dug outside the sarsen circle; the apparent intention was to plant upright in these holes the 60 other leftover bluestones from Stonehenge II, but the plan was never carried out. The holes in both circles were left open to silt up over the succeeding centuries. The oval setting in the centre was also removed.

The final phase of building in Stonehenge III probably followed almost immediately. Within the sarsen horseshoe the builders set a horseshoe of dressed bluestones set close together, alternately a pillar followed by an obelisk followed by a pillar and so on. The remaining unshaped 60-odd bluestones were set as a circle of pillars within the sarsen circle (but outside the sarsen horseshoe). The largest bluestone of all, traditionally misnamed the Altar Stone, probably stood as a tall pillar on the axial line.

About 1100 BC the Avenue was extended from Stonehenge eastward and then southeastward to the River Avon, a distance of about 2,780 m (9,120 feet). This suggests that Stonehenge was still in use at the time.

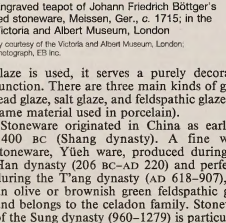
Why Stonehenge was built is unknown, though it probably was constructed as a place of worship of some kind. Notions that it was built as a temple for Druids or Romans are unsound, because neither was in the area until long after Stonehenge was last constructed. Early in the 20th century, the English astronomer Sir Norman Lockyer demonstrated that the northeast axis aligned with the sunrise at the summer solstice, leading other scholars to speculate that the builders were sun worshipers. In 1963 an American astronomer, Gerald Hawkins, purported that Stonehenge was a complicated computer for predicting lunar and solar eclipses. These speculations, however, have been severely criticized by most Stonehenge archaeologists. "Most of what has been written about Stonehenge is nonsense or speculation," said R.J.C. Atkinson, archaeologist from University College, Cardiff. "No one will ever have a clue what its significance was."

**Stones River, Battle of,** also called BATTLE OF MURFREESBORO (Dec. 31, 1862–Jan. 2, 1863), bloody but indecisive American Civil War clash in Tennessee that was a psychological victory for Union forces. General Braxton Bragg's 34,700-man Confederate army was confronted on Stone's River near Murfreesboro by 41,400 Union troops under General William S. Rosecrans, who had orders to drive Bragg out of eastern Tennessee. After the first day's bitter, seesaw battle, the battered Union army was on the verge of retreating, but Rosecrans decided to hold fast. On January 3, Bragg's equally exhausted Confederate forces withdrew southward. Rosecrans' tenacity thus averted a potentially serious Union defeat. Union casualties numbered 12,906; Confederate losses totaled 11,739. Stones River National Battlefield (established 1927) commemorates the battle.

**Stonewall riots,** a series of violent confrontations outside the Stonewall Inn bar in New York City that began in the early hours of Saturday, June 28, 1969, and became an international symbol for homosexual resistance to oppression.

A routine police raid of a gay bar for serving liquor without a license turned violent when, for the first time, a group of transvestites, gay men, and lesbians confronted the arresting officers. Since June 1970, the Stonewall riots have been commemorated annually by gay and lesbian pride parades around the world. In 1999 the U.S. National Park Service placed the Stonewall Inn on the National Register of Historic Places.

**stoneware,** pottery that has been fired at a high temperature (about 1,200° C [2,200°F]) until vitrified (that is, glasslike and impervious to liquid). Although usually opaque, some stoneware is so thinly potted that it is somewhat translucent. Because stoneware is nonporous, it does not require a glaze; when a glaze is used, it serves a purely decorative function. There are three main kinds of glaze: lead glaze, salt glaze, and feldspathic glaze (the same material used in porcelain).



Engraved teapot of Johann Friedrich Böttger's red stoneware, Meissen, Ger., *c.* 1715; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London; photograph, EB Inc.

Stoneware originated in China as early as 1400 BC (Shang dynasty). A fine white stoneware, Yüeh ware, produced during the Han dynasty (206 BC–AD 220) and perfected during the T'ang dynasty (AD 618–907), has an olive or brownish green feldspathic glaze and belongs to the celadon family. Stoneware of the Sung dynasty (960–1279) is particularly noted for its emphasis on beauty of form and its brilliant feldspathic glazes; Chün ware, for example, is covered with a thick, dense, lavender-blue glaze often suffused with crimson purple. Stoneware made in Tz'u-Chou, formerly in Honan, has a grayish white body covered with white slip and then a transparent glaze. The slip was sometimes carved away, revealing the contrasting colour of the clay body

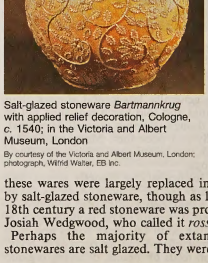


Yüeh stoneware jar, 10th century; in the Museum of Fine Arts, Boston

By courtesy of the Museum of Fine Arts, Boston, Hoyt Collection

beneath. Also from the Sung dynasty are the red to dark brown Chien wares known in Japan as temmoku ware. In the 17th century, China exported to Europe stoneware made in I-hsing, in Kiangsu province; red to dark brown in colour, it was unglazed but cut, faceted, and polished. I-hsing (called *boccaro* in Europe) winepots were highly prized in Europe for making tea, and the ware was copied in Germany, England, and the Netherlands.

In Europe, at Meissen in Saxony, E.W. von Tschirnhaus and J.F. Böttger developed a red stoneware in about 1707. Decoration included applied reliefs, engraving, faceting, and polishing. Because of the vogue for porcelain, stoneware manufacture declined in Germany in the 18th century and was abandoned about 1730. In the Netherlands, also during the 17th century, red stoneware was made by Ary de Milde of Delft and others in imitation of I-hsing ware. In 17th-century England attempts were made to imitate both Meissen red stoneware and I-hsing ware—for example, by John Dwight at Fulham and by John Philip and David Elers in Staffordshire. About 1690



Salt-glazed stoneware *Bartmannkrug* with applied relief decoration, Cologne, *c.* 1540; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London; photograph, Wilfrid Walter, EB Inc.

these wares were largely replaced in England by salt-glazed stoneware, though as late as the 18th century a red stoneware was produced by Josiah Wedgwood, who called it *rosso antico*.

Perhaps the majority of extant glazed stonewares are salt glazed. They were made in

the Rhineland from the 15th century and in England from the 17th. In 18th-century England, salt-glazed stoneware was superseded by lead-glazed earthenware, or creamware, by porcelain, and by Wedgwood's unglazed stonewares—the black basaltes and white jaspers. In the early 19th century it was superseded in the Rhineland by porcelain.

**stonewort,** any of certain green algae of the class Charophyceae, characterized by calcium carbonate deposits as found in the genus *Chara*. These deposits may be so extensive that they form the major part of the calcareous marl of lakes. Superficially resembling the structures of higher plants, stonewort structures include rootlike rhizoids, whorls of



Stonewort (*Chara*), highly magnified
William H. Amos—Helen Wohlberg Inc.

branches at regular intervals, and an erect cylindrical axis surrounded by a sheath of small cells.

Phylogenetically, stoneworts are probably a highly modified branch of the green algae. They are submerged and attached to the muddy bottoms of fresh or brackish rivers and lakes.

**Stoney, George Johnstone** (b. Feb. 15, 1826, Oakley Park, King's County, Ire.—d. July 5, 1911, London, Eng.), physicist who introduced the term electron for the fundamental unit of electricity.

In 1848 Stoney became assistant to the astronomer William Parsons Rosse, who secured for him a professorship in natural philosophy (natural science) at Queen's College, Galway (1852). In 1857 he became secretary of the Queen's University, Dublin.

From his work on molecular physics and kinetic theory of gases, he estimated the number of molecules in a volume of gas under standard conditions. Though his method for estimating the value of the electronic charge was sound (1874), his result was incorrect because of an erroneous idea of the number of atoms in a gram of hydrogen. Stoney also proposed explanations for the escape of hydrogen and helium from the field of Earth's gravity and the absence of atmospheres on moons.

**Stonies** (people): *see* Assiniboin.

**Stonington,** town ("township"), New London county, southeastern Connecticut, U.S., on Long Island Sound and the Rhode Island state line. The town includes Stonington Borough and the villages of Mystic and Pawcatuck. Settled in 1649 and made a borough in 1801, Stonington later developed prosperous shipbuilding and whaling industries. It is now a centre of fishing and resort activities, with some light manufacturing. Pop. (1990) 16,919.

**Stonington Island,** island, eastern Marguerite Bay, west of Palmer Peninsula, Antarctica. The island, about 2,500 feet (760 m) long and 1,000 feet (300 m) wide, was named for Stonington, Conn., the home port of the sloop *Hero,* from which Nathaniel Palmer saw Antarctica in 1820. It was the East Base, for aerial reconnaissance, of the U.S. Antarctic service commanded by Richard E. Byrd in the late 1930s.

**Stony Brook,** unincorporated village in Brookhaven Town ("township"), Suffolk county, southeastern New York, U.S. Located on the northern shore of Long Island, on Stony Brook Harbor, it was settled by Boston colonists in 1655. In the 19th century the shipbuilding industry flourished there. Stony Brook is now a tourist and educational centre for the North Shore and is an example of a rehabilitated community, planned in Federal architectural style. It has art and history museums, and its Carriage House museum houses an international collection of more than 300 horse-drawn vehicles. The Stony Brook campus of the State University of New York was moved there in 1962 from Oyster Bay. Pop. (1990) 13,726.

**Stony Point,** town, Rockland county, southeastern New York, U.S., on the west bank of the Hudson River, about 38 miles (61 km) north of midtown New York City. The name derives from the rocky promontory jutting into the Hudson. The Stony Point Battlefield Reservation (part of the Palisades Interstate Park) commemorates an event in July 1779 during the American Revolution, when a strongly fortified British post was stormed and captured by General Anthony Wayne's American troops. The Treason (Joshua Hett Smith) House (now demolished) was where General Benedict Arnold and Major John André met (Sept. 21, 1780) to arrange for the betrayal of West Point to the British; the site at West Haverstraw is now occupied by Helen Hayes (orthopedic) Hospital.

Traprock (basalt) and gypsum are quarried locally. Ski Stony Point is a winter attraction. Pop. (1990) 12,814.

**Stony Tunguska** (Russia): *see* Podkamennaya Tunguska River.

**Stonyhurst College,** Roman Catholic school for boys at Clitheroe, in Lancanshire, Eng., conducted by the Jesuits. It originated in a college for English boys founded at Saint-Omer (France) in 1593, later moved to Bruges and then to Liège. In 1794 it moved into its present home, Stonyhurst Hall. Its observatory has been made famous by many astronomers of wide reputation. Among its teachers have been the poet Gerard Manley Hopkins (classics), the Roman Catholic Modernist George Tyrrell (philosophy), and the astrophysicist Pietro Angelo Secchi (astronomy).

**stool,** armless and backless seat for one person. Folding stools with skin or fabric seats and solid framed stools with wood or rush seats were known to the Egyptians, the early Greeks and Romans, and the Vikings. These stools were supported on four straight legs or on four legs arranged crosswise—the "X" stool. Most variations of stool construction have been reflected either in the padded or hard top or in the support decorations.

Passing almost unchanged from antiquity into medieval use, the stool remained the common seating furniture. Late medieval stools, which resembled small benches, were called board, or slab-ended, stools; they were made obsolete by the standard joint stool, which was produced, in the 17th century, in upholstered sets with chairs and footstools.

The use of stools has often reflected a society's etiquette. In Europe, from the Middle Ages through the 17th century, strict protocol prescribed their use, and in Africa the stool often denotes the office of a tribal chief and carries with it religious symbolism.

By the 19th century, stools had become primarily rustic or ornamental furniture. The exception was the development of the barstool, a high stool (with or without arms and back) usually fixed to a central post and used in bars and cocktail lounges.

**stop,** also called PLOSIVE, in phonetics, a consonant sound characterized by the momentary blocking (occlusion) of some part of the oral cavity. A completely articulated stop usually has three stages: the catch (implosion), or beginning of the blockage; the hold (occlusion); and the release (explosion), or opening of the air passage again. A stop differs from a fricative (*q.v.*) in that, with a stop, occlusion is total, rather than partial. Occlusion may occur at various places in the vocal tract from the glottis to the lips; stops are thus classified as to their place of articulation—glottal, velar, palatal, alveolar, dental, bilabial, etc. In English, *b* and *p* are bilabial stops, *d* and *t* are alveolar stops, *g* and *k* are velar stops. A stop for which there is no English letter is the glottal stop, which occurs in the Scottish, Cockney, and Brooklynese pronunciation of the *tt* in "bottle" ("bo'l"); in other tongues (*e.g.,* Arabic) the glottal stop has a separate mark in the script.

*To make the best use of the Britannica, consult the* INDEX *first*

**Stopes, Marie Charlotte Carmichael** (b. Oct. 15, 1880, Edinburgh, Scot.—d. Oct. 2, 1958, near Dorking, Surrey, Eng.), advocate of birth control who, in 1921, founded the United Kingdom's first instructional clinic for contraception. Although her clinical work, writings, and speeches evoked violent opposition, especially from Roman Catholics, she greatly influenced the Church of England's gradual relaxation (from 1930) of its stand against birth control.



Marie Stopes, 1953
BBC Hulton Picture Library

After obtaining a doctorate in botany from the University of Munich in 1904, Stopes taught at the University of Manchester. A specialist on fossil plants and the problems of coal mining, she had established a considerable academic reputation when the failure of her first marriage, which was annulled in 1916, caused her to turn to the problems of marriage. She initially saw birth control as an aid to marriage fulfillment and as a means to save women from the physical strain of excessive childbearing. In this respect she differed from several other early leaders of the birth-control movement, who were more concerned with eliminating overpopulation and poverty.

In 1918 she married Humphrey Verdon Roe, cofounder of the A.V. Roe aircraft firm, who

helped her in the crusade that she then began. Their original birth-control clinic was founded three years later in London. In the meantime she wrote *Married Love* and *Wise Parenthood* (both 1918), which were widely translated. Her *Contraception: Its Theory, History and Practice* (1923, new ed. 1931) was, when it first appeared, the most comprehensive treatment of the subject. After World War II she promoted birth control in East Asian countries.

**stoping,** in mining engineering, the opening of large underground rooms, or stopes, by the excavation of ore. Stoping is practiced in underground mineral mining when the surrounding rock is strong enough to permit the drilling, blasting, and removal of ore without caving. In mines where the rock requires no artificial support, the operation is known as open stoping. A common open-stoping method is room-and-pillar mining, in which pillars of ore are left standing to support the rock over a flat-lying ore body.

In many mining operations, stopes must be supported artificially. The principal supported-stoping method, practiced on steeply dipping ore bodies, is cut-and-fill mining, in which the opened stope is back-filled with waste materials as each layer of ore is removed. In another supported method, known as shrinkage stoping, blasted ore is removed only in part in order to support the walls of the stope and also to serve as the floor for the next round of drilling and blasting.

**Stoppard, Tom,** original name TOMAS STRAUSSLER (b. July 3, 1937, Zlín, Czech. [now in Czech Republic]), Czech-born British playwright whose work is marked by verbal brilliance, ingenious action, and structural dexterity.

Stoppard's father was a company physician whose Czech company sent him (with his family) to a branch factory in Singapore in 1938/39. After the Japanese invasion, his father stayed on (and was killed), but Mrs. Straussler and her two sons escaped to India, where in 1946 she married a British officer, Kenneth Stoppard. Soon afterward the family went to live in England. Tom Stoppard (he had assumed his stepfather's surname) quit school and started his career as a journalist in Bristol in 1954. He began to write plays in 1960 after moving to London. In 1965 Stoppard was one of five new writers whose short stories were anthologized in *Introduction 2* (1964).

His first play, *A Walk on the Water* (1960), was televised in 1963. A stage version was produced in Berlin and Vienna in 1964; and, with some additions and a new title, *Enter a Free Man,* it reached London in 1968. His play *Rosencrantz and Guildenstern Are Dead* (1964–65) was given an amateur performance at the Edinburgh Festival (1966), then entered the repertory of Britain's National Theatre in 1967. The irony and brilliance of this work derive from placing two minor characters of *Hamlet* into the centre of dramatic action, driving home Stoppard's theme that man is but a minor character in the greater scheme of things, controlled by incomprehensible forces. It became a sensational success, appearing on Broadway and in theatres as far apart as Tokyo and Buenos Aires. Stoppard's next play, the lengthy one-act *The Real Inspector Hound* (1968), was a spoof of convoluted, Agatha Christie-style murder mysteries; it has proved to be one of his most popular and enduring plays.

*Jumpers,* a witty view of the academic world in crisis, was a popular and critical success of the 1972–73 London season, as was *Every Good Boy Deserves Favour,* with music by André Previn, in 1978–79. *Night and Day* was produced in 1978, and *Undiscovered Country* (1980), an adaptation of a play by Arthur Schnitzler, was produced in 1979. *The Real Thing* (1982), Stoppard's first romantic comedy, deals with art and reality and features a playwright as protagonist. *Arcadia,* set in a Derbyshire country house, premiered in 1993. One of his most acclaimed later plays, *The Invention of Love* (1997), explores the life of poet A.E. Houseman. Stoppard also wrote a number of radio plays and screenplays: among the latter were *The Romantic Englishwoman* (1975), *Despair* (1978), and *Brazil* (1985). He directed the film version of *Rosencrantz and Guildenstern are Dead* (1991), for which he also wrote the screenplay. Other Stoppard screenplays include *Billy Bathgate* (1991) and *Enigma* (2001), as well as his best-known work for the screen, the Oscar-winning *Shakespeare in Love* (1998), cowritten with Marc Norman.

**Stora Sjöfallet National Park,** park in Norrbotten *län* (county), northern Sweden, located immediately north of Sarek National Park, near the Norwegian border. The park, which was established in 1909, has an area of 493 square miles (1,278 square km). The park's name, meaning "great waterfall," refers to Stora Falls, the falls in the upper Lule River that plunge 130 feet (40 m) over a rocky crest into Langas (lake) at high water. The park is an extensively mountainous and glacial region divided longitudinally by other large lakes, including Lake Akkaj, which forms a reservoir for the Porjus power station downstream from the falls. There is an extensive variety of tundra and woodland vegetation and wildlife in the park.

**Storace, Stephen,** in full STEPHEN JOHN SEYMOUR STORACE (b. April 4, 1762, London, Eng.—d. March 19, 1796, London), composer whose comic operas were highly popular in 18th-century England.

Storace was the son of an Italian double-bass player and an English mother. About 1776 he went to Naples to study the violin, and after a few years he went to Vienna, where, it is believed, he studied under Mozart. He produced two operas in Vienna and in 1787 returned to London, where he spent the rest of his life writing comic operas for Drury Lane. The most successful of these included *The Haunted Tower* (1789), *The Pirates* (1792), and the afterpiece *No Song, No Supper* (1790). His operas show the influence of the Italianate style of Vienna as well as that of Mozart.

**storage,** the means of holding and protecting commodities for later use.

Foodstuffs were probably the first goods to be stored, being put aside during months of harvest for use in winter. To preserve it from rotting, food was treated in a variety of ways—*e.g.,* dried, smoked, pickled, or sealed in water- and air-tight containers and placed in cool, dark cellars for storage. Modern refrigeration techniques made it possible to store agricultural products with a minimum of change in their natural condition.

Commerce created another need for storage facilities. The goals in commercial storage are protection from weather and from destructive animals like rodents and insects, as well as security from theft. Storage facilities must also serve as a reservoir to accommodate seasonal and fluctuating demand. Efficiency in the transportation of goods often makes the accumulation of a reserve in storage (called stockpiling) advisable, for it enables a factory to produce more of a single item than is immediately marketable before initiating the often costly and time-consuming procedures for adjusting production lines for another product. Thus, storage serves commerce as a holding operation between manufacture and market. In another type of storage, called terminaling, pipelines are used to transport products in flowable form directly from the factory to the point of storage.

Transportation, especially transportation over long distances by slow means (such as water-borne shipment), may technically be considered as an aspect of storage. Consignment of goods by diverting shipments is a way to satisfy immediate market demand. The use of such "rolling warehouses" is common in both the chemical and lumber industries.

The rule of thumb in transporting of goods is that the higher the volume shipped at one time, the lower the cost per item. Thus, the economics of making a large number of shipments must be weighed against the cost of accumulating goods in storage for a single shipment of a large number of items. Within the marketing process, transportation and storage have what are called place-time values, derived from the appropriate appearance of products when and where they are needed. In manufacturing as well, a high value must be placed on the insurance provided by the storing of parts (raw materials, components, machinery) necessary for production so that they are easily available when necessary.

Large companies typically manufacture different but related items at a variety of locations, seldom producing their complete line at a single plant. Through the operation of storage houses called distribution centres, companies are able to offer their customers a complete selection of all their products, efficiently shipping whole mixed orders at once, rather than piecemeal from each factory.

Accurate market forecasting is essential to the successful functioning of a distribution centre, where the flow of products must be continuous in order that space not be wasted on unused or obsolete items. Further consolidation of the process is accomplished by the public warehouse, to which many companies ship their products, and from which a buyer can purchase a variety of items in a single shipment. Of course, in public warehousing, the manufacturer loses control over the handling of the product and over some aspects of customer relations. This disadvantage must be weighed against the underutilization of personnel and facilities that occurs in a private operation susceptible to fluctuating demand.

Some goods can be stored in bulk with identical goods of the same quality and specifications without distinction as to manufacturer ownership. Thus, products such as chemicals or grains from different producers are placed in the same tank or silo in the warehouse. Each of these products can then be sold at a price lower than otherwise possible owing to the savings realized over individual storage and handling of small amounts. Similarly, the same product purchased by two retailers can continue to be stored together and then separated as shipments to individual markets are made. Such storage is dynamic—that is, the movement of products is fairly constant, and accessibility of items is essential.

Custody storage is a static type of storage. Goods of a high value such as business records and personal items are kept safe for a long period of time without handling. Capacity and security are then the most relevant factors.

Storage facilities are tailored to the needs of accessibility, security, and climate. Refrigerated and heated space must be carefully designed and efficiently planned. In all storage facilities, fireproof materials such as concrete and steel are preferable. These materials lend themselves readily to prefabrication and have good insulating and acoustic properties.

Warehousing, the dynamic aspect of storage, is largely an automated process, designed to facilitate stock rotation by means of a combination of equipment such as stacker cranes built into the storage area, remote-controlled forklift trucks for vertical and horizontal movement of goods, and gravity flow racks, in which pallets are automatically replaced in

a line. Many warehouses are computer-controlled from dispatching towers.

**storage tube** (electronics): *see* memory tube.

**storax,** any of about 100 species of the genus *Styrax*, shrubs and trees of the family Styracaceae, mostly in tropical or warm regions. The deciduous leaves are alternate



Snowdrop bush (*Styrax officinalis*)
Edward F. Anderson

and short-stalked. The white flowers, usually borne in pendulous terminal clusters, have a five-lobed corolla (the petals, collectively). Among the best known cultivated species are *Styrax japonicum* (Japanese snowbell), native to East Asia and growing to about 9 metres (30 feet) tall; *S. obassia* (fragrant snowbell), native to Japan and growing to about 9 m; *S. americana,* native to southeastern North America and growing from 1.8 to 2.7 m; and *S. officinalis* (snowdrop bush), native to eastern Europe and Asia Minor and growing to about 6 m. A resin known as storax, used in incense, was formerly obtained from *S. officinalis.*

**Store Bælt** (channel, Denmark): *see* Great Belt.

**Storey, David (Malcolm)** (b. July 13, 1933, Wakefield, Yorkshire, Eng.), English novelist and playwright whose brief professional rugby career and lower-class background provided material for the simple, powerful prose that won him early recognition as an accomplished storyteller and dramatist.

After completing his schooling at Wakefield at 17, Storey signed a 15-year contract with the Leeds Rugby League Club; he also won a scholarship to the Slade School of Fine Art in London. When the conflict between rugby and painting became too great, he paid back three-quarters of his signing-on fee, and Leeds let him go.

Storey had written and laid aside seven novels before his eighth, *This Sporting Life* (1960), was published, and for it Storey received the MacMillan Award. It is the story of a professional rugby player and his affair with his widowed landlady. Storey wrote the script for a film based on the novel and directed by Lindsay Anderson in 1966—the beginning of a remarkably fruitful professional relationship between the two. Other novels followed: *Flight into Camden* (1960), a story that won the John Llewellyn Rhys Memorial Prize in 1961 and the Somerset Maugham Award in 1963, about an independent young woman who defies her mining family by going off to live with her married lover in London; *Radcliffe* (1963), about the struggle for power in a homosexual relationship; *Pasmore* (1972), on the regeneration of a man who had given himself up for lost; and *Saville* (1976), an autobiographical account of the breaking away of a coal miner's son from village life, awarded the Booker Prize. Storey later published *A Prodigal Child* (1982).

Storey also established a reputation as a playwright. His first play, *The Restoration of Arnold Middleton* (performed 1966), won immediate recognition. *In Celebration* (performed 1969; filmed 1974), directed by Anderson, returned to a recurring Storey theme: the power that the past has over the present and the impossibility of making a clean break with one's lower class roots and background. *The Contractor* (performed 1969) was praised for its poetic atmosphere; *Home* (1970), a quiet, ironic conversation piece set in an insane asylum; *The Changing Room* (1971), a tense, plotless play set in the changing room of a semiprofessional rugby team; and *Life Class* (1974), about a failed art master. Later plays include *Mother's Day* (1976), *Sisters* (1978), and *Early Days* (1980).

**Storia della Scienza, Museo di** (Italian: Museum of the History of Science), in Florence, collection of scientific instruments and maps begun in 1929 to show the progress of science from ancient times. Much of the collection formerly belonged to the Medici. There is a model of an alchemist's studio, a water clock, and a collection of weighing machines. Other exhibits include collections of clocks, compasses, quadrants and sextants, calculators, globes, sundials, and surgical instruments of the18th century. Preserved there are the telescope with which Galileo discovered the satellites of Jupiter and other instruments used by him, as well as one of the first cylinder phonographs built by Edison in 1890.

**stork,** any of 17 species of large, long-necked, birds constituting the family Ciconiidae (order Ciconiiformes), related to the herons, flamingos, and ibises. Storks range from about 60 centimetres (2 feet) to more than 150 centimetres (5 feet) in height. All or part of the head and upper neck may be bare of feathers and brightly coloured. Storks are voiceless or nearly so, for lack of a fully developed syrinx (vocal organ), but some of them clatter their bills loudly when excited. They fly, alternately flapping and soaring, with neck outstretched and legs trailing.





(Top) African wood stork (*Ibis ibis*); (bottom) white stork (*Ciconia ciconia*)
M.P. Kahl

Storks occur mainly in Africa, Asia, and Europe; one species, the black-necked stork, also occurs in Australia. Three New World species occur between Florida and Argentina.

Most storks are found in flocks except during the breeding season, when they pair off. They feed during the day. Most eat small animals caught in shallow water and fields. Some, like the marabou stork of Africa and the adjutant stork of India, feed primarily on carrion. The nest, a large twig platform built by both sexes, is constructed in trees, on rock ledges, or, in the case of the white stork, on rooftops and chimneys, often in colonial groupings. Three to six chalky-white eggs are incubated by both parents and hatched in about five weeks.

Taxonomically, storks are separated as typical storks (subfamily Ciconiinae) and wood storks (Mycteriinae). Wood storks (one species of *Mycteria* and three species of *Ibis*), originally called wood ibises, have decurved bills, resembling ibises in that respect. In typical storks the bill is straight or nearly so.

The adjutant stork of India and southeastern Asia (*Leptoptilos dubius*), or adjutant bird, and the lesser adjutant (*L. javanicus*) are typical scavengers with naked pink skin on the head and neck.

The African wood stork (*Ibis ibis*), or yellow-billed stork, is about 100 cm (3 ft) tall, with a yellowish bill and red facial skin.

The black stork (*Ciconia nigra*) of Europe, Asia, and Africa is about 100 cm tall, black with a white spot on the belly and a red bill and red legs.

Two open-billed storks, openbills, or shell storks, *Anastomus lamelligerus* of tropical Africa and *A. oscitans* of southern Asia, are small storks that eat water-snails. When the mandibles of these birds are closed, a wide gap remains except at the tips, probably an adaptation for holding snails.

The saddle-billed stork (*Ephippiorhynchus senegalensis*), or saddlebill, is a colourful stork of tropical Africa. More than 120 cm (four feet) tall, it has exceptionally long, thin legs and neck. The slightly upturned bill is red, crossed by a broad black band surmounted in front of the eyes by a small yellow plate.

The white stork (*Ciconia ciconia*) breeds across Europe and Asia and winters south to South Africa. It is a stately bird about 100 cm tall, white with black flight feathers, a dark red bill, and reddish legs. Its population is decreasing, partly because of destruction of its habitat by man; one race, the Oriental white stork (*C. c. boyciana*), is considered endangered.

The wood stork of the New World (*Mycteria americana*), often wrongly called "jabiru," ranges from the southern United States to Argentina. It is white with black wings and tail and a decurved bill. *See also* jabiru; marabou; hammerhead; shoebill.

**storksbill,** also called HERONSBILL, any of several flowering plants of the genus *Erodium*, in the geranium family (Geraniaceae), of worldwide distribution. Many species are wild flowers useful in garden borders and rock gardens; some are used for forage; and a number of them are weedy. The common names refer to the five-parted long, bill-like capsules, which contain the seeds.

The name storksbill is also sometimes applied to *Pelargonium* species, the common geraniums of greenhouse and garden.

**storm,** violent atmospheric disturbance, characterized by low barometric pressure, cloud cover, precipitation, strong winds, and possibly lightning and thunder.

Storm is a generic term, popularly used to describe a large variety of atmospheric disturbances, ranging from ordinary rain showers and snowstorms to thunderstorms, wind and wind-related disturbances, such as gales, tornadoes, tropical cyclones, and sandstorms.

In meteorological terminology storm is restricted to a cyclone with a strong low pressure centre, strong winds, ranging from 103–117 kilometres per hour (64–73 miles per hour), accompanied by heavy precipitation, and at times lightning and thunder.

**Storm, (Hans) Theodor Woldsen** (b. Sept. 14, 1817, Husum, Schleswig—d. July 4, 1888, Hademarschen), poet and novelist whose novellas are among the finest in German literature. He is an outstanding representative of German poetic Realism, which had as its aim the portrayal of the positive values of everyday life. He took for his models the late Romantics and Eduard Mörike, who, along with Gottfried Keller, Paul von Heyse, and the Russian writer Ivan Turgenev, was his friend and correspondent. Storm's early lyrics (*Gedichte,* 1852; "Poems") are songlike and characterized by their simplicity and beauty of form. Their main themes are love, nature, and an intense love of homeland.

Storm practiced law in Husum until 1853, when the Danish occupation of Schleswig forced him to move to Potsdam. His strong patriotic feelings are expressed in his poetry from this period. After living in Heiligenstadt, he returned to Schleswig when the Danish left it in 1864. A year later his wife died, occasioning the climax of his lyrics in the cycle *Tiefe Schatten* (1865). By this time, however, he had already begun to concentrate on writing novellas. One of his most important early works is *Immensee* (1850; Eng. trans., 1863), which, like so many of his works, is coloured by a haunting nostalgia. As his writing matured his novellas displayed subtler psychological insight, greater realism, and a wider scope of themes—including class tensions, social problems, and religious bigotry—expressing his recurrent concern with man's isolation and struggle with his fate. His last and greatest novella, *Der Schimmelreiter* (1888; *The Rider on the White Horse,* 1917), shows vivid imagination and great narrative verve. Among his other major works are the charming story *Pole Poppenspäler* (1874), and the novellas *Aquis submersus* (1875) and *Im Schloss* (1861).

**Storm Bay,** inlet of the Tasman Sea, indenting southeastern Tasmania, Australia. About 16 miles (26 km) long and 25 miles wide, it is bounded by North Bruny Island (west) and the Tasman Peninsula (east) and opens into Norfolk and Frederick Henry bays to the northeast. The Derwent River estuary enters the bay from the northwest by way of Hobart. It was named by the Dutch navigator Abel Tasman in 1642 when a storm forced his ships out to sea before they could anchor there. The British explorers George Bass and Matthew Flinders sailed its waters in 1798–99.

**storm petrel,** any member of about 20 species of seabirds constituting the family Hydrobatidae, or sometimes considered as Oceanitidae (order Procellariiformes). Ranging in length from about 13 to 25 centimetres (5½ to 10 inches), all are dark gray or brown, sometimes lighter below, and often with a white rump. The wings are shorter than those of most other procellariiforms and are rounded at the tips; the bill is of medium length; the nostril tubes (common to all members of the order) are united on the upper surface of the bill; the toes are webbed, except for the small, elevated hind toe; the tail is medium to long and square, forked, or wedge shaped.

Storm petrels fall into two behavioral and structural groups. Most of the species breeding in the southern oceans are shorter winged, square tailed, long legged, and short toed. With wings spread, they patter over the water, "walking," and pick up minute marine organisms. An example is Wilson's petrel (*Oceanites oceanicus*), which breeds on islets along the Antarctic continent and near the Antarctic Circle and winters in the North Atlantic from about June to September.

Most northern species have longer wings, forked or wedge-shaped tails, shorter legs, and longer toes; when foraging, they swoop over the water like tiny terns. Leach's petrel (*Oceanodroma leucorhoa*) breeds on islands in the North Atlantic and south to about 28° N in the Pacific. Several other *Oceanodroma* species occur in the North Pacific. The British storm petrel (*Hydrobates pelagicus*) breeds on islands and cliffs along the coasts of Europe.

Storm petrels are colonial breeders, nesting in burrows in soft soil or in crevices in rocks. They breed on islands along the coasts of North and South America, in the eastern and southern Atlantic, and throughout the Pacific. A single whitish egg is incubated by both parents, which come and go by night and so are rarely seen by potential predators. The chicks are deserted a week or more before they are fully fledged. While the parents molt at sea, the young complete their growth and leave the burrow to feed themselves at sea.

**Størmer, Fredrik (Carl Mülertz)** (b. Sept. 3, 1874, Skien, Nor.—d. Aug. 13, 1957, Oslo), geophysicist and mathematician who developed a mathematical theory of auroral phenomena.



Størmer
Norsk Telegrambyra

Professor of pure mathematics at the University of Christiania (Oslo, after 1924) from 1903 to 1946, Størmer began his mathematical work with studies of series, function theory, and number theory. He produced a number of papers on pure mathematics, and many of his results are of considerable importance. In 1895 he demonstrated that there are only four nontrivial solutions for the equation $m \tan^{-1}(1/x) + n \tan^{-1}(1/y) = k\pi/4$, in which $m$, $n$, $k$, $x$, and $y$ are integers.

In 1903 Størmer became interested in Kristian Birkeland's experiments with the auroralike effect obtained by bombarding a magnetized sphere with electrons. Taking as his starting point the work of Henri Poincaré of France on the equations of motion of a charged particle in the region of a single magnetic pole, Størmer pursued a theoretical study of Birkeland's experiments. He published the first of a series of papers on his findings in 1904. He continued his research and publication of the theory of auroral phenomena until 1950. In addition to providing valuable contributions to the formation of an explanation of auroras, his work found important application to the study of cosmic rays and their behaviour in the vicinity of Earth.

In 1909 Størmer initiated a program of auroral observation to gather data that could be compared with his theoretical findings. By using two or more well-separated sites connected by telephone, simultaneous photographs made it possible to measure accurately the position and form of auroras in the atmosphere. He later organized a permanent network of stations in Norway for the study of auroras and special types of clouds.

Størmer's *The Polar Aurora* (1955) is a valuable account of his theoretical studies and observations. He was elected a foreign member of the Royal Society of London in 1951.

**Störmer, Horst L.,** in full HORST LUDWIG STÖRMER (b. April 6, 1949, Frankfurt am Main, W.Ger. [now Ger.]), German-born American physicist who, with Daniel C. Tsui and Robert B. Laughlin, was awarded the 1998 Nobel Prize in Physics for the discovery and explanation of the fractional quantum Hall effect.

After earning a Ph.D. in physics at the University of Stuttgart (1977), Störmer moved to the United States. In 1978 he joined the research staff of Bell Laboratories in Murray Hill, N.J., working with Tsui. Störmer was head of the Physical Research Laboratory at Bell Labs from 1992 to 1998, when he became a professor at Columbia University.

The research of Störmer and Tsui was based on the Hall effect, which denotes the voltage that develops between the edges of a thin current-carrying ribbon placed flat between the poles of a strong magnet. In 1980 Klaus von Klitzing discovered that at extremely low temperatures, though the strength of an applied magnetic field is increased smoothly and continuously, the corresponding change in the voltage of the deflected current (the Hall resistance) occurs in discrete jumps or steps, thereby exhibiting quantum properties. Störmer and Tsui extended Klitzing's work, observing the Hall effect in semiconductors at temperatures close to absolute zero and under extremely powerful magnetic fields. In 1982 they saw that under these conditions, the Hall effect varies not only stepwise but in fractional increments, implying that the charge carriers in the current carry exact fractions of an electron's charge. In 1983 Laughlin explained this phenomenon, proposing that the electrons in the powerful magnetic fields form a quantum fluid made up of quasi-particles that have fractional electric charges.

**Stormont,** eastern suburb of Belfast, seat of the government of Northern Ireland. Located on an estate of 300 acres (120 ha), it includes the Parliament building and Stormont House, official residence of the prime minister of Northern Ireland. The Parliament House (1928–32) is built in the Greek classical style. It has four main floors and accommodates the House of Commons and Senate chambers.



Parliament House at Stormont, Northern Ireland
G.R. Allen—Bruce Coleman

**Storni, Alfonsina** (b. May 29, 1892, Sala Capriasca, Switz.—d. Oct. 25, 1938, Mar del Plata, Arg.), poetess who became one of the foremost poets in South American literature.

Forced to earn her living at an early age, she joined a theatrical troupe and later taught school in the rural areas of Argentina. She went to Buenos Aires in 1913, where she continued to teach school and worked with a young people's theatre group. Her first book, *La inquietud del rosal* (1916; "The Inquietude of the Rosebush"), brought her recognition from the literary circles in Buenos Aires; but it was her volume *El dulce daño* (1918; "The Sweet Injury") that won her popular success. Although she hated men, Storni felt a strong need for love, and she was able to express the tension and passion of these ambivalent feelings in poetry both simple and deeply sensual, expressing an original note in erotic poetry in a sensitive manner. She lost much of this sensitivity in her later work, *El mundo de siete pozos* (1934; "The World of Seven Wells") and *Mascarilla y trébol* (1938; "Mask and Trefoil"), as despair drove her to an involved and tortured intellectual poetry, more highly stylized but lacking the simplicity and passion of her early work. Knowing that she was incurably ill, she committed suicide in 1938.

**Stornoway,** burgh and largest town and port of the Outer Hebrides, Scotland. It lies on the island of Lewis and Harris; the quickest sea-crossing from the mainland takes 4½ hours from Kyle of Lochalsh, and there are air services from Glasgow and Inverness. It grew from the 18th century as a fishing town; but herring fishing has declined, and the chief industry now is the manufacture of Harris




Fishing boat in Stornoway harbour, island of Lewis and Harris, Western Isles
Tourist Photo Library

tweed. It is the seat of the Western Isles region and district authority. Pop. (1981) 13,409.

**Storr, Paul** (b. 1771, London—d. March 4, 1844, London), goldsmith particularly noted for his outstanding craftsmanship in the execution of richly ornamented works, especially presentation silver. A notable example is the cup made for presentation to the British admiral Lord Nelson to mark his victory at the battle of the Nile in 1798 (National Maritime Museum, Greenwich, London).

Storr served an apprenticeship with Andrew Fogelberg, a plate worker of Swedish origin, after which he established his own shop (1796); later, in 1807, he began an association with Rundell and Bridge (later Rundell, Bridge and Rundell), a firm of royal goldsmiths.

For this firm he carried out many commissions, and his work ranged from simple tableware to the highly ornate work for which he is best known. In many cases the firm used his services merely as a craftsman, the design work being carried out by others. Some of his



Silver fruit stand by Paul Storr, 1812; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

designs were based on ancient Roman silver; others were in a revived Rococo style. He broke with the firm in 1819 and three years later formed a partnership with John Mortimer, which continued until 1838.

**Storstrøms,** *amtskommune* (county), Denmark, created in 1970 from the former counties of Maribo and Præstø. It has an area of 1,311 sq mi (3,396 sq km). The southernmost part of Denmark, the county embraces southeastern Sjælland (Zealand); Lolland, Falster, and Møn islands; and several islets. Impressive limestone cliffs occur at Stevns Klint and Møns Klint on Sjælland. Fertile clay loams support mixed farming and dairying, and there are fisheries and meat-canning plants. The principal population centres are Nykøbing Falster (the administrative seat), Næstved, Vordingborg (*qq.v.*), Maribo, and Nakskov. Pop. (1982 est.) 259,624.

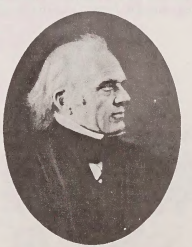
**Story, Joseph** (b. Sept. 18, 1779, Marblehead, Mass., U.S.—d. Sept. 10, 1845, Cambridge, Mass.), associate justice of the United States Supreme Court (1811–45), who joined Chief Justice John Marshall in giving juristic support to the development of American nationalism. While also teaching law at Harvard (1829–45), he delivered lectures that he elaborated into a monumental series of nine legal commentaries, some of which had international influence.

After graduation from Harvard, Story practiced law at Salem, Mass. (1801–11), became prominent in the Jeffersonian Republican (afterward called the Democratic) Party, was elected to the state legislature (1805), served part of a term in the U.S. House of Representatives (1808–09), returned to the Massachusetts House of Representatives (1810), and was chosen its speaker (1811).

In November 1811 Pres. James Madison appointed Story, at the age of only 32 and without judicial experience, to the Supreme Court. The President did so despite the opposition of Jefferson, who believed Story had contributed to the failure of the foreign trade embargo enacted during Jefferson's presidency. Although Madison thought Story would contest the Federalist Party nationalism of Chief Justice Marshall, the new justice soon joined Marshall in construing the Constitution broadly in favour of expanding federal power. His opinion for the court in *Martin* v. *Hunter's Lessee* (1816) established the appellate authority of the Supreme Court over the highest state courts in all civil cases involving the federal Constitution, statutes, and treaties. This decision was called by Charles Warren, historian of the Supreme Court, "the keystone of the whole arch of Federal judicial power."

From the death of Marshall (July 6, 1835) until the confirmation of Roger Brooke Taney as his successor (March 16, 1836), Story presided over the court. In *Prigg* v. *Pennsylvania,* 16 Peters 539 (1842), Story, who opposed slavery, upheld the federal Fugitive Slave Act of 1793 in order to strike down state statutes concerning the recapture of escaped slaves. In *Swift* v. *Tyson,* 16 Peters 1 (1842; overruled 1938), he, in effect, created a "federal common law" for commercial cases by holding that federal trial courts, taking jurisdiction when the parties were citizens of different states, need not follow decisions by the courts of the state in which the cause of action arose.

In 1829 Story accepted the first Dane professorship of law, founded specifically for him at Harvard Law School by a writer on law, Nathan Dane. The endowment paid for the publication of Story's commentaries: *Bailments* (1832), *On the Constitution,* 3 vol. (1833), *The Conflict of Laws* (1834), *Equity Jurisprudence,* 2 vol. (1836), *Equity Pleadings* (1838), *Agency* (1839), *Partnership* (1841), *Bills of Exchange* (1843), and *Promissory*



Joseph Story, photograph by Mathew Brady
By courtesy of the Library of Congress, Washington, D.C.

*Notes* (1845). His works on equity made him, along with Chancellor James Kent of New York, a founder of equity jurisprudence in the United States. The commentary on conflicts affected numerous statutes and treaties of Latin American nations. Alexis de Tocqueville drew heavily on Story's constitutional commentary.

*The Life and Letters of Joseph Story,* 2 vol. (1851), still the definitive biography, was written by his son William Wetmore Story, a noted sculptor. *Joseph Story* (1959), a collection of essays (some by Story himself), was edited by Mortimer D. Schwartz and John C. Hogan.

**Story, William Wetmore** (b. Feb. 12, 1819, Salem, Mass., U.S.—d. Oct. 7, 1895, Vallombrosa, Italy), sculptor now remembered as the centre of a circle of literary, theatrical, and social celebrities and for his "Cleopatra." A description of this work in Nathaniel Hawthorne's novel *The Marble Faun* (1860) contributed to its wide popularity in the United States and Great Britain. There is a replica of it in the Metropolitan Museum of Art in New York City. Henry James's *William Wetmore Story and His Friends* (1903) is an entertaining account of Story's life in Rome, where he lived from 1856 until his death.

**Storyville,** 38-block region of New Orleans, La., U.S., that from 1897 to 1917 was the most famous red-light district in the United States.

The district was created when Alderman Sidney Story, responding to public protests against rampant prostitution in New Orleans, succeeded in having the City Council adopt an ordinance in January 1897 limiting brothels, saloons, and other businesses of vice to

a prescribed area. The area (which, to his dismay, unofficially acquired his name) came to include five blocks each on Bienville, Conti, Customhouse, and St. Louis streets and three blocks each on Marais, North Basin, North Franklin, North Robertson, Treme, and Villere streets. The houses of assignation that quickly proliferated throughout the area included everything from cheap 25-cent brothels to extremely elegant establishments on North Basin Street.

When the United States entered World War I in 1917, the Army and Navy issued orders prohibiting prostitution within five miles of military sites. The federal government ordered Storyville closed down, and the city, under duress, acquiesced. Legal protests by local businesses, which went all the way to the U.S. Supreme Court, failed to change the order.

**Stoss, Veit,** Polish WIT STOSZ, or STWOSZ (b. 1438/47, Swabia [Germany]—d. 1533, Nürnberg), one of the greatest sculptors and wood-carvers of 16th-century Germany. His nervous, angular forms, realistic detail, and



"The Archangel Raphael," wood sculpture by Veit Stoss, 1516–18; in the German National Museum, Nürnberg

By courtesy of the Germanisches Nationalmuseum, Nurnberg

virtuoso wood carving synthesized the sculptural styles of Flemish and Danubian art and, together with the emotional force and dramatic realism of the Dutch sculptor Nicolaus Gerhaert von Leyden, exercised tremendous influence on the late Gothic sculpture of Germany, especially that of Nürnberg.

Stoss grew up in Nürnberg. From 1477 to 1496 he worked mainly in Poland, Bohemia, and Hungary. His principal works are the majestic high altar, carved in limewood and painted, of the Church of the Virgin Mary in Kraków (1477–89) and the sculptured tombs of King Casimir IV and Archbishop Zbigniew Oleśnicki in the cathedrals of Kraków and Gniezno, respectively. When he returned to Nürnberg, he was defrauded of his savings. Attempting to regain them by forgery, he was discovered and branded, and he passed an embittered old age encumbered with civic disabilities, even though the Holy Roman emperor Maximilian I granted him full pardon.

His work of this period includes important wood and stone sculpture in the churches of St. Sebaldus (1499, 1520) and St. Lorenz (1513, 1518) in Nürnberg and a carved altar in Bamberg cathedral (1523). These late works reveal greater restraint and compositional clarity, which probably derived from a study of the works of the Nürnberg painter Albrecht Dürer.

**Stössel, Anatoly Mikhaylovich** (Russian general): *see* Stessel, Anatoly Mikhaylovich.

**Stothard, Thomas** (b. Aug. 17, 1755, London, Eng.—d. April 27, 1834, London), painter, designer, and illustrator, best known for his graceful and distinctive work in book illustration, including editions of *Clarissa, Tristram Shandy, Robinson Crusoe, Pilgrim's Progress, The Vicar of Wakefield, The Rape of the Lock,* and the works of William Shakespeare, Lord Byron, John Milton, and others.

In 1777 Stothard became a student of the Royal Academy. He was elected full academician in 1794 and was appointed librarian in 1812. Stothard began to exhibit oil paintings at the Royal Academy in 1778 and continued to do so until his death. His oils are usually small in size and free in handling, often with rich and glowing colouring. His best-known painting is "The Canterbury Pilgrims," which heralds the Pre-Raphaelite style.

**Stoughton,** urban town (township), Norfolk county, eastern Massachusetts, U.S., in the southern Boston metropolitan area. It was settled about 1713 as part of Dorchester and was separately incorporated in 1726 and named for William Stoughton, first lieutenant governor of the Massachusetts Bay Colony. The Suffolk Resolves, which formed the basis for the Declaration of Independence, were initially drafted in Doty Tavern in old Stoughton prior to their discussion at nearby Dedham and adoption at Milton. The town supplied cannon, cast by Paul Revere, and powder to colonial forces during the American Revolution.

Now mainly residential, Stoughton has textile and shoe industries (dating from the 1800s) and some light manufactures including plastics, machine tools, and rubber specialties. Pop. (1991 est.) 26,686.

**Stour, River,** river, eastern England, with a length of 47 miles (76 km). It rises in eastern Cambridgeshire and flows eastward through East Anglia, forming most of the county boundary between Suffolk and Essex, through country made famous by the paintings of the artist John Constable. The Stour enters the North Sea at Harwich by a tidal estuary. Several other and less important English rivers have the same name.

**stout,** dark, heavy-bodied beer popular in Great Britain and Ireland. *See* beer.

**Stout, George Frederick** (b. Jan. 6, 1860, South Shields, Durham, Eng.—d. Aug. 18, 1944, Sydney, Australia), English psychologist and philosopher who advanced a system of psychology emphasizing mental acts.

While a student at the University of Cambridge, Stout studied principally with the psychologist James Ward and, like him, came to approach psychology philosophically. He developed a concept, akin to Aristotle's, of the soul as the form of the body and joined Ward in opposing the prevalent theory of associationism.

A fellow of St. John's College, Cambridge (1884–96), Stout published his first and perhaps most original work, *Analytic Psychology,* 2 vol., in 1896. Its view of the role of activity in intellectual processes was later verified experimentally by the Swiss psychologist Jean Piaget. Stout also lectured on comparative psychology at the University of Aberdeen before becoming reader in mental philosophy at the University of Oxford (1898–1902). His *Manual of Psychology* (1899) formulated many principles later developed experimentally by the Gestalt school of psychology, which takes a comprehensive approach to examining mental life, the whole of which is regarded as greater than the sum of the parts. Stout was professor of logic and metaphysics at St. Andrews University, Fife, from 1903 to 1936. He published another major work, *Mind and Matter* (1931).

**Stout, Rex (Todhunter)** (b. Dec. 1, 1886, Noblesville, Ind., U.S.—d. Oct. 27, 1975, Danbury, Conn.), American author who wrote genteel mystery stories revolving around the elegantly eccentric and reclusive detective Nero Wolfe and his wisecracking aide, Archie Goodwin.

Stout worked odd jobs until 1912, when he began to write sporadically for magazines. After writing four moderately successful novels, Stout turned to the form of the detective story. In *Fer-de-Lance* (1934) he introduced Nero Wolfe, the obese, brilliant aesthete who solves crimes without leaving his New York City brownstone house. Wolfe has, as did Stout, a passion for gourmet foods and gardening. The mysteries are narrated by Archie Goodwin, Wolfe's link to the outside world. Stout wrote 46 Wolfe mysteries; the well-written books remained very popular. Stout was active in numerous organizations supporting democracy and world federalism, including the Writers Board for World Government.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Stout, Sir Robert** (b. Sept. 28, 1844, Lerwick, Shetland Islands, Scot.—d. July 19, 1930, Wellington, N.Z.), New Zealand statesman and judge who helped unify the Liberal Party during the late 1870s; as prime minister (1884–87) he worked to expand opportunities for small farmers.

A surveyor and an advocate of radical land reform in Lerwick, Stout emigrated to New Zealand in 1863 after hearing of the Otago gold rush. Finding no work as a surveyor, he became a teacher and then a barrister and solicitor in the Supreme Court (1871). Elected to Parliament as a Liberal (1875), he opposed the abolition of provinces, the leading issue of the time, and gained a national reputation. In 1878 he was named attorney general and minister of lands and immigration under Sir George Grey, in whose ministry he sponsored legislation restructuring secondary schools and helped to draft the first Land Tax Act (1878).

After a five-year period of legal and journalistic pursuits, Stout returned to politics in 1884, serving as premier, attorney general, and later as minister of education. He sponsored legislation that reformed the civil service, reorganized hospitals and charitable institutions, and provided probation for first offenders. The failure of his policies to stave off economic depression led to the downfall of his cabinet in 1887, the year that he was knighted; he then again gave up politics to concentrate on his legal practice until 1893. Although Prime Minister John Ballance preferred that Stout succeed him in 1893, Richard John Seddon gained the post. A member of Parliament from 1893 to 1898, Stout was one of the founders of the Victoria University College, Wellington, in 1897. He retired from politics in 1898, finding opposition to Seddon hopeless.

From 1899 to 1926, Stout served as chief justice and was a member of the legislative council (1926–30). He also acted as chancellor of the University of New Zealand from 1903 to 1923.

**stove,** device used for heating or cooking. The first of historical record was built in 1490 in Alsace, entirely of brick and tile, including

the flue. The later Scandinavian stove had a tall, hollow iron flue containing iron baffles arranged to lengthen the travel of the escaping gases in order to extract maximum heat. The Russian stove had as many as six thick-walled masonry flues; it is still widely used in northern countries. The stove is often installed at the intersection of interior partition walls in such a manner that a portion of the stove and the flue is inside each of four rooms; a fire is maintained until the stove and flues are hot, and then the fire is extinguished and the flues closed, storing the heat.



Potbellied stove, *c.* 1870s
Culver Pictures, Inc.

The first manufactured cast-iron stove was produced at Lynn, Mass., in 1642. This stove had no grates and was little more than a cast-iron box. About 1740 Benjamin Franklin invented the "Pennsylvania fireplace," which incorporated the basic principles of the heating stove. The Franklin stove burned wood on a grate and had sliding doors that could be used to control the draft (flow of air) through it. Because the stove was relatively small, it could be installed in a large fireplace or used free-standing in the middle of a room by connecting it to a flue. The Franklin stove warmed farmhouses, city dwellings, and frontier cabins throughout North America. Its design influenced the potbellied stove, which was a familiar feature in some homes well into the 20th century. The first round cast-iron stoves with grates for cooking food on them were manufactured by Isaac Orr at Philadelphia, Pa., in 1800. The base-burning stove for burning anthracite coal was invented in 1833 by Jordan A. Mott.

Cooking became the predominant function of stoves in the 20th century as central heating became the norm in the developed world. Iron cooking stoves using wood, charcoal, or coal tended to radiate large amounts of heat that made the kitchen unpleasantly hot during the summertime, however. In the 20th century they were replaced by steel ranges or ovens that are heated by natural gas or electricity.

**Stow, John** (b. 1525, London, Eng.—d. April 6, 1605, London), one of the best-known Elizabethan antiquaries, author of a famous *Survey of London* (1598; revised and enlarged, 1603).

Stow was a prosperous tailor until about 1565–70, after which he devoted his time to collecting rare books and manuscripts, a hobby that left him impoverished. Self-educated, with a passion for learning, he became the friend of famous antiquaries and was employed by Matthew Parker, archbishop of Canterbury, to edit medieval chronicles. He had already published an edition of Chaucer (1561) and a *Summarie of Englyshe Chronicles* (1565; many abridged versions). His first original work was *The Chronicles of England* (1580), revised as *Annales of England* (1592).

The *Survey,* which is in the form of a perambulation around the London wards, contains details of the buildings, monuments, people, life, and customs of London at a time of transition from medieval to modern, along with an account of the city's origins and growth.

**Stow, Randolph,** in full JULIAN RANDOLPH STOW (b. Nov. 28, 1935, Geraldton, W.Aus., Australia), Australian novelist and poet noted for his economical style and great powers of description.

Stow's first novel, *A Haunted Land* (1956), a wild, almost Gothic tale, appeared in the same year he graduated from the University of Western Australia. In 1957 he began to teach English at the University of Adelaide and brought out his second novel, *The Bystander,* a further treatment of the themes of *A Haunted Land.* In 1963 appeared *Tourmaline,* another strange, powerful, and terrifying novel, and in 1965 *The Merry-Go-round in the Sea* was published. In the latter novel the heritage of a land built on its contrasting traditions of convict settlement and South Pacific paradise clashes with the values of a new Australia emerging from the impact of World War II. Other novels include *To the Islands* (1958; rev. ed. 1981); *Visitants* (1979), a study of the impact of tribal life on Australians; and *The Girl Green as Elderflower* (1980).

Among Stow's books of poetry are *Act One* (1957), *Outrider* (1962), and *A Counterfeit Silence* (1969). He also published *Poetry from Australia* (1969) with Judith Wright and William Hart-Smith. Stow also wrote a book for children entitled *Midnite* (1967) and two libretti for operas scored by Peter Maxwell Davies, *Eight Songs for a Mad King* (publ. 1969) and *Miss Donnithorne's Maggot* (prod. 1974, publ. 1977).

**Stowe,** former estate of the Temple family, the dukes of Buckingham (the title became extinct in 1889), in Buckinghamshire, England. The mansion was begun in 1697 and was remodeled in 1775. It is now the site of Stowe School. Among the architects, designers, and decorators who worked on the house were Sir John Vanbrugh, Robert Adam, Grinling Gibbons, and William Kent. The estate's famous gardens date from the 18th century and include several classical temples designed by James Gibbs. The gardens were originally formal but were gradually transformed into a landscaped park.

**Stowe, Calvin E.,** in full CALVIN ELLIS STOWE (b. April 26, 1802, Natick, Mass., U.S.—d. Aug. 22, 1886, Hartford, Conn.), professor of biblical studies who greatly influenced the development of public education in the United States.

Though raised in poverty following his father's death in 1808, Stowe managed to secure a sufficient preparatory education to enter Bowdoin College in Brunswick, Maine, from which he graduated with honours in 1824. The following year he began religious studies at Andover Theological Seminary in Andover, Mass., graduating in 1829.

Stowe edited a religious newspaper, the *Boston Recorder,* until 1831, when he accepted a position as professor of Greek at Dartmouth College in Hanover, N.H. In 1833 he moved to Cincinnati as professor of biblical literature at Lane Theological Seminary. While there he married Harriet Elizabeth Beecher, the daughter of seminary president Lyman Beecher.

Stowe vigorously promoted the development of free public schools throughout the western United States. Cincinnati's College of Teachers, created in 1833 largely owing to Stowe's enthusiastic backing, urged universal public education in order to Americanize immigrants.

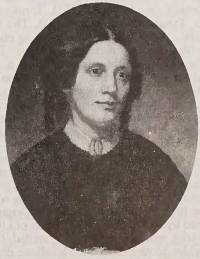
In 1836 Stowe investigated public education in England and Europe and subsequently published his *Report on Elementary Instruction in Europe,* in which he urged Ohio to follow the Prussian example of state-supported education and teacher training. The Ohio legislature ordered a copy of the report for every school district in the state, and it was also distributed by several other state legislatures.

Stowe moved to Bowdoin College for two years and then to Andover Theological Seminary as professor of sacred literature, a post he retained until he resigned in 1864 because of poor health. Three times during the 1850s Calvin and Harriet Beecher Stowe made triumphant tours of Europe in connection with her novel *Uncle Tom's Cabin.* In 1864 they moved to Hartford, Conn., and in 1866 they began spending winters in Florida.

In addition to his famous *Report,* Calvin Stowe wrote *Introduction to the Criticism and Interpretation of the Bible* (1835), *The Religious Element in Education* (1844), *The Right Interpretation of the Sacred Scriptures* (1853), and *Origin and History of the Books of the Bible* (1867).

**Stowe, Harriet Beecher,** née HARRIET ELIZABETH BEECHER (b. June 14, 1811, Litchfield, Conn., U.S.—d. July 1, 1896, Hartford, Conn.), American writer and philanthropist, the author of the novel *Uncle Tom's Cabin,* which contributed so much to popular feeling against slavery that it is cited among the causes of the American Civil War.

Stowe was the daughter of a prominent Congregationalist minister, Lyman Beecher. She first was a pupil and then began to teach at her sister's school in Hartford and, after 1832, in Cincinnati, Ohio. There she took an active part in the literary and school life, contributing stories and sketches to local journals and compiling a school geography, until the school closed in 1836.



Harriet Beecher Stowe, oil painting by Alanson Fisher, 1853; in the Harriet Beecher Stowe House, Hartford, Conn.
By courtesy of the Harriet Beecher Stowe Center

That same year she married Calvin Ellis Stowe, a clergyman and seminary professor, who encouraged her literary activity and was himself an eminent biblical scholar. Despite privation and anxiety, due largely to her husband's precarious health, she wrote continually and in 1843 published *The Mayflower; or, Sketches of Scenes and Characters Among the Descendants of the Pilgrims.*

She lived for 18 years in Cincinnati, separated only by the Ohio River from a slave-holding community; she came in contact with fugitive slaves and learned about life in the South from friends and from her own visits there. In 1850 her husband became professor at Bowdoin

College and moved his family to Brunswick, Maine.

In Brunswick, Stowe wrote the story of *Uncle Tom's Cabin; or, Life Among the Lowly* for serial publication in the *National Era*, an anti-slavery paper of Washington, D.C. Her name became anathema in the South. But elsewhere the book had an unparalleled popularity and was translated into at least 23 languages; the dramatic adaptation of *Uncle Tom's Cabin* played to capacity audiences. Stowe reinforced her story with *The Key to Uncle Tom's Cabin* (1853), in which she accumulated a large number of documents and testimonies against slavery.

In 1853, when she made a journey to Europe, she was lionized in England. Later, however, British public opinion turned against her with publication in 1869 of a magazine article, "The True Story of Lord Byron's Life," detailing her charge that the poet had had an incestuous love for his sister. In 1856 she published *Dred: A Tale of the Great Dismal Swamp*, in which she depicted the deterioration of a society resting on a slave basis. When *The Atlantic Monthly* was established the following year, she found a ready vehicle for her writings; she also found outlets in the *Independent* of New York and later the *Christian Union*, of which papers her brother, Henry Ward Beecher, was editor.

She thereafter led the life of a woman of letters, writing novels, of which *The Minister's Wooing* (1859) is best known, and many studies of social life in both fiction and essay. Stowe published also a small volume of religious poems and toward the end of her career gave some public readings from her writings.

**Stowosz, Wit:** *see* Stoss, Veit.

**Stoyadinovitch, Milan** (Serbian statesman): *see* Stojadinović, Milan.

**Strabane,** Irish AN SRATH BÁN, town, seat, and district (established 1973), formerly in County Tyrone, Northern Ireland. The town is located on the River Mourne at its confluence with the Finn to form the River Foyle near the Irish Republic border. It is a market and employment centre for both Strabane district and County Donegal, Irish Republic, to the west. Long a flax-spinning centre, the town of Sion Mills, 3 mi (5 km) south of Strabane, now also has large mills spinning synthetic fibres.

Strabane district has an area of 333 sq mi (862 sq km) and is bordered by the districts of Londonderry and Limavady to the north, Magherafelt to the east, Omagh to the south, and the Irish Republic to the west. Originally inhabited by the ancient O'Neill clan of Ulster, the district was more recently settled (17th century) by Scots Protestants. Strabane district is composed of river valleys and rolling lowlands and rises to the heather-covered moorlands of the Sperrin Mountains (and altitudes of more than 2,230 ft [680 m] above sea level) in the east. Low-lying areas of the district are grazed by cattle, sheep, and pigs. Salmon fishing is popular in the district's many rivers, and the town of Castlederg in the isolated west is known for its manufacture of tweeds. Pop. (1981) town, 10,340; district, 34,371.

**strabismus,** also called SQUINT, or HETEROTROPIA, failure of the eyes to align properly on the object toward which a person seeks to direct his gaze. The deviant eye may be directed inward, toward the other eye (cross-eye, or esotropia); outward, away from the other eye (walleye, or exotropia); upward (hypertropia); or downward (hypotropia). The squint is called comitant if the deviation remains constant no matter in what direction the gaze is directed; noncomitant, if the degree of misalignment varies with the direction of gaze.

Strabismus is most often the result of some abnormality in the nervous controls—in the reception of images on the retina and their transmission to the higher centres of the brain or in the transmission over the motor nerves of impulses that bring into play the muscles that align the eyes. Nonalignment from defects in the muscles themselves is rare.

When a baby is born his eyes operate independently and are able to distinguish only light and movement. At birth the foveas, the areas in the retinas that are used for sharp vision, are not developed. From about the third month the baby has functioning foveas and develops the ability to change the shape of his lenses for near and far vision and to direct the gaze of his two eyes symmetrically toward an object. Thus the fusional reflex develops, and the complex of nerve impulses and muscle action holds the gaze of the two eyes on an object in such a way that the images on the two retinas are merged into one impression. If any defect in the visual apparatus—*e.g.*, a scar on a cornea, a congenital clouding of a lens, or a tumour—interferes with the reception of an image, the development of the fusional reflex is impeded and the baby becomes cross-eyed or, less often, walleyed. This type of strabismus—strabismus from a defect in the sensory apparatus—is comitant.

If one or more of the muscles that operate to direct the eye's gaze are paralyzed—that is, fail to function because they do not receive impulses over a motor nerve—strabismus of a noncomitant type occurs. In one particular position the eyes seem aligned, but, as the direction of gaze changes, the strabismus becomes apparent.

The chief danger of strabismus is monocular blindness: if the two eyes are of unequal strength, so that one is always the deviant eye, the deviant eye tends to become functionally blind as a result of suppression of the unwanted image. Often, in treatment of strabismus, the "good" eye of the affected child is covered for a period before correctional surgery, so that the child will use the previously unused eye and build up its vision.

**Strabo** (b. 64/63 BC, Amaseia, Pontus—d. after AD 23?), Greek geographer and historian whose *Geography* is the only extant work covering the whole range of peoples and countries known to both Greeks and Romans during the reign of Augustus (27 BC–AD 14). Its numerous quotations from technical literature, moreover, provide a remarkable account of the state of Greek geographical science, as well as of the history of the countries it surveys.

Strabo belonged on his mother's side to a famous family, whose members had held important offices under Mithradates V (around 150–120 BC), as well as under Mithradates the Great, the opponent of Rome (132–63 BC). His first teacher was the master of rhetoric Aristodemus, a former tutor of the sons of Pompey (106–48 BC) in Nysa (now Sultanhisar in Turkey) on the Maeander. He moved to Rome in 44 BC to study with Tyrannion, the former tutor of Cicero, and with Xenarchus, both of whom were members of the Aristotelian school of philosophy. Under the influence of Athenodorus, former tutor of Octavius, who probably introduced him into the future emperor's circle, he turned toward Stoical philosophy, the precepts of which included the view that one unique principle ceaselessly pervading the whole universe causes all phenomena.

It was in Rome, where he stayed at least until 31 BC, that he wrote his first major works, his 47-book *Historical Sketches*, published around 20 BC, of which but a few quotations survive. A vast and eclectic compilation, it was meant as a continuation of Polybius' *Histories*. The *Historical Sketches* covered the history of the known world from 145 BC—that is, from the conquest of Greece by the Romans—to the Battle of Actium (31 BC), or to the beginnings of the principate of the Roman emperor Augustus (27 BC).

In 29 BC, Strabo visited the island of Gyaros (today known as Yiáros, or Nisós) in the Aegean Sea, on his way to Corinth, Greece, where Augustus was staying. In 25 or 24, together with Aelius Gallus, prefect of Egypt, who had been sent on a military mission to Arabia, he sailed up the Nile as far as Philae. There are then no further references to him until AD 17, when he attended the triumph of the Roman general Germanicus Caesar (15 BC to AD 19) in Rome. He died after having devoted his last years to compiling his second important work, his *Geographical Sketches*. Judging by the date when he wrote his personal notes, he must have worked on the book after his stay in Egypt and then have put it aside from 2(?) BC to AD 14, when he started the final edition, which he brought to an end in AD 23.

The first two books, in effect, provide a definition of the aims and methods of geography by criticizing earlier works and authors. Strabo found fault with the map designing of the Greek scholar Eratosthenes, who lived from *c.* 276 to *c.* 194 BC; Eratosthenes had combined astronomical data with coast and road measurements, but Strabo found his work lacking in precision. Although Strabo closely followed the treatise against Eratosthenes of the Greek astronomer Hipparchus, who had lived in the 2nd century BC, he blamed Hipparchus for neglecting the description of the Earth. On the other hand, he appreciated Polybius, who, in addition to his historical works, had written two books on European geography that Strabo admired for their descriptions of places and peoples. Although he praised Posidonius, the Greek historian and philosopher who lived from about 135 to 51 BC, for his knowledge of physical geography and ethnography, he rejected Posidonius' theory of climatic zones and particularly his hypothesis that the equatorial zone was habitable. This critical study led him logically to decide in favour of a descriptive type of geography, based on a map with an orthogonal (perpendicular) projection. The problem of projecting the sphere on a flat surface is not dealt with at any length, for his work, as he said, was not designed for mathematicians but for statesmen who must know countries, natural resources, and customs.

In books III to VI, Strabo described successively Iberia, Gaul, and Italy, for which his main sources were Polybius and Posidonius, both of whom had visited these countries; in addition, Artemidorus, a Greek geographer born around 140 BC and author of a book describing a voyage around the inhabited Earth, provided him with a description of the coasts and thus of the shape and size of countries. Book VII was based on the same authorities and described the Danube Basin and the European coasts of the Black Sea. Writing about Greece, in books VIII to X, he still relied upon Artemidorus, but the bulk of his information was taken from two commentators of Homer—Apollodorus of Athens (2nd century BC) and Demetrius of Scepsis (born around 205 BC)—for Strabo placed great emphasis on identifying the cities named in the Greek epic the *Iliad*. Books XI to XIV describe the Asian shores of the Black Sea, the Caucasus, northern Iran, and Asia Minor. Here Strabo made the greatest use of his own observations, though he often quoted historians who dealt with the wars fought in these regions and cited Demetrius on problems of Homeric topography in the region about ancient Troy. India and Persia (Book XV) were described according to information given by the historians of the campaigns of Alexander the Great (356 to 323 BC), whereas his descriptions of Mesopotamia, Syria, Palestine, and the Red Sea (Book XVI) were based on the accounts of the expeditions sent out by Mark Antony

(about 83 to 30 BC) and by the emperor Augustus, as well as on chapters on ethnography in Posidonius and on the book of a Red Sea voyage taken by the Greek historian and geographer Agatharchides (2nd century BC). Strabo's own memories of Egypt, supplemented by the writings of Posidonius and Artemidorus, provided material for the substance of Book XVII, which dealt with the African shores of the Mediterranean Sea and with Mauretania.

Obviously, personal travel notes formed only a small part of the material used in this considerable work, although Strabo prided himself on having travelled westward from Armenia as far as the regions of Tuscany opposite Sardinia, and southward from the Black Sea as far as the frontiers of Ethiopia. Even on the subject of Italy, where he lived for a long time, Strabo did not himself contribute more than a few scattered impressions. His material, accordingly, mostly dates from the time of the sources he used, although the reader is not made aware of this. The value of firsthand observations, chosen from the sources with care, compensates, however, for his lack of originality and contemporaneousness. Strabo showed himself equally competent in selecting useful information—giving distances from city to city and mentioning the frontiers between countries or provinces as well as the main agricultural and industrial activities, political statutes, ethnographic peculiarities, and religious praices. He also took interest in the histories of cities and states, and—when he knew them—mentioned the circumstances under which they were founded, related myths or legends, wars they had instigated or endured, their expansion or recession, and their celebrities. Geological phenomena were reported when they were in some way unusual or when they furnished an explanation for other phenomena—such as the Atlantic tides in Iberia, the volcanic landscapes to be seen in southern Italy and Sicily, the fountains of naphtha occurring near the Euphrates River, and the rise and fall of the Nile waters. Paradoxically, although the description of Greece fills three whole books, such elements are virtually neglected in them. In this part, indeed, Strabo was more attracted by the problem of identifying the localities mentioned in Homer's works than in the geographical realities. These books, however, illustrate another side of his thought, based on the conviction that Homer was perfectly acquainted with the geography of the Mediterranean area and that the correct critical interpretation would reveal his vast learning. This classical thesis is abundantly defended in Strabo's introduction, which attacks the skepticism of Eratosthenes; moreover, it represents, in Strabo's work, the specific contribution to learning of the Greek cultural tradition. (F.La.)

BIBLIOGRAPHY. The *Geography* was seldom used in ancient times but was often copied in Byzantium; it first appeared in western Europe as a Latin translation issued in Rome in about 1469 and was then published in the Aldine edition of 1516, based on a faulty manuscript. The first critical edition was that of I. Casaubon (1587, then 1620), which was followed by that of G. Kramer—the first to be based upon an analysis of the manuscripts, 3 vol. (1844–52). Various scientific editions by F. Sbordone, books 1–6 (1963–70); F. Lasserre, G. Aujac, and R. Baladié, books 1–6, 10 (1966–71), with French translation; and W. Aly, books 1–6 (1972), are available. These include information from a newly discovered palimpsest from the library of the Calabrian theologian Cassiodorus (born *c.* AD 485). Meanwhile, H.L. Jones's edition, *The Geography of Strabo*, with an English translation, notes, and maps, remains usable (Loeb Library, 8 vol., 1917–32); it also includes a select bibliography. Fragments of the *Historical Sketches* were last edited and commented upon by F. Jacoby, *Die Fragmente der griechischen Historiker*, vol. 2A (1925). W. Aly, *Strabonis Geographica*, vol. 4 (1957); and G. Aujac, *Strabon et la science de son temps* (1966), are excellent standard works.

**Strachan, John** (b. April 12, 1778, Aberdeen, Aberdeenshire, Scot.—d. Nov. 1, 1867, Toronto), educator and clergyman who, as the first Anglican bishop of Toronto, was responsible for organizing the church in Canada as



Strachan, detail of a portrait by an unknown artist
By courtesy of the Ontario Archives, Toronto

a self-governing denomination within the Anglican community.

Strachan emigrated from Scotland to Canada in 1799. After teaching school in Kingston, he was ordained in 1803 and appointed curate at Cornwall and then rector of York (now Toronto). He served on the Executive Council of Upper Canada (Ontario), and in 1820 he was appointed to the Legislative Council and became part of the ruling Tory oligarchy. He became archdeacon of York in 1825 and organized the establishment of the University of Toronto in 1827.

Strachan worked to maintain a privileged position for the Church of England in Canada. Adverse criticism led him to resign from the Executive Council. In 1839 he became first bishop of the newly created diocese of Toronto, and he managed to double the number of churches and to establish many schools there. He became president of Kings College in 1843, and, after Kings College was secularized (1849), he established the University of Trinity College in 1851. Strachan created the Anglican synod of clergy and laity in the British colonial empire in 1851. His political power diminished after the granting of responsible government to the colony in 1849.

**Strachey, John** (b. May 10, 1671, Chew Magna, Eng.—d. June 11, 1743, Greenwich), early geologist who was the first to suggest the theory of stratified rock formations. He wrote *Observations on the Different Strata of Earths and Minerals* (1727) and stated that there was a relation between surface features and the rock structure, an idea that was not commonly accepted until a century later.

**Strachey, (Evelyn) John (St. Loe)** (b. Oct. 21, 1901, Guildford, Surrey, Eng.—d. July 15, 1963, London), British Socialist writer and Labour politician known for his contributions to leftist thought and for his peacetime rationing policies as British food minister.

Son of John St. Loe Strachey, publisher and editor of *The Spectator*, Strachey broke with his family's Conservative allegiances and in 1923, while a student at Oxford, joined the radical Independent Labour Party, whose periodical the *Socialist Review* he began editing the following year. He also became editor of *The Miner*, published by the British Miners' Federation, and became known for his publicizing of the miners' cause during the General Strike of 1926. Elected to Parliament in 1929, he quit the Labour caucus in early 1931 and moved closer to Communism.

Defeated in 1931, Strachey began writing and giving lectures, eventually breaking with the Communists with the outbreak of World War II in 1939. During the war he served in a succession of posts—air raid warden, public relations officer, radio commentator, and Royal Air Force wing commander. With the war's end, Strachey was returned to Parliament in the June 1945 elections and was appointed undersecretary for air in the new Labour government. In May 1946 he became minister of food and began the rationing of bread. He also carried out an unsuccessful scheme to mechanize the growth of peanuts (groundnuts) in East and Central Africa. After serving as war minister (1950–51), he continued in Parliament as Labour spokesman on defense and commonwealth matters.

A creative and erudite interpreter of Marxist thought, Strachey published a number of works, including *The Coming Struggle for Power* (1932), *The Nature of Capitalist Crisis* (1935), *The Theory and Practice of Socialism* (1936), and *What Are We To Do?* (1938)—all works of his Communist period; then his moderately leftist *A Programme for Progress* (1940), *Contemporary Capitalism* (1956), *The End of Empire* (1959), and *On the Prevention of War* (1962), which offered proposals for dealing with tensions between the West and the Soviet Union.

**Strachey, (Giles) Lytton** (b. March 1, 1880, London—d. Jan. 21, 1932, Ham Spray House, near Hungerford, Berkshire, Eng.), English biographer and critic who opened a new era of biographical writing at the close of World War I. Adopting an irreverent attitude to the past and especially to the monumental life-and-letters volumes of Victorian biography, Strachey proposed to write lives with "a brevity which excludes everything that is redundant and nothing that is significant." He is best known for *Eminent Victorians*—short sketches of the Victorian idols Cardinal Manning, Florence Nightingale, Thomas Arnold, and Gen. Charles "Chinese" Gordon.

After studying at Cambridge (1899–1903), Strachey lived in London, where he became a leader in the artistic, intellectual, and literary Bloomsbury group (*q.v.*). He published critical writings, especially on French literature, but his greatest achievement was in biography. After *Eminent Victorians* (1918) and *Queen Victoria* (1921), he wrote *Elizabeth and Essex* (1928) and *Portraits in Miniature* (1931). Treating his subjects from a highly idiosyncratic point of view, he was fascinated by personality and motive and delighted in pricking the pretensions of the great and reducing them to somewhat less than life-size. His aim was to paint a portrait; and though this led to caricature and sometimes, through tendentious selection of material, to inaccuracy, he taught biographers a sense of form and of background, and he sharpened their critical acumen.

His defects as a biographer arose mainly from his limited vision of life. He saw politics largely as intrigue, religion as a ludicrous anachronism, and personal relations as life's supremely important facet. Though bitterly attacked during his lifetime and after, Strachey remains a phenomenon in English letters and a preeminent humorist and wit.

**Strachwitz, Moritz (Karl Wilhelm Anton), Graf von** (count of ) (b. March 13, 1822, Peterwitz, Silesia—d. Dec. 11, 1847, Vienna), German poet remembered for his *Neue Gedichte* ("New Poems"), which included such distinctive poems as "Der Himmel ist blau" and a national patriotic song, "Germania."

After studying in Breslau and Berlin, Strachwitz settled on his estate in Moravia, where he did his writing. He was involved with a Berlin literary club, Tunnel über der Spree, and competed with the novelist Theodor Fontane in writing ballads. He died in Vienna on his way home from a trip to Italy.

Strachwitz was the most promising of the younger lyric poets of his time. His *Lieder*

*eines Erwachenden* (1842; "Songs of Awakening") especially showed his lyric genius and went through several editions. *Neue Gedichte* (1848) reveals a Romantic strain but also exhibits the influence of the German poet and dramatist August von Platen. Strachwitz' political lyrics have aristocratic leanings lacking in those of his contemporaries. His collected works, *Sämtliche Lieder und Balladen* ("Collected Songs and Ballads"), appeared in 1912.

**Stradbroke Island,** two islands consisting of North and South sections, off Moreton Bay, southeastern Queensland, Australia, named for the Earl of Stradbroke in 1827. It was originally one island, but a storm in 1892 severed it in two by creating Jumpinpin Channel. South Stradbroke is about 14 mi (23 km) long and ½ mi wide. North Stradbroke, facing Brisbane across the bay, is about 24 mi long and up to 7 mi wide and has an area of 123 sq mi (319 sq km); it rises to 720 ft (219 m) at Mt. Hardgrave and has several large interior lagoons. Formerly the location of a penal colony, it is now the site of several resort towns. Hardwood timbers are cut, and beach sands are worked for rutile, zircon, and titanium.

**Stradella, Alessandro** (b. 1642, Monfestino, Papal States—d. Feb. 28, 1682, Genoa), Italian composer, singer, and violinist.

Stradella apparently lived for periods in Modena, Venice, Rome, and Florence. In Turin in 1677 an attempt was made to murder him, for reasons that are not known, though it was believed to be at the instigation of a Venetian senator with whose fiancée Stradella had eloped. A document in Modena confirms his murder in 1682.

Stradella was one of the finest composers of chamber cantatas, of which he wrote more than 200 for religious observance (*e.g., Christmas Cantata*); his fresh, mellifluous melodies are frequently supported by harmonies bolder than are usually found in music of this period. Particularly interesting in his instrumental music is his novel application of concerto grosso texture to accompaniments of arias in some of his stage works and oratorios. Stradella's legendary life, embroidered from conjecture and scanty facts, was the subject of eight 19th-century operas and of at least one novel.

**Stradivari, Antonio,** Latin STRADIVARIUS (b. 1644?, Cremona, Duchy of Milan—d. Dec. 18, 1737, Cremona), Italian violin maker who brought the craft of violin-making to its highest pitch of perfection.

Stradivari was still a pupil of Nicolò Amati in 1666 when he began to place his own label



Stradivari, detail of an engraving by Fred Hillemacher, c. 1886, after a portrait, 1681
J.P. Zioto

on violins of his making. These at first followed the smaller of Amati's models, solidly constructed, with a thick yellow varnish. In 1684 Stradivari began to produce larger models, using a deeper-coloured varnish and experimenting with minute details in the form of the instrument. His "long" models, dating from 1690, represent a complete innovation in the proportions of the instrument; from 1700, after returning for a few years to an earlier style, he again broadened and otherwise improved his model. He also made some fine cellos and violas. The Stradivari method of violin making created a standard for subsequent times; he devised the modern form of the violin bridge and set the proportions of the modern violin, with its shallower body that yields a more powerful and penetrating tone than earlier violins. It was long thought that the secret of Stradivari's acoustically perfect violins lay in their varnish, the formula of which, though much debated, has never been discovered. However, modern research has isolated certain factors that influence the beauty of a violin's tone. Among these are the thickness (and, hence, the vibrational properties) of its wooden top and back plates, the condition of the microscopic pores within the wood of the violin, and lastly the formula of the varnish. Stradivari's success probably came from expertly optimizing all these and other factors within his designs.

**Most famous instruments of Antonio Stradivari**

violins

| name | date | name | date |
|---|---|---|---|
| Hellier | 1679 | Alard* | 1715 |
| Sellière | before 1680 | Cessol | 1716 |
| | | Messiah | 1716 |
| Tuscan | 1690 | Sasserno | 1717 |
| Betts | 1704 | Maurin | 1718 |
| Ernst | 1709 | Lauterbach | 1719 |
| La Pucelle | 1709 | Blunt | 1721 |
| Viotti | 1709 | Rode | 1722 |
| Vieuxtemps | 1710 | Sarasate | 1724 |
| Parke | 1711 | Deurbroucq | 1727 |
| Boissier | 1713 | Kiesewetter | 1731 |
| Dolphin | 1714 | Habeneck | 1736 |
| Gillot | 1715 | Muntz | 1736 |

cellos

| name | date |
|---|---|
| Archinto | 1689 |
| Tuscan | 1690 |
| Aylesford | 1696 |
| Cristiani | 1700 |
| Servais | 1701 |
| Gore-Booth | 1710 |
| Duport | 1711 |
| Adam | 1713 |
| Batta | 1714 |
| Piatti† | 1720 |
| Bauduot | 1725 |
| Gallay | 1725 |

violas

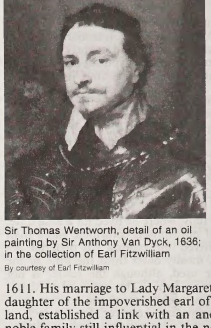
| name | date |
|---|---|
| Tuscan | 1690 |
| ‡ | |
| Archinto | 1696 |
| Macdonald | 1701 |
| Paganini | 1731 |

*The finest violin. †The finest cello.
‡Two unnamed violas of 1696 formerly belonging to Philip IV of Spain.

Stradivari's sons Francesco (1671–1743) and Omobono (1679–1742) were also violin makers. They are believed to have assisted their father, probably with Carlo Bergonzi, who appears to have succeeded to the possession of Antonio's stock-in-trade.

**Strafford, Thomas Wentworth, 1st earl of,** BARON OF RABY, also called (1611–28) SIR THOMAS WENTWORTH, or (from 1628) VISCOUNT WENTWORTH, BARON WENTWORTH OF WENTWORTH WOODHOUSE, BARON OF NEWMARCH AND OVERSLEY (b. April 13, 1593, London—d. May 12, 1641, London), leading adviser of England's King Charles I. His attempt to consolidate the sovereign power of the king led to his impeachment and execution by Parliament.

*Early life and career.* Wentworth was the eldest surviving son of Sir William Wentworth, a Yorkshire landowner. Educated at St. John's College, Cambridge, and at the Inner Temple, he was knighted by James I in



Sir Thomas Wentworth, detail of an oil painting by Sir Anthony Van Dyck, 1636; in the collection of Earl Fitzwilliam
By courtesy of Earl Fitzwilliam

1611. His marriage to Lady Margaret Clifford, daughter of the impoverished earl of Cumberland, established a link with an ancient and noble family still influential in the north.

Wentworth represented Yorkshire in the parliaments of 1614 and 1621 and Pontefract in 1624. His wife died childless (1622), and he married Arabella Holles, daughter of John, earl of Clare, a peer out of favour at court who brought Wentworth into touch with the critics of the King's expensive and inefficient policy of war against Spain and, from 1627, against France. Along with other critics of the court he was prevented from sitting in the Parliament of 1626, and later in the year he refused to subscribe to the forced loan imposed to pay for the war, and was for some time under arrest. Despite his record of opposition to the King's policy, Wentworth was approached by the crown—anxious to strengthen its position in the north—with the offer of a barony (1628). He was appointed lord president of the north (virtually governor of England north of the Humber) and in 1629 was given a seat on the Privy Council.

Wentworth's return to the service of the court, coming so soon after his vehement opposition to it in Parliament, startled even some of his closest friends. His conduct was no doubt partly inspired by personal ambition, though he had logical reasons for his change of front since in the summer of 1628 the King gradually abandoned his war policy.

On the Privy Council Wentworth seems to have advocated the paternalist government that distinguished the early years of the King's personal rule: closer supervision of justices of the peace and more effective implementation of the Poor Laws, of laws against enclosure, and of measures for dealing with famine, though he was not above privately making profit out of the corn shortage of 1631. As lord president of the north he quelled all defiance of his authority and made many enemies by his insistence on the honour due to him as the King's representative, but his administration was on the whole just and efficient; he supervised the local justices and curbed the often tyrannous excesses of local magnates. In 1631 he was deeply distressed by the death of his much-loved wife, though he provoked scandalous rumours not long afterward by secretly marrying (October 1632) Elizabeth Rodes, the young daughter of a neighbouring squire.

*Lord deputy of Ireland.* The King meanwhile had appointed him lord deputy of Ireland. Taking up his office in the summer of 1633, he immediately set himself to consolidate the royal authority, break the power of the dominant clique of "new English" landowners, extend English settlement, improve methods of agriculture, increase the productivity of the land, and stimulate industry and trade. His ultimate goal was to assimilate Irish law and customs to the English system and to make a

prosperous Protestant Ireland into a source of revenue to the English crown.

Wentworth continued his effective and firm-handed administration of Ireland until 1639, when he was recalled to England by King Charles. The King needed advice and support in handling a Scottish revolt precipitated by an ill-conceived attempt to enforce episcopacy on the Scots. Wentworth was created earl of Strafford (1640) and was expected to resolve the crisis. But his policy of making war on Scotland proved disastrous for both himself and the King. The English Parliament, called especially to vote money for the war, proved recalcitrant, and Strafford, in command of the English army, failed to prevent the Scots from overrunning the northern counties. The King, unable to pay his own troops or to buy off the Scots, was compelled by joint English and Scottish action to call a new Parliament in November 1640.

Strafford was the chief target of attack from both nations. He was advised to leave the country, but the King relied on his help and assured him that he should not suffer in life or fortune. Detained by illness, he reached Westminster on November 10 with the intention of impeaching the King's opponents in Parliament for treasonable correspondence with the Scots. The leader of the Commons, John Pym, acted first by impeaching Strafford before he could take his seat in the House of Lords.

His trial began in March 1641. The basic accusation was that of subverting the laws and was supported by a charge that he had offered to bring over the Irish army to subdue the King's opponents in England. More detailed charges rested on his administration in Ireland and the north. He conducted his defense with great skill, and it looked at one point as though he might be acquitted. Pym therefore introduced a bill of attainder (*i.e.*, a summary condemnation to death by special act of Parliament). The Commons passed it by a large majority; the Lords, intimidated by popular rioting, passed it, too, but by a much smaller majority.

*Execution.* While an angry mob surged around Whitehall, Strafford wrote to the King releasing him from his promise of protection, and Charles, afraid for the safety of the Queen, gave his consent to the bill. Strafford went to the scaffold on May 12, 1641, in the presence of an immense and jubilant crowd. In his last speech he once more professed his faith in "the joint and individual prosperity of the king and his people," for which, in his view, he had always worked.

He remains an enigmatic figure in English history: ambitious, greedy for power and wealth, ruthless, and sometimes dishonest, but with a vision of benevolent authoritarian government and efficient administration to which he often gave persuasive expression. He made innumerable enemies, but his few close friends were deeply attached to him. In the last weeks of his life his dignity, eloquence, and loyalty to the King made a deep impression even on some of his enemies. (C.V.W.)

BIBLIOGRAPHY. C.V. Wedgwood, *Thomas Wentworth, First Earl of Strafford, 1593–1641: A Revaluation* (1961), includes an extensive bibliography. The *Earl of Strafford's Letters and Despatches*, ed. by William Knowler, 2 vol. (1739–40), is still the largest printed collection of Strafford's papers, but it contains only about a 12th of the manuscript material in the possession of Strafford's descendant, Earl Fitzwilliam. J.P. Cooper, "The Fortune of Thomas Wentworth, 1st Earl of Strafford," *Economic History Review*, Second Series, 11:227–248 (1958), is of great importance for Wentworth's financial interests and character.

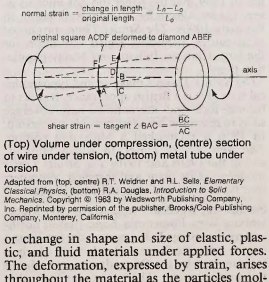
**Stragorodsky, Ivan Nikolayevich:** *see* Sergius.

**straight-line evolution:** *see* orthogenesis.

**straight-rail billiards,** billiard game played with three balls (one red and two white) on a table without pockets. The object is to score caroms by hitting both object balls with a cue ball. A player may use either white ball as cue ball but not one that has been placed on one of the small spots marked on the table, as at the start of the game or after one is knocked off the table. Only three caroms may be scored when both object balls are in the crotch, a small triangle marked in each corner of the table. On the third carom, one or both object balls must be driven out of the crotch or the player loses the turn at play. Other rules are the same as in billiards (*q.v.*).

*Where the same name may denote a person, place, or thing, the articles will be found in that order*

**strain,** in physical sciences and engineering, number that describes relative deformation




(Top) Volume under compression, (centre) section of wire under tension, (bottom) metal tube under torsion

Adapted from (top, centre) R.T. Weidner and R.L. Sells, *Elementary Classical Physics*, (bottom) R.A. Douglas, *Introduction to Solid Mechanics*, Copyright © 1963 by Wadsworth Publishing Company, Inc. Reprinted by permission of the publisher, Brooks/Cole Publishing Company, Monterey, California.

or change in shape and size of elastic, plastic, and fluid materials under applied forces. The deformation, expressed by strain, arises throughout the material as the particles (molecules, atoms, ions) of which the material is composed are slightly displaced from their normal position.

Strains may be divided into normal strains and shear strains on the basis of the forces that cause the deformation. A normal strain is caused by forces perpendicular to planes or cross-sectional areas of the material, such as in a volume that is under pressure on all sides or in a rod that is pulled or compressed lengthwise.

A shear strain is caused by forces that are parallel to, and lie in, planes or cross-sectional areas, such as in a short metal tube that is twisted about its longitudinal axis.

In deformation of volumes under pressure, the normal strain, expressed mathematically, is equal to the change in volume divided by the original volume. In the case of elongation, or lengthwise compression, the normal strain is equal to the change in length divided by the original length. In each case the quotient of the two quantities of the same dimension is itself a pure number without dimensions. In some applications, the change (decrease) in volume or in length for compression is taken to be negative, whereas the change (increase) for dilation or tension is designated as positive. Compressive strains, by this convention, are negative, and tensile strains are positive.

In shear strain, right angles (90° angles) within the material become changed in size, as squares are deformed into diamond shapes the angles of which depart from 90°. Thus, in the illustration of the metal tube, the right angle CAF in the unstrained tube decreases to the acute angle BAF when the tube is twisted. The change in the right angle is, therefore, equal to angle BAC the tangent of which, by definition, is the ratio of BC divided by AC. This ratio is the shear strain, the value of which is zero for no deformation and becomes increasingly greater as angle BAC increases. Shear strains are also dimensionless.

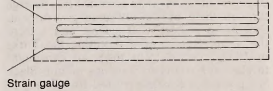
**strain gauge,** device for measuring the changes in distances between points in solid bodies that occur when the body is deformed. Strain gauges are used either to obtain information from which stresses (internal forces) in bodies can be calculated or to act as indicating elements on devices for measuring such quantities as force, pressure, and acceleration.

Until the 1930s most strain gauges used either compound mechanical lever systems or mirrors and optical levers. Magnifications as high as 1,200 to 1 were common, and deformations as small as about 1 micron (0.00005 inch) were measured. The gauge lengths on these instruments were from ½ to 1 in. (1¼ to 2½ cm), and their comparatively large size and weight made them incapable of responding faithfully to the fluctuating strains resulting from dynamic loading.

The resistance strain gauge is a valuable tool in the field of experimental stress analysis. It operates on the principle, discovered by the British physicist William Thompson (later Lord Kelvin) in 1856, that the electrical resistance of a copper or iron wire changes when the wire is either stretched or compressed.

The gauge shown in the figure consists of a length of very fine wire looped into a grid pattern and cemented between two sheets of very thin paper. It is firmly glued (bonded) to the surface on which the strain is to be measured and is energized by an electric current. When the part is deformed, the gauge follows any stretching or contracting of the surface, and its resistance changes accordingly. This resistance change is amplified and converted into strain, after proper calibration.

The wire-type grids were the first commercial form of the resistance gauge; they are now produced as flat foils by printed-circuit techniques, in the form of a grid on a plastic backing.




Strain gauge

Resistance gauges are made in a variety of shapes, sizes, and types, mostly about the size of a postage stamp; gauge lengths as short as 0.015 in. (0.038 cm) are available, and strains as small as 0.000001 inch per inch can be detected. These gauges can be used on the surface of almost any solid material or imbedded in the interior of concrete; being light, they are particularly suitable for measuring rapidly varying strains and the strains in rotating shafts.

Resistance gauges can be classified as trans-

ducers, *i.e.*, devices for converting a mechanical displacement into an electrical signal.

Two other methods of measuring the strain on an object are photoelasticity and stress-analysis holography. Photoelasticity provides a visual method of observing the strain on an object by viewing the effects of polarized light on a bi-refringent (double-refracting) material bonded to the object. As the test object is stressed, fringe patterns in the bi-refringent material represent the regions of strain within the object. Stress holography also allows direct visual observation of the strain on an object. The hologram of an object is superimposed over the object. As long as the original object and the hologram match, nothing is observed. If the object is stressed, however, fringe patterns form from which the strain on the object can be determined.

**strain theory,** in chemistry, a proposal made in 1885 by the German chemist Adolf von Baeyer that the stability of carbocyclic compounds (*i.e.*, those of which the molecular structure includes one or more rings of carbon atoms) depends on the amount by which the angles between the chemical bonds deviate from the value (109°28′) observed in compounds not containing such rings. The amount of deviation is the measure of the strain of the ring; the greater the strain, the less stable is the ring. Baeyer postulated that these rings are planar and concluded that strain exists in three- and four-membered rings and in rings of six or more atoms, the strain increasing with the size of the ring. The least strained ring is that of five-carbon cyclopentane, in which the bond angles are 108°.

Baeyer's ideas, although still considered essentially correct, have been significantly extended. Another German chemist, H. Sachse, in 1890 suggested that in rings of six or more atoms the strain can be relieved completely if the ring is not planar but puckered, as in the so-called chair and boat conformations of cyclohexane. These large rings should then be as stable as those of five atoms—a conclusion that has been verified experimentally. For example, no significant difference referable to strain has been found between the stability of cyclotriacontane, with 30 atoms in the ring, and that of cyclopentane, with only 5.

**Strait of ——** : *see under* substantive word (*e.g.*, Magellan, Strait of ).

**Straits Question,** in European diplomacy of the 19th and 20th centuries, a recurrent controversy over restrictions on the passage of warships through the Bosporus, the Sea of Marmara, and the Dardanelles, the strategic straits connecting the Black Sea with the Aegean and Mediterranean seas.

The straits were in Turkish territory, but when Russia gained control of the north shore of the Black Sea in the 18th century, Russian commercial vessels were accorded free passage through them by the Ottoman government. Seeking to protect itself against attack from the south, Russia, after defeating the Turks in 1833, exacted from them an agreement to close the straits to warships of non-Black Sea powers at Russia's request (the Treaty of Hunkiar Iskelesi). This agreement was cancelled by the London Straits Convention of July 15, 1841, in which all the major European powers subscribed to the rule that no non-Turkish warships might cross the straits during peacetime. Britain and France, as allies of Ottoman Turkey, did send their fleets through the straits to attack Russia during the Crimean War (1853–56). The 1841 convention remained in force until it was reversed by the post-World War I Lausanne Convention (July 24, 1923), which allowed free passage for all warships. This satisfied neither Soviet Russia nor the new Turkish Republic and was revised by the Montreux Convention (July 20, 1936), which reestablished Turkey's full right to fortify the straits and restricted access by navies of non-Black Sea states; this agreement was never abrogated.

**Straits Settlements,** former British crown colony on the Strait of Malacca, comprising four trade centres, Penang, Singapore, Malacca, and Labuan, established or taken over by the British East India Company. The British settlement at Penang was founded in 1786, at Singapore in 1819; Malacca, occupied by the British during the Napoleonic Wars, was transferred to the East India Company in 1824. The three territories were established as a crown colony in 1867. Labuan, which became part of Singapore Settlement in 1907, was constituted a fourth separate settlement in 1912.

The Straits colony, occupied by Japanese during World War II, was broken up in 1946, when Singapore became a separate crown colony. Singapore attained full internal self-government in 1959, became a part of Malaysia in 1963, and became an independent republic in 1965. Labuan was incorporated in North Borneo (later Sabah) in 1946, which in turn became a part of Malaysia in 1963. Penang and Malacca were included in the Malayan Union in 1946, the Federation of Malaya in 1948, and Malaysia in 1963.

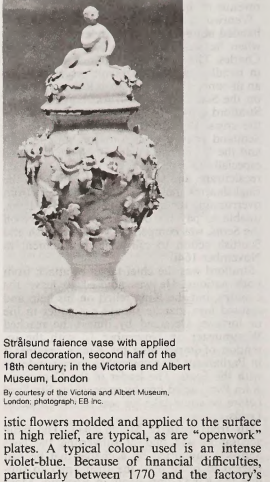
**Straits Times, The,** morning daily newspaper published in Singapore, generally recognized as one of the outstanding English-language papers of the Far East.

It was founded in 1845 as a single-sheet weekly by Robert Carr Woods to provide commercial information needed by Singapore's bustling port community. The paper became a daily in 1858. Its facilities were destroyed by fire in 1869, but the paper did not miss an issue. Under Alexander William Still, editor in the early 1900s, *The Straits Times* promoted local causes, including higher education for the large Chinese, Indian, and Malay population there.

*The Straits Times*'s makeup and typographical style give it a British appearance. It seeks to balance local and international news coverage so as to reach the broadest possible readership. In 1956 it established a Malaysian edition, *The New Straits Times*, in Kuala Lumpur, and in the 1960s and 1970s *The Straits Times* modernized its plant and installed computerized typesetting and editorial equipment.

**Stralsund,** Swedish STRÅLSUND, city, Mecklenburg-West Pomerania *Land* (state), northeastern Germany, Baltic port on the Strelasund (strait) opposite Rügen island, with which it is connected by the Rügendamm, a road and rail embankment. There was a village that specialized in ferrying goods and passengers to Rügen island as early as 1200; it was chartered in 1234. Stralsund joined the Hanseatic League in 1293. During the Thirty Years' War it was unsuccessfully besieged in 1628 by imperial forces under Albrecht von Wallenstein. It was transferred to Sweden in 1648, occupied by the French in 1807 and by the Danes in 1814, and passed to Prussia in 1815. Although heavily damaged in World War II, it retains its medieval Gothic churches and town hall. Its port facilities and shipbuilding yards were expanded after World War II, and fishing and fish processing are its important industries. Pop. (1989 est.) 75,498.

**Stralsund faience,** tin-glazed earthenware made at Stralsund, Swed. (now Stralsund, Ger.), from around 1755 to 1792. The factory was founded by Johann Ulrich Giese, who leased it to Johann Eberhard Ludwig Ehrenreich. The latter had founded a faience factory at Marieberg in Sweden, and the products of Stralsund differ little from Marieberg ware. All-white vases, decorated with naturalistic flowers molded and applied to the surface in high relief, are typical, as are "openwork" plates. A typical colour used is an intense violet-blue. Because of financial difficulties, particularly between 1770 and the factory's closing in 1792, the quantity of production was not large, but it was of high quality.



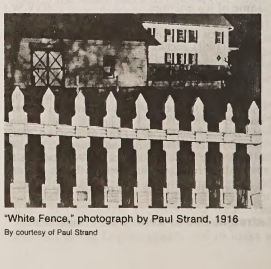
Strålsund faience vase with applied floral decoration, second half of the 18th century; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London; photograph, EB inc.

**Strand, Paul** (b. Oct. 16, 1890, New York City—d. March 31, 1976, near Paris), photographer whose works contributed to the emphasis on abstract and objective qualities in 20th-century U.S. photography.

When he was 17 years old, Strand began to study photography with Lewis W. Hine, later noted for his photographs of industrial workers and immigrants. At Hine's urging, Strand began to frequent the galleries at "291" in New York, where he met Alfred Stieglitz, the leader of the Photo-Secession Group and was influenced also by the avant-garde paintings of Picasso, Cézanne, and Braque. Their works led him to emphasize abstract form and pattern in his photographs, such as "Shadow Pattern, New York" and "Wall Street" (both 1915). In one of the boldest photographs of the period, "White Fence" (1916), Strand deliberately destroyed perspective to build a powerful composition from tonal planes and rhythmic pattern.

Strand at this time did not attempt to emulate painting by manipulating his negatives or his prints, common practices of the Photo-Secessionists. Instead, he relied on strictly photographic methods, realizing that the camera's objectivity is at once its limitation and its chief asset. Strand's objective photographs of



"White Fence," photograph by Paul Strand, 1916

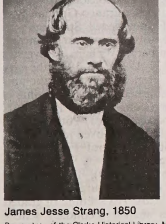
By courtesy of Paul Strand

urban subjects were published by Stieglitz in his magazine *Camera Work*. Strand rejected soft-focus pictorialism in favour of the minute detail and rich, subtle tonal range afforded by the use of large-format cameras. The purity and directness of Strand's depictions of natural forms and architecture presaged the work of other American photographers seeking to express abstract formal values through the unadorned photographic image.

After serving in World War I, Strand collaborated with the painter and photographer Charles Sheeler on the documentary film *Manhatta*. While working as a free-lance motion picture cameraman, he devoted his free time to still photography, revealing the beauty of natural forms in Colorado (1926) and Maine (1927–28). In his photographs of the Gaspé Peninsula in Quebec (1929) and of New Mexico (1930), he achieved a new understanding of landscape, revealing a deep awareness of what he called "the spirit of place."

Appointed chief photographer and cinematographer by the Mexican government in 1933, he made the motion picture *Redes* (*The Wave*) about Mexican fishermen. Returning to the United States, Strand was a cameraman for the director Pare Lorentz on the government-sponsored documentary film *The Plow That Broke the Plains* (1936). In 1937 Strand formed Frontier Films to make documentaries. Of the nonprofit company's seven films, Strand photographed only *Native Land* (1942). After World War II his work appeared mainly in photographic books: *Time in New England* (with Nancy Newhall; 1950), *La France de profil* (with Claude Roy; 1952; "France in Profile"), *Un Paese* (1954), and *Tir A'Mhurain, Outer Hebrides* (1962).

**Strang, James Jesse,** also called JESSE JAMES STRANG (b. March 21, 1813, Scipio, N.Y., U.S.—d. July 9, 1856, Voree, Wis.), American churchman, dissident of the Church of Jesus Christ of Latter-day Saints (Mormons), whose futile attempt to succeed Joseph Smith as its leader led him to found the Strangite sect.



James Jesse Strang, 1850
By courtesy of the Clarke Historical Library, Mount Pleasant, Mich.

Admitted to the bar in 1836 after teaching for a brief period, Strang also served as postmaster for five years at Ellington, N.Y., and owned and edited a weekly paper. In 1843 he followed his wife's family to Burlington, Wis. He met Joseph Smith the next year in Nauvoo, Ill. Despite an earlier philosophical skepticism, Strang became a Mormon convert and was ordained an elder by Smith.

After Smith's assassination in June 1844, Strang exhibited a letter, purportedly written by Smith, that named Strang his successor. He also claimed to have had a vision appointing him "seer, revelator, and prophet" of the Mormon Church. He was out-generaled, however, by Brigham Young, and the Twelve Apostles denounced Strang as an impostor and forger and expelled him from the church. Young became Smith's successor. Nevertheless, Strang persuaded a group of his own followers, including Smith's brother William, to move to Voree, Wis. (near Burlington), where they organized the new sect. There in 1845 he allegedly translated (with the aid of magic spectacles given him by an angel) *The Book of the Law of the Lord* from golden plates from the Ark of the Covenant. Strang then established a secret society that swore allegiance to him and operated under puritanical rules.

Dissension prompted Strang to relocate the colony in 1847 to Beaver Island, in northern Lake Michigan. By 1849 the city of St. James was established on the island's northern coast. The following year Strang received another revelation in the "plates of Laban." It sanctioned polygyny, and he was married to four wives at one time. He also claimed that it sanctioned his coronation, and in July he became King James I. The Strangites endured considerable persecution, but Strang was able to preserve the sect and to gain acquittal in the several lawsuits brought against him.

Twice elected to the legislature in Michigan (1852, 1854), Strang had more than 5,000 followers when he was shot on June 16, 1856, by two former Strangites. Though he knew death was near, he refused to appoint a successor. Lake Michigan fishermen subsequently drove more than 2,000 Strangites from their homes and all but extinguished the sect.

**Strange, James Stanley, Baron:** *see* Derby, James Stanley, 7th Earl of.

**strange particle,** subatomic particle, either a meson or baryon, that contains a strange quark (*q.v.*).

**Strangford Lough,** Irish LOCH CUAN, inlet of the Irish Sea between Ards and Down districts, Northern Ireland. The lough (lake) is about 16 miles (26 km) long and 4 miles (6 km) wide, with a very narrow entrance, which cuts across the northeast-southwest trend of the rocks in the area. The edges of the lough are characterized by many drumlins, or long oval mounds, which are also seen in submerged form in the lough. Strangford Lough afforded sheltered entry to northeastern Ireland from early times, and there is plentiful evidence of old settlements around its shores.

**Strangford Treaty** (1810), agreement between the Portuguese government, then in exile in its Brazilian colony, and Great Britain, represented by its ambassador, Lord Strangford. The treaty provided for the importation of British manufactures into Brazil and the exportation of Brazilian agricultural produce to Great Britain; also, British naval vessels were allowed to be resupplied in Brazilian ports, British Protestants were given freedom of worship in Brazil, and cases involving British subjects resident in Brazil were to be tried only before judges appointed by the British crown. The treaty gave Britain the sole right to these commercial privileges in Brazil. Its initial effects on Brazilian manufacturing were deleterious, although it contributed in the long run to the nation's commerce.

**strangles,** horse disease caused by *Streptococcus equi,* a bacterium that invades nasal and throat passages and forms abscesses in lymph nodes and other parts of the body. It is one of a group of diseases called distemper of horses. Young horses are most susceptible to it, and outbreaks of the disease usually occur where a number of horses are stabled. Mortality is low. Treatment includes complete rest and antibiotic therapy. Isolation of infected animals and rigid sanitation of quarters help reduce the spread of the disease. Preventive preparations are used but are not always effective.

**Stranitzky, Joseph Anton** (b. 1676, Graz?, Austria—d. May 19, 1726, Vienna), actor and manager of the indigenous Austrian popular theatre, who developed the improvisational character Hanswurst.

Stranitzky began his career as an itinerant puppeteer. After his arrival in Vienna (*c.* 1705) he formed his own company, which performed burlesques and farces in German, often based on Italian libretti. By 1711 he and his troupe had become so popular that they were allowed to take possession of Vienna's newly constructed Kärntnertor theatre that same year, thus making it the first permanent home of German-language comedy.

Stranitzky's success rested in large part on his portrayal of Hanswurst, the sly, knowing, Viennese servant character he adopted and modified to provide opportunity for improvised comedy within vernacular, coarsely humorous plays called *Haupt und Staatsaktionen* ("chief and state plays"). Fourteen of these plays attributable to Stranitzky still exist; they reveal how he adapted opera libretti for his materials. A year before his death, Stranitzky called Gottfried Prehauser to Vienna to portray Hanswurst and manage the company, but the character was already so popular that it had been copied, costume and all, by comedians throughout Austria and Germany. Hanswurst was further modified by Franz Schuch at midcentury but disappeared with the decline in popularity of improvised comedy at the end of the 18th century.

**Straparola, Gianfrancesco** (b. *c.* 1480, Caravaggio, duchy of Milan [Italy]—d. after 1557), Italian author of one of the earliest and most important collections of traditional tales.

Straparola's *Piacevoli notti* (1550–53; *The Nights of Straparola*) contains 75 novellas (short prose tales) that were later used as source material by William Shakespeare, Molière, and others; it introduced into European literature 20 folktales, among them "Beauty and the Beast" and "Puss in Boots." Straparola's tales, drawn from many sources, soon became famous throughout Europe. Using a technique borrowed from Boccaccio's *Decameron,* Straparola set his stories within a frame. Each one is told on a successive night by a party of men and women relaxing at Murano, a suburb of Venice. Little is known of Straparola's personal life.

**strapwork,** decorative motif, in flat relief, consisting variously of interlaced scrollwork, braiding, shield forms, or cross-hatching, often pierced with circular or oval holes. At times strapwork is bordered with a raised fillet (band). The whole design is usually formed



Strapwork, ceiling of the Long Gallery, Blickling Hall, Norfolk, England, 1626
A.F. Kersting

of connected units, all on the same plane, as though made by an elaborately cut and pierced strap that has been applied to a flat surface. Strapwork is usually done in wood, metal, or plaster, although stone has been used occasionally, as in the Salzhaus at Frankfurt am Main (late 16th century).

Strapwork developed from the flat scrolls common in Islamic metalwork. It was used extensively in the 16th and early 17th centuries and was a characteristic form of Mannerist decoration. In Flanders, the Netherlands, and Germany, strapwork was most fully developed. In fact, in the architectural ornamentation and furniture of the Low Countries, it was often the only type of ornament used. Strapwork was introduced into England in the late 16th century by Flemish and German woodworkers, and it was made popular in 18th-century French decoration by Jean Berain, court designer to Louis XIV.

**Strasberg, Lee** (b. Nov. 17, 1901, Budzanów, Pol., Austria-Hungary [now Budzanov, Ukraine]—d. Feb. 17, 1982, New York, N.Y., U.S.), theatre director, teacher, and actor, known as the chief American exponent of "method acting," or the Stanislavsky method (*q.v.*), in which the actor is encouraged to use his emotional experience and memory in preparing to "live" a role.

Strasberg's family emigrated to the United States when he was seven, and he grew up on the Lower East Side of New York City. By the age of 15 he had begun acting in plays at the Christie Street Settlement House. He later took lessons at the American Laboratory Theatre, whose instructors, Richard Boleslavski and Maria Ouspenskaya, had studied in Moscow under Konstantin Stanislavsky. Strasberg began his professional career, as actor and stage manager, in the 1920s with the Theatre Guild. In 1931 he joined with Harold Clurman and Cheryl Crawford to form the Group Theatre, which for 10 years staged a number of brilliant experimental plays, including the Pulitzer Prize-winning *Men in White* (1934).

From 1941 to 1948 Strasberg was in Hollywood for what he later called "an unfruitful but nevertheless educational experience." In 1948 he was back in Manhattan, having joined the Actors Studio, Inc., which had been founded the previous year by Elia Kazan, Cheryl Crawford, and Robert Lewis, all former associates of the Group Theatre. Strasberg was artistic director of the Actors Studio from 1948 until his death, over the years counseling such students in "The Method" as Julie Harris, Geraldine Page, Marlon Brando, Anne Bancroft, Rod Steiger, Eli Wallach, Patricia Neal, Sidney Poitier, Dustin Hoffman, and Robert DeNiro and developing such noted plays as *A Hatful of Rain*, *Any Wednesday*, and *The Night of the Iguana*.

Strasberg made his film acting debut in *The Godfather, Part II* (1974) and subsequently appeared in *The Cassandra Crossing* (1977), *And Justice for All* (1979), *Boardwalk* (1979), and *Going in Style* (1979).

**Strasbourg,** German STRASSBURG, city, capital of Bas-Rhin *département*, Alsace *région*, eastern France. It lies 2.5 miles (4 km) west of the Rhine River on the Franco-German frontier.

Besides its traditional role as the chief city of Alsace, Strasbourg is also the seat of the Council of Europe, an episcopal see, a university town, and an international communications centre. The river port, which lies east of the city on the Rhine River, is connected with the Rhône and the Marne rivers by canals. It is one of the main French grain ports and also handles fuel oil, food, and industrial products. Strasbourg became an industrial centre after World War II with petroleum refineries, metallurgical works, and food-processing plants. It is traversed by the Ill River, which divides to form an island on which the old town and most of the famous buildings are situated.

Strasbourg's 11th–15th-century Cathedral of Notre-Dame, damaged in 1870 and in World War II, has been carefully restored. Built of red Vosges sandstone, it is a harmonious edifice despite the variety of its architectural styles. It has an asymmetrical facade (mainly 13th century) with fine sculptured portals and only one tower, which has a tall (455 feet [139 m]) and graceful 15th-century spire. Some of the cathedral's sculptures, together with vestiges from other old French churches, are exhibited in the Maison de l'Oeuvre Notre-Dame, next to the cathedral.

The 18th-century Château des Rohan, a former episcopal palace, houses three museums. The district called La Petite France has very well-preserved old streets with wooden houses, as well as some picturesque canals.

The city was originally a Celtic village, and under the Romans it became a garrison town called Argentoratum. It was captured in the 5th century by the Franks, who called it Strateburgum, from which the present name is derived. In 842 Charles II the Bald, king of the West Franks, and Louis I the German, king of the East Franks, took an oath of alliance there, the Serment de Strasbourg, a text of which is the oldest written document in Old French. After a struggle for power between its citizens and the bishops in the European Middle Ages, Strasbourg became a free city within the Holy Roman Empire.



Château des Rohan, Strasbourg, Fr.
Art Resource

It was mainly Protestant after the Reformation but cautiously avoided the religious conflicts of the Thirty Years' War (1618–48). In 1681 Louis XIV of France seized the city in peacetime and obtained ratification for his arbitrary action by the Treaty of Rijswijk (1697). The town retained its privileges until the French Revolution. In 1792 Rouget de Lisle, a French poet, musician, and soldier, composed in Strasbourg the anthem of the Rhine Army, since known as "La Marseillaise." In the Franco-German War (1870–71) the Germans captured Strasbourg after a 50-day siege and annexed it. The city reverted to France after World War I. It was occupied by Germany again (1940–44) during World War II. The city gained international status with the opening there in 1979 of the European Assembly, representing electorates in the member countries of the European Economic Community. Pop. (1990) 252,338.

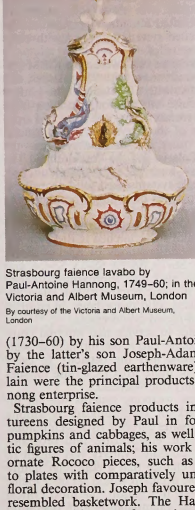
**Strasbourg I, II, and III, Universities of,** French UNIVERSITÉS DE STRASBOURG I, II, AND III, autonomous state-financed institutions of higher learning in Strasbourg, Fr., established in 1970 under France's 1968 Orientation Act, reforming higher education, as successors to the former University of Strasbourg. The original university was founded by Protestants in 1537 as a German gymnasium (secondary school for the study of the classics) when Strasbourg was under German rule. The gymnasium became an academy in 1566 and a university in 1621.

The school was influenced from its beginning by the Protestant Reformation and subsequently by the continuing struggle between France and Germany for control of the province of Alsace. Along with Strasbourg itself, the university passed into French hands in 1681. It was suppressed in 1792 during the French Revolution and was succeeded in the early 19th century by various schools and faculties that were loosely consolidated into a new university. After the Franco-German War ended in 1871, France ceded Strasbourg to Germany and the university was reorganized, becoming the Emperor William University of Strasbourg (1872–1918). In 1919 the city again came under French control and the university was reestablished as an autonomous French university. From 1939 to 1945, during the German occupation of World War II, the school's faculties were moved to Clermont Ferrand University in central France, then back to Strasbourg in 1945.

Johannes Sturm (1507–89), the principal founder, directed the Strasbourg Gymnasium for more than 40 years. His method of graded courses of studies shaped secondary school programs throughout Europe. Johann Wolfgang von Goethe completed law studies at Strasbourg in 1771, and Louis Pasteur was a professor of chemistry there. Albert Schweitzer studied medicine there from 1905 to 1913.

The modern universities are composed of a number of teaching and research units, each having administrative and academic independence. Louis Pasteur University (Strasbourg I) is the school of medicine and sciences, with related research centres and an observatory. The University of Human Sciences (Strasbourg II) has units of languages and letters, philosophy and theology (both Roman Catholic and Protestant), and supplementary research centres. Strasbourg III is the University of Juridical, Political, and Social Sciences.

**Strasbourg ware,** pottery made mostly in Strasbourg, Fr., under the direction of members of the Hannong family from 1721 to 1780. The factory was founded by Charles-François Hannong and was later administered



Strasbourg faience lavabo by Paul-Antoine Hannong, 1749–60; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London

(1730–60) by his son Paul-Antoine and then by the latter's son Joseph-Adam (1762–80). Faience (tin-glazed earthenware) and porcelain were the principal products of the Hannong enterprise.

Strasbourg faience products included large tureens designed by Paul in forms such as pumpkins and cabbages, as well as naturalistic figures of animals; his work ranged from ornate Rococo pieces, such as clock cases, to plates with comparatively unsophisticated floral decoration. Joseph favoured vessels that resembled basketwork. The Hannongs were early practitioners of overglaze painting in France, and Strasbourg colour schemes were often dominated by an intense carmine.

The development of porcelain production at the Hannong factory owed much to the arrival in 1753 of Johann Jakob Ringler, who had learned the secret of making porcelain at Vienna. Because the royal factory of Sèvres in 1753 prohibited porcelain making at other French factories, Paul Hannong moved his porcelain enterprise to Frankenthal, Ger., in 1755. The prohibition being relaxed in 1766, Paul's son Joseph resumed making porcelain at Strasbourg. He did not prosper, however, and in 1780 he fled because of debt.

**Strasburger, Eduard Adolf** (b. Feb. 1, 1844, Warsaw, Pol., Russian Empire [now in Poland]—d. May 18, 1912, Bonn, Ger.), German plant cytologist who elucidated the process of nuclear division in the plant kingdom.

Strasburger was educated at the universities of Paris, Bonn, and Jena, where he received a Ph.D. in 1866. He taught at the universities of Warsaw (1868), Jena (1869–80), and Bonn (1880–1912). Strasburger's earliest research was a continuation of the work begun by the German botanist Wilhelm Hofmeister on the alternation of generations. Strasburger was the first to provide an accurate description of the embryonic sac in gymnosperms (such as conifers) and angiosperms (the flowering plants) along with a demonstration of double fertilization in the angiosperms. He set forth the basic principles of mitosis in his *Über Zellbildung und Zelltheilung* (1876; "On Cell Formation and Cell Division"), and in each succeeding edition he clarified and modified the description of the process until in the third edition (1880) he enunciated one of the modern laws of plant cytology: that new nuclei can arise only from the division of other nuclei. In 1882 he devised the terms cytoplasm and nucleoplasm to describe the cell body and nucleus, respectively. Next, he showed that during fertilization in the flowering plants the nucleus is the primary structure concerned in heredity. In 1888 he established that the nuclei of the germ cells of angiosperms undergo meiosis—*i.e.,* a reduction division yielding nuclei with half the number of chromosomes of the original nuclei.

Strasburger's later work on the upward movement of sap proved that the process is physical rather than physiological. With other outstanding botanists, he wrote *Lehrbuch der Botanik* (1894; "Textbook of Botany").

**Strassburg** (city, France/Germany): *see* Strasbourg.

**Strassburg, Gottfried von** (poet): *see* Gottfried von Strassburg.

**Strasser, Gregor; and Strasser, Otto** (respectively b. May 31, 1892, Geisenfeld, Ger.—d. June 30, 1934, Berlin; b. Sept. 10, 1897, Windsheim, Ger.—d. Aug. 27, 1974, Munich), brothers who occupied leading positions in the National Socialist German Workers' (Nazi) Party during its formative period. Their leftist leanings and opposition to Adolf Hitler caused their downfall shortly before Hitler's accession to power.

The brothers were born into a Bavarian middle-class family. Gregor joined the fledgling Nazi Party in 1920, and in 1923 he participated in Hitler's Munich (Beer Hall) Putsch; during Hitler's subsequent imprisonment, he came to head the outlawed party. Gregor was an effective public speaker and gifted organizer, and after Hitler's release he took over the party organization in northern Germany, was elected to the Reichstag (federal lower house), and soon built a mass movement with the help of his brother Otto and the young Joseph Goebbels. The Strasser brothers appealed to the lower-middle classes and the proletariat by advocating a socialism couched in nationalist and racist terminology; the Nazi gains at the polls after 1928 were partly due to their efforts. Otto, however, became disillusioned with Hitler when he began to realize that the National Socialist German Workers' Party, as it was evolving under Hitler's leaderhip, was becoming neither socialist nor a party of the workers. After Hitler began forming alliances with Germany's industrial magnates in return for their financial support, Otto left the party (1930) and organized the Schwarze Front (Black Front).

Gregor, on the other hand, remained with Hitler and, by the early 1930s, was head of the Nazi political organization and second only to Hitler in power and popularity. As leader of the party's left wing, however, he opposed Hitler's courting of big business as well as his anti-Semitism and instead favoured radical social reforms along socialist lines. He finally resigned his party offices in 1932. Hitler was able to avert large-scale losses in membership after Strasser's defection, and, after Hitler's accession to the chancellorship, the brothers lost almost all their influence. Gregor was murdered on Hitler's orders during the Röhm purge of 1934. Otto managed to escape and went into exile. He finally settled in Canada. Returning to Germany in 1955, he failed in an attempt to reenter politics.

**Strassmann, Fritz** (b. Feb. 22, 1902, Boppard, Ger.—d. April 22, 1980, Mainz, W.Ger.), German physical chemist who, with Otto Hahn, discovered neutron-induced nuclear fission in uranium (1938) and thereby opened the field of atomic energy.

Strassmann received his Ph.D. from the Technical University in Hannover in 1929. He helped develop the rubidium-strontium method of dating widely used in geochronology. Beginning in 1934 he joined Hahn and Lise Meitner in their investigations of the radioactive products formed when uranium is bombarded by neutrons. Strassmann's mastery of analytic chemistry contributed to the team's recognition of the lighter elements produced from neutron bombardment, which were the result of the splitting of the uranium atom into two lighter atoms.

After serving briefly on the staffs of the Hannover and Kaiser Wilhelm institutes (destroyed in 1944), Strassmann in 1946 became professor of inorganic and nuclear chemistry at the University of Mainz, where he established the Institute of Inorganic Chemistry (later the Institute of Nuclear Chemistry). From 1945 to 1953 he was director of the chemistry department at the Max Planck Institute for Chemistry.

**Strategic Arms Limitation Talks** (SALT), negotiations between the United States and the Soviet Union that were aimed at curtailing the manufacture of strategic missiles capable of carrying nuclear weapons. The first agreements, known as SALT I and SALT II, were signed by the United States and the Union of Soviet Socialist Republics in 1972 and 1979, respectively, and were intended to restrain the arms race in strategic (long-range or intercontinental) ballistic missiles armed with nuclear weapons. First suggested by U.S. President Lyndon B. Johnson in 1967, strategic arms limitation talks were agreed on by the two superpowers in the summer of 1968, and full-scale negotiations began in November 1969.

Of the resulting complex of agreements (SALT I), the most important were the Treaty on Anti-Ballistic Missile (ABM) Systems and the Interim Agreement and Protocol on Limitation of Strategic Offensive Weapons. Both were signed by President Richard M. Nixon for the United States and Leonid Brezhnev, general secretary of the Soviet Communist Party, for the U.S.S.R. on May 26, 1972, at a summit meeting in Moscow.

The ABM treaty regulated antiballistic missiles that could theoretically be used to destroy incoming intercontinental ballistic missiles (ICBMs) launched by the other superpower. The treaty limited each side to only one ABM deployment area (*i.e.,* missile-launching site) and 100 interceptor missiles. These limitations prevented either party from defending more than a small fraction of its entire territory, and thus kept both sides subject to the deterrent effect of the other's strategic forces. The ABM treaty was ratified by the U.S. Senate on Aug. 3, 1972. The Interim Agreement froze each side's number of ICBMs and submarine-launched ballistic missiles (SLBMs) at current levels for five years, pending negotiation of a more detailed SALT II. As an executive agreement, it did not require U.S. Senate ratification, but it was approved by Congress in a joint resolution.

The SALT II negotiations opened late in 1972 and continued for seven years. A basic problem in these negotiations was the asymmetry between the strategic forces of the two countries, the U.S.S.R. having concentrated on missiles with large warheads while the United States had developed smaller missiles of greater accuracy. Questions also arose as to new technologies under development, matters of definition, and methods of verification.

As finally negotiated, the SALT II treaty set limits on the number of strategic launchers (*i.e.,* missiles that can be equipped with multiple independently targetable reentry vehicles [MIRVs]), with the object of deferring the time when both sides' land-based ICBM systems would become vulnerable to attack from such missiles. Limits were put on the number of MIRVed ICBMs, MIRVed SLBMs, heavy (*i.e.,* long-range) bombers, and the total number of strategic launchers. The treaty set an overall limit of about 2,400 of all such weapons systems for each side. The SALT II treaty was signed by President Jimmy Carter and Brezhnev in Vienna on June 18, 1979, and was submitted to the U.S. Senate for ratification shortly thereafter. But renewed tensions between the superpowers prompted

Carter to remove the treaty from Senate consideration in January 1980, after the Soviet Union's invasion of Afghanistan. The United States and the Soviet Union voluntarily observed the arms limits agreed upon in SALT II in subsequent years, however. Meanwhile, the renewed negotiations that opened between the two superpowers in Geneva in 1982 took the name of Strategic Arms Reduction Talks (*q.v.*), or START.

**Strategic Arms Reduction Talks** (START), negotiations between the United States and the Soviet Union that were aimed at reducing those two countries' arsenals of nuclear warheads and of the missiles and bombers capable of delivering such weapons. The START negotiations were successors to the Strategic Arms Limitation Talks of the 1970s. In resuming strategic-arms negotiations with the Soviet Union in 1982, U.S. President Ronald Reagan renamed the talks START and proposed radical reductions, rather than merely limitations, in each superpower's existing stocks of missiles and warheads. After a hiatus during 1983–85, START negotiations resumed in the latter year and culminated in July 1991 with a comprehensive strategic arms-reduction agreement agreed to by U.S. President George Bush and Soviet leader Mikhail Gorbachev. The treaty called for the Soviets to reduce their arsenal of nuclear warheads and bombs from about 11,000 to 8,000 (a reduction of 25 percent), while the United States would reduce its stocks of such weapons from about 12,000 to 10,000 (a 15-percent reduction). Reductions were specifically mandated for the numbers of strategic missiles, heavy bombers, and mobile launchers that each side could have. After the collapse of the Soviet Union, negotiations between the United States and Russia, Ukraine, Belarus, and Kazakhstan led to a supplementary agreement, signed on May 23, 1992, by which the parties pledged to adhere to the 1991 treaty and by which Ukraine, Belarus, and Kazakhstan agreed to either destroy their strategic nuclear warheads or turn them over to Russia.

**Strategic Defense Initiative** (SDI), byname STAR WARS, proposed U.S. strategic defensive system against potential nuclear attacks—as originally conceived, from the Soviet Union. The SDI was first proposed by President Ronald Reagan in a nationwide television address on March 23, 1983. Because parts of the defensive system that Reagan advocated would be based in space, the proposed system was dubbed "Star Wars," after the space weaponry of a popular motion picture of the same name.

The SDI was intended to defend the United States from attack from Soviet intercontinental ballistic missiles (ICBMs) by intercepting the missiles at various phases of their flight. For the interception, the SDI would require extremely advanced technological systems, yet to be researched and developed. Among the potential components of the defense system were both space- and earth-based laser battle stations, which, by a combination of methods, would direct their killing beams toward moving Soviet targets. Air-based missile platforms and ground-based missiles using other nonnuclear killing mechanisms would constitute the rear echelon of defense and would be concentrated around such major targets as U.S. ICBM silos. The sensors to detect attacks would be based on the ground, in the air, and in space and would use radar, optical, and infrared threat-detection systems.

Though initial funding for the SDI had been approved by the U.S. Congress by the mid-1980s, the program aroused a heated debate among both arms experts and public officials over its military and political implications and its technical feasibility. Proponents of the SDI asserted that the overwhelming technological obstacles to its implementation could eventually be overcome and that an effective defensive system would deter potential Soviet attacks. Critics of the program argued variously that the scheme was unworkable, that it encouraged a further arms race, and that it undermined established arms-control agreements and weakened the prospects for further arms-control agreements. Testing continued on a number of SDI-related devices, but the breakup of the Soviet Union in 1991 changed the conditions of such defense.

**strategic weapons system,** any weapons system designed to strike an enemy at the source of his military, economic, or political power. In practice, this means destroying a nation's cities, factories, military bases, transportation and communications infrastructure, and seat of government. Strategic weapons systems use atomic or thermonuclear devices, because only these weapons have sufficient explosive power to destroy, with relative ease and quickness, the entire war-making capability of a large nation. The term strategic weapons system refers not merely to the explosive devices themselves but rather to the complex delivery systems that enable these warheads to reach their targets. Indeed, the distinguishing feature of a strategic weapons system is its ability to deliver thermonuclear warheads accurately from one continent to another.

Strategic weapons systems can consist of any of the following delivery systems: intercontinental ballistic missiles (ICBMs), that is, missiles having a range exceeding 3,500 miles (5,630 km); some intermediate-range ballistic missiles (IRBMs), that is, missiles having a range between 600 and 3,500 miles (965 and 5,630 km); submarine-launched ballistic missiles, which are in effect IRBMs or ICBMs launched from submarines; and cruise missiles, which are shorter-range missiles that can be launched from aircraft, ships, or submarines and can thereby reach strategic distances. All these delivery systems carry thermonuclear warheads. Another important strategic weapons system is that of long-range heavy bombers, or strategic bombers, which can fly intercontinental distances and drop free-fall bombs or launch cruise missiles, both thermonuclear-armed.

The considerations involved in managing the storage, maintenance, and accurate delivery of these weapons are numerous. The missile itself requires maintenance and security of its propulsion system and propellant; its internal guidance system; its on-board computer, if any; and its payload, the reentry vehicle (RV) or warhead. If it carries a cluster of multiple independently targeted RVs (MIRVs), then the risk is multiplied. In addition, the silo in which each missile is mounted—or the submarine or airplane, and, if the latter, its base—and its readiness to function when needed are concerns, as are the up-to-dateness of the target that each RV is programmed to hit, the launch-control procedure, and the intricate communications web that holds the system together.

Five countries—the United States, Russia (heir to the Soviet Union), China, the United Kingdom, and France—operated such systems in the late 20th century, but only the first two maintained missile arsenals large enough to require strategic weapons systems of extreme complexity.

In the late 20th century, Western knowledge of the strategic weapons system of China was limited. At least 60 IRBMs were known to be stationed in western China, and small numbers of ICBMs were known to exist. The Chinese also possessed a type of submarine-launched ballistic missile (SLBM). France maintained two strategic systems in the late 20th century. One was built around a two-stage, solid-fueled IRBM carrying a thermonuclear warhead. The other was based on a submarine-launched IRBM with three solid-propellant stages. The United Kingdom operated a submarine-launched system equipped with older U.S. Polaris missiles.

The United States had two active ICBM systems—the Minuteman, with 950 missiles, and the newer MX, with 50 missiles. The United States had cruise missiles for launching from submarines, surface ships, and land and from the bombers of the Strategic Air Command (SAC). The other U.S. missile systems—the obsolescent Polaris, and the Poseidon and Trident systems—were all submarine-launched. All U.S. missile systems used solid propellant. SAC had two types of strategic bombers, the B-52 and the newer B-1.

In the late 20th century, Russia maintained numerous major silo-launched ICBM systems, with the U.S. designations of SS-11, SS-16, SS-17, SS-18, SS-19, SS-20, SS-23, SS-24, and SS-25. Russia also had submarine-launched systems and strategic bombers. The latest Soviet ICBMs used solid propellants, in contrast to their liquid-fueled predecessors.

Many missiles in service had internal computers; all could carry thermonuclear warheads; and most had the capacity to carry from 3 to 14 or more MIRVs. Cruise missiles could carry only one warhead.

Each of these weapons systems was an intricate network of communications among people and missiles carrying hydrogen bombs. Elaborate design, engineering, and programming of the "fail-safe" variety was meant to minimize the chance that a computer failure or some simple accident would set off a major catastrophe. For this reason, the most critical concern in the maintenance and operation of strategic weapons systems was to provide certain and secure communication between civil and military commanders and to provide "backup" computer and other facilities wherever failure of a component could have lethal consequences.

**strategus,** plural STRATEGI, Greek STRATĒGOS, plural STRATEGOI, in ancient Greece, a general, frequently functioning as a state officer with wider functions; also, a high official in medieval Byzantium.

An annual board of 10 strategi was introduced in Athens during the reorganization of the tribal system under Cleisthenes (*c.* 508 BC), each of the 10 tribal units being represented in the army by a *taxis* ("regiment") led by a strategus. At the Battle of Marathon in 490, the 10 strategi formed a council, which advised the polemarch. After 487, when the archons ceased to be chosen by lot, the polemarch was superseded by the strategi as commander of the army, and the command of the *taxeis* passed to taxiarchs subordinate to them. Usually several strategi were assigned to a particular operation; sometimes one strategus alone received command of a small-scale campaign, and occasionally all 10 may have been employed on a major undertaking. When more than one strategus shared command of a campaign, they were in law equal, and any predominance that one of them may have exercised depended on his personal qualities.

In the 5th century the strategi exercised political influence, especially in foreign affairs. They may have had special rights of access to the Boule (council), which prepared the agenda for the Ecclesia (assembly). Sometimes they conducted negotiations with foreign states, but treaties needed ratification by the Ecclesia. They were often included among the officers required to swear to treaties on behalf of the state. The importance of the office was further enhanced by two aspects: it was elective, as opposed to the magistracies filled by lot, and allowed the strategi indefinite re-election. Men commanding public confidence could thus establish themselves in consider-

able power, owing to the continuity and time afforded by the office.

In Hellenistic Greece the strategi became supreme magistrates in most federations and leagues (*e.g.*, the Achaean and Aetolian). Alexander the Great and his generals and the Macedonian kings also appointed officers with this title. Strategi as civil governors of nomes—having almost completely lost their military character—appeared in Egypt in the 3rd century BC and continued under Roman rule until the 4th century AD.

*Where the same name may denote a person, place, or thing, the articles will be found in that order*

**strategy,** in warfare, the science or art of employing all the military, economic, political, and other resources of a nation to achieve the objects of war. This is the modern meaning, reflecting the need for general military and economic mobilization for warfare. In the 18th and early 19th centuries, however, when the term first became current, strategy denoted the art of projecting and directing campaigns and the movements and dispositions of military forces in war.

A brief treatment of strategy follows. For full treatment, *see* MACROPAEDIA: War, Theory and Conduct of.

Strategy has traditionally been distinguished from tactics in the following ways: (1) strategy deals with the entire theatre of war and the use of battles to win war, whereas tactics is concerned primarily with the use of troops and equipment to win battles, and (2) tactics is concerned with the handling of troops on the battlefield, whereas strategy deals with the favourable positioning of those troops as a prelude to battle.

Although such great historical generals as Alexander the Great, Hannibal, and Julius Caesar have been singled out as forerunners of the modern art of strategy in their farsighted and careful planning of campaigns, the foundations of the ancient art of warfare were tactics and battles. It was only with the growth of professional armies and the Napoleonic campaigns of the early part of the 19th century that the principles of modern strategy took shape. The operational strategies of Napoleon principally consisted of the concentration of all his forces against the enemy at a critical point, the careful preparation and the uniting of forces before the action to deliver an overpowering weight of striking power in a shock attack, and the selection of battlegrounds advantageous to his forces. All these strategies formed classic illustrations by which succeeding military scientists such as Carl von Clausewitz could identify the underlying principles of modern warfare. Clausewitz asserted that military and political strategy must go hand in hand and that victory in war was achieved by the destruction of the enemy's forces on the battlefield rather than by the mere occupation of territory. He also was the first to define strategy as the employment of battles to gain the end of war.

The American Civil War marked a transition to a new era of strategy; for example, the accurate firepower of the long-range infantry rifle shattered the effectiveness of the rapidly concentrated infantry attack in which Napoleonic strategy had culminated. The victory of the more populous and industrialized North over the agrarian South also revealed the growing strategic importance of economic and manpower resources in war.

Several schools of strategic thought arose in the late 19th and early 20th centuries, ranging from the emphasis by German military leaders on victory by decisive battle and skillful offensive action to the American Alfred Thayer Mahan's stress on the conduct of economic warfare by the application of sea power and its concomitant control of world trade. However, virtually all strategic doctrines of the time were confounded by the reality of World War I, in which the overwhelming firepower of such modern weapons as the machine gun and high-powered field artillery rendered classic military movements such as the frontal attack temporarily obsolete. Offensive warfare gave way to that of attrition and static defense, to the use of the naval blockade in an effort to starve the enemy and deny him vital raw materials, and to the systematic mobilization of a nation's total human and material resources in a prolonged effort to break the will and fighting ability of the enemy.

Between the world wars, strategic doctrines hovered uncertainly between the defensive mentality of the French and the growing numbers of proponents of such new weapons as airplanes and tanks. The latter were proved right in the initial campaigns of World War II, when the Germans combined air power and swiftly moving tank columns into a new form of assault (blitzkrieg) that overthrew defensive superiority. The countervailing Allied strategy utilized the proven effectiveness of the new mobile weapons and counted on superior industrial and manpower resources to turn the tide of battle. One important development of the war was the strategic bombardment of the enemy heartland from the air with the goal of destroying his industrial capacity and demoralizing his population. However, it was the final strategic (and tactical) innovation—the United States' use of atomic bombs on the Japanese cities of Hiroshima and Nagasaki—that fundamentally altered the premises of modern grand strategy. The subsequent development of even more powerful thermonuclear weapons and of intercontinental ballistic missiles capable of striking any target in the world within minutes endowed the prospect of general war with the near-certainty of the mutual annihilation of its participants. Thus, the main aim of the new nuclear strategy became not to win war (as had been the case with all previous military strategies) but simply to prevent the outbreak of nuclear war (deterrent strategy). Deterrence of a nuclear first strike by the enemy was ensured by the threat of massive retaliation on the part of the target nation. The ensuing postwar arms race between the superpowers represented their attempts to maintain the quantitative and technological balance of destructive capacity needed to deter successful nuclear aggression by one side.

**Stratemeyer, Edward** (b. Oct. 4, 1862, Elizabeth, N.J., U.S.—d. May 10, 1930, Newark, N.J.), American writer of popular juvenile fiction, whose Stratemeyer Literary Syndicate (1906–84) produced such books as the *Rover Boys* series, the *Hardy Boys* series, the *Tom Swift* series, the *Bobbsey Twins* series, and the *Nancy Drew* series.

Stratemeyer worked as a store clerk and, on the side, began writing stories in imitation of those of Horatio Alger and popular adventure writers, selling his first magazine story in 1888. In the following decade he became editor of *Good News* (1893–95), for which he wrote boys' stories, and of his own journal, *Bright Days* (1896). His first book, *Richard Dare's Venture,* appeared in 1894, the first in a series, and about 1896 he began writing concurrently several series, such as the *Rover Boys' Series for Young Americans,* beginning in 1899, and the *Boy Hunters Series,* beginning in 1906. Over the years he wrote hundreds of books and stories.

In 1906 he founded the Stratemeyer Literary Syndicate, which published various juvenile series, written by himself and others. (Any one series might have had several authors, all using the same pseudonym.) After his death in 1930, his company was largely directed by his daughter, Harriet Stratemeyer Adams (1893?–1982), who under pseudonyms wrote many of the novels in the *Nancy Drew, Dana Girls, Hardy Boys,* and *Bobbsey Twins* series. In 1984 the publisher Simon & Schuster acquired all rights to the Stratemeyer Literary Syndicate.

**Stratford,** city, seat (1853) of Perth county, southeastern Ontario, Canada. It lies along the Avon River in the heart of dairy-farming country. The settlement was founded during the winter of 1831–32 by William Seargeant (or Sargint), who erected the Shakespeare Hotel near the Avon; both the river and the settlement were originally called Little Thames, but both had received their present names by 1835, probably at the insistence of William Dunlop of the Canada (development) Company, to honour the birthplace of William Shakespeare, at Stratford-upon-Avon in England.



The Festival Theatre, Stratford, Ont.
Malak, Ottawa

The city is best known as the site of the Stratford Festival, held each summer since 1953; the festival's theatrical performances, particularly of plays by Shakespeare, were originally directed by Tyrone Guthrie and are held in the Festival Theatre (built 1957), the Avon Theatre (acquired 1964), and Third Stage (established 1971). Lake Victoria, the centre of Stratford's park system, was created in the early 20th century by damming the Avon for one of the city's numerous mills (for lumber, grain, and woolens). Railway repair shops, engineering industries, and light manufacturing combine with the arts and tourism to form the city's economic base. Inc. village, 1853; town, 1858; city, 1885. Pop. (1991) 27,666.

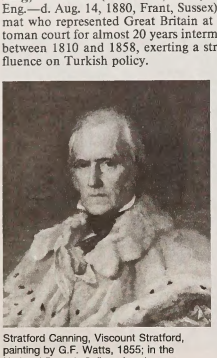
**Stratford** (England): *see* Stratford-on-Avon; Stratford-upon-Avon.

**Stratford,** town, Taranaki local government region, west-central North Island, New Zealand, on the Patea River. Land was set aside in 1877 for the town, which was constituted five years later. Gazetted a borough in 1898, it was originally known as Stratford-on-Patea in honour of William Shakespeare. Many of the local streets bear names of characters from his plays. Stratford is situated on the New Plymouth–Wanganui highway and rail line and is a market for lambs and cattle from upland stations. It is also a tourist centre for the Mount Egmont area to the west, lies on the natural-gas pipeline from the Kapuni fields to Auckland, and has various light industries. Pop. (1990 est.) 10,050.

**Stratford,** urban town ("township"), Fairfield county, southwestern Connecticut, U.S., on

the Long Island Sound and the Housatonic River, just east of Bridgeport. The original site was a Pequannock Indian tract called Cupheag (Harbour). European settlers arrived in 1639, and their settlement was named, in 1643, for either Stratford-upon-Avon or Stratford-le-Bow, in England. Confirmation of land titles and boundaries was granted by patent in 1685. Stratford has several pre-Revolutionary houses, including the David Judson House and Museum (1723). Early economic activities were shipbuilding and oyster fishing. Diversified manufactures now include aircraft engines, helicopters, industrial machinery, and machine tools. Pop. (1999 est.) 49,010.

**Stratford (de Redcliffe), Stratford Canning, Viscount** (b. Nov. 4, 1786, London, Eng.—d. Aug. 14, 1880, Frant, Sussex), diplomat who represented Great Britain at the Ottoman court for almost 20 years intermittently between 1810 and 1858, exerting a strong influence on Turkish policy.



Stratford Canning, Viscount Stratford, painting by G.F. Watts, 1855; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Stratford Canning was a cousin of George Canning, British foreign secretary (1807–09, 1822–27) and prime minister (1827), and, through the latter's aid, was educated at Eton College and at King's College, Cambridge. George Canning first enlisted him in the foreign service in 1807. As chargé d'affaires and de facto ambassador at Constantinople (1810–12), Stratford Canning helped to arrange the Treaty of Bucharest (May 28, 1812) between Turkey and Russia, thereby freeing Russian troops to resist a French invasion force led by Napoleon I. As minister to Switzerland (1814–18), he introduced a plan for a perpetually neutral Swiss confederation, which was approved (March 20, 1815) by the Congress of Vienna. He then served (1820–23) as minister to the United States.

During his service as ambassador in Constantinople in 1825–29 and in 1831, Canning was involved with the movement for Greek independence from Turkey. On his next embassies to Constantinople (1841–46, 1848–51), he became a close friend of the sultan Abdülmecid I and statesman Mustafa Reşid. Canning encouraged the Tanzimat, a program of limited Westernizing reforms for Turkey, and after 1848 he secured Turkish protection for Lajos Kossuth and other nationalist refugees from Hungary and Poland.

Created viscount in 1852, Canning was sent to Constantinople once more in 1853. He supported the sultan's resistance to Russia's attempts to increase its influence over Ottoman affairs but simultaneously tried, without success, to prevent the outbreak of the Crimean War, in which Britain sided with Turkey. After leaving Turkey in 1858, Canning lived in semiretirement. The peerage became extinct upon his death, his only son having predeceased him.

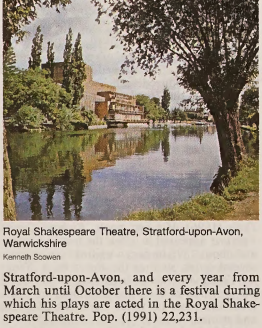
**Stratford-on-Avon,** district, county of Warwickshire, England. It is in the southern part of the county and occupies almost half of the county. Its best-known feature is the town of Stratford-upon-Avon, famous for its associations with William Shakespeare. The district is overwhelmingly rural. In the vicinity of Alcester, an old village of Roman origin, are several large country houses open to the public; they include Ragley Hall and Coughton Court. Area 377 square miles (977 square km). Pop. (1998 est.) 114,700.

**Stratford-upon-Avon,** also called STRATFORD, town ("parish"), Stratford-on-Avon district, county of Warwickshire, England, and the birthplace of William Shakespeare. It is a major British tourist centre because of its associations with Shakespeare.

Stratford-upon-Avon stands where a Roman road forded the River Avon, and a 19th-century bridge still spans the river alongside a 15th-century arched stone bridge. The first royal charter was granted in 1553. Stratford-upon-Avon, for centuries a country market town, became a busy tourist centre because of its special association with Shakespeare, who was born in 1564 in a half-timbered house on Henley Street. He attended the local grammar school adjoining the medieval Chapel of the Guild of the Holy Cross. In 1597 Shakespeare returned from London to the house known as New Place, where he died in 1616. His grave is in the parish church of Holy Trinity.

It was not until 1769—more than 150 years after the playwright's death, when the actor-producer David Garrick began the annual birthday celebrations—that an attempt was made to preserve buildings and other memorials of Shakespeare's life in the town.

By the river, the group of modern buildings known as the Shakespeare Centre includes a library and art gallery (opened in 1881) and a theatre (opened in 1932). April 23—the date of Shakespeare's death and, approximately, also of his birth—is celebrated annually in



Royal Shakespeare Theatre, Stratford-upon-Avon, Warwickshire

Kenneth Scowen

Stratford-upon-Avon, and every year from March until October there is a festival during which his plays are acted in the Royal Shakespeare Theatre. Pop. (1991) 22,231.

**Strathclyde,** in British history, native Briton kingdom that, from about the 6th century, had extended over the basin of the River Clyde and adjacent western coastal districts, the former county of Ayr. Its capital was Dumbarton, "fortress of the Britons," then known as Alclut. The name Strathclyde was not used until the 9th or 10th century.

Converted to Christianity in the early 6th century, the men of Strathclyde, in alliance with the Cumbrians, later in the century waged war against the still-pagan Anglo-Saxon kingdom of Bernicia (later part of the larger kingdom of Northumbria). In the 7th century, however, the Northumbrians established supremacy over the whole of Cumbria, but Strathclyde was not finally defeated until 756. Vikings overran and destroyed Dumbarton in 870, and, in the first half of the 10th century, Strathclyde became subject to the Anglo-Saxon kings of England, one of whom, Edmund I, in 945 leased it to Malcolm I, king of Scots. Thereafter, Strathclyde's destiny lay with the Scots. It became a province of Scotland after the death of its king Owain the Bald, who in 1016 (or possibly 1018) helped Malcolm II defeat the English at Carham.

**Strathclyde,** former administrative region of western Scotland. It was divided in 1996 into the council areas of Argyll and Bute, West Dunbartonshire, East Dunbartonshire, City of Glasgow, North Lanarkshire, South Lanarkshire, East Renfrewshire, Renfrewshire, Inverclyde, North Ayrshire, East Ayrshire, and South Ayrshire. "Strathclyde," the name of the ancient British kingdom that extended in pre-Anglian times far south into what is now northwestern England, was adopted in 1975 to designate the administrative region. It was dominated by Glasgow and its metropolitan area, but it included extensive rural areas, from the southern Inner Hebrides and Highlands of Argyllshire in the north to the Southern Uplands of Ayrshire and Lanarkshire in the south. Pop. (1995 est.) 2,283,700.

**Strathcona and Mount Royal (of Mount Royal and of Glencoe), Donald Alexander Smith, 1st Baron** (b. Aug. 6, 1820, Forres, Moray, Scot.—d. Jan. 21, 1914, London, Eng.), Canadian fur trader, financier, railway promoter, and statesman.

Smith was apprenticed to the Hudson's Bay Company in 1838 and worked for many years at the fur trade in Labrador. He served as chief commissioner for the company in Canada from 1870 to 1874, and, after becoming the principal shareholder, he was governor of the Hudson's Bay Company from 1889 to 1914.

Smith entered politics in 1870 as Conservative member for Winnipeg in the new Manitoba legislature. Becoming a member for Selkirk in the Canadian House of Commons in 1871, he withdrew his support of the Conservative leader Sir John Macdonald during the Pacific Scandal (1873), thus contributing to the defeat of the Conservative ministry. With his partners he successfully promoted the St. Paul, Minneapolis and Manitoba Railway, but because of Macdonald's antipathy he was not formally a member of the syndicate formed to build the Canadian Pacific Railway in 1880. Nevertheless, his financial support was vital to the enterprise, and he was accorded the honour of driving the last spike at Craigellachie, B.C., in 1885. He became president of the Bank of Montreal in 1887 and honorary president in 1905.

Defeated in Selkirk in 1880, he returned to Parliament in 1887 and remained until 1896, when he was appointed high commissioner for Canada in London. There he was knighted in 1886 and was granted a peerage in 1897 (revised 1900). His peerage passed to his only child, Margaret Charlotte Howard.

**Strathkelvin,** former district, former Strathclyde region, western Scotland. In 1996 most of the district was assigned to the new council area of East Dunbartonshire and the remainder to North Lanarkshire. The former district is situated to the northeast of Glasgow, and it includes the small industrial and residential burghs of Bishopbriggs and Kirkintilloch, which was the seat of the district authority,

and some farming country. Pop. (1989 est.) 89,420.

**stratification,** the layering that occurs in most sedimentary rocks and in those igneous rocks formed at the Earth's surface, as from lava flows and volcanic fragmental deposits. The layers range from several millimetres to many metres in thickness and vary greatly in shape. Strata may range from thin sheets that cover many square kilometres to thick lenslike bodies that extend only a few metres laterally.

Planes of parting, or separation between individual rock layers, are termed stratification planes. They are horizontal where sediments are deposited as flat-lying layers, and they exhibit inclination where the depositional site was a sloping surface. The bottom surface of a stratum roughly conforms to irregularities of the underlying surface; the stratification plane above the stratum, however, tends to be nearly horizontal.

Stratification in sedimentary rocks may result from changes in texture or composition during deposition; it also may result from pauses in deposition that allow the older deposits to undergo changes before additional sediments cover them. A sequence of strata, therefore, may appear as alternations of coarse and fine particles, as a series of colour changes resulting from differences in mineral composition, or merely as layers of similar aspect separated by distinct planes of parting. No direct relationship exists between the thickness and extent of strata and the rate of deposition or the time represented; for example, a stratum of limestone 2.5 cm (1 inch) thick may take longer to form than a stratum of sandstone 3 m (10 feet) in thickness. The most common cause of stratification is variation in the transporting ability of the depositing agent. Water and wind sort sediments according to size, weight, and shape of particles, and these sediments settle in layers of relative homogeneity. Differences in sediment composition resulting from different sources, and variation in sediment brought about by change in agents of deposition, also lead to stratification.

Where layers have been deformed, the record of past movements of the Earth's surface is preserved in the stratification, making possible the interpretation of geologic events and permitting such practical results as the location of mineral deposits, petroleum fields, and groundwater reservoirs.

Stratification in sedimentary rocks varies greatly both in degree of prominence and in details of structure. In general, it is best developed in fine-grained sediments and is least apparent and least persistent in coarse-grained materials such as conglomerates. Two important and distinctive structural types are recognized as characteristic of particular environments. These are cross-bedding, which is common in fluvial or eolian deposits, and graded bedding, which reflects transport by density (or turbidity) currents or, in certain cases, varved deposits.

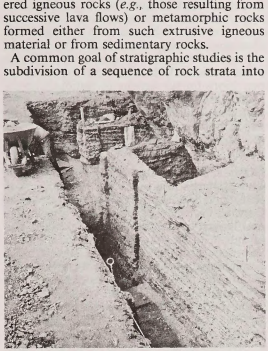
Stratification in volcanic rocks differs in some respects from that in sedimentary rocks. Fragmental volcanic material becomes sorted in flight under the influence of gravity, particle size, and wind. Falling to the ground, it may form well-sorted layers. If it falls into lakes or the sea, it becomes layered like any other waterborne detrital matter. Stratification also may result from successive flows of liquid lava or alternations between flows and ashfalls.

Not all sedimentary deposits are stratified. Those transported by ice alone, landslide deposits, and residual soils, for example, exhibit no stratification. Original stratification may be destroyed by plants or animals, by recrystallization of limestones, or by other disturbances subsequent to deposition.

**stratigraphy,** scientific discipline concerned with the description of rock successions and their interpretation in terms of a general time scale. It provides a basis for historical geology, and its principles and methods have found application in such fields as petroleum geology and archaeology.

Stratigraphic studies deal primarily with sedimentary rocks but may also encompass layered igneous rocks (*e.g.,* those resulting from successive lava flows) or metamorphic rocks formed either from such extrusive igneous material or from sedimentary rocks.

A common goal of stratigraphic studies is the subdivision of a sequence of rock strata into



Trench excavated in the floor of Veratic cave showing layers spanning nearly 10,000 years, near Birch Creek, Idaho

By courtesy of Idaho State University Museum; photograph, Lloyd Furniss

mappable units, determining the time relationships that are involved, and correlating units of the sequence—or the entire sequence—with rock strata elsewhere. Following the failed attempts during the last half of the 19th century of the International Geological Congress (IGC; founded 1878) to standardize a stratigraphic scale, the International Union of Geological Sciences (IUGS; founded 1961) established a Commission on Stratigraphy to work toward that end. Traditional stratigraphic schemes rely on two scales: (1) a time scale (using eons, eras, periods, epochs, ages, and chrons), for which each unit is defined by its beginning and ending points, and (2) a correlated scale of rock sequences (using systems, series, stages, and chronozones). These schemes, when used in conjunction with other dating methods—such as radiometric dating (the measurement of radioactive decay), paleoclimatic dating, and paleomagnetic determinations—that, in general, have been developed within the last half of the 20th century, have led to somewhat less confusion of nomenclature and to ever more reliable information on which to base conclusions about Earth history.

Because oil and natural gas almost always occur in stratified sedimentary rocks, the process of locating petroleum reservoir traps has been facilitated significantly by the use of stratigraphic concepts and data.

An important principle in the application of stratigraphy to archaeology is the law of superposition—the principle that in any undisturbed deposit the oldest layers are normally located at the lowest level. Accordingly, it is presumed that the remains of each succeeding generation are left on the debris of the last.

**Straton** OF LAMPSACUS, Straton also spelled STRATO, Latin STRATO PHYSICUS (d. *c.* 270 BC), Greek philosopher and successor of Theophrastus as head of the Peripatetic school of philosophy (based on the teachings of Aristotle). Straton was famous for his doctrine of the void (asserting that all substances contain void and that differences in the weight of substances are caused by differences in the extension of the void), which served as the theoretical base for the Hellenistic construction of air and steam engines as described in Hero of Alexandria's work. An orthodox Aristotelian, Straton tempered his master's interpretation of nature with an insistence on causality and materialism, denying any theological force at work in the processes of nature. Straton's writings as a whole are lost.

**stratosphere,** upper portion of the atmosphere, a nearly isothermal layer (layer of constant temperature) that is located above the troposphere. The stratosphere extends from its lower boundary of about 6 to 17 km (4 to 11 miles) altitude to its upper boundary (the stratopause) at about 50 km (30 miles). *See* atmosphere.

**Stratton, Charles,** pseudonym GENERAL TOM THUMB (b. Jan. 4, 1838, Bridgeport, Conn., U.S.—d. July 15, 1883, Middleboro, Mass.), midget showman who was the first major attraction promoted by the American circus impresario P.T. Barnum.

Born to parents of normal stature, Stratton ceased growing at the age of six months and remained 25 inches (0.6 m) tall, weighing 15 pounds, until his teens; he later grew to 40 inches (1 m) and 70 pounds. He was not quite five years old when Barnum hired him for his museum, but Barnum publicized him as General Tom Thumb, an 11-year-old dwarf from England; he quickly became a celebrated figure in the United States and abroad. In 1863 Stratton married Lavinia Warren (1841–1919), another of Barnum's midgets, in an elaborately staged ceremony in Grace Episcopal Church, New York City.

**Straus** FAMILY, Jewish-American immigrant family whose members prospered as owners of Macy's department store in New York City and distinguished themselves in public service and philanthropy. The Straus family originated in Otterberg, Bavaria (Germany), from which Lazaras Straus, the patriarch, emigrated in 1852. He settled at Talbotton, Ga., U.S., where he was joined by his wife and three sons, Isidor, Nathan, and Oscar Solomon.

During the American Civil War the family aided the Confederacy, but, following its defeat, they resettled in New York City. There they established L. Straus and Sons, a merchandising firm that in 1888 Isidor and Nathan parlayed into a part interest in R.H. Macy and Company. By 1896 they had acquired full ownership of the department store. Isidor served for a short time in the U.S. House of Representatives (1894–95) and in later years engaged in philanthropic works. He and his wife perished aboard the liner *Titanic* in 1912. Their son Jesse Isidor Straus became president of Macy's in 1919 and was succeeded in that office by his son Jack Isidor Straus, who served as company president from 1939 to 1956.

Nathan Straus gained distinction for his philanthropic efforts to improve the health and nutrition of needy children. His brother Oscar Solomon was the first Jewish U.S. Cabinet member and represented the United States in Turkey under three administrations.

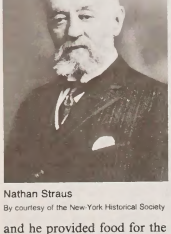
*Consult the* INDEX *first*

**Straus, Nathan** (b. Jan. 31, 1848, Otterberg, Bavaria [Germany]—d. Jan. 11, 1931, New York, N.Y., U.S.), an owner of Macy's department store in New York City and a pioneer in public health and child welfare; he has been considered the person who did the most for the city's welfare in the first quarter of the 20th century.

Straus first achieved prominence as a merchant, becoming in 1896 a co-owner with his brother Isidor Straus of R.H. Macy and Company. His philanthropic work began in the eco-

nomic depression of 1892 when he distributed food and coal in New York City and supplied pasteurized milk to young children in 36 American cities, thus lowering the infant mortality rate. By 1920 he had established 297 milk-distribution depots in the United States and abroad.

In 1909 Straus built the first tuberculosis preventorium for children in Lakewood, N.J.,



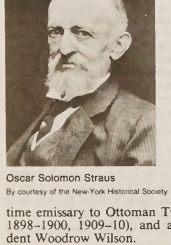
Nathan Straus
By courtesy of the New-York Historical Society

and he provided food for the poor during the harsh winter of 1914–15 in New York City. The last 20 years of his life, largely devoted to public-health work in Palestine, resulted in the building of two major health centres and many child-welfare stations.

**Straus, Oscar** (b. March 6, 1870, Vienna, Austria—d. Jan. 11, 1954, Bad Ischl), Austrian composer known for his operetta *The Chocolate Soldier*.

Straus studied in Vienna and with Max Bruch in Berlin and became a theatre conductor in Austria and Germany. He lived in Berlin until 1927 and in 1939 became a French citizen. He was in New York City and Hollywood between 1940 and 1948 and then returned to Europe. *Der tapfere Soldat* (1908; *The Chocolate Soldier*) was based on George Bernard Shaw's play *Arms and the Man.* Among his other operettas were *Ein Walzertraum* (1907; *A Waltz Dream*) and *Rund um die Liebe* (1914; *All Around Love*). He also composed the music for the motion picture *La Ronde* (1950).

**Straus, Oscar Solomon** (b. Dec. 23, 1850, Otterberg, Bavaria [Germany]—d. May 3, 1926, New York, N.Y., U.S.), the first Jewish U.S. Cabinet member (1906–09), three-



Oscar Solomon Straus
By courtesy of the New-York Historical Society

time emissary to Ottoman Turkey (1887–89, 1898–1900, 1909–10), and adviser to President Woodrow Wilson.

A brother of Nathan Straus, the philanthropist and owner of R.H. Macy & Company, a New York City department store, Oscar Straus represented the United States in Constantinople (now Istanbul) on two missions between 1887 and 1900. In 1902 he was appointed a member of the Permanent Court of Arbitration at The Hague, to which he was reappointed in 1908, 1912, and 1920.

In 1906 President Theodore Roosevelt named Straus secretary of commerce and labour, and three years later he was again sent to Turkey as its first U.S. ambassador. As a delegate representing the League to Enforce Peace to the Versailles Peace Conference in 1919, Straus aided President Wilson in the incorporation of provisions for the League of Nations into the Versailles Treaty and was active in advocating measures for the protection of Jewish minorities in Europe. His memoirs, *Under Four Administrations: From Cleveland to Taft,* were published in 1922.

**Strauss, David Friedrich** (b. Jan. 27, 1808, Ludwigsburg, Württemberg [Germany]—d. Feb. 8, 1874, Ludwigsburg), controversial German-Protestant philosopher, theologian, and biographer whose use of dialectical philosophy, emphasizing social evolution through the inner struggle of opposing forces, broke new ground in biblical interpretation by explaining the New Testament accounts of Christ mythologically.

Influenced during his studies at the universities of Tübingen and Berlin (1825–31) by the doctrine of G.W.F. Hegel, Strauss proposed a developmental theory of formative Christianity in which the interaction of inherent, conflicting forces and interpretations led to a higher religious synthesis. Such an analysis inspired his first major work, *Das Leben Jesu kritisch bearbeitet,* 2 vol. (1835–36; *The Life of Jesus Critically Examined*), in which he denied the historical value of the Gospels and rejected their supernatural claims, describing them as "historical myth," or the unintentionally created, legendary embodiment by 2nd-century writers of the primitive Christian community's popular hopes.

The ensuing furor among German Protestants prompted Strauss to mitigate his attack by commenting that such criticism did not essentially destroy Christianity, because all religions were based on ideas, not facts. This apology, however, did not avert his exclusion from further teaching either at Tübingen or at the University of Zürich, where, in 1839, he was debarred from a professorship he had been invited to assume.

In retirement from academic theological circles for more than 20 years, he resided in Ludwigsburg and Darmstadt, where he produced several biographies of political and intellectual figures and held political office as provincial legislator. His religious odyssey closed with the publication of *Der alte und der neue Glaube* (1872; *The Old Faith and the New*), in which he ventured to replace Christianity with scientific materialism, a personalized form of Darwinism. Criticized for an inadequate understanding of the biblical and theological sources he criticized, Strauss nevertheless not only influenced 20th-century liberal and eschatological schools of biblical thought but also challenged subsequent scholars with the search for the "historical Jesus."

**Strauss, Franz Josef** (b. Sept. 6, 1915, Munich, Ger.—d. Oct. 3, 1988, Regensburg, W.Ger.), German politician, longtime leader of the Bavarian Christian Social Union.

Strauss studied at the University of Munich and was an active member of a Roman Catholic youth organization that clashed with the Nazis of Adolf Hitler. Called up for military service in 1939, he was captured by U.S. forces near the end of World War II. After his release in 1945, he served as councillor to the Bavarian Ministry of the Interior and in 1946 was appointed deputy county director in the Schongau district by the American occupation authorities. Strauss helped found the Bavarian Christian Social Union (CSU) in 1945 and was elected to the Bundestag (Federal Parliament) in August 1949. After being reelected in September 1953, he was appointed minister without portfolio by Chancellor Konrad Adenauer. In 1955 he became minister for atomic affairs and deputy chairman of the Defense Council. In October 1956 Adenauer appointed him minister of defense. As defense minister until 1962, Strauss oversaw West Germany's rearmament and played a major role in building up the Bundeswehr (armed forces) and in acquiring tactical nuclear weapons.

Strauss's political future seemed enhanced when, in 1961, he became chairman of the CSU. He was involved in the "Spiegel Affair" of October 1962, when the editors of *Der Spiegel,* a weekly news magazine that had frequently criticized him, were arrested and their files seized on suspicion of treason for publishing an article about a NATO exercise. This police action so shook public opinion that Strauss had to resign from the Cabinet in December. He continued his leadership of the CSU, however, and returned to national office in 1966 as minister of finance, continuing in that position until the elections of 1969, which brought the coaligned Social Democratic Party (SPD) and the Free Democratic Party (FDP) to power.

Strauss's power in Bavaria was increased when he was elected premier of that *Land* (state) in November 1978, and in 1979 the opposition parties of the CSU and the Christian Democratic Union (CDU) nominated Strauss as their candidate for chancellor of West Germany in 1980. He was unsuccessful in his bid, however, because most voters considered his stance too far right of centre.

Strauss continued to criticize the domestic and foreign policies of Social Democratic chancellor Helmut Schmidt, who pursued his policy of *Ostpolitik* (improving West Germany's relations with eastern Europe in the spirit of détente). In the 1980s, however, he modified his stance and advocated greater economic contacts between western and eastern Europe. Strauss remained the leader of the CSU and premier of Bavaria until his death. The economic policies he pursued helped make Bavaria one of West Germany's most prosperous states.

Strauss was the author of *The Grand Design: A European Solution to German Reunification* (Eng. trans. 1965), *Herausforderung und Antwort* (1968; *Challenge and Response*), and *Finanzpolitik: Theorie und Wirklichkeit* (1969). Later works include *Deutschland Deine Zukunft* (1975; "Germany Your Future"), *Zur Lage* (1979; "Regarding Conditions"), and *Gebote der Freiheit* (1980; "Precepts of Freedom").

**Strauss, Johann,** THE ELDER (b. March 14, 1804, Vienna, Austria—d. Sept. 24, 1849, Vienna), one of the principal composers of Viennese waltzes.

Strauss became a viola player in the dance orchestra of Michael Pamer, a composer of light music. Later he conducted the orchestra of Josef Lanner and in 1826 performed at the gardens of the "Zwei Tauben" the *Täuberlwalzer,* the first of many sets of Viennese waltzes named for the places where they were first played.

He established his reputation as a composer of Viennese waltzes in 1830 by conducting at the "Sperl," a popular dance hall in the Leopoldstadt. There he was idolized to the extent of becoming known in the musical world as "the Austrian Napoleon." In 1834 he was appointed bandmaster to the 1st Vienna Militia Regiment and the following year was made director of the imperial court balls. He embarked in 1833 on the first of his many European tours, visiting London in 1838. Of his 18 marches, the *Radetzky March* became particularly popular.

Strauss's complete works, including—besides

waltzes—galops, polkas, quadrilles, and other dances, were published by his son Johann the Younger in 1889. His works are remarkable for their rhythmic verve and charm of melodic design, and they represent the style of Viennese dance music at its best.

Strauss's other sons, Josef (1827–70) and Eduard (1835–1916), became known as conductors, as did Eduard's son Johann. Josef was also a composer of waltzes.

**Strauss, Johann,** THE YOUNGER (b. Oct. 25, 1825, Vienna, Austria—d. June 3, 1899, Vienna), "the Waltz King," a composer famous for his Viennese waltzes and operettas.

Strauss was the eldest son of the composer Johann Strauss the Elder. Because his father wished him to follow a nonmusical profession, he started his career as a bank clerk. He



Johann Strauss the Younger, detail of a charcoal drawing by Leopold Horowitz, 1896

By courtesy of the Historisches Museum der Stadt Wien

studied the violin without his father's knowledge, however, and in 1844 conducted his own dance band at a Viennese restaurant. In 1849, when the elder Strauss died, Johann combined his orchestra with his father's and went on a tour that included Russia (1865–66) and England (1869), winning great popularity. In 1870 he relinquished leadership of his orchestra to his brothers, Josef and Eduard, in order to spend his time writing music. In 1872 he conducted concerts in New York City and Boston.

Strauss's most famous single composition is *An der schönen blauen Donau* (1867; *The Blue Danube*), the main theme of which became one of the best-known tunes in 19th-century music. His many other melodious and successful waltzes include *Morgenblätter* (1864; *Morning Papers*), *Künstlerleben* (1867; *Artist's Life*), *Geschichten aus dem Wienerwald* (1868; *Tales from the Vienna Woods*), *Wein, Weib und Gesang* (1869; *Wine, Women and Song*), *Wiener Blut* (1871; *Vienna Blood*), and *Kaiserwaltzer* (1888). Of his nearly 500 dance pieces, more than 150 were waltzes. Among his stage works, *Die Fledermaus* (1874; *The Bat*) became the classical example of Viennese operetta. Equally successful was *Der Zigeunerbaron* (1885; *The Gypsy Baron*). Among his numerous other operettas are *Der Karneval in Rom* (1873; *The Roman Carnival*) and *Eine Nacht in Venedig* (1883; *A Night in Venice*).

**Strauss, Joseph B(aermann)** (b. Jan. 9, 1870, Cincinnati, Ohio, U.S.—d. May 16, 1938, Los Angeles, Calif.), American civil engineer and builder of the Golden Gate Bridge, San Francisco.

After graduating from the University of Cincinnati in 1892, Strauss served a short apprenticeship as a draftsman, taught briefly, and became principal assistant to the bridge engineer Ralph Modjeski. He then founded his own engineering company, with offices in Chicago and San Francisco. Specializing in the design of movable bridges, he invented a type of bascule bridge (drawbridge) and a vertical-lift bridge.

In the early 1920s, when public opinion in San Francisco was beginning to favour a bridge over the Golden Gate (the entrance to San Francisco Bay), Strauss submitted a design proposal that was received with cautious enthusiasm, for the span length was more than double that of any existing bridge. He eventually modified his original concept of a combination suspension-cantilever into one of a simple suspension bridge with a main span of 4,200 feet (1,280 m). Completed in 1937, the Golden Gate Bridge remained the longest bridge in the world until construction of the Verrazano-Narrows Bridge, New York City, in the 1960s.

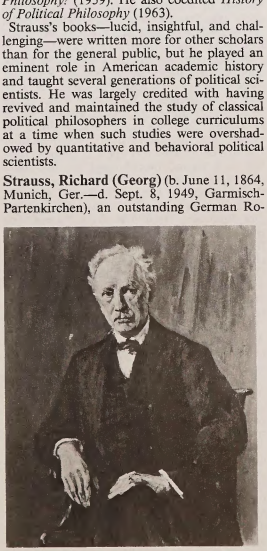
**Strauss, Leo** (b. Sept. 20, 1899, Kirhhain, Ger.—d. Oct. 18, 1973, Annapolis, Md., U.S.), German-born American political philosopher and interpreter of classical political theory.

Strauss served in the German army during World War I. After receiving his Ph.D. from the University of Hamburg (1921), he was a research assistant at the Academy for Jewish Research, Berlin (1925–32), and then worked as a Rockefeller fellow in England and France. He immigrated to the United States in 1938 (naturalized 1944) and served as a professor of political science at the New School for Social Research, New York City (1938–49), the University of Chicago (1949–68), Claremont (California) Men's College (1968–69), and St. John's College, Annapolis (1969–73).

He wrote a number of books on such political philosophers as Thomas Hobbes, Niccolò Machiavelli, Benedict de Spinoza, and Socrates. Among his more noted works are *On Tyranny* (1948; rev. ed. 1968); *Natural Right and History* (1950), widely praised for its scholarly incisiveness; *Persecution and the Art of Writing* (1952); and *What Is Political Philosophy?* (1959). He also coedited *History of Political Philosophy* (1963).

Strauss's books—lucid, insightful, and challenging—were written more for other scholars than for the general public, but he played an eminent role in American academic history and taught several generations of political scientists. He was largely credited with having revived and maintained the study of classical political philosophers in college curriculums at a time when such studies were overshadowed by quantitative and behavioral political scientists.

**Strauss, Richard (Georg)** (b. June 11, 1864, Munich, Ger.—d. Sept. 8, 1949, Garmisch-Partenkirchen), an outstanding German Romantic composer of the late 19th and early 20th centuries. His symphonic poems of the 1890s and his operas of the following decade have remained an indispensable feature of the standard repertoire throughout the 20th century.



Richard Strauss, portrait by Max Liebermann, 1918; in the National-Galerie, Berlin

By courtesy of the Staatliche Museen zu Berlin, Germany

*Life.* Strauss's father, Franz, was the principal French-horn player of the Munich Court Orchestra and was recognized as Germany's leading virtuoso of the instrument. His mother came from the prominent brewing family of Pschorr. During a conventional education, Strauss still devoted most of his time and energy to music. When he left school in 1882, he had already composed more than 140 works, including 59 lieder (art songs) and various chamber and orchestral works. These juvenilia reflect Strauss's musical upbringing by his father, who revered the classics and detested Richard Wagner both as a man and as a composer, even though he was a notable performer of the horn passages in performances of Wagner's operas.

Through his father's connections, Strauss on leaving school met the leading musicians of the day, including the conductor Hans von Bülow, who commissioned Strauss's *Suite for 13 Winds* for the Meiningen Orchestra and invited Strauss to conduct that work's first performance in Munich in November 1884. Following this successful conducting debut, Bülow offered Strauss the post of assistant conductor at Meiningen. Thenceforward Strauss's eminence as a conductor paralleled his rise as a composer. Among the conducting posts he went on to hold were those of third conductor of the Munich Opera (1886–89), director of the Weimar Court Orchestra (1889–94), second and then chief conductor at Munich (1894–98), conductor (and later director) of the Royal Court Opera in Berlin (1898–1919), and musical codirector of the Vienna State Opera (1919–24).

At Meiningen Strauss met the composer Alexander Ritter, who reinforced that admiration for Wagner's music which Strauss had previously nurtured in secret so as not to upset his father. Ritter urged Strauss to abandon classical forms and to express his musical ideas in the medium of the symphonic, or tone, poem, as Franz Liszt had done. Strauss had to work his way to mastery of this form, a half-way stage being his *Aus Italien* (1886; *From Italy*), a "symphonic fantasy" based on his impressions during his first visit to Italy. In Weimar in November 1889, he conducted the first performance of his symphonic poem *Don Juan.* The triumphant reception of this piece led to Strauss's acclamation as Wagner's heir and marked the start of his successful composing career. At Weimar, too, in 1894 he conducted the premiere of his first opera, *Guntram,* with his fiancée Pauline de Ahna in the leading soprano role. She had become his singing pupil in 1887, and they were married in September 1894. Pauline's tempestuous, tactless, and outspoken personality was the reverse of her husband's aloof and detached nature, and her eccentric behaviour is the subject of countless anecdotes, most of them true. Nevertheless the marriage between them was strong and successful; they adored each other and ended their days together 55 years later.

The years 1898 and 1899 saw the respective premieres of Strauss's two most ambitious tone poems, *Don Quixote* and *Ein Heldenleben* (*A Hero's Life*). In 1904 he and Pauline, who was the foremost exponent of his songs, toured the United States, where in New York City he conducted the first performance of his *Symphonia Domestica* (*Domestic Symphony*). The following year, in Dresden, he enjoyed his first operatic success with *Salome,* based on Oscar Wilde's play. Although *Salome* was re-

garded by some as blasphemous and obscene, it triumphed in all the major opera houses except Vienna, where the censor forbade Gustav Mahler to stage it.

In 1909 the opera *Elektra* marked Strauss's first collaboration with the Austrian poet and dramatist Hugo von Hofmannsthal. Strauss wrote the music and Hofmannsthal the libretti for five more operas over the next 20 years. With the 1911 premiere of their second opera together, *Der Rosenkavalier*, they achieved a popular success of the first magnitude. Their subsequent operas together were *Ariadne auf Naxos* (1912; *Ariadne on Naxos*), *Die Frau ohne Schatten* (1919; *The Woman Without a Shadow*), and *Die ägyptische Helena* (1928; *The Egyptian Helen*). But in 1929 Hofmannsthal died while working on the opera *Arabella*, leaving Strauss bereft.

After 1908 Strauss lived in Garmisch, in Bavaria, in a villa that he built with the royalties from *Salome*. He conducted in Berlin until 1919, when he agreed to become joint director, with Franz Schalk, of the Vienna State Opera. His appointment proved unfortunate, since it coincided with a postwar mood that relegated Strauss and similar late Romantic composers to the category of "old-fashioned." Strauss was neither interested nor skilled in politics, national or musical, and he resigned from his post in Vienna in 1924. This political naïveté tainted Strauss's reputation when the National Socialists came to power in Germany in 1933. Though able to manipulate grand dukes and kaisers, he proved to be no match for the ruthless totalitarians of the Third Reich and unwittingly allowed himself to be used by them for a time. Thus from 1933 to 1935 he served as president of Germany's Reichsmusikkammer (Chamber of State Music), which was the state music bureau. But in the latter year he fell foul of the Nazi regime. After Hofmannsthal's death in 1929 he had collaborated with the Jewish dramatist Stefan Zweig on a comic opera, *Die schweigsame Frau* (1935; *The Silent Woman*). This collaboration was unacceptable to the Nazis. The opera was banned after four performances and Strauss was compelled to work with a non-Jewish librettist, Joseph Gregor. The fact that his son's wife was Jewish was also held against him. Above all else a family man, Strauss used every shred of his influence as Germany's greatest living composer to protect his daughter-in-law and her two sons. He spent part of World War II in Vienna, where he was out of the limelight, and in 1945 he went to Switzerland. Allied denazification tribunals eventually cleared his name, and he returned to Garmisch in 1949, where he died three months after his 85th birthday celebrations.

*Works.* Strauss's first major achievement was to harness the expressive power of the huge Wagnerian opera orchestra for the concert hall. Although some of his early Mendelssohnian works, such as the violin concerto (composed 1882) and the first horn concerto (1882–83), are still played, the real Strauss emerged with the symphonic poem *Don Juan* (composed 1889), in which his ardent melodic gifts, descriptive powers, and mastery of instrumentation first became fully evident. Harmonically even richer is the climax of the symphonic poem *Tod und Verklärung* (1888–89; *Death and Transfiguration*), in which a dying man surveys his life and ideals. The rondo form is used in the tone poem *Till Eulenspiegels lustige Streiche* (1894–95; *Till Eulenspiegel's Merry Pranks*), wherein Strauss found the exact instrumental sounds and colours to depict the 14th-century rogue Till's adventures, from his scattering pots and pans in a market and mocking the clergy to his death-squawk on a D clarinet on the gallows. *Also sprach Zarathustra* (1896; *Thus Spoke Zarathustra*) is ostensibly a homage to the philosopher Friedrich Nietzsche but is actually a concerto for orchestra in which the entities of man and nature are illustrated and contrasted by opposing tonalities.

To illustrate the exploits of *Don Quixote* (1897), Strauss employed the variation form in this tone poem. Sheep, windmills, and flying horses are magically described in music that is suffused with poetry. *Don Quixote* was followed by the quasi-autobiographical tone poem *Ein Heldenleben* (1898), in which Strauss's adversaries are the music critics (characterized by petulant woodwinds) whom he defeats in a battle scene of astonishing power and virtuosity before retiring to the countryside to contemplate his "works of peace" (a string of musical self-quotations) with his wife.

Two other tone poems followed that were dignified by the title symphony. In *Symphonia Domestica* (1903), a huge orchestra describes 24 hours in the life of the Strauss family household, including bathing the baby, quarrels, and love making. In *Eine Alpensinfonie* (1911–15; *Alpine Symphony*) an even larger orchestra (more than 150 players) describes a day in the Bavarian Alps, with a thunderstorm, a waterfall, and the view from a mountain summit as highlights.

Like his great contemporary Gustav Mahler, Strauss wrote magniloquently for a large orchestra but was also able to achieve textures of chamber-music delicacy. But whereas Mahler's music explores his own spiritual and psychological obsessions, Strauss's music is more objective and is concerned with sensuous emotions and everyday life, rather than with spiritual torment and death. The opulence of Strauss's orchestrations is tempered by harmonic acerbity.

Strauss had an unrivaled descriptive power and a remarkable ability to convey psychological detail. This last quality was particularly evident in his operas. His first opera was the Wagnerian-influenced *Guntram* (1892–94, rev. 1940). His next stage work, the satirical comic opera *Feuersnot* (1900–01; *Fire-Famine*), employs impish humour to mock small-town prudery and hypocrisy. With *Salome* (1903–05), Strauss transferred his mastery of the orchestral tone-poem to an opera that is outstanding for the intensity with which it conveys Salome's naive lust for John the Baptist and the depravity of her stepfather Herod's court. His next opera, *Elektra* (1906–08), is a second blockbusting one-act study of female obsession, in this case revenge. In this score Strauss went as far toward atonality as he ever desired. *Elektra* was followed by *Der Rosenkavalier* (1909–10), a "comedy in music" that is set in 18th-century Vienna and features an anachronistic string of waltzes and characters like the Marschallin, Baron Ochs, Octavian, and Sophie, whom audiences at once took to their hearts. This opera remains Strauss's most popular stage work, despite its occasional dull passages.

Strauss had two musical gods, Wolfgang Amadeus Mozart and Richard Wagner, and in his work they struggle for possession of his artistic soul. The battle is fought most persuasively and equally in the opera *Ariadne auf Naxos* (1912, rev. 1916), in which Strauss's light, parodistic vein and his heroic style are blended and reconciled. At the opposite extreme is *Die Frau ohne Schatten*, a Wagnerian version of Mozart's *The Magic Flute* that requires singing on a scale to match its grandiose conception and staging. Its portraiture of the lowly dyer Barak and his shrewish wife is a foretaste of *Intermezzo* (1918–23), where the protagonists are Strauss and Pauline, thinly disguised. Arnold Schoenberg was among the first to recognize the mastery and seriousness of this opera, which was at first lightly regarded but in which Strauss perfected his conversational melodic recitative.

With their last opera together, *Arabella* (1929–32), Strauss and his librettist Hofmannsthal returned to Vienna and amorous intrigue in their most romantic and lyrical work. Strauss's opera with Zweig, *Die schweigsame Frau* (1933–34; *The Silent Woman*), has only lately come into its own as a delightful comedy. Of Strauss's three operatic collaborations with Gregor, the best is *Daphne* (1936–37). For his final opera, *Capriccio* (1940–41), Strauss and the conductor Clemens Krauss wrote an inspired "conversation piece" on the relative importance of words and music in opera. These two media are personified by a poet and a composer who are rivals for the love of a widowed countess, who is herself given the last of Strauss's marvelously rewarding roles for the female voice.

This last opera initiated the composer's "Indian summer," when he recaptured the freshness of his youth in a second horn concerto (1942), an oboe concerto (1945–46), two wind sonatinas (1943–45), and a concertino for clarinet and bassoon (1947). He also composed, in *Metamorphosen* (1945–46), a study for 23 solo strings that is an elegy for the German musical life that the Nazis had destroyed. Strauss's last, profoundly poignantly retrospective *Vier letzte Lieder* (1948; *Four Last Songs*) for soprano and orchestra crowned a career of which his 200 songs comprise an important part.

As a young composer, Strauss came under the influence of Wagner, Hector Berlioz, and Liszt just when his technique and imagination were sharpened to make the most of their impact. From the tone poem *Aus Italien* onward, his style became recognizable as the big, bravura, flexible, post-Romantic panoply that dominated audiences in the late 19th and early 20th centuries. But, having achieved fame as an avant-garde composer, Strauss after *Der Rosenkavalier* became a conservative whose musical evolution was pursued in isolation, unaffected by the advances and experiments going on around him. He spent the last 38 years of his life refining and polishing his style, writing often for smaller orchestras, partly out of practical considerations (to ensure the audibility of sung words in the theatre) and partly because large-scale Romantic musical textures were becoming less and less significant. In later years Strauss's style became more classical in the Mozartean sense. Indeed, the opera *Capriccio* and other late works may be said to have achieved a perfect fusion of the late German Romantic and the Neoclassical manner.

(M.K.)

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**Stravinsky, Igor (Fyodorovich)** (b. June 17 [June 5, Old Style], 1882, Oranienbaum [now Lomonosov], near St. Petersburg, Russia—d. April 6, 1971, New York, N.Y., U.S.), Russian-born composer whose work had a revolutionary impact on musical thought and sensibility just before and after World War I, and whose compositions remained a touchstone of modernism for much of his long working life.

Stravinsky's father was one of the leading Russian operatic basses of his day, and the

mixture of the musical, theatrical, and literary spheres in the Stravinsky family household exerted a lasting influence on the composer. Nevertheless his own musical aptitude emerged quite slowly. As a boy he was given lessons in piano and music theory. But then he studied law and philosophy at St. Petersburg University (graduating in 1905), and only gradually did he become aware of his vocation for musical composition. In 1902 he showed some of his early pieces to the composer Nikolay Rimsky-Korsakov (whose son Vladimir was a fellow law student), and Rimsky-Korsakov was sufficiently impressed to agree to take Stravinsky as a private pupil, while at the same time advising him not to enter the conservatory for conventional academic training.

Rimsky-Korsakov tutored Stravinsky mainly in orchestration and acted as the budding composer's mentor, discussing each new work and offering suggestions. He also used his influence to get his pupil's music performed. Several of Stravinsky's student works were performed in the weekly gatherings of Rimsky-Korsakov's class, and two of his works for orchestra, the *Symphony in E-flat Major* and a song cycle using words by Aleksandr Pushkin and entitled *The Faun and the Shepherdess,* were played by the Court Orchestra in 1908, the year Rimsky-Korsakov died. In February 1909 two short but brilliant orchestral pieces, the *Scherzo fantastique* and *Fireworks,* were performed in St. Petersburg at a concert attended by the impresario Sergey Diaghilev, who was so impressed by Stravinsky's promise as a composer that he quickly commissioned some orchestral arrangements for the summer season of his Ballets Russes in Paris. For the 1910 ballet season Diaghilev approached Stravinsky again, this time commissioning the musical score for a new full-length ballet on the subject of *The Firebird.*

The premiere of *The Firebird* at the Paris Opéra on June 25, 1910, was a dazzling success that made Stravinsky known overnight as one of the most gifted of the younger generation of composers. This work showed how fully he had assimilated the flamboyant Romanticism and orchestral palette of his master. *The Firebird* was the first of a series of spectacular collaborations between Stravinsky and Diaghilev's company. The following year saw the Ballets Russes's premiere on June 13, 1911, of the ballet *Petrushka,* with Vaslav Nijinsky dancing the title role to Stravinsky's musical score. Meanwhile, Stravinsky had conceived the idea of writing a kind of symphonic pagan ritual to be called *Great Sacrifice,* but Diaghilev persuaded him to cast it in the form of a ballet. The result was *The Rite of Spring* (*Le Sacre du printemps*), the composition of which was spread over two years (1911–13). The first performance of *The Rite of Spring* at the Théâtre des Champs Élysées on May 29, 1913, provoked one of the more famous first-night riots in the history of music. This highly original composition, with its shifting and audacious rhythms and its unresolved dissonances, has been said to mark the start of the modernist movement in music. From this point on, Stravinsky was known as "the composer of *The Rite of Spring*" and the destructive modernist par excellence. But he himself was already moving away from such post-Romantic extravagances, and world events of the next few years only hastened that process.

Stravinsky's successes in Paris with the Ballets Russes effectively uprooted him from St. Petersburg. He had married his cousin Catherine Nossenko in 1906, and, after the premiere of *The Firebird* in 1910, he brought her and their two children to France. The outbreak of World War I in 1914 seriously disrupted the Ballets Russes's activities in western Europe, however, and Stravinsky found he could no longer rely on that company as a regular outlet for his new compositions. The war also effectively marooned him in Switzerland,



Stravinsky, 1929

By courtesy of the Gernsheim Collection, Humanities Research Center, The University of Texas at Austin; photograph, Felix H. Man

where he and his family had regularly spent their winters, and it was there that they spent most of the war. The Russian Revolution of October 1917 finally extinguished any hope Stravinsky may have had of returning to his native land.

By 1914 Stravinsky was exploring a more restrained and austere, though no less vibrantly rhythmic kind of musical composition. His musical production in the following years is dominated by sets of short instrumental and vocal pieces that are based variously on Russian folk texts and idioms and on ragtime and other style models from Western popular or dance music. He expanded some of these experiments into large-scale theatre pieces. *The Wedding,* a ballet cantata begun by Stravinsky in 1914 but completed only in 1923 after years of uncertainty over its instrumentation, is based on Russian village wedding customs. The "farmyard burlesque" *Renard* (1916) is similarly based on Russian folk idioms, while *The Soldier's Tale* (1918), a mixed-media piece using speech, mime, and dance accompanied by a seven-piece band, eclectically incorporates ragtime, tango, and other modern musical idioms in a series of highly infectious instrumental movements. After World War I the Russian folk strain in Stravinsky's music began to fade, but not before it had produced a masterpiece in the *Symphonies of Wind Instruments* (1920).

The compositions of Stravinsky's first maturity—from *The Rite of Spring* in 1913 to the *Symphonies of Wind Instruments* in 1920—make use of a modal idiom based on Russian sources and are characterized by a highly sophisticated feeling for irregular metres and syncopation and by brilliant orchestral mastery. But Stravinsky's adaptation of some music by G.B. Pergolesi for a commedia dell'arte ballet, *Pulcinella* (1919–20), prompted him to reconsider his aesthetic stance, and the result was an important change in his music: he abandoned the Russian features of his early style and instead adopted a Neoclassical idiom. Stravinsky's Neoclassical works of the next 30 years usually take some point of reference in past European music—a particular composer's work or the Baroque or some other historical style—as a starting point for a highly personal and unorthodox treatment that nevertheless seems to depend for its full effect on the listener's experience of the historical model from which Stravinsky borrowed.

The Stravinskys left Switzerland in 1920 and lived in France until 1939, and Stravinsky spent much of this time in Paris. (He took French citizenship in 1934.) Having lost his property in Russia during the revolution, Stravinsky was compelled to earn his living as a performer, and many of the works he composed during the 1920s and '30s were written for his own use as a concert pianist and conductor. His instrumental works of the early 1920s include the *Octet for Wind Instruments* (1923), *Concerto for Piano and Wind Instruments* (1924), *Piano Sonata* (1924), and the *Serenade in A* for piano (1925). These pieces combine a Neoclassical approach to style with what seems a self-conscious severity of line and texture. Though the dry urbanity of this approach is softened in such later instrumental pieces as the *Violin Concerto in D Major* (1931), *Concerto for Two Solo Pianos* (1932–35), and the *Concerto in E-flat* (or *Dumbarton Oaks* concerto) for 16 wind instruments (1938), a certain cool detachment persists.

In 1926 Stravinsky experienced a religious reconversion that had a notable effect on his stage and vocal music. A religious strain can be detected in such major works as the operatic oratorio *Oedipus Rex* (1927), which uses a libretto in Latin, and the cantata *Symphony of Psalms* (1930), an overtly sacred work that is based on biblical texts. Religious feeling is also evident in the ballets *Apollo Musagetes* and *The Fairy's Kiss* (both 1928) and in *Persephone* (1934). The Russian elements in Stravinsky's music never quite disappeared during this period: the ballet *The Fairy's Kiss* is based on music by Peter Ilich Tchaikovsky, and the *Symphony of Psalms* has some of the antique austerity of Russian Orthodox chant, despite its Latin text.

In the years following World War I, Stravinsky's ties with Diaghilev and the Ballets Russes had been renewed, but on a much looser basis, and the only new ballet Diaghilev commissioned from Stravinsky was *Pulcinella* (1920). Stravinsky's *Apollo Musagetes,* his last ballet to be mounted by Diaghilev, premiered in 1928, a year before Diaghilev's own death and the dissolution of his ballet company.

In 1938 Stravinsky's oldest daughter died of tuberculosis, and the deaths of his wife and mother followed in 1939, just months before World War II broke out. Early in 1940 he remarried, his second wife being Vera de Bosset, whom he had known for many years. In autumn 1939 Stravinsky had visited the United States to deliver the Charles Eliot Norton Lectures at Harvard University (later published as the *The Poetics of Music*), and in 1940 he and his new wife settled permanently in Hollywood, Calif. They became U.S. citizens in 1945.

During the years of World War II, Stravinsky composed two important symphonic works, the *Symphony in C* (1938–40) and the *Symphony in Three Movements* (1942–45). The *Symphony in C* represents a summation of Neoclassical principles in symphonic form, while the *Symphony in Three Movements* successfully combines the essential features of the concerto with the symphony. From 1948 to 1951 Stravinsky worked on his only full-length opera, *The Rake's Progress,* a Neoclassical work (with a libretto by W.H. Auden and the American writer Chester Kallman) based on a series of moralistic engravings by the English artist William Hogarth. *The Rake's Progress* is a mock-serious pastiche of late 18th-century grand opera but is nevertheless typically Stravinskyan in its brilliance, wit, and refinement.

The success of these late works masked a creative crisis in Stravinsky's music, and his resolution of this crisis was to produce the most remarkable body of late composition in the second half of the 20th century. After World War II a new musical avant-garde had emerged in Europe that rejected Neoclassicism and instead claimed allegiance to the serial, or twelve-tone, compositional techniques of the Viennese composers Arnold Schoenberg, Alban Berg, and especially Anton von Webern. (Serial music is based on the repetition of a series of tones in an arbitrary but fixed pattern without regard for tradi-

tional tonality.) According to Robert Craft, a young American conductor and scholar who entered Stravinsky's household in 1948 and remained his intimate associate until the composer's death, the realization that he was regarded as a spent force threw Stravinsky into a major creative depression, from which he emerged, with Craft's help, into a phase of serial composition in his own intensely personal manner. A series of cautiously experimental works (the *Cantata,* the *Septet, In Memoriam Dylan Thomas*) was followed by a pair of hybrid masterpieces, the ballet *Agon* (completed 1957) and the choral *Canticum Sacrum* (1955), that still retain some kind of tonal framework. These in turn led on to the choral work *Threni* (1958), a setting of the biblical Lamentations of Jeremiah in which a strict twelve-tone method of composition is applied to chantlike material whose underlying character recalls that of such earlier choral works as *The Wedding* and the *Symphony of Psalms.* In his *Movements* for piano and orchestra (1959) and his orchestral *Variations* (1964), Stravinsky refined his manner still further, pursuing a variety of arcane serial techniques to support a music of increasing density and economy and possessing a brittle, diamantine brilliance. Stravinsky's serial works are generally much briefer than his tonal works but have a denser musical content.

Though always in mediocre health (he suffered a stroke in 1956), Stravinsky continued full-scale creative work until 1966. His last major work, *Requiem Canticles* (1966), is a profoundly moving adaptation of modern serial techniques to a personal imaginative vision that was deeply rooted in his Russian nature. This piece is an amazing tribute to the creative vitality of a composer then in his 80s.

*Assessment.* Like that of so many masters, Stravinsky's fame rests mistakenly on only a few works and one or two of his more important achievements. In *The Rite of Spring* he presented a new concept of music involving constantly changing rhythms and metric imbalances, a brilliantly original orchestration, and drastically dissonant harmonies that have echoed down the 20th century. Later Stravinsky was regarded as the typical rootless exile, a creative chameleon who could dart from style to style but who never recaptured the creative depth of his first masterpieces. Yet the more spectacular modernisms of *The Rite of Spring* belong to the evolution of Russian nationalist music from Modest Mussorgsky to Rimsky-Korsakov, while that work's feeling of "primitive dynamism" is a period feature that is found in much music of the early 20th century. Nor were the discordant harmonies of *The Rite of Spring* anything new in 1913, though Stravinsky was the first to pursue Claude Debussy's purely sensual approach to chords into a harmony that was not itself obviously beautiful.

The percussive violence and barbaric tone colours of *The Rite of Spring* did, however, conceal a new kind of rhythmic sensibility and an empirical attitude to sonority that can be traced through all of Stravinsky's later music, whatever its apparent stylistic allegiance. Stravinsky's approach was empirical in that he was not prepared to accept established musical practice about development but instead preferred to subject his musical material to a personal system of tests. Working always at the piano, he experimented endlessly with different chord combinations and spacings, explored the asymmetrical patterns of compound metres, and used devices of prolongation and elision to break down the tradition of symmetrical phrasing. Given such sonorities as basic sound objects, rhythm is then regarded as a cumulative process, an adding together of such objects into varied groups, as opposed to the varied subdivision of regular groups that forms the basic method of classical music. Not surprisingly, this procedure tended to work against the past musical styles that Stravinsky used as models in his Neoclassical works, which probably accounts for their intriguing rhythmic obliquity, just as his experimental attitude to chords produced curious distortions of classical harmony. Stravinsky worked in the same way, in fact, throughout his life, and the same basic principles of construction and dynamics inform *Threni* and the *Requiem Canticles* as *Petrushka* and *The Rite of Spring.* He had immense influence on the way later composers have felt pulse, rhythm, and form.

Stravinsky rejected the Germanic idea that thematic development is the only basis of serious writing. From early on, he preferred a sculptural approach in which the sound object is all-important and large musical structures are achieved cumulatively, with much repetition allied to subtle variations in interior detailing. In his longer works, especially the sacred and theatrical ones, this tends toward an effect of ritual. The power of *Oedipus Rex* and the *Symphony of Psalms,* as of *The Rite of Spring,* is the power of a solemn reenactment, and it was in his sense of the motion and specific gravity of such solemnities that Stravinsky was at his most forceful and inspired.

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**straw,** the stalks of grasses, particularly of such cereal grasses as wheat, oats, rye, barley, and buckwheat. When used collectively, the term straw denotes such stalks in the aggregate after the drying and threshing of grain.

Human beings from ancient times have used straw as litter and fodder for cattle, as a covering for floors, for coarse bedding, and even as clothing. The thatched roof, which is still used in some parts of the world, consists of straw laid down to a thickness of 1 foot (0.3 m) or more and secured by strong cords, with the fibres running in the direction to be taken by rainwater. Straw may also be woven to make baskets or hats. Either in its natural colour or dyed in attractive hues, straw is woven into matting for floor and furniture coverings in some regions. In modern industry, chemically pulped straw is used in the manufacture of coarse paper and in a type of cardboard (strawboard) that is suited to the production of cheap paper boxes. Straw has also been used to fabricate sun-dried bricks. The latter are made of clay that is moistened and kneaded and then combined with chopped straw, after which it is dried in the sun or baked in crude ovens. The use of straw in making bricks is mentioned in the Old Testament.

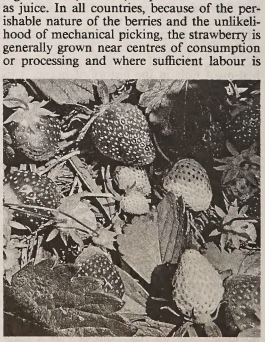
**strawberry,** fruit plant of eight main species of the genus *Fragaria* (family Rosaceae), native to the temperate regions of the Northern Hemisphere but widely cultivated in the Southern Hemisphere as well. The cultivated varieties are mainly derived from two species, *F. virginiana* and *F. chiloensis,* that are native to the Americas. The strawberry is a low-growing, herbaceous plant with a fibrous root system and a crown from which arise basal leaves. The leaves are compound, with three leaflets, sawtooth-edged and hairy. The flowers, generally white, rarely reddish, are borne in small clusters on slender stalks arising, like the surface-creeping stems, from the axils of the leaves. As a plant ages, the root system becomes woody, and the "mother" crown sends out runners that touch ground and root, thus enlarging the plant.

The strawberry fruit in the botanical sense is not a berry and is much more than a single fruit; it is the greatly enlarged stem end, or receptacle, in which are partially embedded the many true fruits, or achenes, popularly called seeds. Rich in vitamin C, the strawberry also provides iron and other minerals. It is eaten fresh as a dessert fruit, used as a pastry or pie filling, and may be preserved in many ways. The strawberry shortcake, made of fresh strawberries, sponge cake, and whipped cream, is a traditional American dessert.

The cultivated, large-fruited strawberry originated in Europe in the 18th century. Most countries developed their own varieties during the 19th century, and these are often specially suitable for the climate, day length, altitude, or type of production required in a particular region.

The strawberry succeeds on a surprisingly wide range of soils and situations and, compared with other horticultural crops, has a low fertilizer requirement. It is, however, susceptible to drought and requires moisture-retaining soil or irrigation by furrow or sprinkler. Runner plants are planted in early autumn if a crop is required the next year. If planted in winter or spring, the plants are deblossomed to avoid a weakening crop the first year. Plants are usually retained for one to four years. Runners may be removed from the spaced plants, or a certain number may be allowed to form a matted row alongside the original parent plants. The spaced plants per acre vary from 7,000 to 17,000. In areas with severe winters, plants are put out in the spring and protected during following winters by covering the rows with straw or mulches.

Strawberries are produced commercially both for immediate consumption and for processing as frozen, canned, or preserved berries or as juice. In all countries, because of the perishable nature of the berries and the unlikelihood of mechanical picking, the strawberry is generally grown near centres of consumption or processing and where sufficient labour is



Strawberries (*Fragaria virginiana*)
Grant Heilman—EB Inc.

available. The berries are picked directly into small baskets and crated for marketing or put into trays for processing. Early crops can be produced under glass or plastic covering. Strawberries are very perishable and require cool, dry storage. They are grown throughout most of the United States and Canada; in European countries, including France, Italy, the United Kingdom, Bulgaria, and Poland; in southern and eastern Africa; in New Zealand and Australia; and also in Japan.

**Strawson, Sir Peter (Frederick)** (b. Nov. 23, 1919, London, Eng.), British philosopher, an exponent and reformer of the linguistic analysis school originally centred on the Cambridge philosopher Ludwig Wittgenstein.

Strawson was a fellow of University College, Oxford, from 1948 to 1968, afterward serving as a fellow of Magdalen College and Waynflete professor of metaphysical philosophy in the University of Oxford. He was knighted in 1977. Strawson integrated the study of metaphysics with linguistic philosophy and extended its scope beyond the limits set by its more empirically oriented adherents. Attempting to describe the actual structure of human thought about the world, he used such general notions as existence, identity, and unity. Among his writings are *Individuals: An Essay in Descriptive Metaphysics* (1959), *Freedom and Resentment* (1974), *Subject and Predicate in Logic and Grammar* (1974), and *Scepticism and Naturalism: Some Varieties* (1985). He edited *Philosophical Logic* (1967) and *Studies in the Philosophy of Thought and Action* (1968).

**Strayhorn, Billy,** byname of WILLIAM THOMAS STRAYHORN (b. Nov. 29, 1915, Dayton, Ohio, U.S.—d. May 31, 1967, New York, N.Y.), American pianist and composer who spent his entire career in collaboration with and as amanuensis to the composer and bandleader Duke Ellington.

Educated privately, Strayhorn applied to Ellington in 1938 for work as a lyricist, using his own composition "Lush Life" as a credential. In 1939 Ellington made his first recording of a Strayhorn composition; it was the first of many, including the highly popular "Take the 'A' Train" and "Chelsea Bridge," an excellent example of the composer's refined, impressionistic style. Strayhorn was also an accomplished pianist who rarely did justice to his own talent. His work as a composer became so intertwined with Ellington's that it was said that eventually neither man was able to distinguish his own contributions to their joint work. Strayhorn worked on most of Ellington's major concert works and unquestionably exerted a great influence upon him.

**Štrbské Pleso,** small morainic lake, Prešov *kraj* (region), Slovakia. It lies at the end of a narrow-gauge electric railway from Poprad. At 4,455 feet (1,358 m) in elevation, it is the most popular of the lakes in the High Tatra mountain range.

A picturesque village of the same name has developed around the lake, with tourist, skiing, and health centres. Within the area are more than 100 lakes and several waterfalls, and the highest peaks in Tatra National Park are nearby. Just south of the lake, but several hundred feet lower than it, is an important pass between the Biely Váh and Poprad rivers.

**streak,** the colour of a mineral in its powdered form. It is usually obtained by rubbing the mineral on a hard, white surface, such as a tile of unglazed porcelain, so as to yield a line, or streak, of fine powder. The colour of the streak is usually constant for a given species of mineral, even though the mineral may vary considerably in colour as it occurs in the field. Indeed, the colour of a streak may differ considerably from the colour of the unpowdered mineral. Streak is one of the more useful diagnostic properties, since it is a quick way to distinguish between different species of minerals that are otherwise similar in appearance.

**stream of consciousness** (literature): *see* consciousness, stream of.

**streambed,** also called STREAM CHANNEL, any long, narrow, sloping depression on land that is shaped by flowing water. Streambeds can range in width from a few feet for a brook to several thousand for the largest rivers. The channel may or may not contain flowing water at any time; some carry water only occasionally. Streambeds may be cut in bedrock or through sand, clay, silt, or other unconsolidated materials commonly resulting from earlier stream deposition.

Stream channels cut in bedrock are generally more stable and usually have steeper slopes, less width, and greater local variations in gradient, with rapids and waterfalls being common. They most often occur in upstream areas and are somewhat straighter because they tend to follow faults, joints, or other weak structural elements. The downstream reaches of rivers or streams are commonly alluvial channels that have lower slopes and a general absence of rock ledges. These channels constantly shift vertically and laterally; they are usually meandering, braided, or random, with few straight reaches. Narrow, more sinuous alluvial beds have a higher silt and clay composition than do straighter and wider beds. Sandy beds depend on vegetation to stabilize their banks.

The shape, or cross section, of a streambed is determined by a stream's discharge, the amount and size of sediment transported, and the resistance to erosion of the bedrock or alluvium of the banks and bottom. In its lower reaches, a larger stream (one with greater discharge) has a greater width-to-depth ratio. The side slopes are related to the silt-to-clay ratio of the sediments and to the erosive force of the flow. Steep banks generally occur in clay-rich materials. In many cases, the cross section of a stream is almost trapezoidal and becomes asymmetrical along the curves of a stream's path, with the deepest part of the stream occurring at the outside of the curve.

**streamlining,** in aerodynamics, the contouring of an object, such as an aircraft body, to reduce its drag, or resistance to motion through a stream of air.

A moving body causes the air to flow around it in definite patterns, the components of which are called streamlines. Smooth, regular airflow patterns around an object are called laminar flow; they denote a minimum of disturbance of the air by the object's motion through it. Turbulent flow occurs when air is disturbed and separates from the surface of the moving body, with the consequent formation of a zone of swirling eddies in the body's wake. This eddy formation represents a reduction in the downstream pressure on the moving object and is a principal source of drag. Streamlining, then, is the contouring of an aircraft or other body in such a way that its turbulent wake is reduced to a minimum. The mechanics of airflow patterns lead to two principles for subsonic streamlining: (1) the forward part of the object should be well rounded, and (2) the body should gradually curve back from the midsection to a tapering rear section. An efficiently streamlined body thus takes on the look of a horizontally inclined teardrop shape.

An aircraft or other body that is traveling at supersonic speeds requires a different streamlined form from that of a subsonic aircraft because it is moving faster than the speed at which the pressure impulses it creates are propagated in air. Because the pressure waves can no longer be transmitted ahead of an aircraft moving at supersonic speed, they pile up in front of it, creating a compression, or shock, wave. Further shock waves are created at the midsection and tail of the supersonic aircraft. The strength of these shock waves is dependent on the magnitude of the change in the air's direction, which in turn is dependent on the sharpness or angle of the forward tip and other surfaces of the aircraft's body. Supersonic aircraft thus have sharply pointed noses and tails and straight, narrow bodies to minimize the intensity of the shock waves (and attendant drag).

**Streator,** city, La Salle county, Illinois, U.S., on the Vermillion River. The village was laid out in 1868 after the discovery of coal in the vicinity. It was first called Hardscrabble, from the difficult climb up from the river, and was then known as Unionville after the American Civil War. It was renamed in 1872 for Worthy Streator, president of the Vermillion Coal Company, which opened mines there. When the mines were exhausted, the community turned to manufacturing brick, clay pipe, and glass, drawing on local deposits of clay, shale, and silica sand. The city's economy is still primarily industrial but is augmented by agriculture (corn [maize] and soybeans). Inc. village, 1870; city, 1882. Pop. (2003 est.) 14,050.

**Středočeský** (Czech: "Central Bohemia"), *kraj* (region), north-central Czech Republic. It is bordered by Severočeský *kraj* on the north, Východočeský *kraj* on the east, Jihočeský *kraj* to the south, and Západočeský *kraj* to the west. Prague serves as the regional capital but is administered separately. The southern part of the region consists mostly of the northerly ranges of the Středočeská Highlands and other uplands, while the north is composed of lowlands formed by the Labe (Elbe) and Vltava (Moldau) rivers, the two main drainage systems that meet south of Mělník.

Corn (maize) for animal feed, sugar beets, wheat, barley, oats, alfalfa, potatoes, and clover are the main crops grown in the *kraj;* sugar beets, wheat, and barley predominate in the northern lowlands, whereas oats, rye, potatoes, and flax are better suited to the hilly south. Rakovník, Mělník, and Kladno *okresy* (districts) produce hops, both for the domestic brewing industry and for export. Apples, plums, pears, cherries, and walnuts grow in the north, and the Labe and Vltava valleys are noted for vineyards as well. Pigs, cattle, and poultry are the main livestock reared; dairying accounts for about two-fifths of the cattle. Forests of fir, spruce, pine, oak, and beech cover slightly more than one-fourth of Středočeský *kraj,* mainly in the western districts, where lumbering and paper milling are carried on.

Bituminous coal is mined around Kladno, Slaný, and Mělník; bituminous and anthracite coal and refractory clay are mined around Rakovník. Příbram is a major lead, zinc, silver, and uranium mining centre; to the northeast, Mníšek pod Brdy is an iron-ore mining centre. Kutná Hora is a centre for lead, zinc, and silver mining. Large limestone quarries are located along the Berounka River southwest of Prague. Refractory clay, sand, gravel, and glass sand are quarried along the Labe River between Kolín and Mělník. Dams on the Vltava provide hydroelectric energy and improve navigation on that river.

Heavy industries are concentrated in northern Středočeský *kraj.* Kladno-Slaný is a major industrial centre west of Prague, producing steel, engineering products, electronics ware, textiles, and processed food. North of Prague, Kralupy nad Vltavou and Neratovice have important chemical works; Kralupy also has an oil refinery and produces petrochemicals, synthetic rubber, and wood products; Mělník and Kostelec nad Labe refine sugar from sugar beets; and beer is produced in Velké Popovice

and Benešov. In the northeastern part of Středočeský *kraj*, Mladá Boleslav is the site of a large Škoda automobile plant and also has food-processing industries. Kolín–Kutná Hora has an oil refinery and produces petrochemicals, steel, textiles, and processed foods; Kolín is also a Labe River port. Beroun–Králův Dvůr, southwest of Prague, produces steel, cement, cotton textiles, and limestone. Most of the southern towns in the *kraj* have light traditional industries; of these, Sázava is noted for glassworks, as is Poděbrady, near Kolín, and Rakovník has a renowned ceramics industry.

Although most cultural institutions are located in Prague, several other towns are noteworthy. Nelahozeves, northwest of Prague, is the birthplace of the Czech composer Antonín Dvořák (1841); his house is a memorial museum. To the east, Kutná Hora is conserved under national trust; many of its buildings survive from the 13th and 14th centuries. Kačina, to the northeast, has an imperial-period palace (1822) that now houses an agricultural museum and library. Southwest of Prague, Příbram is the site of the Svatá Hora pilgrimage site. East of Kladno lies the site of Lidice (*q.v.*), the miners' village obliterated by the Nazis in June 1942.

A thermal mineral-water spa that developed in Středočeský *kraj* in the early 20th century draws visitors to Poděbrady. The reservoirs behind the Vltava River dams have improved navigation and also have been developed as resorts. The Koněprusy caves at Zlatýkůň, 6 miles (9 km) south of Beroun, rediscovered in 1950, have stalactite- and stalagmite-covered rooms extending 1 mile (1.6 km) in length on three levels.

The population of Středočeský *kraj* is primarily Czech with small enclaves of Slovaks in the western and Labe River districts. Area excluding Prague, 4,252 square miles (11,014 square km). Pop. (2003 est.) 1,128,674.

**Streep, Meryl,** original name MARY LOUISE STREEP (b. June 22, 1949, Summit, N.J., U.S.), American film actress known for her masterful technique, expertise with dialects, and subtly expressive face.

Streep started voice training at age 12 and took up acting in high school. In 1971 she graduated from Vassar College in Poughkeepsie, N.Y., with a degree in drama and costume design. After working in summer stock theatre, Streep studied drama at Yale University, where she earned a Master of Fine Arts in 1975. She then moved to New York City to begin a career as a professional actress.

Streep made her Broadway debut in 1975 with *Trelawny of the "Wells."* Two years later she appeared in her first feature film, *Julia* (1977), but it was her performance in *The Deer Hunter* (1978) that earned Streep widespread recognition. Though her role was relatively small, she displayed a quiet softness that contrasted sharply with the bravado of the male characters and deepened the film's testament to the devastating effects of the Vietnam War on young Americans. That same year she also starred in the television miniseries *Holocaust*, for which she won an Emmy Award.

Over the next 10 years, Streep confirmed her reputation as one of Hollywood's finest dramatic actresses. Her performances in *Kramer vs. Kramer* (1979)—as a mother who leaves her young son and then fights to regain his custody—and *Sophie's Choice* (1982)—as a Polish survivor of a Nazi concentration camp—earned her Academy Awards for best supporting actress and leading actress, respectively. She further demonstrated her range and her gifts for rendering complex emotional states and seamless characterization in such roles as a modern-day actress portraying a Victorian woman of mystery in *The French Lieutenant's Woman* (1981), a factory-worker-turned-activist in *Silkwood* (1983), and the aristocratic Danish author Isak Dinesen in *Out of Africa* (1985). She won the Cannes film festival and New York Film Critics' Circle awards for best actress for her moving performance in *A Cry in the Dark* (1988) as Lindy Chamberlain, the real-life Australian mother accused of murdering her baby daughter.

By the late 1980s Streep's reputation as a brilliant technical actress came to be a burden. Her name was typically associated with a serious, often depressing sort of film, and some critics complained that her performances lacked compassion. As a result, Streep tried to change her popular image by appearing in a handful of comedies, including *Postcards from the Edge* (1990) and *Death Becomes Her* (1992), and in the action-adventure film *The River Wild* (1994). For the most part, these films were not well received, and Streep returned to dramatic films that required more technical skill and less personal charisma. She gave memorable performances in *The Bridges of Madison County* (1995), *Marvin's Room* (1996), and *The Hours* (2002). In 2003 Streep received an unprecedented 13th Academy Award nomination (for best supporting actress in *Adaptation* [2002]), surpassing Katherine Hepburn's 12 nominations. In addition to her numerous acting awards, Streep was made Commander in the Order of Arts and Letters (the highest cultural award presented by the French government) in 2002.

**Street, George Edmund** (b. June 20, 1824, Woodford, Essex, Eng.—d. Dec. 18, 1881, London), English architect of the High Victorian period, noted for his many English churches in the Gothic Revival style.

Street first worked with Sir George Gilbert Scott in London for five years. In 1849 he opened his own practice, and he eventually designed about 260 buildings during his professional career. The majority of Street's buildings were for ecclesiastical use and were usually highly original, unconventional adaptations and bold restylings of 13th-century French and English Gothic architecture. Starting with a number of small churches and schools in Cornwall, his works proliferated throughout England—in Oxfordshire, Buckinghamshire, Berkshire, and Yorkshire. These churches vary in appearance from the elaborate and decorative St. James the Less (1858–61), Oxford, to the barren austerity of St. George's (1861), Oakengates, Shropshire. His most famous work, however, was a secular building, the nobly picturesque Law Courts in London—competed for in 1866, begun in 1874, and still unfinished at the time of Street's death.

Street was a close friend of many of the Pre-Raphaelite artists and helped train such masters of late 19th-century English architecture and design as William Morris, Philip Webb, and Richard Norman Shaw. Street was the diocesan architect to Oxford, York, Winchester, and Ripon. He was also professor of architecture at the Royal Academy, where he lectured on medieval architecture, and in 1881 he was elected president of the Royal Institute of British Architects. His publications, *Brick and Marble in the Middle Ages* (1855) and *Some Account of Gothic Architecture in Spain* (1865; reprinted 1968), illustrated with his own drawings, were widely used as sourcebooks for Gothic Revival architectural detail.

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**street film,** type of realistic motion picture, popular in Germany during the 1920s, that dealt with the lives of common people during a time of economic depression; the term refers to the importance in the films of urban street scenes (usually filmed on studio sets of great ingenuity). The street in these films was not only a place of violence but also a place where virtues that had seemingly been abandoned by middle-class society flourished among prostitutes and other outcasts. The hero of the picture usually broke away from the security of a traditional home, sought adventure in the street, and then returned to a conventional life.

*The Street* (1923) was the prototype of a series of such films, which included *Joyless Street* (1925), *Tragedy of the Street* (1927), and *Asphalt* (1929). The realistic tone and experimental use of the camera influenced the production of outstanding street films, notably *The Last Laugh* (1924), directed by F.W. Murnau, who used the camera subjectively in his portrayal of an aging doorman played by the famed actor Emil Jannings. The disintegration of society and the return to traditional values that characterized street films foreshadowed the movement toward authoritarianism in the 1930s.

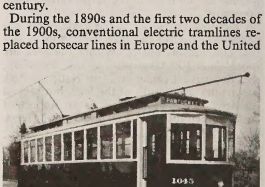
**street piano:** *see* barrel piano.

**streetcar,** also called TRAM, OT TROLLEY CAR, vehicle that runs on track laid in the streets, operated usually in single units and usually driven by electric motor.

Early streetcars were either horse-drawn or depended for power on storage batteries that were expensive and inefficient. In 1834 Thomas Davenport, a blacksmith from Brandon, Vt., U.S., built a small battery-powered electric motor and used it to operate a small car on a short section of track. In 1860 an American, G.F. Train, opened three lines in London and one line in Birkenhead. The system was called tramways in Britain and was established at Salford in 1862 and Liverpool in 1865. The invention of the dynamo (generator) led to the application of transmitted power by means of overhead electrified wires to streetcar lines, which subsequently proliferated in Britain, Europe, and the United States.

The cable car, the invention of Andrew Hallidie, was introduced in San Francisco on Sacramento and Clay streets in 1873. The cars were drawn by an endless cable running in a slot between the rails and passing over a steam-driven shaft in the powerhouse. The system was well-adapted for operation on steep hills and reached its most extensive use in San Francisco and Seattle. The cars operated more smoothly than did early electric cars, but they could run only at a constant speed; breaking or jamming of the cable tied up all the cars on the line. Beginning about 1900, most cable trackage was replaced by electric cars; but the Seattle lines lasted until the 1930s, and a portion of the San Francisco system continued in operation in the late 20th century.

During the 1890s and the first two decades of the 1900s, conventional electric tramlines replaced horsecar lines in Europe and the United




Electric streetcar in Providence, R.I., c. 1925
The Bettmann Archive

States and made their appearance in the larger cities of Asia, Africa, and South America. In the United States, electric streetcars replaced horse-drawn cars at a particularly rapid rate from 1902 to 1917. The motors and cars were gradually improved: the tiny four-wheeled cars were replaced by heavy eight-wheeled cars that had much greater carrying capacity, and wooden car bodies were replaced by steel ones. The possession of a streetcar line became essential for a growing town or small city, and the larger city streetcar systems extended their lines farther and farther out into the suburbs. The development of streetcars in Europe was equally rapid and continued over a longer period. Many European cities constructed highly efficient streetcar systems, and the electric car became the chief means of urban transport.

British trams usually were double-deck cars operated by two men, one of whom collected the fare; rates were charged according to a zone system. European streetcars were similar to the British, but single-deck cars were common. Power was supplied from overhead wires through a bent piece called a bow or by a collapsible and adjustable frame called a pantograph, in contrast to the universal use of the single trolley pole in the United States. In Britain a conduit system was sometimes used in place of the overhead wires. It consisted of an underground conduit with a continuous slot that contained two conductor rails from which the tram's contacts collected power.

During the World War I period, streetcar enterprises encountered financial difficulties; as wage and materials costs rose, the companies were squeezed by the fixed fares set almost universally by the municipal franchises. Finally, government action permitted fare raises; but by then the use of automobiles had spread, and many cities shifted to motor-bus systems of public transportation. The direct operating expenses of the bus, per mile, were greater than those of streetcars, but the heavy expenses of track construction and maintenance ultimately rendered streetcars uneconomical. In the United States streetcars began to be supplanted by automobiles and buses in the 1930s, and this trend accelerated during the '40s and '50s. In Britain the substitution of buses for trams was hastened during the 1930s by the development of improved double-deck buses, and by the early '50s there were no trams left running in London. The last major British tram system was that of Glasgow, which employed relatively modern double-deck cars. Paris closed the last of its street-car lines in the 1930s, and in other parts of France and in Italy many cities shifted to bus operation.

There were still many major streetcar systems in operation in the late 20th century, however, primarily in the cities of central and eastern Europe and Russia. Streetcar systems are largely municipal, with private bus competition not permitted. In the 1980s some cities in the United States began adopting Light Rail Transit; the trackage for this modern electric trolley system was less expensive to construct than that for elevated or underground metropolitan train systems. Light Rail systems were constructed in such American cities as San Diego, Sacramento, and San Jose, Calif., Portland, Ore., and Buffalo, N.Y.

**Streeter, Burnett Hillman** (b. Nov. 17, 1874, Croydon, Surrey, Eng.—d. Sept. 10, 1937, near Basel, Switz.), English theologian and biblical scholar, noted for his original contributions to knowledge of Gospel origins.

Educated at Queen's College, University of Oxford, Streeter spent most of his life there, becoming chaplain in 1928 and provost in 1933. He was ordained in 1899 and for 15 years (from 1922 to 1937) was a member of the Archbishop's Commission on Doctrine in the Church of England. He wrote or contributed to a dozen volumes in the fields of philosophy of religion, comparative religion, and New Testament studies.

Streeter became widely known as a student of the New Testament. His most important work was *The Four Gospels: A Study of Origins* (1924), in which he originated a "four document hypothesis" (including a Proto-Luke) as a solution to the synoptic problem and developed the theory of "local texts" in the manuscript transmission of the New Testament. This work was followed by *The Primitive Church* (1929), in which he argued that there were three systems (not one) of church government in the earliest Christian churches.

Streeter's other works included *Foundations: A Statement of Christian Belief in Terms of Modern Thought, by Seven Oxford Men* (1912), *The Chained Library* (1931), *Reality: A New Correlation of Science and Religion* (1926), and *The Buddha and the Christ* (Bampton Lectures, 1932).

**Streicher, Julius** (b. Feb. 22, 1885, Fleinhausen, Ger.—d. Oct. 16, 1946, Nürnberg, W.Ger.), Nazi demagogue and politician who gained infamy as one of the most virulent advocates of the persecution of Jews during the 1930s.

Streicher served in the German army during World War I and afterward taught elementary school in Nürnberg. He joined the Nazi Party in 1921, becoming one of the earliest Nazis in southern Germany and a close friend of Adolf Hitler. In 1925 Streicher was appointed gauleiter (district leader) of Franconia, which, after the Nazis came to power in 1933, he administered from his chief bailiwick, Nürnberg. As the founder (1923) and editor of the anti-Semitic weekly newspaper *Der Sturmer*, Streicher achieved a position of great wealth and influence in Nazi Germany. *Der Sturmer's* crude anti-Jewish invective provided a focus for Hitler's persecutory racial policies; the newspaper initiated the general campaign that led to the passage of the Nürnberg laws in 1935.

Streicher's irresponsible behaviour and sexual and sadistic excesses eventually alienated many of his fellow party officials, and he was stripped of his party posts in 1940 after a commission investigated the scandalous irregularities of his business transactions and personal life. He continued to serve as editor of *Der Sturmer* throughout the war years, however, owing to Hitler's protection of him.

After the collapse of Germany, Streicher, disguised as a painter, was captured on May 23, 1945, by U.S. troops near Waldring, Bavaria. Indicted along with other top Nazi leaders to stand trial on charges of war crimes before the International Military Tribunal at Nürnberg, Streicher was found guilty on Oct. 1, 1946, of crimes against humanity and was sentenced to death by hanging.

**Streisand, Barbra,** original name BARBARA JOAN STREISAND (b. April 24, 1942, Brooklyn, N.Y., U.S.), American singer and actress, one of the most popular vocalists and motion-picture comediennes from the 1960s on.

After graduating from high school, Streisand studied acting briefly, became a singer in nightclubs, and made her first appearance on the Broadway stage in *I Can Get It for You Wholesale* in 1962. Her performance in the Broadway musical *Funny Girl* (1964) established her as a major star. Beginning in 1963, she released a series of best-selling record albums that featured vibrant and original interpretations of popular songs. Her career in motion pictures began with the film version of *Funny Girl* (1968) and included performances in *Hello Dolly* (1969), *On a Clear Day You Can See Forever* (1970), *The Owl and the Pussycat* (1970), *What's Up Doc?* (1972), *The Way We Were* (1973), *For Pete's Sake* (1974), and *A Star Is Born* (1976). The uninhibited energy and exuberance she displayed in these films made her one of Hollywood's leading female performers during the 1970s. She made her directorial debut in 1983 with *Yentl,* in which she also starred, and she continued to record albums and to perform in live and televised concerts.

**Streitberg, Wilhelm (August)** (b. Feb. 23, 1864, Rüdesheim, Nassau [Germany]—d. Aug. 19, 1925, Leipzig, Ger.), German historical linguist who, with Karl Brugmann, founded (1891) and edited *Indogermanische Forschungen* ("Indo-European Researches"), an influential journal in the field of Indo-European linguistic studies.

Much of Streitberg's scholarly work concerns comparative and historical Germanic linguistics. His books include *Urgermanische Grammatik* (1896; "Proto-Germanic Grammar"), *Gotisches Elementarbuch* (1897; "Gothic Primer"), and *Die gotische Bibel* (1908–10; "The Gothic Bible"), which presents the extant biblical texts written in the Gothic language. During his academic career he held professorships at Freiburg (1889–98), Münster (1899–1909), Munich (1909–20), and Leipzig (1920 until his death).

**Strelitziaceae,** family of flowering plants in the ginger order (Zingiberales) that range in size from perennial herbs to trees. The family includes three genera (*Ravenala, Phenakospermum,* and *Strelitzia*) and seven species.

*R. madagascariensis,* the traveller's tree (*q.v.*), native to Madagascar, has a palmlike trunk and leaves with the appearance of a fan. The water that is stored in the leaf bases may enable it to withstand dry conditions. The only species of *Phenakospermum,* a tree similar to *Ravenala,* grows in South American swamps. Some species of the southern African genus *Strelitzia* look like palm trees. Others are herbs bearing exotic flowers (*e.g.,* bird-of-paradise flower, *S. reginae*). *S. augusta,* which grows to more than 5 m (16 feet) in height, has banana-like fruit and resembles the traveller's tree. In this family large flowers are enclosed in bracts (leaflike structures), and both leaves and bracts occur in two vertical rows. *See also* bird-of-paradise flower.

**streltsy,** singular STRELETS (Russian: "musketeer"), Russian military corps established in the middle of the 16th century that formed the bulk of the Russian army for about 100 years, provided the tsar's bodyguard, and, at the end of the 17th century, exercised considerable political influence. Originally composed of commoners, the *streltsy* had become a hereditary military caste by the mid-17th century. Living in separate settlements (*slobody*), they performed police and security duties in Moscow and in the border towns where they were garrisoned; they often also engaged in trades and crafts. In 1681 there were about 55,000 *streltsy,* 22,500 of whom were stationed in Moscow.

The *streltsy* became discontented and unreliable in the second half of the 17th century after the government began paying them in land instead of money and grain. They then became involved in the succession struggle begun in 1682 between rival partisans of the half brothers Peter I and Ivan V. Supporting Ivan, they staged a revolt against the Naryshkin family (the relatives of Peter's mother, who had assumed actual power), named both Ivan and Peter tsars, and made Ivan's sister Sophia regent. In 1698, having unsuccessfully attempted to unseat Peter I (the Great) and restore Sophia to the regency (Peter had displaced her in 1689), the *streltsy* were forcibly disbanded by the tsar, with hundreds of them being executed or deported. Though revived briefly by Peter to participate in the Great Northern War (1702), the corps was gradually absorbed into the regular army thereafter.

**strengite,** phosphate mineral similar to variscite (*q.v.*).

**strepsipteran,** any of about 400 species of insects that constitute the order Strepsiptera and are notable for their bizarre form of parasitism. (Some authorities classify them within the beetle family Meloidae.) Strepsipterans are para-



Strepsipteran male (*Stylops pacifica*) fertilizing a female living in the abdomen of the host bee (*Andrena complexa*)
E.S. Ross

sitic in planthoppers, leafhoppers, treehoppers, froghoppers, bees, and other insects. Mature females are usually wingless and saclike; the males have large, fanlike hindwings, short, clublike forewings, bulging eyes, and comblike antennae. The bristly and long-legged *Stylops* larvae are picked up from a flower by bees and transported to a bee nest, where they penetrate bee larvae and live as parasites first within the larva and later in the adult bee. The *Stylops* female remains permanently in the puparium formed from the last larval skin inside the host except for its head, which protrudes from the mature bee's abdomen. The male comes out of the host as a winged adult and locates and fertilizes the female through an opening in the puparium beneath her head. The young develop inside the female, emerge through the same opening, and are carried to a flower by the bee. Although bees so parasitized live an almost normal life span, their reproductive organs do not develop.

**Streptelasma,** extinct genus of corals, existing as single animals rather than colonial forms and found as fossils in marine rocks of Ordovician to Devonian age (505 to 360 million years old). Each horn-shaped specimen represents a single individual. The hard, and thus preserved, parts of the animal consist of a carbonate skeletal structure distinctive in form and construction.

**streptobacillary fever,** also called HAVERHILL FEVER, or ERYTHEMA ARTHRITICUM EPIDEMICUM, acute infection caused by the microorganism *Streptobacillus moniliformis,* transmitted to humans by rat bite or by the ingestion of contaminated foods and characterized by the sudden onset of chills, fever, and vomiting followed by the development of a skin rash and inflammation of the joints. An ulcerative lesion may be observed at the site of the rat bite. Formation of abscesses in the brain, heart muscle, and other tissues is a rare but serious complication. The infection responds well to penicillin. It was first described in Haverhill, Mass., U.S., in 1926; some 86 persons were infected then, apparently by the ingestion of contaminated raw and unpasteurized milk. Haverhill fever sometimes refers only to cases in which there is no history of rodent bite. *See also* rat-bite fever.

**streptococcus,** any member of a genus of spheroidal bacteria belonging to the family Streptococcaceae. The term streptococcus (Latin: "twisted berry") refers to the bacteria's characteristic grouping in chains that resemble a string of beads. Streptococci are microbiologically characterized as gram-positive.

The genus *Streptococcus* contains a variety of species, some of which cause disease in humans and animals, while others are important in the manufacture of certain fermented products. *S. pyogenes,* often referred to as group A streptococcus bacteria, can cause rheumatic fever, impetigo, streptococcal toxic shock syndrome, strep throat, tonsillitis, and other upper respiratory infections. Necrotizing fasciitis, a rapidly spreading infection of the skin and underlying tissue caused by *S. pyogenes,* has been popularly referred to as the "flesh-eating disease." *S. agalactiae,* or group B streptococcus bacteria, can cause infections of the bladder and uterus in pregnant women; in newborn infants infection may result in sepsis (blood poisoning), meningitis, or pneumonia. *S. pneumoniae,* also called pneumococcus, causes pneumonia, sinusitis, otitis media, and meningitis. Fecal (enterococcal) species occur in great numbers in the bowel and can cause urinary tract infections and endocarditis. *S. mutans,* of the viridans species, inhabits the mouth and contributes to tooth decay. Among the lactic species, *S. lactis* and *S. cremoris* are used in commercial starters for the production of butter, cultured buttermilk, and certain cheeses.

**Streptomyces,** genus of filamentous bacteria of the family Streptomycetaceae (order Actinomycetales) that includes more than 500 species occurring in soil and water. Many species are important in the decomposition of organic matter in soil, contributing in part to the earthy odour of soil and decaying leaves and to the fertility of soil. Certain species are noted for the production of broad-spectrum antibiotics, chemicals that the bacteria naturally produce to kill or inhibit the growth of other microorganisms.

*Streptomyces* are characterized as gram-positive aerobic bacteria of complex form. They form a threadlike net called a mycelium that bears chains of spores at maturity. Their branching strands are 0.5 to 1.0 micrometre in diameter.

The antibiotic producers include: *S. aureofaciens* (yielding chlortetracycline), *S. rimosis* (oxytetracycline; *see* tetracycline), *S. griseus* (streptomycin), *S. erythraeus* (erythromycin), and *S. venezuelae* (chloramphenicol).

**streptomycin,** antibiotic synthesized by the soil organism *Streptomyces griseus.* The drug acts by interfering with the ability of a microorganism to synthesize certain vital proteins. It was the first antimicrobial agent developed after penicillin and the first antibiotic effective in treating tuberculosis. Because it was effective against a wide variety of diseases, streptomycin was used often, with the result that many initially sensitive microorganisms, including the bacterium that causes tuberculosis, became resistant to the antibiotic. It is used in combination with penicillin for treating endocarditis and with tetracyclines in the treatment of plague, tularemia, and brucellosis.

**Stresa,** town, Verbano-Cusio-Ossola *provincia,* Piemonte (Piedmont) *regione,* northwestern Italy. It lies on the western shore of Lake Maggiore, north of the Novara *provincia* border. A health and tourist resort noted for its pleasant climate and scenic surroundings, it is a favourite site for congresses. A conference held there in 1935 between Italy, Great Britain, and France unsuccessfully attempted to deal with Adolf Hitler's announcement that Germany would rearm despite the prohibitions contained in the Treaty of Versailles. Antonio Rosmini-Serbati, founder of the Institute of Charity (congregation of Rosminians), died there in 1855. Pop. (2001 est.) 4,945.

**Stresemann, Gustav** (b. May 10, 1878, Berlin, Ger.—d. Oct. 3, 1929, Berlin), chancellor (1923) and foreign minister (1923, 1924–29) of the Weimar Republic, largely responsible for restoring Germany's internation-



Stresemann
By courtesy of Bildarchiv Preussischer Kulturbesitz SPK, Berlin

al status after World War I. With French foreign minister Aristide Briand, he was awarded the Nobel Peace Prize in 1926 for his policy of reconciliation and negotiation.

*Youth and education.* Stresemann was the son of Ernst Stresemann, a Berlin innkeeper and beer distributor. He was the only one of five children able to attend high school and ultimately the university. From early childhood he displayed a strong "inclination toward solitude," as he put it as a student, as well as a tendency to be melancholy and to daydream. At school he displayed an unusual gift for history, especially modern history. He was especially interested in the lives of great personalities, particularly Napoleon and J.W. von Goethe, both of whom fascinated him throughout his life and inspired several of his literary studies.

Stresemann, attending the universities of Berlin and Leipzig from 1897 to 1900, first studied literature and history but changed to economics, probably to improve his professional prospects rather than in recognition of his practical gifts. During his student years he belonged to a relatively progressive fraternity and retained a lifelong attachment to the sentimental glories of student life. In 1900 he received his doctorate with a dissertation entitled "The Growth of the Berlin Bottled-Beer Industry." The subject of his study, based on his knowledge of his father's business and dealing with the decline of a sector of small business as a result of competition from giant industry, was characteristic of his origins as well as of his point of view. It was used against him in future political struggles by the right-wing opposition.

As a liberal Prussian Protestant, Stresemann became a typical representative of the chauvinistic spirit prevailing in imperial Germany. He believed in the spiritual, military, and economic superiority of the German Empire, and his political idealism manifested itself in a sentimental enthusiasm for the heroic liberalism of 1848, as well as in a romantic style of speech.

*Political rise.* After completing his studies, Stresemann began his professional career in a trade association. Unusually rapid success in commerce gave him a springboard into politics. As an administrative assistant in the German Chocolate Makers' Association from 1901 to 1904, he gained a reputation as an accomplished organizer and negotiator. Already, in 1902, he had founded the Saxon Manufacturers' Association. As its legal representative until 1911, he occupied an important position in economic life at the age of 25.

His wife, whom he married in 1903, was the sister of a fraternity brother and the daughter of the Berlin industrialist Adolf Kleefeld. Of Jewish extraction, the charming and elegant Frau Stresemann played a leading role in Berlin society of the 1920s. They had two sons.

After initially sympathizing with the ideas of the Protestant social reformer Friedrich Naumann and collaborating with his National Social Union, Stresemann joined the rightist National Liberal Party in 1903. Strongly represented in Saxony at the time, the party became Stresemann's political home. Often involved in conflicts over his support of social-welfare measures with the right wing of his party (which was dominated by representatives of heavy industry), he attracted general notice at his first appearance at a party congress in 1906.

As a Dresden city councillor from 1906 to 1912 and editor of the Dresden magazine *Sächsische Industrie* ("Saxon Industry"), Stresemann became a well-known writer on economics and an expert on municipal affairs. Recognizing the importance of the press in influencing public opinion, he took advantage of it to support his aims.

He was elected in 1907 to the Reichstag (parliament) as a National Liberal from the Annaberg district in the Saxon metal-mining country, and thus he succeeded in gaining a foothold in national politics. At 28 he was the youngest deputy in the Reichstag. The party chairman, Ernst Bassermann, helped to advance his political career, and he was soon considered Bassermann's "crown prince." Stresemann was primarily interested in economic policy both as a journalist and a deputy. He energetically defended the interests of the commercial middle class, but his advocacy of extended social-welfare legislation embroiled him in a conflict with the representatives of his party's right wing, which in 1912 prevented his reelection to the National Liberal Party executive committee. After losing his seat in the new Reichstag elections in the same year, he travelled with other business leaders to the United States to study economic conditions.

By this time Stresemann, who had moved to Berlin, was one of the best known leaders of German economic life. He occupied leading positions in a number of trade associations, including the German-American Economic Association, established at his suggestion. Stresemann's many offices brought him financial independence. He was known for his organizational gifts, knew how to handle people, and was aware of the power he wielded. As a member of the pan-German Deutscher Kolonialverein (German Colonial League) and an advocate of a strong naval construction program, he supported the imperialist goals of German policy carried out under the aegis of Alfred von Tirpitz and Bernhard, Fürst von Bülow. Tirpitz had served as state secretary of the Imperial Naval Office, in which post he created the German battle fleet, and Bülow was chancellor of Germany (1900–1909).

*Policies during World War I.* Stresemann was a part of the great majority of Germans who, in the firm belief that Germany was conducting a purely defensive war, greeted the outbreak of World War I with enthusiasm. Because of his poor health he was exempted from military service. His political hour struck, however, in December 1914, when he was returned to the Reichstag in a special election.

During the war, Stresemann emerged as one of the most vociferous exponents of pan-Germanism and as a champion of Germany's extensive claims on Polish and Russian territory in the east and on French and Belgian territory in the west. He virtually took over leadership of his party's Reichstag faction from Ernst Bassermann, whom military service and illness kept away from Berlin much of the time. During these years Stresemann moved increasingly to the right. From 1916 he worked closely with the German Army Supreme Command under Field Marshal Paul von Hindenburg and Gen. Erich Ludendorff and became their parliamentary mouthpiece. He thus advocated unrestricted U-boat warfare and opposed the policy of Chancellor Theobald von Bethmann Hollweg, who held to a moderate course and did not allow himself to be committed to expansionist war aims.

Stresemann played a leading role in Bethmann Hollweg's overthrow in July 1917 but failed to bring back to power the former chancellor Bülow, whom he admired. After Bassermann's death in the same month, Stresemann succeeded him as leader of the party's Reichstag faction, becoming chairman of the entire party later in the same year. Despite radical differences within the National Liberal ranks, Stresemann was able to prevent a party split between the Reichstag faction and its more conservative counterpart in the Prussian House of Deputies over the Prussian three-class suffrage system, in which a citizen's vote was weighted according to the value of his property. Hoping to strengthen the monarchy, Stresemann advocated abolition of the voting system. On the other hand, he allowed himself to be deceived about the seriousness of the military situation of the *Reich* and its allies until the Supreme Command admitted defeat at the end of September 1918.

*Conversion into a "realistic republican."* The defeat, the collapse of the monarchy on Nov. 9, 1918, and Emperor William II's flight to Holland were cruel blows to Stresemann. Nonetheless, he quickly accommodated himself to the realities of a republican Germany. When, however, the newly formed left-liberal German Democratic Party, led by Friedrich Naumann and the renowned sociologist Max Weber, refused to admit him to its higher councils, Stresemann founded his own party, the German People's Party. A right-liberal grouping of educated and propertied elements, it sought to rally the right-wing supporters of the former National Liberal Party. Stresemann, fundamentally a monarchist and an opponent of the Weimar Republic, assumed an ambiguous "wait-and-see" attitude during the rightist Kapp Putsch of March 1920. When the putsch was suppressed, however, he prepared to cooperate politically with the republic. He tried to persuade the democratic parties that the German People's Party was qualified to participate in a coalition and pressed for a position in the government. For the time being, however, he was still counted among the "national opposition" to the Weimar coalition—the Social Democrats, the German Democratic Party, and the Centre Party.

Stresemann, a member of the German National Constituent Assembly in Weimar in 1919–20, was an opponent of the new German constitution. He also opposed the Treaty of Versailles and was to devote his political life to its revision. From 1920 until his death Stresemann was a Reichstag deputy and chairman of the German People's Party, and in August 1923 he became chancellor of the *Reich* at the head of a "Great Coalition," composed of representatives of the Social Democrats, the Centre, and the German Democrats, as well as of his People's Party.

As chancellor from Aug. 13 to Nov. 23, 1923, during the crisis over the Allied occupation of the Ruhr, and as foreign minister from August 1923 to his death, Stresemann exercised decisive influence over the fate of the Weimar Republic, and he became a statesman of European stature. His first decision as chancellor was to abandon the policy of passive resistance in the Ruhr, which in January 1923 had been occupied by French and Belgian troops to enforce payment of German war reparations. This policy had accelerated inflation and was precipitating a financial collapse.

On the domestic scene, he sought to steer his way among opposing domestic forces. While proceeding harshly against Communist-influenced state governments in Thuringia and Saxony, he displayed a lenient attitude toward revolutionary attempts of the radical right, such as Adolf Hitler's putsch of Nov. 9, 1923, in Munich. At the height of the internal political crisis of November 1923 there was danger that the occupied territory west of the Rhine (occupied by the Allies) might withdraw from the *Reich.* Only the stabilization of the currency in the middle of November—the last significant achievement of Stresemann's government—restored domestic order and created the basis for economic recovery.

*Years as foreign minister.* Overthrown by a vote of no confidence, the Cabinet resigned in November 1923. Stresemann took over the post of foreign minister in the new government and held it, unchallenged until his death, in coalition governments of varying composition under three chancellors ranging from the left to centre. His policy was aimed at securing a reconciliation with the victorious Western powers, especially France, for Germany had already renewed ties with Russia through the Treaty of Rapallo in 1922. By meeting the reparation payments, for the reduction of which he fought as stubbornly as he did for removal of French troops from west of the Rhine, he hoped to gain a favourable position for his negotiations with the victorious Allies. His enduring aim was to obtain equal rights for Germany and to restore it to its former position among the nations of Europe.

Principally, however, this meant a revision of Germany's eastern border of 1919, which would require Poland to return Danzig, the Polish Corridor, and Upper Silesia, as well as the annexation of Austria. Realistically appraising Germany's central position in Europe and exploiting Anglo-French and Anglo-Soviet tensions, Stresemann tried to achieve his goals through negotiation, but his seesaw policy between East and West was strongly criticized by many contemporary critics. Yet Stresemann retained his optimism, often carrying it to extremes, and this outlook frequently led him to underestimate opposition both at home and abroad.

Stresemann's successes in dealing with the Allied powers during those years can be marked out in stages. In 1924 the U.S.-proposed Dawes Plan was signed, providing for reduction in payment of reparations and stabilization of German finances. It was followed by the Pact of Locarno in 1925, which included acceptance of the new Franco-German border, agreements to arbitrate disputes with other nations, and immunity from new sanctions by the victors of World War I.

In 1926 the first Rhineland zone was evacuated by the Allies, Germany was admitted to the League of Nations, and the Berlin Treaty with the Soviet Union, an agreement providing for mutual neutrality, was signed. In 1928 the Kellogg–Briand Pact outlawing war was signed by Germany. Stresemann did not live to see the complete evacuation of French troops from the Rhineland and the completion of the new settlement reducing German reparations through the Young Plan (also a U.S. proposal) in 1929, although he had conducted the negotiations when already marked by death.

Any summary of Stresemann's diplomatic successes should not obscure the fact that he had to devote an extraordinary amount of effort to combatting strong domestic opposition that arose, above all, from his own party. Stresemann, who took the importance of the press into consideration, used publicity to promote his policy but, by making

premature statements, often aroused political hopes that could not be realized. After his spectacular secret meeting in 1926 with Aristide Briand, which gave rise to exaggerated hopes, Franco-German rapprochement came to a standstill. In the last two years of his life, which were marked by illness, Stresemann became increasingly dissatisfied at his failure to further his foreign policy, especially after his party dwindled and large sections of it went over to the extreme right. He himself contemplated formation of a new party of the liberal centre. The domestic struggle in particular weakened his already precarious health, and he died after suffering two strokes, at the age of 51.

*Assessment.* By virtue of his six years of service as foreign minister and the esteem he enjoyed, particularly abroad, Stresemann made an essential contribution to securing the Weimar Republic's stability and survival for a few years. Because of domestic undercurrents and opposition, he succeeded at the cost of extraordinary personal effort.

On his death, the republic, which honoured him with a state funeral, lost one of its few statesmen. In his personal as well as his political development he embodied the uncertainty of the period of transition from monarchy to republic. Yet he was unable to integrate his own party, over which he jealously maintained leadership, into the Weimar state and thus failed, as he wrote in 1929, to form the bridge "between the old and the new Germany."

As an advocate of a "policy of national realism," as opposed to a "pacifist policy of resignation," he was by no means a champion of European unification. He supported its objectives, however, since he could thus more easily obtain the urgently sought revision of the Treaty of Versailles.

Stresemann's image is still controversial. He was first pronounced a hero after 1945, when he was viewed as a champion of a united Europe. This view was succeeded in the 1950s by an increasingly critical evaluation, especially during the disclosure of his voluminous literary estate, which was at first exclusively at the disposal of U.S. historians. He was then portrayed as a flexible and opportunistic politician of nationalistic sympathies who shrewdly adjusted his aims to meet the needs of the time, and it was said that Stresemann had not become a democrat out of conviction but rather that he had raised "finessing" to the level of a principle. His volatile character and sentimental attachment to uniforms and tradition were also emphasized. The Communists, meanwhile, regarded him as a representative of monopoly capitalism and a forerunner of Hitler.

One of his more recent biographers has convincingly characterized Stresemann as a "pragmatic conservative" who remained flexible in his choice of political means while pursuing his national aims of restoration of German wealth and power and the continuation of German traditional social and economic order. Others have emphasized the European aspect of the German "patriot" Stresemann, a viewpoint from which German historical research has in the meantime departed. Yet, his political changeability notwithstanding, Stresemann is counted among the few statesmen of his time. (R.Mo.)

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*To make the best use of the Britannica, consult the* INDEX *first*

**stress,** in psychology and biology, any strain or interference that disturbs the functioning of an organism. The human being responds to physical and psychological stress with a combination of psychic and physiological defenses. If the stress is too powerful, or the defenses inadequate, a psychosomatic or other mental disorder may result.

Stress is an unavoidable effect of living and is an especially complex phenomenon in modern technological society. There is little doubt that an individual's success or failure in controlling potentially stressful situations can have a profound effect on his ability to function. The ability to "cope" with stress has figured prominently in psychosomatic research. Researchers have reported a statistical link between coronary heart disease and individuals exhibiting stressful behavioral patterns designated "Type A." These patterns are reflected in a style of life characterized by impatience and a sense of time urgency, hard-driving competitiveness, and preoccupation with vocational and related deadlines.

Various strategies have been successful in treating psychological and physiological stress. Moderate stress may be relieved by exercise and any type of meditation (*e.g.*, yoga or Oriental meditative forms). Severe stress may require psychotherapy to uncover and work through the underlying causes. A form of behaviour therapy known as biofeedback enables the patient to become more aware of internal processes and thereby gain some control over bodily reactions to stress. Sometimes, a change of environment or living situation may produce therapeutic results.

**stress,** in physical sciences and engineering, force per unit area within materials that arises from externally applied forces, uneven heating, or permanent deformation and that permits an accurate description and prediction of elastic, plastic, and fluid behaviour. A stress is expressed as a quotient of a force divided by an area.

There are many kinds of stress. Normal stress arises from forces that are perpendicular to a cross-sectional area of the material, whereas shear stress arises from forces that are parallel to, and lie in, the plane of the cross-sectional area. If a bar having a cross-sectional area of four square inches (26 square centimetres) is pulled lengthwise by a force of 40,000 pounds (18,000 kilograms) at each end, the normal stress within the bar is equal to 40,000 pounds divided by four square inches, or 10,000 pounds per square inch (which units are usually abbreviated to psi). This specific normal stress that results from tension is called tensile stress. If the two forces are reversed, so as to compress the bar along its length, the normal stress is called compressive stress. If the forces are everywhere perpendicular to all surfaces of a material, as in the case of an object immersed in a fluid that may be compressed itself, the normal stress is called hydrostatic pressure, or simply pressure. The stress beneath the Earth's surface that compresses rock bodies to great densities is called lithostatic pressure.

Shear stress in solids results from actions such as twisting a metal bar about a longitudinal axis as in tightening a screw. Shear stress in fluids results from actions such as the flow of liquids and gases through pipes, the sliding of a metal surface over a liquid lubricant, and the passage of an airplane through air. Shear stresses, however small, applied to true fluids produce continuous deformation or flow as layers of the fluid move over each other at different velocities like individual cards in a deck of cards that is spread. For shear stress, *see also* shear modulus.

Reaction to stresses within elastic solids causes them to return to their original shape when the applied forces are removed. Yield stress, marking the transition from elastic to plastic behaviour, is the minimum stress at which a solid will undergo permanent deformation or plastic flow without a significant increase in the load or external force. The Earth shows an elastic response to the stresses caused by earthquakes in the way it propagates seismic waves, whereas it undergoes plastic deformation beneath the surface under great lithostatic pressure.

**stress,** in phonetics, intensity given to a syllable of speech by special effort in utterance, resulting in relative loudness. This emphasis in pronunciation may be merely phonetic (*i.e.*, noticeable to the listener, but not meaningful), as it is in French, where it occurs regularly at the end of a word or phrase; or it may serve to distinguish meanings, as in English, in which, for example, stress differentiates the noun from the verb in the word "permit."

**stress** (music): *see* accent.

**Streuvels, Stijn,** pseudonym of FRANK LATEUR (b. Oct. 3, 1871, Heule, near Courtrai, Belg.—d. Aug. 15, 1969, Ingooigem, near Courtrai), Belgian novelist and short-story writer whose works are among the masterpieces of Flemish prose.

The nephew of the priest and poet Guido Gezelle, he discovered his literary gifts while at school at Avelgem. Employed as a master baker in Avelgem for 15 years, he found time to learn German, English, Danish, and some Russian and, after 1892, to write his first stories. He contributed to the periodical *Van Nu en Straks* ("Today and Tomorrow") and in 1899 achieved fame with his first collection, *Lenteleven* (*The Path of Life*, 1915). In 1905 he settled in the village of Ingooigem and devoted himself entirely to writing.

Streuvels found his subjects in the village life of southwest Flanders—an isolated and agrarian Flanders that no longer exists. He defined his chosen locality by precise reference to dialect and folklore, but he was no mere chronicler. His keen observation was enriched by his imaginative power, his feeling for atmosphere, and his rich resources of language. He created a world in which nature is an ever-present force—nature described with a visionary power resembling that of the painter van Gogh. At his best he was a master of characterization, especially in his presentation of farmers and farm workers who struggle against the land and against destiny, as in *Langs de wegen* (1902; *Old Jan*, 1936) and in his masterpiece, *De vlaschaard* (1907; "The Flax Field"). His epic but lyrical prose style, perfectly suited to his subject, is among the best of its period.

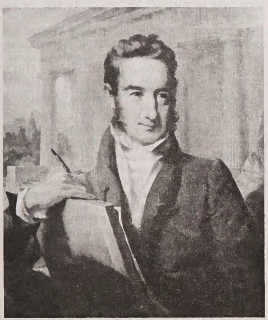
**striated muscle,** also called VOLUNTARY MUSCLE, STRIPED MUSCLE, OR SKELETAL MUSCLE, the most common of the three types of muscle in the body. Striated muscle is attached to bone and produces all of the movements of body parts in relation to each other; unlike smooth and cardiac muscle, striated muscle is under voluntary control. Its fibres are long and thin, crossed with a regular pattern of fine red and white lines, giving the muscle

its distinctive appearance and name. *Compare* smooth muscle.

**Strickland, William** (b. 1788, Navesink, N.J., U.S.—d. April 6, 1854, Nashville, Tenn.), U.S. architect and engineer who was one of the leaders of the Greek Revival in the first half of the 19th century.

Strickland first became known as a scene painter, although he studied architecture under Benjamin Latrobe from 1803 to 1805. In 1810 he designed the Masonic Temple in Philadelphia. Strickland enjoyed greater popular success than Latrobe because he was willing to provide straightforward architectural statements without the sophistications insisted upon by Latrobe. For this reason Strickland's design for the Second Bank of the United States (built 1819–24) was preferred over that submitted by his mentor; Strickland followed exactly the prescription of bank president Nicholas Biddle that the style be "purest Grecian" to symbolize the freedom of business from government. Strickland also designed in Greek Revival style the Merchants' Exchange building (1834), the United States Naval Asylum (1826), the United States Mint (1829), and the United States Custom House, all in Philadelphia, as well as the Athenaeum (1836–38) in Providence, R.I., and the United States mints in Charlotte, N.C. (1835), and New Orleans (1835–36).

His engineering projects were nearly as well known as his architectural designs. In 1825



William Strickland, oil on canvas by John Neagle, 1829; in the Yale University Art Gallery

By courtesy of the Yale University Art Gallery, the Mabie Brady Garvan Collection

he was sent to Europe to study internal improvements and on his return did much to encourage the construction of the original line of the Pennsylvania Railroad Company. He also constructed the Delaware Breakwater, a commission from the U.S. government. At the time of his death he was in Nashville, superintending the construction of the state house, the design of which was based on several well-known Greek buildings. It is regarded by many as his best work. By a special act of the state legislature he was buried in the building.

Strickland was among the first to lecture on architecture in the United States and was the author of several technical publications on engineering and architectural projects he had headed. His principal pupil was another Greek revivalist, Thomas Ustick Walter.

Agnes Addison Gilchrist's *William Strickland: Architect and Engineer, 1788–1854* (1950) was reprinted in 1969 with additional material.

**strigiform** (bird order): *see* owl.

**Strigonium** (Hungary): *see* Esztergom.

**Strijdom, Johannes Gerhardus,** Strijdom also spelled STRYDOM (b. July 14, 1893, Willowmore, Cape Colony—d. Aug. 24, 1958, Cape Town), prime minister of the Union of South Africa (1954–58) noted for his uncompromising Afrikaner sympathies. As head



Strijdom

Archiv fur Kunst und Geschichte, West Berlin

of the government, he translated this attitude into a vigorous program of apartheid, or separation of the races.

After graduating from Victoria College, Stellenbosch, he moved to Pretoria (1914), where he entered the civil service. Three years later he qualified in law at Pretoria University and began a successful practice at Nylstroom, Transvaal. Strijdom became increasingly interested in politics, however, paying particular attention to the rights of his fellow Afrikaners. In 1929 he was elected to Parliament as a member of the Nationalist Party from Waterberg, a seat he continued to hold until his death. His tenacity in political matters led to his characterization as "the Lion of Waterberg."

Strijdom was a loyal follower of J.B.M. Hertzog, prime minister and leader of the Nationalist Party, until 1934, when Hertzog and Jan Smuts entered into a coalition. For a time Strijdom was the only member of Parliament from the Transvaal to support Daniel F. Malan's Purified Nationalist Party, contributing much to its victory in the election of 1948. He was rewarded with the post of minister of lands and irrigation in Malan's Cabinet. In that office for six years, he became well-known for advocating white supremacy in South Africa.

After the retirement of Malan, Strijdom succeeded him as head of the party and on Dec. 3, 1954, assumed the office of prime minister. Strijdom's rise to power represented a victory for the party's more extreme Transvaal faction over the moderate Cape faction. As a result, he pursued a policy of strict apartheid, which was furthered by radically changing the composition of the Senate in 1955 so as to ensure the necessary two-thirds majority in a joint sitting of both houses of Parliament. The following year the Cape Coloured voters were placed on a separate electoral roll. Strijdom fell ill in December 1957 and was succeeded on his death by Hendrik Frensch Verwoerd.

**strike,** collective refusal by employees to work under the conditions required by employers. Strikes arise for a number of reasons: from disputes about wages and the conditions of employment; in sympathy with other striking workers; from jurisdictional disputes between two unions; or for purely political goals (as in the general strike; *q.v.*). Strikes not authorized by the central union body (wildcat strikes) may be directed against the union leadership as well as the employer.

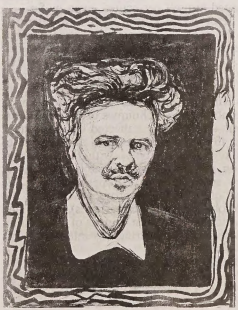
The right to strike is granted in principle to workers in nearly all industrial countries, although some require a series of specified efforts at settlement preceding the strike and others forbid purely political strikes and strikes by public employees. The types and purposes of strikes and their frequency depend on a great variety of factors, including a country's political system, its history, and the role of the trade unions.

Most strikes and threats of strikes are intended to inflict a cost on the employer for failure to meet specific wage and other demands of the union. Among Japanese unions, on the other hand, strikes are not intended to halt production for long periods of time and are more akin to demonstrations. Occasionally, as in some western European countries, strikes have been politically motivated, stemming from a general class consciousness among the workers. In countries ruled by governments with a strong Socialist orientation, strikes may be directed against the governments and their policies.

**strike,** in geology, direction of the line formed by the intersection of a fault, bed, or other planar feature and a horizontal plane. Strike indicates the attitude or position of linear structural features such as faults, beds, joints, and folds. Trend is the direction of the line formed by the intersection of the planar feature with the ground surface; trend is the same as strike only if the ground surface is parallel to the horizontal plane. Dip is the angle at which a planar feature is inclined to the horizontal plane; it is measured in a vertical plane perpendicular to the strike of the feature. Plunge is the vertical angle between the horizontal plane and the axis or line of maximum elongation of a feature. Plunge is measured along the axis of a fold, whereas dip is measured along the limbs. Pitch is the angle between the axis of the feature and the strike of the plane containing the axis.

**Strimón, Potamós** (Greece–Bulgaria): *see* Struma River.

**Strindberg, (Johan) August** (b. Jan. 22, 1849, Stockholm—d. May 14, 1912, Stockholm), Swedish playwright, novelist, and short-story writer, who combined psychology and Naturalism in a new kind of European



Strindberg, lithograph by Edvard Munch, 1896

By courtesy of the Munch-Museet, Oslo; photograph, O. Vaering

drama that evolved into Expressionist drama. His chief works include *The Father* (1887), *Miss Julie* (1888), *Creditors* (1888), *A Dream Play* (1902), and *The Ghost Sonata* (1907).

*Early years.* Strindberg's father, Carl Oskar Strindberg, was a bankrupt aristocrat who worked as a steamship agent, and his mother was a former waitress. His childhood was marred by emotional insecurity, poverty, his grandmother's religious fanaticism, and neglect, as he relates in his remarkable autobiog-

raphy *Tjänstekvinnans son* (1886–87; *The Son of a Servant*, 1913). He studied intermittently at the University of Uppsala, preparing in turn for the ministry and a career in medicine but never taking a degree. To earn his living, he worked as a free-lance journalist in Stockholm, as well as at other jobs that he almost invariably lost. Meanwhile he struggled to complete his first important work, the historical drama *Mäster Olof* (published in 1872), on the theme of the Swedish Reformation, influenced by Shakespeare and by Henrik Ibsen's *Brand*. The Royal Theatre's rejection of *Mäster Olof* deepened his pessimism and sharpened his contempt for official institutions and traditions. For several years he continued revising the play—later recognized as the first modern Swedish drama—thus delaying his development as a dramatist of contemporary problems.

In 1874 he became a librarian at the Royal Library, and in 1875 he met the Finno-Swedish Siri von Essen, then the unhappy wife of an officer of the guards; two years later they married. Their intense but ultimately disastrous relationship ended in divorce in 1891, when Strindberg, to his great grief, lost the custody of their four children. At first, however, marriage stimulated his writing, and in 1879 he published his first novel, *The Red Room*, a satirical account of abuses and frauds in Stockholm society: this was something new in Swedish fiction and made its author nationally famous.

He also wrote more plays, of which *Lucky Peter's Travels* (1881) contains the most biting social criticism. In 1883, the year after he published *Det nya riket* ("The New Kingdom"), a withering satire on contemporary Sweden, Strindberg left Stockholm with his family and for six years moved restlessly about the Continent. Although he was then approaching a state of complete mental breakdown, he produced a great number of plays, novels, and stories. The publication in 1884 of the first volume of his collected stories, *Married*, led to a prosecution for blasphemy. He was acquitted, but the case affected his mind, and he imagined himself persecuted, even by Siri.

He returned to drama with new intensity, and the conflict between the sexes inspired some of the outstanding works written at this time, such as *The Father*, *Miss Julie*, and *The Creditors*. All of these were written in total revolt against contemporary social conventions. In these bold and concentrated works, he combined the techniques of dramatic Naturalism—including unaffected dialogue, stark rather than luxurious scenery, and the use of stage props as symbols—with his own conception of psychology, thereby inaugurating a new movement in European drama. *The People of Hemsö*, a vigorous novel about the Stockholm skerries (rocky islands), always one of Strindberg's happiest sources of inspiration, was also produced during this intensively creative phase.

The years after his return to Sweden in 1889 were lonely and unhappy. Even though revered as a famous writer who had become the voice of modern Sweden, he was by now an alcoholic unable to find steady employment. In 1892 he went abroad again, to Berlin. His second marriage, to a young Austrian journalist, Frida Uhl, followed in 1893; they finally parted in Paris in 1895.

A period of literary sterility, emotional and physical stress, and considerable mental instability culminated in a kind of religious conversion, the crisis that he described in *Inferno*. During these years Strindberg devoted considerable time to experiments in alchemy and to the study of theosophy.

*Late years.* His new faith, coloured by mysticism, re-created him as a writer. The immediate result was a drama in three parts, *To Damascus*, in which he depicts himself as "the Stranger," a wanderer seeking spiritual peace and finding it with another character, "the Lady," who resembles both Siri and Frida.

By this time Strindberg had again returned to Sweden, settling first in Lund and then, in 1899, in Stockholm, where he lived until his death. The summers he often spent among his beloved skerries. His view that life is ruled by the "Powers," punitive but righteous, was reflected in a series of historical plays that he began in 1889. Of these, *Gustav Vasa* is the best, masterly in its firmness of construction, characterization, and its vigorous dialogue. In 1901 he married the young Norwegian actress Harriet Bosse; in 1904 they parted, and again Strindberg lost the child, his fifth.

Yet his last marriage, this "spring in winter," as he called it, inspired, among other works, the plays *The Dance of Death* and *A Dream Play*, as well as the charming autobiography *Ensam* ("Alone") and some lyrical poems. Renewed bitterness after his parting from his last wife provoked the grotesquely satirical novel *Svarta Fanor* (1907; "Black Banners"), which attacked the vices and follies of Stockholm's literary coteries, as Strindberg saw them. *Kamarspel* ("Chamber Plays"), written for the little Intima Theatre, which Strindberg ran for a time with a young producer, August Falck, embody further developments of his dramatic technique: of these, *The Ghost Sonata* is the most fantastic, anticipating much in later European drama. His last play, *The Great Highway*, a symbolic presentation of his own life, appeared in 1909.

*Assessment.* To the end, Strindberg debated current social and political ideas (returning to the radical views of his youth) in polemical articles, while his philosophy was expounded in the aphoristic *Zones of the Spirit* (1907–12). He was ignored in death, as in life, by the Swedish Academy but mourned by his countrymen as their greatest writer. On Swedish life and letters he has exercised a lasting influence and is admired for his originality, his extraordinary vitality, and his powerful imagination, which enabled him to transform autobiographic material into dramatic dialogue of exceptional brilliance.

The pregnant, colloquial style of Strindberg's early novels and, especially, of his short stories, brought about a long-overdue regeneration of Swedish prose style, and *The Son of a Servant* gave perhaps the strongest impulse since Jean-Jacques Rousseau's *Confessions* to the publication of discreditable self-revelations. His greatest influence, however, was exerted in the theatre, through his critical writings (such as the introduction to *Miss Julie*), his plays, and the production devices that their staging dictated. The continuous, brutal action and the extreme realism of the dialogue of *Miss Julie* and other plays written between 1887 and 1893 reached the ne plus ultra of naturalistic drama.

With the later phantasmagoric plays, such as *To Damascus, A Dream Play,* and *The Ghost Sonata*, Strindberg led that section of the revolt against stage realism that issued in the Expressionist drama, which was developed mainly in Germany after 1912 and which influenced such modern playwrights as Sean O'Casey, Elmer Rice, Eugene O'Neill, Luigi Pirandello, and Pär Lagerkvist. (B.Mo.)

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*Novels. Röda rummet* (1879; *The Red Room*, 1913); *Hemsöborna* (1887; *The People of Hemsö*, 1959), *I havsbandet* (1890; *By the Open Sea*, 1913).

*Short stories. Giftas*, 2 vol. (1884–85; *Married*, 1913); *Fagervik och skamsund* (1902; *Fair Haven and Foul Strand*, 1913); *Sagor* (1903; *Tales*, 1930).

*Autobiography. Tjänstekvinnans son* (1886–87; *The Son of a Servant*, 1913); *Le Plaidoyer d'un fou* (first published in French, 1888, enlarged, 1893; *The Confession of a Fool*, 1912); *Inferno* (1898; Eng. trans. 1912); *Legender* (1898; *Legends*, 1912); *Ensam* (1903).

*Translations.* There is no English-language edition of the complete works of Strindberg. Individual works are, however, readily available. Recommended modern translations include *Twelve Plays* by Elizabeth Sprigge (1963); *The Plays of Strindberg* by Michael Meyer (1964); and the series begun by Walter Johnson in 1955.

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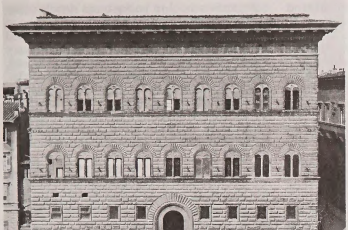
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**string puppet:** *see* marionette.

**string quartet,** musical composition for two violins, viola, and cello in several (usually four) movements. It has been the predominant genre of chamber music since *c.* 1750. *See* quartet.

**stringcourse,** in architecture, decorative horizontal band on the exterior wall of a building. Such a band, either plain or molded, is usually formed of brick or stone. The stringcourse occurs in virtually every style of Western architecture, from Classical Roman through Anglo-Saxon and Renaissance to modern.

Often the stringcourse is used as a line of



Stringcourses on the facade of the Palazzo Strozzi, Florence, begun by Benedetto da Maiano, 1489, and continued by Il Cronaca
Alinari—Art Resource/EB Inc.

demarcation between the stories of a multistoried building. It is also used, especially in classical and neoclassical works, as an extension of the upper or lower horizontal line of a bank of windows. Examples may be seen on the Pantheon, built in Rome in the 2nd century AD; on many palaces of Renaissance Italy, including the Palazzo Medici-Riccardi (1444–59) and the Palazzo Strozzi (1489–1539), both in Florence; and on various manor houses in the English Renaissance style of the mid-16th to early 19th centuries.

**stringed instrument,** any musical instrument that produces sound by the vibrations of strings. The strings, which may be of gut, vegetable fibre, plastic, or metal, are plucked, struck, or made to resonate through the use of a bow that is passed over the strings with varying degrees of pressure, according to the type of sound and degree of dynamic required.

A brief treatment of stringed instruments follows. For full treatment, *see* MACROPAEDIA: Musical Instruments.

Stringed instruments can be classified into four types: zithers, in which the strings run the length of the instrument body (*e.g.,* dulcimer, Japanese koto); lutes, in which the strings are stretched over a resonator and a neck (*e.g.,* violin, guitar); lyres, in which the strings run over a resonator to a yoke consisting of two arms and a crosspiece (*e.g.,* ancient Greek lyre [*lyra*], and cithara, or kithara); and harps, in which all the strings lie in the same plane but run at an angle to the resonator.

In the West, stringed instruments make up the first section of the orchestra. The most commonly played are those of the violin family, the guitar, and the harp. The piano is a popular keyboard instrument (*q.v.*) that is stringed.

The violin family, or "strings," consists of the violin, viola, cello (violoncello), and double bass (or contrabass). The violin is the smallest of the group (but with a four-octave range), and like the viola it is held under the chin. The cello is supported by a spike and is held between the player's feet, and the large double bass is played with the performer either standing up or seated on a high stool. Andrea Amati (*c.* 1520–78) is considered the founder of the violin family of instruments as they are recognized today, standardizing the models and beginning the dynasty of makers from Cremona, Italy, and the surrounding Brescian and northern regions. Antonio Stradivari (1644?–1737), however, created the outstanding instruments of all time: they are beautiful both in structure and varnish, and they are mellow and strong in sound. The bow was standardized by François Tourte (1747–1835) into a concave, long, thin instrument from the stockier, convex bow.

The strings are the main body of the symphony orchestra and also make up the harmonious string quartet (two violins, viola, cello). The violin commands a huge repertory, in classical music as well as in the jazz and folk idioms.

The double bass is more closely related to the viola da gamba family (the viols) than the other members of the violin family. Like the viols, it has sloping shoulders, is tuned in 4ths (not 5ths), is played resting on or between the legs rather than the arm, and frequently has a flat, rather than arched, back; it was also the last instrument of the violin family to use a convex bow. The viols, which existed alongside the violins until the 18th century, differ from violins in other ways, including having six strings (rather than four) and a fretted fingerboard. The bass viol is the most frequently played today.

The guitar, a waisted instrument with six strings and frets, is strummed or plucked with the fingernails, fingertips, finger picks, or plectrum. The guitar is an ancient instrument and is now frequently associated with Spanish flamenco and popular music, though it also enjoys a large classical repertory through the works of such composers as Heitor Villa-Lobos and Isaac Albeníz. Andrés Segovia, in the 20th century, transcribed much classical music for the guitar. Its sound is delicate yet capable of great power and expression. Similar in design to the guitar is the lute, which is also plucked and held in the same manner. The body is pear-shaped and often made with intricately inlaid wood. The lute was frequently used to accompany madrigals during the 16th century and also has medieval associations with the troubadours and minstrels. Similar, but with an even more rounded back and metal strings, is the mandolin. It has frets and is played with a plectrum. Another important plucked instrument, with its origins in ancient Greece, is the lyre. It is plucked with both hands, one using a plectrum.

The harp bears little relation to other stringed instruments. An apparently simple idea (6½ octaves of strings stretched vertically between two points changing the pitch according to length) is made more complex through the addition of seven pedals that alter the notes by a tone or semitone. The harp, ornamental in design, is ancient in origin and depicted in many early paintings. It stands on a base and is played tipped back against the shoulder.

Of the many ethnomusicological stringed instruments throughout the world, those best known in the West fall predominantly into the zither or lute categories; they include the ch'in of China; the koto and the samisen of Japan; the sitar of India (of Persian origin), which has frets and sympathetic strings; and the *sārangī* of India, which is played with a bow and has many sympathetic strings.

**Stringocephalus,** extinct genus of large brachiopods, or lamp shells, found as fossils in Devonian marine rocks (408 to 360 million years old). *Stringocephalus* is widely distributed and occurs in western North America, Asia, and northern Europe. Several forms are known. The shell is characterized by a well-developed, curved, beaklike structure.

**strip-mining,** surface mining (*q.v.*), especially for the extraction of coal.

**striped muscle:** *see* striated muscle.

**striped polecat,** also called STRIPED WEASEL: *see* zorille.

**stripping reaction,** in nuclear physics, process in which a nucleus, during a grazing collision, absorbs part of the projectile, the remainder continuing on its hyperbolic Coulomb trajectory. An example is the (*d, p*) stripping reaction involving an aluminum-27 nucleus and a deuteron. The deuteron (consisting of one proton and one neutron) grazes the aluminum nucleus, which captures the neutron to become aluminum-28, and the proton continues on with a velocity comparable to that of the incident deuteron.

**Strobane** (trademark), of a chlorine-containing organic compound used as an insecticide. *See* toxaphene.

**strobilus** (botany): *see* cone.

**stroboscope,** instrument that provides intermittent illumination of a rotating or vibrating object in order to study the motion of the object or to determine its rotary speed or vibration frequency. A machine part, for example, may be made to appear to slow down or stop; the effect is achieved by producing illumination in very short, brilliant bursts that always occur when the moving part is in the same phase of its motion.

Early stroboscopic devices utilized either intermittent vision or interrupted light; in both cases a spinning or oscillating disk with a narrow radial slot either allowed the object to be viewed at regular intervals or permitted light to illuminate it at successive instants, thus exposing it at precisely the times it reached a given point in its motion.

The modern electronic stroboscope employs a gas-filled discharge lamp to produce very short, repetitive, brilliant flashes of light. Typically, a flash duration of about one microsecond (0.000001 second) and flashing rates ranging from 110 to 150,000 per minute are achieved. Using special techniques, flashing rates of more than 500,000 per minute have been obtained.

The brilliant short-duration flash produced by a stroboscope is admirably suited for photographing rapidly moving objects. Single flashes with durations of one millionth of a second can be used in such photography, while for ordinary photography, flash durations of one thousandth of a second are common.

**Strode, William** (b. *c.* 1599—d. Sept. 9, 1645, London, Eng.), a leader of the Puritan opposition to England's King Charles I and one of the five members of the House of Commons whom the king tried to impeach in January 1642. The incident enraged the Commons and caused it to begin preparing for war with the Royalists.

Strode, who first entered Parliament in 1624, played a leading role in securing passage, on March 2, 1629, of three strongly worded resolutions condemning the king's religious and financial policies. As a consequence, he was arrested and imprisoned for 11 years. Upon his release in January 1640, he immediately became one of the king's most bitter and fiery opponents. As a member of the Long Parliament (beginning November 1640), he advocated parliamentary control over ministerial appointments and the militia, and he pro-

posed that Parliament meet annually. He supported the impeachment and trial of Thomas Wentworth, Earl of Strafford, and the Grand Remonstrance of November 1641, and, when Charles tried to arrest him and four other Parliamentary leaders for treason (January 1642), he was with difficulty persuaded to flee from the House of Commons. Opposing all suggestions of a compromise with the king, he urged on the preparations for war and was present at the Battle of Edgehill (October 23). He was bitterly opposed to Archbishop William Laud, and on Nov. 28, 1644, he carried the Commons' message to the Lords desiring that the ordinance for the archbishop's execution might be hastened.

Strode died at Tottenham, London, in 1645 and by order of Parliament was buried in Westminster Abbey. His body was disinterred in 1661, following the restoration of Charles II.

**Stroessner, Alfredo** (b. Nov. 3, 1912, Encarnación, Paraguay), military leader who became president of Paraguay after leading an army coup in 1954. His presidency, which lasted until his overthrow in a coup in 1989, was the longest period of unbroken rule by one individual in a Latin-American country in the 20th century.

Stroessner, the son of a German immigrant, attended the Military College in Asunción and was commissioned in the Paraguayan army in 1932. He rose through the ranks to become general and in 1951 was made commander in chief of the armed forces. In 1954 he deposed President Federico Chávez and later assumed the presidency after an election in which he was the sole candidate for the office.

Stroessner attempted to placate the rural poor and urban labourers and at the same time supported the interests of the large landholders and businessmen. His administration stabilized the currency, moderated inflation, and provided some new schools, public health facilities, and roads; half of the national income, however, was spent on a military establishment necessary to preserve his authority. During Stroessner's presidency, Paraguay participated in the building of the massive Itaipú Dam along the Brazil–Paraguay border in 1975–82. Stroessner's supporters dominated the nation's legislature and courts and had the constitution modified in 1967 and 1977 to legitimize his six consecutive elections to the presidency. His administration was accused of harsh suppression of its political opponents. He was elected to an eighth successive term as president in 1988 but was overthrown by a military coup in 1989. He thereupon went into exile abroad.

**Stroganov** FAMILY, wealthy Russian family of merchants, probably of Tatar origin, famous for their colonizing activities in the Urals and in Siberia in the 16th and 17th centuries. The earliest mention of the family occurs in 15th-century documents that refer to their trading in one of the provinces of Novgorod.

In 1515 Anika (Ioanniki) Stroganov started salt mining in Solvychegodsk; and in 1558 Tsar Ivan IV made a grant of lands along the Kama and Chusovaya rivers to Grigory Stroganov. The Stroganovs were allowed to attract inhabitants to those territories, to build towns, and to maintain their own armed forces for defense, and they were exempted from taxes for 20 years. They engaged in salt and iron mining and in the timber and fur trades and had extensive agricultural interests. They founded the town of Kankor in 1588 and that of Kergedan in 1564. In 1566 Yakov Stroganov petitioned Ivan IV to include the Stroganov estates in the *oprichnina—i.e.,* in the crown land administered under the personal control of the tsar. This request was granted in August 1566. A new grant of land in 1568 considerably increased their estates.

The Stroganovs traded with Siberia, but complications in their relations with the khan of Siberia, Kuchum, led to operations of a military nature. They also occasionally had to take arms against the indigenous inhabitants, as in 1572. In 1574 Ivan IV summoned the Stroganovs to discuss plans for the future of Siberia. Two months later they received a grant of land in Siberia along the Tura and Tobol rivers. In 1581 the Stroganovs equipped the expedition of Yermak Timofeyevich, which was to lay the foundation for Russia's annexation of Siberia.

During the Time of Troubles the Stroganovs were of great assistance to the second levy raised by Prince D.M. Pozharski and Kuzma Minin, whose activities brought about the accession of Michael Romanov to the tsardom in 1613. The Stroganovs supported Michael's government, paying their taxes in advance and lending large sums to the empty treasury. They were rewarded by a rise in rank and became answerable for their actions to the tsar alone.

In 1688 Grigory Dmitriyevich Stroganov (1650–1715) became the sole owner of all the family's vast estates. He built and equipped two naval vessels for Peter I the Great and aided him financially. He was made a baron. In 1798 the tsar Paul I raised Grigory Dmitriyevich's heirs to the dignity of count. Throughout the 18th and 19th centuries the family produced statesmen and other eminent persons who continued the tradition of service.

The Stroganovs also became famous for their services to Russian art. Their patronage and commissions resulted in the building of many churches and in the creation of the so-called Stroganov school of icon painting in the 16th and 17th centuries. This school—to which such famous painters as Prokopy Chirin, Istoma Savin, and the latter's sons Nikofor and Nazari belonged—introduced the techniques of miniature painting as well as rich ornamentation and colouring and an extensive use of gold leaf.

**Stroganov school,** school of icon painting that flourished in Russia in the late 16th and 17th centuries. The original patrons of this group of artists were the wealthy Stroganov family, colonizers in northeastern Russia; but the artists perfected their work in the service of the tsar and his family in Moscow. Representing the last vital stage of Russian medieval painting before the westernization of Russian art at the end of the 17th century, the so-called Stroganov school produced not so much a coherent style as a type of icon. Designed specifically for private use, this type was characterized by its small size, its miniature technique, and its exquisite refinement of detail. The icons of the Stroganov school, while retaining Byzantine-inspired Russian forms, nevertheless represent a radical departure from most of what had been valued in the long tradition of Russian painting; monumentality was replaced by precious virtuosity and deep emotion by decorative elegance. The preoccupation with style and technique over content was, perhaps, typical of the end of a cultural phase.

In its richness and refinement, the art of the Stroganov school reflected the tastes of royal and noble patrons. Working in a muted colour range dominated by golden brown, the Stroganov masters substituted for the colouristic brilliance of the earlier Russian tradition a lavish use of gold and silver linear highlights whose strongly abstract patterns matched the mannered fragility of the figures. They embellished their icons with frames and halos of beaten gold and silver. The naturalism proscribed by the church for major representations was ingeniously introduced by the Stroganov school in background details of architecture, vegetation, and even atmospheric effects. Finally, the Stroganov masters excelled at composition; though their works are very small and sometimes include many figures, they never appear crowded.

The Stroganov school remained influential until the end of the 17th century, but after about 1650 it gradually declined and lost its refinement. The foundation of the new capital of St. Petersburg in 1703 by Tsar Peter I the

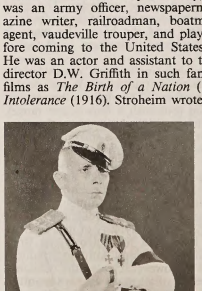


"SS. Boris and Gleb," icon by a follower of Prokopy Chirin, Stroganov school, 17th century; in the State Tretyakov Gallery, Moscow
Novosti Press Agency, Moscow

Great marked a turning point in Russian art: although icon painting continued to follow the Russo-Byzantine tradition throughout the 19th century, the major artistic activity shifted to secular art and Europe's Baroque style.

**Stroheim, Erich von,** byname of HANS ERICH MARIA STROHEIM VON NORDENWALL, original name ERICH OSWALD STROHEIM (b. Sept. 22, 1885, Vienna—d. May 12, 1957, near Paris), one of the most critically respected motion-picture directors of the post-World War I period, best-known for the uncompromising realism and perfection of detail in his films. He also wrote motion pictures and won recognition as an actor and is remembered for portraying sadistic, monocled Prussian officers.

Educated in a military academy, Stroheim was an army officer, newspaperman, magazine writer, railroadman, boatman, book agent, vaudeville trouper, and playwright before coming to the United States in 1914. He was an actor and assistant to the leading director D.W. Griffith in such famous early films as *The Birth of a Nation* (1915) and *Intolerance* (1916). Stroheim wrote the script



Stroheim in *Foolish Wives,* 1922
Brown Brothers

and played the leading role in *Blind Husbands* (1919), his first independently directed picture. As an early exemplar of the changing postwar morality, it intimated that a woman had the right to seek love outside of an unsatisfying marriage. The aura of reality that made the characters come alive was characteristic of *The Devil's Passkey* (1920) and *Foolish Wives* (1922), pictures that enhanced his reputation as a director.

Stroheim's masterpiece was *Greed* (1924), an adaptation of Frank Norris' novel *McTeague* (1899), dealing with the power of money to corrupt. A landmark in film realism, its grim irony and brutal honesty were untempered by optimism or compassion. It was cut from its original 10-hour length yet retained much of its power, because the meaning of each scene was brought out by carefully constructed detail rather than by the juxtaposition of scenes. It was a film classic and strongly influenced such later directors as King Vidor and Josef von Sternberg.

Although *The Merry Widow* (1925), *The Wedding March* (1928), and *Queen Kelly* (1928) were commercially successful, Stroheim's reputation for extravagance, his fanatical insistence on complete artistic freedom regardless of any economic considerations, and his sophisticated treatment of controversial subjects ended his Hollywood directing career. He returned to Europe as an actor and thereafter appeared only occasionally in American pictures—*e.g., Five Graves to Cairo* (1943). One of his notable characterizations was the prison-camp commandant in Jean Renoir's *La Grande Illusion* (1937), and he was nominated for an Academy Award for his performance in *Sunset Boulevard* (1950).

*Consult the* INDEX *first*

**stroke,** also called APOPLEXY, or CEREBROVASCULAR ACCIDENT (CVA), a sudden impairment of brain function resulting either from a substantial reduction in blood flow to some part of the brain or from intracranial bleeding. The consequences may include transient or lasting paralysis on one or both sides of the body, difficulties in using words or in eating, and a loss in muscular coordination. A stroke may cause cerebral infarctions—dead sections of brain tissue. Smoking, high cholesterol, diabetes, aging, and heritable defects are among the major factors making stroke more likely.

Stroke occurs in conjunction with at least one of the following four events:

1. A blood clot forms within a blood vessel of the brain (thrombosis). This is the most common cause of strokes.

2. A blood clot lodges in an artery supplying brain tissue after originating in another portion of the body and traveling to the brain. This is known as an embolism. A heart attack, damage to a valve, and an irregular heartbeat called atrial fibrillation can cause blood clots that may reach the brain.

Both the first and second types of clotting reduce or stop the flow of blood to brain cells. During the early stages of stroke from these two causes, the illness may be further complicated by the oozing of blood and fluid into the surrounding areas (edema).

3. An intermittent insufficiency in the flow of blood results temporarily from a spasm of the arteries or the sludging of the blood as it passes through segments of vessels that have been narrowed by arteriosclerosis (atherosclerosis). Arteriosclerosis commonly results from the buildup of fatty deposits on artery walls.

4. Hemorrhage occurs after an artery ruptures, usually as a result of a weakening of the arterial wall because of arteriosclerosis or because of a thinning of the wall along with bulging (an aneurysm), which may be congenital or develop later in life. The walls of arteries in the brain can become weakened by the assault of high blood pressure. (Hypertension, as this is called, can also accelerate arteriosclerosis.)

So-called "little strokes" result when long, thin arteries penetrating deep into the brain become blocked by arteriosclerosis, causing areas of surrounding tissue to lose their blood supply. The tissue may then wither, creating minute holes, called lacunes. A succession of these little strokes over the years can riddle the brain, causing dementia similar to Alzheimer's disease.

*Consequences.* The initial onset of stroke may be massive in its effects, producing widespread paralysis, inability to speak, coma, or death within a short time, usually within several hours or days. On the other hand, the onset may be manifested by a series of transient little strokes during which the patient may experience weakness and numbness of an arm, a leg, or a side of the face. There may be temporary difficulty in speech, confusion of thought, or visual disturbances. These little strokes may recur many times, but eventually they are usually followed by more widespread and permanent paralysis.

The groups of muscles and nerves involved are a direct reflection of the artery and brain tissues involved. If the left side of the brain (the dominant side for most persons) is affected, there is a paralysis of the right side of the body, because most of the nerves cross to the opposite side of the body from their origin in the brain. However, the combinations of signs and symptoms are innumerable.

Hemorrhagic strokes are commonly associated with high blood pressure. They frequently produce massive neurological signs, and death is more common with them than with thrombo-embolic strokes. However, hemorrhagic strokes may be minute and recurrent, gradually producing widespread damage.

*Treatment.* Precise history and physical examination, especially for neurological changes, are essential to differentiate stroke from a tumour and from brain injury resulting from other causes. It is also important to determine whether the stroke is due to a thrombosis or embolism on the one hand or a hemorrhage on the other. Examination of the spinal fluid for evidence of blood is often essential. Diagnostic imaging (as by CAT scan) may clarify the diagnosis. Establishing a differential diagnosis is essential because anticoagulant drugs are widely used in the treatment of strokes due to thromboses or emboli but are contraindicated when due to hemorrhage. A stroke may have both a clotting and a significant hemorrhagic factor present, and this presents difficulties.

Many strokes are due to closure of one of the two carotid arteries that supply the brain after passing up the sides of the neck from the aorta. If the closure involves only a small segment, surgery may be attempted to remove the obstruction or to insert a graft or synthetic bypass.

Many victims of stroke may live for a further 10 to 20 years or longer, so it is vital that they should not lapse into unnecessary invalidism. Early and persistent efforts for rehabilitation are therefore essential, including both physical and speech therapy. These therapies should begin within a day or two after the stroke so that painful muscle contractures or deformities will not occur.

**stromatolite,** layered deposit, mainly of limestone, formed by the growth of blue-green algae (primitive one-celled organisms). These structures are usually characterized by thin, alternating light and dark layers that may be flat, hummocky, or dome-shaped. The alternating layers are largely produced by the trapping of sediment washed up during storms on some occasions and by limestone precipitation by the blue-green algae on others.

Stromatolites were common in Precambrian time (*i.e.,* more than 570 million years ago). Some of the first forms of life on Earth are recorded in stromatolites present in rocks 3.5 billion years old. Although stromatolites continue to form in certain areas of the world today, they grow in greatest abundance in Shark Bay in western Australia. A matlike layer of blue-green algae is able to grow on the surface of sediments in the shallow waters there because evaporation causes high concentrations of salt that discourage snails and other organisms from eating the blue-green algae.

**Stromboli Island,** Italian ISOLA STROMBOLI, Latin STRONGYLE, northeasternmost of the Eolie Islands (Lipari Islands), in the Tyrrhenian Sea (of the Mediterranean), off northeastern Sicily. It is administered as part of Messina province, Sicily, Italy, and has an area of 5 square miles (12 square km). Of volcanic formation, the island is still active, and fluid lava flows continuously from its crater to the sea, although the last serious eruption was in 1921. Dates, olives, and fruits are grown, and there is a significant tourist trade, attracted by the volcano, the climate, and the beaches of Stromboli. Pop. (latest est.) 382.

**stromeyerite,** a sulfide mineral of copper and silver (CuAgS) that occurs as compact masses with copper and lead minerals in deposits at Altai, Siberia, Russia; Santiago, Chile; and Butte, Mont., U.S. Stromeyerite is a member of a group of sulfide minerals that form crystals of the isometric system at high temperatures but assume other symmetries upon cooling. The low-temperature form (below 93°C) of stromeyerite is orthorhombic. For detailed physical properties, *see* sulfide mineral (table).

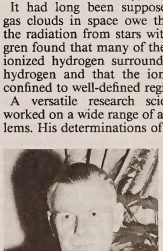
**Strömgren, Bengt (Georg Daniel)** (b. Jan. 21, 1908, Göteborg, Swed.—d. July 4, 1987, Copenhagen, Den.), Danish astrophysicist who pioneered the present-day knowledge of the gas clouds in space.

Son of the noted Swedish-born Danish astronomer Svante Elis Strömgren, he early developed an interest in astronomy. He collaborated with his father on several works of astronomy and in 1940 succeeded him as director of the Royal Copenhagen Observatory.

Strömgren served as an assistant and then associate professor at the University of Chicago from 1936 to 1938 and held a variety of positions in the United States during the late 1940s. In 1951 he was appointed director of Yerkes Observatory, Williams Bay, Wis., and McDonald Observatory, Fort Davis, Texas.

It had long been supposed that luminous gas clouds in space owe their luminosity to the radiation from stars within them. Strömgren found that many of the clouds consist of ionized hydrogen surrounded by un-ionized hydrogen and that the ionized hydrogen is confined to well-defined regions.

A versatile research scientist, Strömgren worked on a wide range of astronomical problems. His determinations of the abundance of



Strömgren, 1957
AP/Wide World Photos

hydrogen, helium, and other elements in space differ little from presently accepted values. He did research on the internal constitution of the stars and contributed to the understanding of the solar atmosphere. After 1951 he carried out an extensive program of measuring stellar spectra using photoelectric techniques. Before his efforts, the classification of stellar spectra was primarily a process of estimation.

In 1957 Strömgren joined the Institute for Advanced Study at Princeton, N.J., and 10 years later he returned to the University of Copenhagen as professor of astrophysics.

**Strömgren sphere**, theoretical spherical volume of gas heated and ionized by a hot central star. It is named for the Swedish-born astrophysicist Bengt Strömgren, who postulated its existence in the 1930s. Bright stars with surface temperatures higher than 20,000 kelvins (K) normally are surrounded by such volumes of gas. The density of the ionized gas ranges from a few to about 1,000 atomic particles per cubic centimetre, and its temperature is about 10,000 K. The radius of Strömgren spheres varies from a few to several hundred light-years, depending on the gas densities and temperatures of the central hot stars. At the edge of such a sphere exists an equilibrium between the rate of ionizations of neutral atoms and the rate of forming neutral atoms by recombinations of atomic nuclei with free electrons.

**Strong, William** (b. May 6, 1808, Somers, Conn., U.S.—d. Aug. 19, 1895, Lake Minnewaska, N.Y.), U.S. Supreme Court justice (1870–80), one of the most respected justices of the 19th-century court.

Admitted to the bar in 1832, Strong practiced law in Reading, Pa., and served in the U.S. House of Representatives (1847–51). While sitting on the Pennsylvania Supreme Court (1857–68), Strong, a Democrat but a firm supporter of the Union, changed his political affiliation and became a Republican.

On Feb. 7, 1870, President Ulysses S. Grant, also a Republican, nominated Strong to succeed the retiring justice Robert C. Grier, a Democrat. At the same time, Grant named Joseph P. Bradley to fill a new seat on the court, which had been made available by a Congressional authorization enlarging the number of the justices from eight to nine. The circumstances of new appointments were such that Grant was charged with a court-packing scheme, and internal dissension with the court was exacerbated. The very day that the two appointees were nominated, the Supreme Court announced its decision in *Hepburn* v. *Griswold* (1870), a case that involved the constitutionality of the Legal Tender Act of 1862. The court, in a 5–3 vote (including a vote for the majority by the ailing Grier), struck down the Legal Tender Act, thus denying Congress the power to issue paper currency as legal tender.

The following year, in *Knox* v. *Lee* and *Parker* v. *Davis* (1871), the newly formed court overturned the Hepburn decision by a vote of 5–4. Strong spoke for the majority, upholding the government's power to enact legal-tender legislation and defending such power under the "necessary and proper" clause of the Constitution. The abrupt reversal of a major decision so soon after the enlargement of the bench renewed the charges against Grant. Despite this controversy, which overshadowed Strong's appointment to the high court and his first major decision, he served with distinction for 10 years, winning the respect of the legal community for his ability and integrity.

**Strong Island** (Caroline Islands): *see* Kosrae.

**strong nuclear force**, a fundamental force that acts between elementary particles of matter and originates in a property known as colour. This property, which has no connection with colour in the usual sense of the word, is somewhat analogous to electric charge. Just as electric charge is the source of the electromagnetic force, so colour is the source of the strong force. Particles without colour, such as electrons and other leptons, do not "feel" the strong force; particles with colour, principally the quarks, do "feel" the strong force. Quantum chromodynamics, the quantum field theory describing strong interactions, takes its name from this central property of colour. (*See also* quantum chromodynamics; quark.)

The strong force binds quarks together in clusters to make more familiar subatomic particles, such as protons and neutrons. It also holds together the atomic nucleus and underlies interactions between all particles containing quarks. This is because the quarks within one cluster can interact with those in another if the clusters are close enough. Protons and neutrons are examples of baryons, which contain three quarks, each with one of the three possible values of colour (red, blue, and green). Quarks may also combine together with antiquarks (which have opposite colour) to form mesons, such as pions and kaons. Baryons and mesons all have a net colour of zero, and it seems that the strong force allows only combinations with zero colour to exist. Attempts to knock out individual quarks, in high-energy particle collisions, for example, result only in the creation of new "colourless" particles, mainly mesons.

In strong interactions, the quarks exchange gluons, the carriers of the strong force. Gluons, like photons (the messenger particles of the electromagnetic force), are massless particles with a whole unit of intrinsic spin. However, unlike photons, which are not electrically charged and therefore do not feel the electromagnetic force, gluons carry colour, which means that they do feel the strong force and can interact among themselves. One result of this difference is that, within its short range (about $10^{-15}$ metre, roughly the diameter of a proton or a neutron), the strong force appears to become stronger with distance, unlike the other forces.

As the distance between two quarks increases, the force between them increases rather as the tension does in a piece of elastic as its two ends are pulled apart. Eventually the elastic will break, yielding two pieces. Something similar happens with quarks, for with sufficient energy it is not one quark but a quark-antiquark pair that is "pulled" from a cluster. Thus, quarks appear always to be locked inside the observable mesons and baryons, a phenomenon known as confinement. At distances comparable to the diameter of a proton, the strong interaction between quarks is about 100 times greater than the electromagnetic interaction. At smaller distances, however, the strong force between quarks becomes weaker, and the quarks begin to behave like independent particles, an effect known as asymptotic freedom. (Ch.Su.)

**Strongyle** (Italy): *see* Stromboli Island.

**strontianite**, a carbonate mineral, strontium carbonate ($SrCO_3$), that is the original and principal source of strontium. It occurs in white masses of radiating fibres, although pale green, yellow, or gray colours are also known. Strontianite forms soft, brittle crystals that are commonly associated with barite, celestite, and calcite in low-temperature veins. Notable deposits exist in North Rhine–Westphalia, Ger.; Strontian, Scot.; and Strontium Hills, Calif., U.S. Strontianite is used in pyrotechnics to impart a red colour and in sugar refining as a clarifying agent. For detailed physical properties, *see* carbonate mineral (table).

**strontium** (Sr), chemical element, one of the alkaline-earth metals of main Group IIa of the periodic table. It is used as an ingredient in red signal flares and is the principal health hazard in radioactive fallout.

*Properties, occurrence, and uses.* Strontium is a soft metal like lead and, when freshly cut, has a silvery lustre. It rapidly reacts in air to take on a yellowish colour; therefore, it is stored in kerosene. It does not occur free in nature. It composes about 0.04 percent of the crust of the Earth, especially as the minerals strontianite (the carbonate) and celestite (the sulfate).

Adair Crawford and William Cruikshank first detected (1790) the element in strontianite found at Strontian in Argyll, Scot. The metal was isolated (1808) by Sir Humphry Davy, who electrolyzed a mixture of the moist hydroxide or chloride with mercuric oxide, using a mercury cathode, and then evaporated the mercury from the resultant amalgam. Strontium may be obtained in the form of sticks by the contact cathode method of electrolysis, in which a cooled iron rod, acting as a cathode, just touches the surface of a fused mixture of potassium and strontium chlorides and is raised as the strontium solidifies on it. Because calcium and barium, which it resembles closely, occur in much greater abundance, strontium metal is not produced in commercially important quantities. The metal is malleable and ductile and a good conductor of electricity.

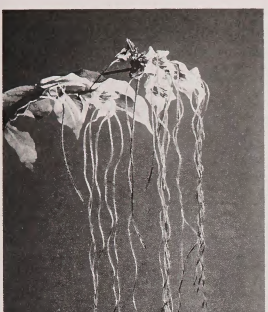
The four naturally occurring isotopes in the order of their abundance are: strontium-88 (82.56 percent), strontium-86 (9.86 percent), strontium-87 (7.02 percent), and strontium-84 (0.56 percent). About 16 artificial isotopes have been produced by nuclear reactions, of which the longest-lived is strontium-90 (approximately 28-year half-life). This isotope, formed by nuclear explosions, is considered the most dangerous constituent of fallout. Strontium can replace some of the calcium in foods and ultimately become concentrated in bones and teeth, where it continues ejecting electrons that cause radiation injury. Controlled amounts of radioactive strontium have been used as a treatment for bone cancer. The heat of its radioactive decay also can be converted to electricity for long-lived, lightweight power sources in navigation buoys, remote weather stations, space vehicles, etc.

*Compounds.* In its compounds strontium has an exclusive oxidation state of +2, as the $Sr^{2+}$ ion. It is an active reducing agent and readily reacts with halogens, oxygen, and sulfur to yield halides, oxide, and sulfide.

Strontium compounds have rather limited commercial value because corresponding calcium and barium compounds serve the same purpose yet are cheaper. A few, however, have found application in industry and elsewhere. Strontium nitrate, $Sr(NO_3)_2$, and strontium chlorate, $Sr(ClO_3)_2$, are extremely volatile and impart a brilliant crimson colour to flames; they are thus used in various pyrotechnic devices, flares, and tracer bullets. Strontium hydroxide, $Sr(OH)_2$, is sometimes used to extract sugar from molasses because it forms a soluble saccharide from which the sugar can be easily regenerated by the action of carbon dioxide. Strontium monosulfide, SrS, is employed as a depilatory and in some luminous paints.

| | |
|---|---|
| atomic number | 38 |
| atomic weight | 87.62 |
| melting point | 769° C |
| boiling point | 1,384° C |
| specific gravity | 2.54 |
| valence | 2 |
| electronic config. | 2-8-18-8-2 or $(Kr)5s^2$ |

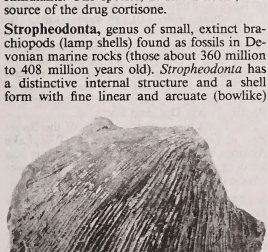
**Strophanthus**, genus of ornamental and drug plants in the dogbane family (Apocynaceae), with more than 40 species of woody vines, shrubs, or small trees that are native to tropical Africa and Southeast Asia. The flower petals of some species are drawn out into long threads. The bark and seeds of some vine-



*Strophanthus preussii*
W.H. Hodge

like species contain toxic alkaloids called strophanthins, which are used as arrow poisons and in low dosages as cardiac and vascular stimulants. One species, *S. sarmentosus,* is a source of the drug cortisone.

**Stropheodonta,** genus of small, extinct brachiopods (lamp shells) found as fossils in Devonian marine rocks (those about 360 million to 408 million years old). *Stropheodonta* has a distinctive internal structure and a shell form with fine linear and arcuate (bowlike)



*Stropheodonta concava,* from Eighteenmile Creek, Erie County, N.Y.
By courtesy of the Buffalo Museum of Science, Buffalo, N.Y.

markings on its concavo-convex shell. *Stropheodonta* is characteristic of an important group of brachiopods, the strophomenids; it is a useful Devonian index fossil.

**Strophomena,** genus of extinct brachiopods (lamp shells) found as fossils in Middle and Upper Ordovician marine rocks (those ranging in age from 438 million to 478 million years old). The shell consists of two parts, or valves, dissimilar in shape—one strongly convex, the other concave. A distinctive laminated pattern occurs at the margins of the shell, along with fine, arcuate (bowlike) growth lines. *Strophomena* is representative of an important group of fossil brachiopods, the strophomenids.

**Strossmayer, Joseph George,** Serbo-Croatian JOSIP JURAJ ŠTROSSMAJER (b. Feb. 4, 1815, Osijek, Slavonia—d. April 8, 1905, Đakovo), Croatian Roman Catholic bishop who inspired and led the National Party, which was dedicated to the development of a strong Yugoslav nationalist movement.

Ordained in 1838, Strossmayer became lecturer in theology at Vienna and chaplain to the Austrian emperor. In 1850 he was installed at Đakovo, with the title bishop of Bosnia and Sirmium.

A firm patriot, Strossmayer fostered the growth of Slavonic nationalism in Croatia-Slavonia, in Dalmatia, and among the Slovenes of south Austria. After aiding the Croatian political and military leader Josip Jelačić in his campaign against Hungary (1848–49), Strossmayer later became a recognized leader of the opposition to Hungarian predominance over and interference with Croatian national interests. He was a member of the Croatian Diet (legislative assembly) from 1860 to 1873. In addition to being the foremost founder of a new university, the South Slav Academy, in 1876, he helped reorganize the whole educational system of Dalmatia and Croatia-Slavonia. Strossmayer built an episcopal palace and a cathedral at Đakovo, founded a seminary for the Bosnian Croats, donated a gallery of valuable pictures to the South Slav Academy, and published a number of collections of national songs and tales. He also erected convents, schools, and libraries.

Strossmayer aided the historian and canonist Augustin Theiner, then librarian at the Vatican, to compile his *Vetera Monumenta Slavorum Meridionalium Historiam Illustrantia* (1863; "Ancient Evidences Illustrating the History of the Southern Slavs"). At the first Vatican Council (1869–70) he was a leading opponent of papal infallibility. He also worked with the Russian ecumenist Vladimir Sergeyevich Solovyov for a reunion of the Roman Catholic and Russian Orthodox churches.

**Stroud,** district, county of Gloucestershire, south-central England. The district occupies an area in the south-central part of the county between the cities of Bristol to the southwest and Gloucester to the north; it borders the River Severn on the west. Stroud district incorporates a section of the limestone Cotswold Hills that rise some 600 to 800 feet (180 to 250 m) on the east and the near sea-level fertile clay vales of Berkeley and Gloucester on the west; the steep-faced western escarpment of the Cotswolds separates the two regions.

Between the 14th and 18th century the Cotswolds were a principal centre of England's woolen trade. Villages within what is now Stroud district became prosperous by either grazing large numbers of sheep or weaving and dyeing fine woolens. The many old and imposing limestone buildings in the district reflect that early period's prosperity.

Today cattle, rather than sheep, generally graze the Cotswolds' undulating tableland. Stroud's picturesque villages and fields of cereals and corn (maize) interspersed with beech groves are popular with tourists. The western valleys next to the Severn produce milk and some cheese, and apples and pears are grown for cider and perry (fermented pear juice).

Stroud town, the district seat, and adjacent communities have an unusually varied manufacturing base. Products include mining equipment, plastics, electronic apparatus, pianos, machine-made fine woolens, scarlet dyes, and most of the world's billiard tablecloths.

The town of Berkeley in the River Severn valley has an eerie, well-preserved medieval castle. Berkeley was the birthplace and lifelong home of Edward Jenner, who in 1796 discovered the principle of vaccination. Area 175 square miles (454 square km). Pop. (1991 prelim.) 108,300.

**Stroud, Robert (Franklin),** byname BIRDMAN OF ALCATRAZ (b. 1890, Seattle, Wash., U.S.—d. Nov. 21, 1963, Springfield, Mo.), American criminal, a convicted murderer who became a self-taught ornithologist during his 54 years in prison, 42 of them in solitary confinement, and made notable contributions to the study of birds.

At the age of 13 Stroud ran away from home and, by the age of 18, was in Juneau, Alaska, working as a pimp and living with a dancehall girl. An argument over the girl led to his fighting and killing a man. Pleading guilty to manslaughter on Aug. 23, 1909, he was sentenced to 12 years in federal prison on McNeil Island in Puget Sound. After stabbing a fellow prisoner and proving generally troublesome, he was transferred to Leavenworth Prison, Kansas (1912), where he continued to be a loner but began to educate himself, taking university extension courses. On March 26, 1916, he stabbed and killed a guard and was tried, convicted, and sentenced to hang; but on April 15, 1920, President Woodrow Wilson commuted his sentence to life imprisonment in solitary confinement.

Thereafter, mostly in solitary confinement, he began raising canaries and other birds, collecting laboratory equipment, and studying the diseases of birds and their breeding and care. Some of his research writings were smuggled out of prison and published; his book, *Stroud's Digest on the Diseases of Birds,* published in 1943, was an important work in the field. In 1942, however, Stroud was transferred to Alcatraz, where he was allowed to continue his research but denied further right of publication. In 1959 he was transferred to the Medical Center for Federal Prisoners at Springfield, Mo., where he spent the last four years of his life.

**Stroudsburg,** town ("borough"), seat of Monroe county, eastern Pennsylvania, U.S. A resort, it lies along Broadhead Creek, adjacent to East Stroudsburg, in the Pocono Mountain area, near the Delaware River (there bridged to New Jersey). The site was first settled in 1769 by Colonel Jacob Stroud who built Fort Penn (1776) there. In 1806 Stroud's son, Daniel, laid out the borough, which was incorporated in 1815. The Stroud Mansion (1795) still stands in the town.

Situated in the midst of the scenic Pocono region of wooded hills, valleys, and lakes, and on the Appalachian Trail, Stroudsburg developed as a summer resort. The Delaware Water Gap, a picturesque gorge carved by the river through the Kittatinny Range and rising to 1,200 feet (366 m), is 3 miles (5 km) to the east. A number of old slate-mining towns such as Bangor and Pen Argyl are to be found in the vicinity. The Pocono Wild Animal Farm is one mile south. Tourism, East Stroudsburg University of Pennsylvania (1893), diversified farming, and light manufacturing are the main economic activities. Pop. (1990) 5,312.

**Strouma River** (Bulgaria-Greece): *see* Struma River.

**struck jury:** *see* blue-ribbon jury.

**structural geology,** scientific discipline that is concerned with rock deformation on both a large and a small scale. Its scope of study is vast, ranging from submicroscopic lattice defects in crystals to fault structures and fold systems of the Earth's crust.

A brief treatment of structural geology follows. For full treatment, *see* MACROPAEDIA: Earth Sciences.

The methods of structural geology are nearly as diverse as those of the geologic sciences as a whole. Small-scale structural features may be studied using the same general techniques that are employed in petrology, in which sections of rock mounted on glass slides are ground very thin and are then examined with polarizing microscopes. On a larger scale, the techniques of field geology are used. These include plotting the orientation of such structural features as faults, joints, cleavage, and small folds. In most cases, the objective is to interpret the structure beneath the surface

by using information available at the surface. Where mountains, continents, ocean basins, and other large-scale features are involved, the methods employed are chiefly those of geophysics and include the use of seismological, magnetic, and gravitational techniques. Furthermore, since the processes that cause rocks to deform can rarely be observed directly, it is necessary to study them by means of computer models in which they are represented mathematically.

**structuralism,** in cultural anthropology, the school of thought developed by the French anthropologist Claude Lévi-Strauss, in which cultures, viewed as systems, are analyzed in terms of the structural relations among their elements. According to Lévi-Strauss's theories, universal patterns in cultural systems are products of the invariant structure of the human mind. Structure, for Lévi-Strauss, referred exclusively to mental structure, although he found evidence of such structure in his far-ranging analyses of kinship, patterns in mythology, art, religion, ritual, and culinary traditions.

The basic framework of Lévi-Strauss's theories was derived from the work of structural linguistics. From N.S. Trubetzkoy, the founder of structural linguistics, Lévi-Strauss developed his focus on unconscious infrastructure as well as an emphasis on the relationship between terms, rather than on terms as entities in themselves. From the work of Roman Jakobson, of the same school of linguistic thought, Lévi-Strauss adopted the so-called distinctive feature method of analysis, which postulates that an unconscious "metastructure" emerges through the human mental process of pairing opposites. In Lévi-Strauss's system the human mind is viewed as a repository of a great variety of natural material, from which it selects pairs of elements that can be combined to form diverse structures. Pairs of oppositions can be separated into singular elements for use in forming new oppositions.

In analyzing kinship terminology and kinship systems, the accomplishment that first brought him to preeminence in anthropology, Lévi-Strauss suggested that the elementary structure, or unit of kinship, on which all systems are built is a set of four types of organically linked relationships: brother/sister, husband/wife, father/son, and mother's brother/sister's son. Lévi-Strauss stressed that the emphasis in structural analysis of kinship must be on human consciousness, not on objective ties of descent or consanguinity. For him, all forms of social life represent the operation of universal laws regulating the activities of the mind. His detractors argued that his theory could be neither tested nor proved and that his lack of interest in historical processes represented a fundamental oversight. Lévi-Strauss, however, believed that structural similarities underlie all cultures and that an analysis of the relationships among cultural units could provide insight into innate and universal principles of human thought.

**structuralism,** in linguistics, any one of several schools of 20th-century linguistics committed to the structuralist principle that a language is a self-contained relational structure, the elements of which derive their existence and their value from their distribution and oppositions in texts or discourse. This principle was first stated clearly, for linguistics, by the Swiss scholar Ferdinand de Saussure (1857–1913). Saussurean structuralism was further developed in somewhat different directions by the Prague school, glossematics, and other European movements.

In the United States the term structuralism, or structural linguistics, has had much the same sense as it has had in Europe in relation to the work of Franz Boas (1858–1942) and Edward Sapir (1884–1939) and their followers. Nowadays, however, it is commonly used, in a narrower sense, to refer to the so-called post-Bloomfieldian school of language analysis that follows the methods of Leonard Bloomfield, developed after 1930. Phonology (the study of sound systems) and morphology (the study of word structure) are their primary fields of interest. Little work on semantics has been done by structural linguists because of their belief that the field is too difficult or elusive to describe.

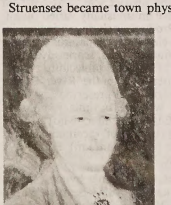
**structuralism,** in psychology, a systematic movement founded in Germany by Wilhelm Wundt (1832–1920) and mainly identified with Edward B. Titchener (1867–1927). Structuralism sought to analyze the adult mind (defined as the sum total of experience from birth to the present) in terms of the simplest definable components and then to find the way in which these components fit together in complex forms.

The major tool of structuralist psychology was introspection (a careful set of observations made under controlled conditions by trained observers using a stringently defined descriptive vocabulary). Titchener held that an experience should be evaluated as a fact, as it exists without analyzing the significance or value of that experience. For him, the "anatomy of the mind" had little to do with how or why the mind functions. In his major treatise, *A Textbook of Psychology* (1909–10), he stated that the only elements necessary to describe the conscious experience are sensation and affection (feeling). The thought process essentially was deemed an occurrence of sensations of the current experience and feelings representing a prior experience.

Although structuralism represented the emergence of psychology as a field separate from philosophy, the structural school lost considerable influence when Titchener died. The movement led, however, to the development of several counter-movements (*i.e.,* functionalism, behaviourism, and Gestalt psychology) that tended to react strongly to European trends in the field of experimental psychology. Behaviour and personality were beyond the scope considered by structuralism. In separating meaning from the facts of experience, structuralism opposed the phenomenological tradition of Franz Brentano's act psychology and Gestalt psychology, as well as the functionalist school and Watson's behaviourism. Serving as a catalyst to functionalism, structuralism was always a minority school of psychology in America.

**Struensee, Johann Friedrich, Graf von** (count of) (b. Aug. 5, 1737, Halle, Prussia [Germany]—d. April 28, 1772, Copenhagen, Den.), German physician and statesman who, through his control over the weak-minded King Christian VII, wielded absolute power in Denmark in 1770–72.

Struensee became town physician of Altona



Struensee, detail from a miniature by an unknown artist; in Gripsholm Castle, Sweden

By courtesy of the Svenska Portrattarkivet, Stockholm

(then in Denmark, now in Germany) in the 1760s. Through acquaintance with certain Danish courtiers, he was named to accompany the mentally unstable Christian VII on a European tour (1768–69), a post that led to Struensee's appointment as court physician in 1769. Dominating the king, he became the lover of Queen Caroline Matilda in 1770. He was soon able to abolish the council of state and the office of statholder (governor) of Norway in 1770. In June 1771 he had the king name him privy Cabinet minister, and in July he was made a count.

From March 1771 until January 1772 Struensee introduced a number of reforms, including freedom of the press, reduction of peasant labour service, a unitary judiciary, and reform of Copenhagen's municipal government. Having alienated many officials, however, he was the victim of a conspiracy in January 1772, when he was arrested and tortured to death for his liaison with the queen.

**struma fibrosa,** also called LIGNEOUS THYROIDITIS: *see* Riedel thyroiditis.

**struma lymphomatosa** (endocrine disorder): *see* Hashimoto's disease.

**Struma River,** also spelled STROUMA, Greek POTAMÓS STRIMÓN, ancient STRYMON, river in western Bulgaria and northeastern Greece, rising in the Vitosha Massif of the Rhodope Mountains in Bulgaria, southwest of Sofia. It follows a course of 258 miles (415 km) southsoutheast via Pernik to the Aegean Sea, which it enters 30 miles (50 km) west-southwest of Kavála. The area of its drainage basin is 4,208 square miles (10,898 square km). The Struma River valley is a direct routeway from Sofia to the Aegean. Major tributaries are the Dzherman, the Rilska, the Angitis, and the Strumeshnitsa (Strumica in Macedonia) rivers. The Struma River valley is a major source of brown coal for Bulgaria—coal is obtained at Pernik, Bobov Dol, and Brezhani.

The river's lower course, south of the Rupel Pass in Greece, was canalized in 1930. Lake Akhinós was drained and Lake Kerkínis was filled in for flood control. The river's lower course is now a wide agricultural valley.

**Strumen River** (Ukraine and Belarus): *see* Pripyat River.

**Struthiomimus,** genus of ostrichlike dinosaurs found as fossils in North America and dating from the Cretaceous Period (144 to 66.4 million years ago). *Struthiomimus* was about 2.5 m (8 feet) long and was a slender, lightly built biped obviously adapted for rapid movement on well-developed and strong hind limbs with three-toed, very birdlike feet. The small, light skull was perched atop a long, slender, and very flexible neck. The forelimbs were long and slender; they terminated in a three-fingered hand that had sharp claws adapted for grasping. The tail, long and slender, probably balanced the body and neck when the animal ran. The jaws of *Struthiomimus* were toothless and probably covered with a rather birdlike horny beak. It has been suggested that *Struthiomimus* and related forms fed upon the eggs of other dinosaurs. *See also* Ornithomimus.

**Struthof** (German Nazi concentration camp): *see* Natzweiler-Struthof.

**Strutt, John William** (English scientist): *see* Rayleigh (of Terling Place), John William Strutt, 3rd Baron.

**Struve, Friedrich Georg Wilhelm von,** Russian VASILY YAKOVLEVICH STRUVE (b. April 15, 1793, Altona, Den. [now in Germany]—d. Nov. 23, 1864, St. Petersburg, Russia), one of the greatest 19th-century astronomers and the first in a line of four generations of distinguished astronomers, who founded the modern study of binary (double) stars.



Friedrich Georg Wilhelm von Struve, detail of a lithograph by H. Mitreuter after a portrait by C.A. Jensen, 1844
Archiv fur Kunst und Geschichte, Berlin

To avoid conscription by the Napoleonic armies, Struve left Germany in 1808 and went first to Denmark and then to Russia. In 1813 he became professor of astronomy and mathematics at the University of Dorpat (now Tartu, Estonia), and four years later he was appointed director of the Dorpat Observatory. In 1824 he obtained a refracting telescope with an aperture of 24 cm (9.6 inches), at that time the finest ever built, and used it in a binary-star survey of unprecedented scope. In his survey of 120,000 stars from the north celestial pole to 15° S declination, he measured 3,112 binaries, more than 75 percent of which were previously unknown. He published his findings in the catalog *Stellarum Duplicium Mensurae Micrometricae* (1837; "Micrometric Measurement of Double Stars"), one of the classics of binary-star astronomy.

In 1835, at the request of Tsar Nicholas I of Russia, Struve went to Pulkovo to supervise the construction of a new observatory. He became director of the Pulkovo Observatory in 1839 but continued his binary-star studies. In 1838 he measured the parallax (the apparent change of position when viewed from two widely separated points) of Vega, one of the first such measurements ever made.

**Struve, Otto** (b. Aug. 12, 1897, Kharkov, Ukraine, Russian Empire [now Kharkiv, Ukraine]—d. April 6, 1963, Berkeley, Calif., U.S.), Russian-American astronomer known for his contributions to stellar spectroscopy, notably the discovery of the widespread distribution of hydrogen and other elements in space.

Struve was the last member of a dynasty of astronomers and a great-grandson of the noted astronomer Friedrich Georg Wilhelm von Struve. His studies at the University of Kharkov were interrupted for service in the Imperial Russian Army (1916–18) and, after the Russian Revolution, in the White Russian Army (1919–20). He endured months of privation in Turkey after the collapse of the White Army, but in 1921 he was able to emigrate to the United States, where, as a staff member at Yerkes Observatory, Williams Bay, Wis., he began the investigations in stellar spectroscopy (the study of the properties of stars through the analysis of the wavelengths of their light) that yielded his most notable contributions to stellar astrophysics. From his studies of Delta Orionis and other stars, he found that the spectrum of light from distant hot stars sometimes contains a dark (absorption) line corresponding to calcium, although this could not be caused by calcium present in the star itself. In 1925 he attributed this stationary calcium line to vast clouds of calcium found primarily in the galactic plane.

Struve became director of Yerkes Observatory in 1932, and in the same year he organized McDonald Observatory, Fort Davis, Texas, of which he later became director. In 1938, after a two-year search, he established the presence of hydrogen in interstellar space. That discovery later proved of prime importance in the development of radio astronomy. He demonstrated that many stars rotate rapidly on their axes, some with rotation periods of a day or less. His studies of many stars with variable luminosity and of the spectra of double, multiple, and peculiar stars were extensive.

In 1947 Struve retired as director of Yerkes and McDonald observatories and became chairman of the astronomy department of the University of Chicago. In 1950 he accepted the directorship of the Leuschner Observatory at the University of California, Berkeley, and from 1959 to 1962 he was director of the National Radio Astronomy Observatory, Green Bank, W.Va. As vice president of the International Astronomical Union from 1948 to 1952 and president from 1952 to 1955, he was instrumental in preventing Cold War tension from destroying that organization. A prolific writer, he published about 700 papers. His major books include *Stellar Evolution* (1950) and *The Universe* (1962).

**Struve, Pyotr Berngardovich** (b. Feb. 7 [Jan. 26, Old Style], 1870, Perm, Russia—d. Feb. 26, 1944, Paris, France), liberal Russian economist and political scientist.

While studying economic theory and history at the University of St. Petersburg, Struve became a Marxist. The Marxist analysis of Russian capitalism that he presented in 1894 in his *Kriticheskiye zametki k voprocy ob ekonomicheskom razvitii rossi* ("Critical Remarks on the Subject of Russia's Economic Development") procured for him a reputation among the left-wing intelligentsia, and in the late 1890s he served as the editor of several Marxist journals, including the influential periodical *Novoye Slovo* ("New Word"). Having become acquainted with Georgy Plekhanov and V.I. Lenin, Struve was asked to compose the manifesto for their nascent Russian Social Democratic Workers' Party after the party held its first congress in 1898.

After his arrest and exile from Russia in 1901, Struve broke with revolutionary Marxism, turning instead to a radical form of constitutional liberalism in which he maintained his highly critical stance toward the tsarist autocracy.

He was perhaps most influential as the editor of the illegal journal *Osvobozhdeniy* ("Liberation"), which appeared from 1902 to 1905 and was published successively in Stuttgart and Paris. The journal, which was regularly smuggled into Russia and had a wide readership, advocated the granting of full civil rights in Russia and the establishment of a constitutional monarchy. Struve had by this time drifted to the right of the socialist movement, and soon after his return to Russia in the aftermath of the Revolution of 1905, he joined the newly founded Constitutional Democratic Party (Kadets). He was elected to the second Duma (1907), but his moderate views and bitter criticism of revolutionary ideologies increasingly alienated him from other Russian progressives. Struve supported the Russian war effort during World War I and continued to edit the independent moderate journal *Russkaya mysly* ("Russian Thought") as he had done since 1905. He opposed the October Revolution of 1917 and participated for a time in White Guard resistance to the Bolsheviks before taking up residence in Paris, where he edited anti-Soviet émigré publications. After 1928 he lived in Belgrade, where he taught and did research on Russian topics.

**Struwwel, Peter:** *see* Hoffmann, Heinrich.

**strychnine,** a poisonous alkaloid that is obtained from seeds of the nux vomica tree (*S. nux-vomica*) and related plants of the genus *Strychnos*. It was discovered by the French chemists Joseph-Bienaimé Caventou and Pierre-Joseph Pelletier in 1818 in Saint-Ignatius'-beans (*S. ignatii*), a woody vine of the Philippines. The nux vomica tree of India is the chief commercial source. Strychnine has a molecular formula of $C_{21}H_{22}N_2O_2$. It is practically insoluble in water and is soluble only with difficulty in alcohol and other common organic solvents. It has an exceptionally bitter taste.

Strychnine has been used in rodent poisons and in smaller doses as a stimulant in veterinary practice. It increases the reflex irritability of the spinal cord, which results in a loss of normal inhibition of the body's motor cells, causing severe contractions of the muscles; arching of the back is a common symptom of poisoning. Strychnine rapidly enters the blood, whether taken orally or by injection, and symptoms of poisoning usually appear within 20 minutes. The symptoms begin with cramps and soon culminate in powerful and agonizing convulsions that subside after a minute but recur at a touch, a noise, or some other minor stimulus. Death is usually due to asphyxiation resulting from continuous spasms of the respiratory muscles.

*Consult the* INDEX *first*

**Strychnos,** genus of tropical woody plants, many of them trees, in the family Loganiaceae (order Gentianales). The flowers are small and usually white or creamy white in colour.

Several of the approximately 150 species in the genus are important sources of drugs or poisons: strychnine, from the seeds of *S. nux-vomica* and other species; and curare (*q.v.*), from the bark of *S. toxifera* and other species. A few species are valued locally for their sweet fruits, including *S. spinosa* (Natal orange) and *S. unguacha.*

**Strydom, Johannes Gerhardus:** *see* Strijdom, Johannes Gerhardus.

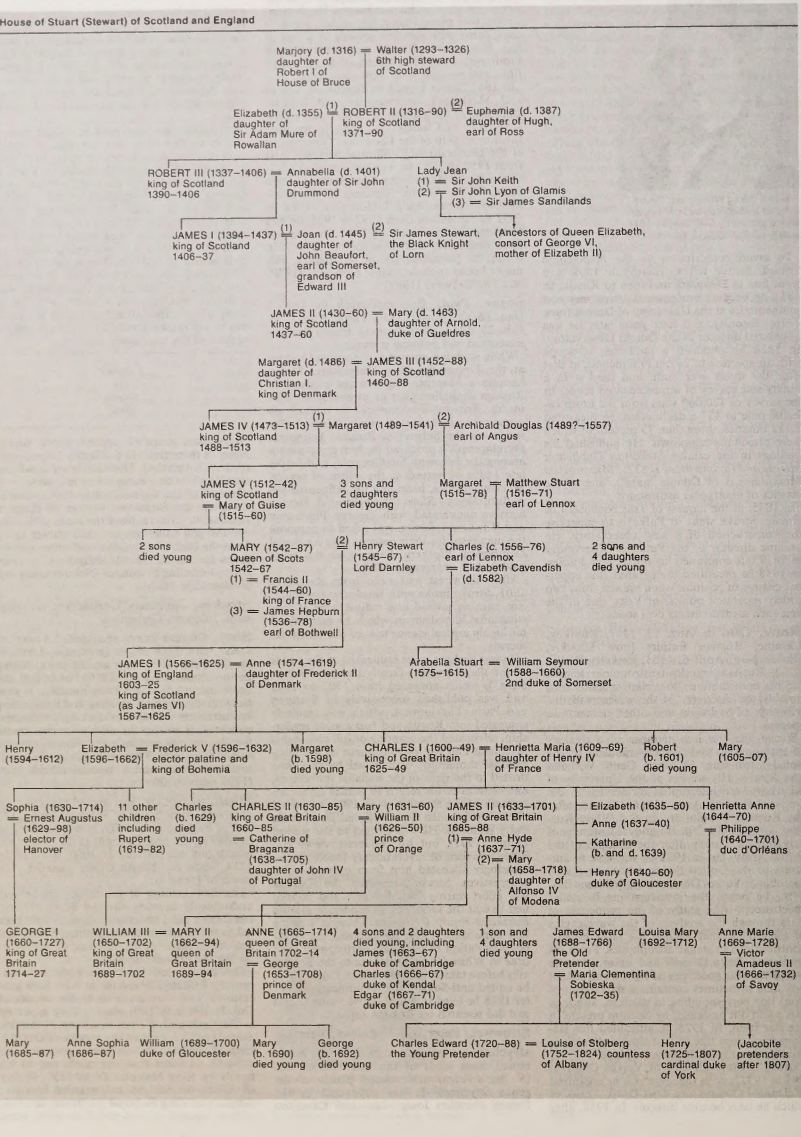
**Stryy,** Russian STRY, also spelled STRYI, or STRYJ, city, Lviv *oblast* (province), Ukraine, on the Stryy River. It is an old town, dating in the chronicles from 1396, but it first became important as a railway junction. It now has various machine-building and engineering industries, as well as food and light industrial concerns. It is also the administrative centre for the natural-gas industry situated in the surrounding area. There is a college of agricultural mechanics and a medical school. Pop. (1991 est.) 68,200.

**Stuart,** HOUSE OF, also spelled STEWART, or STEUART, royal house of Scotland from 1371 and of England from 1603. It was interrupted in 1649 by the establishment of the Commonwealth but was restored in 1660. It ended in 1714, when the British crown passed to the house of Hanover.

The first spelling of the family name was undoubtedly Stewart, the old Scots version, but during the 16th century French influence led to the adoption of the spellings Stuart and Steuart, because of the absence of the letter "w" in the French alphabet.

The family can be traced back to 11th-century Brittany, where for at least four generations they were stewards to the counts of Dol. In the early 12th century they appeared in England, and Walter, third son of the 4th steward of Dol, entered the service of David I, king of Scots, and was later appointed his steward, an office that was confirmed to his family by King Malcolm IV in 1157. Walter (d. 1326), the 6th steward, married Marjory, daughter of King Robert I the Bruce, in 1315,

House of Stuart (Stewart) of Scotland and England



and in 1371 their son Robert, as King Robert II, became the first Stewart king of Scotland. The royal Stewarts had an unlucky history, dogged by sudden death; and seven succeeded to the throne as minors.

The direct male line terminated with the death of James V in 1542. His daughter Mary, Queen of Scots (d. 1587), was succeeded in 1567 by her only son (by Henry Stuart, Lord Darnley), James VI.

In 1603 James VI, through his great-grandmother Margaret Tudor, daughter of Henry VII of England, inherited the English throne as King James I. After the execution (1649) of James's son Charles I, the Stuarts were excluded from the throne until the restoration of Charles II in 1660. Charles II was succeeded in 1685 by his Roman Catholic brother James II (d. 1701), who so alienated the sympathies of his subjects that in 1688 William, prince of Orange, was invited to come "to the rescue of the laws and religion of England." James fled, and by the Bill of Rights (1689) and the Act of Settlement (1701), which denied the crown to any Roman Catholic, he and his descendants were excluded from the throne. But Stuarts still ruled in England and Scotland, for William was the son of Charles II's sister Mary, and his wife Mary was James II's elder daughter. They became joint sovereigns as William III and Mary II. They left no issue, and the Act of Settlement secured the succession to Mary's sister Anne (d. 1714) and on her death without issue to Sophia, electress of Hanover, a granddaughter of James I; Sophia's son and heir became George I, first of the British House of Hanover.

The last male Stuarts of the British royal line were James II's son James Edward (d. 1766), the Old Pretender, and his sons Charles Edward (d. 1788), the Young Pretender (known as Bonnie Prince Charlie), who died without legitimate issue, and Henry (d. 1807), Cardinal Duke of York.

**Stuart, Arabella,** Stuart also spelled STEWART (b. 1575—d. Sept. 25, 1615, London, Eng.), English noblewoman whose status as a claimant to the throne of her first cousin King James I (James VI of Scotland) led to her tragic death.

The daughter of James's uncle Charles Stewart, Earl of Lennox, and great-granddaughter of King Henry VIII's sister Margaret Tudor, Arabella was recognized during the last years of the reign of Queen Elizabeth I as second, after James VI, in line of succession to the English throne. Some Englishmen felt that she was better qualified than James to rule the country because she was English by birth and upbringing. When James became ruler of England in 1603, he invited Arabella to live at the royal court, but the question of her marriage soon created difficulties. James apparently feared that a union between Arabella and a foreign ruler might pose a threat to his position; hence, she was arrested and temporarily imprisoned when she attempted to leave England in 1609, probably to wed an obscure Balkan prince. Upon her release she promptly fell in love with William Seymour (later Duke of Somerset), himself a claimant to the throne. Against James's orders the couple was secretly married on June 22, 1610. When the king received the news, he imprisoned Seymour in the Tower of London and had Arabella taken into custody. The two lovers escaped from confinement, but they failed to rendezvous as planned. Although Seymour made his way to Ostend (in modern Belgium), Arabella was captured aboard ship in the English Channel. Imprisoned in the Tower, she suffered a mental breakdown and finally died in 1615.



Arabella Stuart, painting possibly by Marcus Gheeraerts the Younger, 1605, in the Scottish National Portrait Gallery, Edinburgh

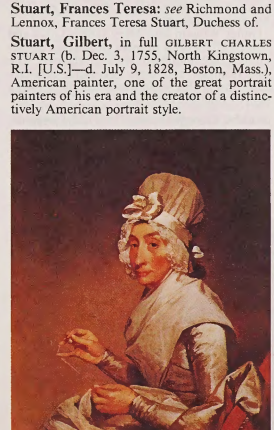
By courtesy of the Scottish National Portrait Gallery, Edinburgh

BIBLIOGRAPHY. P.M. Handover, *Arbella Stuart* (1957); Ian McInnes, *Arabella* (1968).

**Stuart, Charles Edward:** *see* Charles Edward, the Young Pretender.

**Stuart, Frances Teresa:** *see* Richmond and Lennox, Frances Teresa Stuart, Duchess of.

**Stuart, Gilbert,** in full GILBERT CHARLES STUART (b. Dec. 3, 1755, North Kingstown, R.I. [U.S.]—d. July 9, 1828, Boston, Mass.), American painter, one of the great portrait painters of his era and the creator of a distinctively American portrait style.



"Mrs. Richard Yates," oil painting by Gilbert Stuart, 1793–94; in the National Gallery of Art, Washington, D.C.

By courtesy of the National Gallery of Art, Washington, D.C., Andrew Mellon Collection

Stuart grew up in Newport, R.I., where he learned the rudiments of painting. About 1771 he accompanied Cosmo Alexander, a Scotch painter visiting Newport, to Edinburgh, returning to Rhode Island a year later. In 1775 he went to London and entered the studio of the American artist Benjamin West, with whom he worked for about six years. His mature style owes more, however, to Thomas Gainsborough and Sir Joshua Reynolds than to West. In 1782 he opened his own London studio and for five years enjoyed great success, but in 1787 he fled to Dublin to escape his creditors. After six years in Ireland he returned to the United States, where he quickly established himself as the nation's leading portrait painter. He lived in New York City for a short time and moved to Philadelphia, where he lived for about 12 years. He finally settled in Boston in 1805.

Stuart's work was hailed by his contemporaries, and subsequent critics have confirmed this judgment, especially praising its painterly brushwork, luminous colour, and psychological penetration. Of his nearly 1,000 portraits, undoubtedly the most famous is the unfinished head of George Washington (1796) at the Boston Athenaeum. Other fine portraits are those of Mrs. Richard Yates, National Gallery of Art, Washington, D.C.; Mrs. Perez Morton, Worcester Art Museum, Worcester, Mass.; and John Adams, privately owned.

Although Stuart had no formal pupils, many young artists, including John Vanderlyn, Thomas Sully, and John Neagle, availed themselves of the advice he freely gave. Less talented artists, including his own daughter Jane, simply reduced his style to a formula that gave a Stuartesque appearance to much American portraiture of the succeeding generation.

**Stuart, Henry:** *see* Darnley, Henry Stewart, Lord; Gloucester, Henry Stuart, Duke of; York, Henry Stuart, Cardinal Duke of.

**Stuart, James:** *see* Moray, James Stewart, 1st Earl of; Moray, James Stewart, 2nd Earl of.

**Stuart, James Edward:** *see* James Edward, the Old Pretender.

**Stuart, Jeb,** byname of JAMES EWELL BROWN STUART (b. Feb. 6, 1833, Patrick county, Va., U.S.—d. May 12, 1864, Yellow Tavern, near Richmond, Va.), Confederate cavalry officer whose reports of enemy troop movements were of particular value to the Southern command during the American Civil War (1861–65).

An 1854 graduate of the U.S. Military Academy, West Point, N.Y., Stuart resigned his commission to share in the defense of his state when Virginia seceded from the Union (April 1861). At the First Battle of Bull Run (called First Manassas by the South) that July, he distinguished himself by his personal bravery. Later in the year he was promoted to brigadier general and placed in command of the cavalry brigade of the Army of Northern Virginia. Just before the Seven Days' Battle—fought in June 1862 in defense of Richmond—Stuart was sent out by Confederate general Robert E. Lee to locate the right flank of the Federal army under General George B. McClellan. He not only successfully achieved his mission, but he also rode completely around McClellan's army to deliver his report to Lee. In the next campaign he had the good fortune, in his raid against Federal communications, to bring back a staff document from which Lee was able to discover the strength and position of Federal forces.

Stuart, promoted to a major general and commander of the cavalry corps, was present at the Second Battle of Bull Run (Second Manassas, August 1862) and again circled the Federal army, returning with 1,200 enemy horses. During the Maryland campaign that followed, he brilliantly defended one of the passes of South Mountain (Crampton's Gap), thus enabling Lee to concentrate his army in time to meet McClellan's attack. By the winter of 1862 Stuart's extraordinary skill as an intelligence officer was fully recognized, and Lee called him the "eyes of the army."

At the Battle of Fredericksburg (December 1862) Stuart's horse artillery rendered valuable service by checking the Federal attack on General T.J. ("Stonewall") Jackson's corps. The following May at the Battle of Chancellorsville, Stuart was appointed by Lee to take command of the 2nd Army Corps after Jackson had been wounded.

The next campaign at Gettysburg, Pa. (July 1863), was preceded by the cavalry Battle of Brandy Station (June 9), at which for the first time Stuart and his men were met by worthy opposition from the Federal cavalry. The Confederates' northward march to the Potomac River was screened by Stuart's cavalry corps, which held the various approaches on the right flank of the army. Stuart's conduct at

Gettysburg was long a subject of controversy. Though ordered by Lee to deploy his cavalry as a screen while also gathering intelligence for the advancing Confederate army, Stuart instead struck off on a raid, was delayed, and arrived at Gettysburg too late to provide Lee with vital information on the positions and movements of the Union forces. When Stuart did rejoin Lee's army at Gettysburg on July 2, the battle had already begun, and his exhausted forces were of little help.

Throughout the winter of 1863–64 Stuart continued to supply the Confederate command with accurate knowledge of Northern troop movements. But soon after the opening of the 1864 campaign his corps was drawn away from Lee's army by General Philip Sheridan's Federal cavalry forces. In attempting to keep the enemy from reaching Richmond, during the engagement generally known as Spotsylvania Courthouse, Stuart's army met defeat (May 11), and he himself was mortally wounded at close range the next day.

**Stuart, John:** *see* Bute, John Stuart, 3rd Earl of.

**Stuart, Mary:** *see* Mary *under* Mary (Scotland).

**Stuart style,** visual arts produced during the reign of the British house of Stuart; that is, from 1603 to 1714 (excepting the interregnum of Oliver Cromwell). Although the Stuart period included a number of specific stylistic movements, such as Jacobean, Carolean, Restoration, William and Mary, and Queen Anne, there are certain common characteristics that can be said to describe Stuart style. The English artists of the period were influenced by the heavy German and Flemish Baroque but gradually gave way to the academic compromise inspired by Italian Palladianism. For much of the period, artists in England looked for inspiration to contemporary movements (primarily the Baroque) on the Continent—especially in Italy, Flanders, and France.

Under James I (1603–25) the arts were in a period of transition, not fully recovered from the ossification that characterized the last years of the long reign of Elizabeth I. It took 20 years for growth to recommence. The most forward-looking artist of James's reign was Inigo Jones, who, as Surveyor of the King's Works, designed a number of royal buildings in the Italian Renaissance style. The Banqueting House (1619–22) at Whitehall is only one of his masterpieces. The reign of Charles I (1625–49) was as exciting artistically as it was disastrous politically. Jones continued as the crown's architect and designed a number of the sets for the Stuart masques. The Flemish painter Peter Paul Rubens came to England, was knighted, and designed an elaborate ceiling that was installed at the Banqueting House. Another Flemish painter, Sir Anthony Van Dyck, followed Rubens and created an English portrait type that was to serve as the model for two centuries.

When Charles II returned in 1660 from an exile spent chiefly in France, French taste and ideas began to dominate English arts. The outstanding achievement of Charles's reign was the rebuilding of London (destroyed by fire in 1666) under Sir Christopher Wren. Wren's blending of Renaissance, Italian Baroque, and contemporary French elements created a personal architecture that greatly influenced his followers until a reaction set in during the Georgian period (*see* Georgian style). Sir Peter Lely, the portraitist of the Restoration court, worked in a style close to that of Van Dyck but more superficial.

Under William and Mary (1689–1702) and Anne (1702–14) a number of noteworthy architectural monuments were constructed. The fine furniture and other decorative arts created during this period reflected the growing skill of English craftsmen.



Model of a Stuart-style salon or reception room, 1625–50, freely based on Wilton House in Wiltshire designed by Inigo Jones; in the Art Institute of Chicago

By courtesy of Thorne Rooms in Miniature, the Art Institute of Chicago

**Stubbs, George** (b. Aug. 24, 1724, Liverpool, Eng.—d. July 10, 1806, London), outstanding English animal painter and anatomical draftsman.

The son of a prosperous tanner, Stubbs was briefly apprenticed to a painter but was basically self-taught. His interest in anatomy, revealed at an early age, became one of the driving passions of his life. His earliest surviving works are 18 plates etched for Dr. John Burton's *Essay Towards a Complete New System of Midwifery* (1751). In the 1750s Stubbs made an exhaustive analysis of the anatomy of the horse. He rented a farmhouse in a remote Lincolnshire village, where, over a period of 18 months, he undertook the painstaking dissection of innumerable specimens. After moving permanently to London in 1760, Stubbs etched the plates for *Anatomy of the Horse* (1766), which became a major work of reference for naturalists and artists alike. Stubbs soon established a reputation as the leading painter of portraits of the horse. His masterly depictions of hunters and racehorses brought him innumerable commissions. Perhaps more impressive than the single portraits are his pictures of informal groups of horses, such as "Mares and Foals in a Landscape" (*c.* 1760–70; Tate Gallery, London).



"A Lion Attacking a Horse," oil on canvas by George Stubbs, *c.* 1762; in the Yale Center for British Art, New Haven, Conn.

Yale Center for British Art, Paul Mellon Collection

Stubbs also painted a wide variety of other animals, including the lion, tiger, giraffe, monkey, and rhinoceros, which he was able to observe in private menageries. According to the artist Ozias Humphrey, Stubbs was so convinced of the importance of observation that he visited Italy in 1754 only to reinforce his belief that nature is superior to art. Among Stubbs's best-known pictures are several depicting a horse being frightened or attacked by a lion ("Horse Frightened by a Lion," 1770) in which he emphasizes the wild terror of the former and the predatory power of the latter.

Stubbs's historical paintings are among the least successful of his works; much more convincing are his scenes of familiar country activities done in the 1770s. Unfortunately, he tended to execute his paintings in thin oil paint, and relatively few survive in undamaged condition. In later life Stubbs knew considerable hardship. His last years were spent on a final work of anatomical analysis: *A Comparative Anatomical Exposition of the Structure of the Human Body, with that of a Tiger and Common Fowl,* for which he completed 100 drawings and 18 engravings. *The Anatomical Works of George Stubbs* was published in 1975.

**Stubbs, William** (b. June 21, 1825, Knaresborough, Yorkshire, Eng.—d. April 22, 1901, Cuddesdon, near Oxford), influential English historian who founded the systematic study of English medieval constitutional history.

Stubbs was regius professor of history at the University of Oxford (1866–84), bishop of Chester (1884–88), and bishop of Oxford (1888–1901). His reputation in his day rested primarily on a massive study of historical synthesis, *The Constitutional History of England in its Origin and Development,* 3 vol. (1873–78), which traces the development of English institutions from the Teutonic invasion of Britain until 1485. This work has been much criticized, however, and Stubbs's best work is now held to be the 19 volumes of editions of medieval English chronicles that, between 1864 and 1889, he contributed to the Rolls series. His other publications include *Select Charters . . . of English Constitutional History from the Earliest Times to the Reign of Edward the First* (1870), which quickly established itself as a textbook.

**stuccowork,** in architecture, fine exterior or interior plasterwork used as three-dimensional ornamentation, as a smooth paintable surface, or as a wet ground for fresco painting (*q.v.*). Today the term is most often applied exclusively, especially in the United States, to the rougher plaster coating of exterior walls.

Every building tradition in the history of man has produced stuccowork. The ingredients, usually lime, gypsum, and fine sand, may vary greatly in type and amount; but the material used is less significant than the manner in which it is used. Examples of stuccowork occur in the Aztec architecture of Mexico and the Muslim architecture of North Africa and



Detail of Baroque stuccowork by Egid Quirin Asam, c. 1721, in the abbey church of Weltenburg, Ger.
A.F. Kersting

Spain. In ancient Greece stucco was applied to both interior and exterior temple walls as early as 1400 BC. Architects of ancient Rome stuccoed the rough stone or brick walls of huge monuments, such as the baths at Hadrian's Villa, erected at Tivoli about AD 120–130. They also favoured it for low-relief modeling. Tombs dating from the 1st and 2nd centuries AD have extensive stuccowork.

Stuccowork reached new heights in the work of such Baroque artists as Egid Quirin Asam, who often collaborated with his brother Cosmas Damian, a painter. Renaissance designers were also devoted to the use of stuccowork. They used smooth stuccowork in many buildings to contrast with the heavy rusticated stones at the corners and openings. In the work of Raphael and his followers, festoons and medallions of molded stucco were featured on exterior walls. Stuccowork was readily adaptable to the elaborate, ornate styles of post-Renaissance architecture, and, less expensive than stone and easier to model, stucco was then applied for the first time to columns and their entablatures. Post-Renaissance ceilings were especially heavy in stuccowork. In the Renaissance revival of the late 18th and early 19th centuries, stuccowork was used, notably in England, for exterior architectural features.

In the 20th century, as the term began to be applied to exterior surfacing exclusively, stuccowork was for a time limited in use to small-scale, modest buildings, usually residential. In the United States, especially in regions of warmer climate, the stucco bungalow became virtually ubiquitous in the 1920s. Stucco also may be combined with other materials, such as brick, stone, or wood. Because of the many ways in which it can be treated, stuccowork remains popular. It can easily be painted, and pigment can be mixed with wet stucco; surfaces of varying texture can be obtained by the addition of heavy sand or pebbles to the finish coat.

**studbook,** official record of the pedigree of purebred animals, particularly horses and dogs, usually published by a national breed association or similar regulating organization.

Most studbooks are patterned after the British *General Stud Book* for Thoroughbred horses, first published in 1791 by James Weatherby, whose descendants have continued to produce it on behalf of the Jockey Club. Although Weatherby's first book specifically denied that it was either complete or free from error, the *General Stud Book* soon became the supreme authority on Thoroughbred pedigrees. Only horses listed were eligible to compete on licensed racecourses in England, and for years many Thoroughbreds whose ancestors could not all be traced to listed horses were excluded from British racing. Beginning in 1948, however, rules were relaxed somewhat.

**Studebaker, Clement** (b. March 12, 1831, Pinetown, Pa., U.S.—d. Nov. 27, 1901, South Bend, Ind.), American manufacturer who founded a family firm that became the world's largest producer of horse-drawn vehicles and a leader in automobile manufacturing.

Studebaker started a blacksmith and wagon shop in South Bend in 1852 with his brother Henry. When John Mohler Studebaker joined his brothers in 1858, the company had attained prominence in helping to supply wagons to the booming agricultural market in the Midwest. Aided by a large government contract during the American Civil War, the company was incorporated as Studebaker Brothers Manufacturing Company in 1868 and joined by another brother, Peter Everst Studebaker. A fifth brother, Jacob Franklin Studebaker, entered the firm in 1870 and established its first branch office at St. Joseph, Mo., where it helped to outfit settlers moving west. The firm produced more than 750,000 wagons during its history.

The Studebakers began to experiment with automobiles in 1897; by 1902 the firm had built electric cars and, by 1904, gasoline-powered cars. The Studebaker Corporation, which absorbed the original firm in 1911, merged with the Packard Motor Car Company in 1954. The company's U.S. production ceased in 1963, and that of its Canadian operation in 1966.

**student aid,** form of assistance designed to help students pay for their education. In general, such awards are known as scholarships, fellowships, or loans; in European usage, a small scholarship is an exhibition, and a bursary is a sum granted to a needy student. Many awards are in the nature of long-term loans with low rates of interest. In many countries, government subsidies reduce or eliminate tuition and the cost of room and board and other expenses, and in still others students receive allowances for extra expenses. Even in some countries where tuition charges are appreciable, as in Great Britain, a scholarship program supported both by governments and by universities effectively underwrites this cost for most students.

During the latter half of the 20th century, a striking growth in higher education throughout the world has been greatly fostered by student-aid programs. Thus, opportunities for higher education, once limited to an economic and social elite, have become increasingly available to promising students with little money. Students receiving some form of private or public support constitute in all countries an important, and in some an overwhelming, proportion of university enrollment.

The United States has several major scholarship programs, but the number of students in that country receiving government financial aid is proportionately less than in most other countries. U.S. students receive greater support from universities as well as from corporations, foundations, and religious, civic, and other groups.

**Students for a Democratic Society** (SDS), American student organization that flourished in the mid-to-late 1960s and was known for its activism against the Vietnam War.

SDS, founded in 1959, had its origins in the student branch of the League for Industrial Democracy, a social-democratic educational organization. An organizational meeting was held in Ann Arbor, Mich., in 1960, and Robert Alan Haber was elected president of SDS. Initially SDS chapters throughout the nation were involved in the Civil Rights Movement. Operating under the principles of the "Port Huron Statement," a manifesto written by Tom Hayden and Haber and issued in 1962, the organization grew slowly until the escalation of U.S. involvement in Vietnam (1965). SDS organized a national march on Washington, D.C., in April 1965, and, from about that period, SDS grew increasingly militant, especially about issues relating to the war, such as the drafting of students. Tactics included the occupation of university and college administration buildings on campuses across the country. By 1969 the organization had split into several factions, the most notorious of which was the "Weathermen," or "Weather Underground," which employed terrorist tactics in its activities. Other factions turned their attention to the Third World or to the efforts of black revolutionaries. Increasing factionalism within the ranks of SDS and the winding down of the Vietnam War were but two of the reasons for the dissolution of SDS. By the mid-1970s the organization was defunct.

**Student's t-test,** in statistics, method of testing hypotheses about the mean of a small sample drawn from a normally distributed population when the population standard deviation is unknown.

An Englishman, William Sealy Gosset, publishing under the pseudonym Student, developed the *t*-test and *t* distribution. The *t* distribution is a family of curves in which the number of degrees of freedom (the number of independent observations in the sample minus one) specifies a particular curve. As the sample size (and thus the degrees of freedom) increases, the *t* distribution approaches the bell shape of the standard normal distribution. Hence, for tests involving the mean of a sample of size greater than 30, the normal distribution is usually applied.

It is usual first to formulate a null hypothesis, which states that there is no effective difference between the observed sample mean and the hypothesized or stated population mean—*i.e.,* that any measured difference is due only to chance. An alternative hypothesis is also formulated. This may be either two-sided (also termed two-tailed), stating simply that the means are not equivalent, or one-sided, specifying whether the observed mean is larger or smaller than the hypothesized mean. The test statistic $t$ is then calculated. If the observed *t*-statistic is more extreme than the critical value determined by the appropriate reference distribution, the null hypothesis is rejected. The appropriate reference distribution for the *t*-statistic is the $t$ distribution. The critical value depends on the significance level of the test (the probability of erroneously rejecting the null hypothesis).

For example, suppose a researcher wishes to test the hypothesis that a sample of size $n = 25$ with mean $\bar{x} = 79$ and standard deviation $s = 10$ was drawn at random from a population with mean $\mu = 75$ and unknown standard deviation. Using the formula for the *t*-statistic,

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

the calculated $t$ equals 2.00. For a two-sided test at the level of significance $\alpha = 0.05$, the critical values from the $t$ distribution on 24 degrees of freedom are $-2.064$ and 2.064. The calculated $t$ does not exceed these values, hence the null hypothesis is accepted with 95 percent confidence. (The confidence level is $1 - \alpha$.)

A second application of the $t$ distribution tests the hypothesis that two independent random samples have the same mean. The $t$ distribution can also be used to construct confidence intervals for the true mean of a population (the first application) or for the difference between two sample means (the second application). *See also* interval estimation.

**Study of Democratic Institutions, Center for the,** formerly ROBERT MAYNARD HUTCHINS CENTER FOR THE STUDY OF DEMOCRATIC INSTITUTIONS, nonprofit educational institution established at Santa Barbara, Calif., in 1959 and based in Los Angeles from 1988. The educator Robert M. Hutchins (*q.v.*) organized the centre and headed it for 25 years. The purpose of the centre—to clarify the basic issues confronting a democratic society—was served through discussion and criticism, publications, and public meetings. Scholars, public officials, and leaders of thought and action from many countries often met with a small resident staff to discuss and to try to understand the causes of contemporary problems.

The centre had experienced financial difficulties off and on during its history, and in 1979 it was reorganized under a new parent organization—the University of California Santa Barbara Foundation—and became a "center of independent thought and criticism" on the university campus. In 1988 the centre was again reorganized when it moved to Los Angeles, where it absorbed the Institute for National Strategy and took over the publishing of *New Perspectives Quarterly*.

**Stuhlweissenburg** (Hungary): *see* Székesfehérvár.

**Stuka,** German in full STURZKAMPFFLUGZEUG ("dive-bomber"), a low-wing, single-engine monoplane—especially the Junkers JU 87 dive-bomber—used by the German Luftwaffe from 1937 to 1945, with especially telling effect during the first half of World War II. The Stuka was designed to employ the dive-bombing technique developed earlier by the U.S. Navy, *i.e.,* diving vertically at a target, releasing the bombs while still in a dive, and only then pulling out into straight flight to get away. The JU 87 had dive brakes to slow the dive and give the pilot more time to aim his airplane and, thereby, the bomb. It also had hinged external bomb racks that could, when the craft was in a steep dive, swing downward and outward so that the bombs, when released, would clear the airplane's propellers. The JU 87 was armed with four 7.9-millimetre machine guns, two of which were operated by a rear-seat gunner; late in the war, the rear-mounted guns were replaced by a single 13-millimetre gun. The Stuka carried under its fuselage either one 1,100-pound (500-kilogram) or one 550-pound (250-kilogram) bomb, plus two smaller bombs (110 pounds [50 kg]) under each wing. The craft was first used by German pilots in the Spanish Civil War and then in the invasion of Poland and the Low Countries and France. The scream of the diving airplane terrified people on the ground, and this effect was enhanced by the addition of cardboard sirens both to the airplanes and to their bomb load. Although the Stukas, refined from time to time, were used throughout the war, their maximum speed was just 210 miles per hour (335 km per hour), and they proved no match for the British combination of early warning by radar and fast fighter planes.

**Stukeley, William** (b. Nov. 7, 1687, Holbeach, Lincolnshire, Eng.—d. March 3, 1765, London), English antiquary and physician whose studies of the monumental Neolithic Period–Bronze Age stone circles at Stonehenge and Avebury, Wiltshire, led him to elaborate extravagant theories relating them to the Druids (ancient Celtic priest-magicians). These views were widely and enthusiastically accepted in the late 18th century. Despite his romantic theorizing, he was an excellent field archaeologist, and his surveys of the monuments in the 1720s remain of interest. His extensive antiquarian travels are recorded in *Itinerarium Curiosum* (1724; "Observant Itinerary").

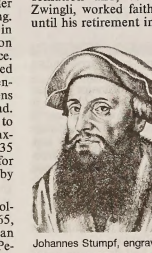
**Stumpf, Carl** (b. April 21, 1848, Wiesentheid, Lower Franconia, Bavaria [Germany]—d. Dec. 25, 1936, Berlin), German philosopher and theoretical psychologist noted for his research on the psychology of music and tone.

Stumpf was influenced at the University of Würzburg by the philosopher Franz Brentano, founder of act psychology, or intentionalism. Appointed lecturer (*Privatdozent*) at the University of Göttingen in 1870, he wrote his first important work, *Über den psychologischen Ursprung des Raumvorstellung* ("The Psychological Origins of Space Perception") three years later and soon thereafter was appointed professor at the University of Würzburg. In 1875 he began experiments for his *Tonpsychologie,* 2 vol. (1883–90; "Tone Psychology"), completed in the course of professorships at the Universities of Prague (1879), Halle (1884), and Munich (1889). This work was important not only for reporting the results of his experiments but also for revising concepts of psychophysics, which attempts to make quantitative measurements of physical stimuli and the sensations they produce.

In 1894 Stumpf entered the most influential phase of his career as professor of philosophy and director of the institute of experimental psychology at the Friedrich-Wilhelm University, Berlin. Continuing his research on tone psychology, he founded the journal *Beiträge zur Akustik und Musikwissenschaft* ("Contributions to Acoustics and Musicology") in 1898 and in 1900 established an archive of primitive music. He was also a cofounder of the Berlin society for child psychology (1900). In two important papers of 1907 he stressed that the experimental study of sensory and imaginal experience (*e.g.,* images, sounds, colours) is antecedent to the study of mental functions (*e.g.,* perceiving, willing, desiring). Thus he drew into psychology his own version of phenomenology (the philosophy that examines conscious phenomena). Until Stumpf's retirement from Berlin in 1921 his institute had numerous students who later developed an experimental phenomenology.

**Stumpf, Johannes** (b. April 23, 1500, Bruchsal, Baden [Germany]—d. 1578, Zürich, Switz.), Swiss chronicler and theologian, one of the most important personalities of the Swiss Reformation.

Stumpf entered the order of the Knights of St. John in Freiburg im Breisgau in 1521 and a year later was appointed prior at Bubikon, Zürich. He there declared himself for the Reformation and, as a friend of Huldrych Zwingli, worked faithfully for the Reformers until his retirement in 1562. Stumpf's reputation rests upon his *Gemeiner loblicher Eydgnoschafft Stetten, Landen und Völckeren chronikwirdiger Thaaten Beschreybung* (1547–48), probably the most famous of Swiss chronicles, describing the deeds of places, lands, and people of the confederation. It was a standard work until the 18th century.



Johannes Stumpf, engraving by D. Meyer
By courtesy of the Bibliotheque Nationale Suisse, Bern

**Stung Treng** (Kampuchea): *see* Stœng Trêng.

**stunt,** in agriculture, common symptom of plant disease, resulting in reduced size and loss of vigour. Stunting may be caused by viral, bacterial, fungal, or nematode (eelworm) infections and by noninfectious (abiotic) means including an excess or lack of water, imbalance of soil nutrients, excess light, chemical or mechanical injuries, insect or mite feeding, and too-deep planting.

**stunt flying,** the performance of aerial feats requiring great skill or daring. It includes maneuvers such as flying inverted and "loop the loop."

Stunt flying as a generic term may include barnstorming, crazy flying (the performance of comedic aerial routines), or any spectacular or unusual flying feat performed for film or television cameras or for any kind of public display or entertainment. Stunt flying may be performed by one or more pilots at the same time and with almost any kind of flying craft.

Although the beginnings of stunt flying are to be found in the "death-defying" performances of balloonists—such as those by the Brazilian aviation pioneer Alberto Santos-Dumont in the 1890s—stunt flying in powered aircraft started with the Wright brothers. In order to demonstrate the full capabilities of their designs, the Wrights engaged professional exhibition pilots. Eugène Lefebvre was the first engineer and chief pilot of the Wright company in France. In the United States the Wrights trained an exhibition team—the Wright Flyers—the stars of the team being Walter Brookins, Arch Hoxsey, and Ralph Johnstone.

The Wrights' greatest rival, Glenn Curtiss, engaged Lincoln Beachey in 1911. In November 1913 Beachey became the first to "loop the loop" in the United States. (The first flyer ever to loop was Russian Petr Nesterov; he performed his loop on Sept. 9 [Aug. 27, Old Style], 1913.)

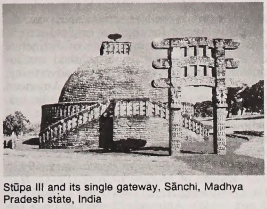
World War I aerial dogfighting provided the training ground for countless postwar stunt flyers, and in Europe the greatest surviving masters of aerial combat were snapped up as test pilots and demonstration pilots for the leading aircraft manufacturers. In the United States barnstormers were the rage. A shortage of jobs and a surplus of inexpensive aircraft provided the impetus for war pilots returning home to start touring as stunt-flying entertainers. Barnstorming was financed principally by the fares charged to passengers for short sightseeing flights, and air shows were mounted to bring the paying public to the field that was temporarily hosting the attraction. Any city with bridges, particularly several bridges in a row, was a ready target for stunt flyers.

The late 1920s–'30s were the golden age of flying in the United States. American stars of the era included Al Williams, Jimmy Doolittle, Joe Mackey, Freddie Lund, and Tex Rankin. Lund was a noted stunt flyer for Hollywood movies.

After World War II a greater concern for safety curtailed the more extreme daredevil activities, and severe penalties were introduced for such feats as flying under bridges. However, exhibitions of stunt flying are still popular attractions at air displays. *See also* aerobatics.

(A.C.)

**stūpa,** Buddhist commemorative monument usually housing sacred relics associated with the Buddha or other saintly persons; it is an architectural symbol of the Buddha's *parinirvāṇa,* or death. The hemispherical form of the *stūpa* appears to have derived from pre-Buddhist burial mounds in India. As most characteristically seen at Sānchi (*q.v.*) in the Great Stūpa (2nd–1st century BC), the monument consists of a circular base supporting a massive solid dome (the *aṇḍa,* "egg," or *garbha,* "womb") from which projects an umbrella (*chatra*). The whole of the Great Stūpa is encircled by a railing and four gateways, which are richly decorated with relief sculpture de-



Stūpa III and its single gateway, Sānchi, Madhya Pradesh state, India
Hole Bildarchiv

picting *Jātaka* tales, events in the life of the Buddha, and popular mythological figures.

The Indian conception of the *stūpa* spread throughout the Buddhist world and evolved into such different-looking monuments as the bell-shaped *dāgaba* ("heart of *garbha*") of Ceylon (now Sri Lanka), the terraced temple of Borobudur in Java, the Lamaist variations in Tibet, and the multistoried pagodas of China, Korea, and Japan. The basic symbolism, in which the central relic is identified with the sacred person or concept commemorated and also with the building itself, is retained. Worship of a *stūpa* consists in walking around the monument in the direction taken by the path of the sun (*pradakṣiṇā*). Even when the *stūpa* is sheltered by a building, it is always a free-standing monument.

Buddhist *stūpas* were originally built to house the earthly remains of the historical Buddha and his associates and are almost invariably found at sites sacred to Buddhism. The concept of a relic was afterward extended to include sacred texts. Miniature *stūpas* and pagodas are also used by Buddhists throughout Asia as votive offerings. *Stūpas* were also built by adherents of Jainism to commemorate their saints.

**Stupino,** city centre of a *rayon* (sector), Moscow *oblast* (province), Russia. It lies southeast of Moscow on the Oka River, which separates it from Kashira. Stupino was incorporated in 1938 and has numerous industries, including metalworking, the production of concrete and electricity, and cotton manufacturing. Pop. (1991 est.) 74,600.

**Sturbridge,** town (township), Worcester county, southern Massachusetts, U.S. Sturbridge lies along the Quinebaugh River, 17 miles (27 km) southwest of Worcester city. It includes the village of Fiskdale. Settled around 1729, the town was incorporated in 1738 and named for Sturbridge, Eng. It developed as an agricultural centre. Old Sturbridge Village, 1.5 miles (3 km) west, is a full-scale reconstruction of a 19th-century New England village with transplanted shops, mills, and houses, and a general store, inn, and meetinghouse. Inc. 1738. Pop. (1990) 7,775.

**Sturdza, Dimitrie Alexandru** (b. March 10, 1833, Miclăuşeni, Moldavia [now Moldova]—d. Oct. 21, 1914, Bucharest, Rom.), Romanian statesman who four times served as prime minister of Romania and played a prominent role in national affairs from preunification days to the peasant uprising of 1907.

The scion of a great boyar family, Sturdza participated through 1857–58 in the Moldavian organizational commissions that prepared the ground for Romanian unification and, later (1866), served on the secret committee that successfully planned the deposition of Romania's first prince, Alexandru Cuza, and his replacement by Prince Karl of Hohenzollern-Sigmaringen, thereafter Carol I. In the cabinets of Ion Ghica and Ion Brătianu he held several ministerial posts and, as foreign minister in 1883, signed a secret treaty with Austria-Hungary and Germany. From 1892 he was chairman of the Liberal Party and served as prime minister in 1895–96, 1897–99, 1901–04, and 1907–09. His last ministry was marked by a 1907 peasant uprising, which he suppressed with great cruelty and at the cost of 10,000 lives. From 1909 he was secretary general of the Romanian Academy.

**Sture, Sten,** THE ELDER, Danish in full STEN GUSTAFSSON STURE DEN ÄLDRE (b. *c.* 1440, Sweden—d. 1503, Sweden), regent of Sweden (1470–97, 1501–03) who resisted Danish domination and built up a strong central administration.

Sten, a member of a powerful noble family, led forces that ended an attempt by the Danish king Christian I to gain control over Sweden in 1471, inflicting a decisive defeat on the Danish ruler in the Battle of Brunkeberg. He helped the Swedish king Charles VIII regain the throne (1467) and was appointed regent on Charles's death (1470). He soon gained passage of measures that reduced German influence in Swedish municipal governments, and he strengthened the nation's legal institutions. In 1477 he obtained permission from Pope Sixtus IV to found a university at Uppsala, the first Scandinavian university and still a source of national pride.

Sten contended throughout his reign with a noble faction led by the Oxenstierna family, which wanted a union with Denmark headed by the Danish king, and a weaker royal government. By the mid-1490s Sten had reduced the power of the state council controlled by dissident nobles, strengthened his control of the government, and expanded his landholdings. Although the Danish king John was accepted as king of Sweden by the state council in 1483, Sten was able to delay his coronation.

Sten's position was weakened, however, when Ivan III, grand prince of Moscow, allied with the Danish king and invaded the Swedish territory of Finland (1495). After being defeated by Danish forces in 1497, Sten was forced to accept John as king of Sweden (1497), but Sten later overthrew the Danish king (1501) and served as regent until his own death. His efforts laid the foundation for the stability of the Swedish monarchy in the 16th century.

**Sture, Sten,** THE YOUNGER, Danish in full STEN SVANTESSON STURE DEN YNGRE (b. *c.* 1492, Sweden—d. Feb. 3, 1520, Lake Malar [now in Sweden]), regent of Sweden from 1513 to 1520. He repeatedly defeated both Danish forces and his domestic opponents, who favoured a union with Denmark, before falling in battle against the Danish king Christian II.

During the regency (1503–12) of Sten's father, Svante (Nilsson) Sture, the nation was continuously at war with Denmark, and the noble-dominated state council (Riksråd) became increasingly powerful. With anti-Danish, peasant support, Sten wrested power from the state council in 1513, ending the regency of Erik Trolle, leader of the pro-union (with Denmark) faction. Using propaganda and effective displays of force, Sten regained control for the regency over both the Riksråd and the church.

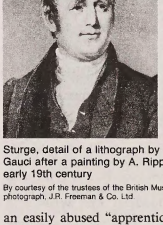
Between 1517 and 1520, Sten waged a civil war against the forces of Archbishop Gustav Trolle, head of the Riksråd and leader of the pro-union faction. His imprisonment of Trolle (1517) provoked a papal interdict and an attack from Denmark, which he repelled. After defeating the forces of the Danish king Christian II again in 1518, Sten was killed in battle against a massive Danish army in 1520. His widow, Kristina Nilsdotter Gyllenstierna, led the continuing resistance to Danish rule until her capitulation in September 1520.

**Sture, Svante (Nilsson)** (b. *c.* 1460—d. Jan. 2, 1512, Vesterås Castle, Sweden), regent of Sweden (1503–12), successor to Sten Sture the Elder.

The son of Nils Bosson Sture (d. 1494) and cousin of King Charles VIII, Svante Sture is mentioned as a senator in 1482. He was one of the magnates who facilitated King John of Denmark's conquest of Sweden by his opposition to Sten Sture the Elder. Subsequently, however, he was reconciled to the latter and succeeded him as regent. He was by no means so imposing a figure as his predecessor, although, like him, Svante in his later years patriotically resisted the Danish claim of sovereignty. Domestically he lacked fixity of purpose and was forced to make repeated concessions to the Riksråd (state council). The latter appeared to be gaining the upper hand when Svante Sture died suddenly.

**Sturge, Joseph** (b. Aug. 2, 1793, Elberton, Gloucestershire, Eng.—d. May 14, 1859, Edgbaston, Birmingham, Warwickshire), English philanthropist, Quaker pacifist, and political reformer who was most important as a leader of the antislavery movement.

A prosperous grain dealer, he visited the West Indies (1836–37) to learn the effects of the statute of Aug. 28, 1833, that abolished slavery de jure in the British colonies but substituted



Sturge, detail of a lithograph by M. Gauci after a painting by A. Rippingille, early 19th century
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd

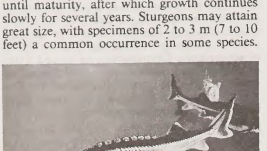
an easily abused "apprenticeship" system. In 1837 he published his evidence of the continued ill treatment of Negroes and testified on the subject before the House of Commons. Full abolition for the British West Indies was enacted on May 23, 1838; afterward, Sturge worked for worldwide abolition through the British and Foreign Anti-Slavery Society. In 1841 he toured the Southern slave states of the United States with the New England poet and Abolitionist John Greenleaf Whittier.

For several years from 1842 Sturge devoted himself to securing the extension of suffrage and the repeal of the Corn Laws (British import duties on grain). Afterward he attended various international peace conferences, and in January 1854 he went to Russia in an unsuccessful attempt to prevent the Crimean War.

**sturgeon,** any of about 20 species of fishes of the family Acipenseridae (subclass Chondrostei), native to temperate waters of the Northern Hemisphere. Most species live in the sea and ascend rivers (possibly once in several years) to spawn in spring or summer; a few others are confined to fresh water. Several species provide caviar from eggs.

Sturgeons are related to the paddlefish and perhaps to the bichir. They have bony plates (scutes) covering the head and five longitudinal rows of similar plates along the body. The tail fin is asymmetrical, the upper lobe being longer than the lower. The toothless mouth, on the underside of the snout, is preceded by four sensitive, tactile barbels that the fish drags over the bottom in search of invertebrates, small fishes, and other food.

Sturgeons are found in greatest abundance in the rivers of southern Russia and Ukraine and in the freshwaters of North America. In early summer they migrate from the sea into rivers or toward the shores of freshwater lakes for breeding purposes. The eggs, or roe, are small, sticky, and numerous. The young grow rapidly until maturity, after which growth continues slowly for several years. Sturgeons may attain great size, with specimens of 2 to 3 m (7 to 10 feet) a common occurrence in some species.



Sturgeon (*Acipenser*)
Russ Kinne—Photo Researchers

Sturgeons are valued for their flesh, eggs, and swim bladder. Their flesh is sold fresh, pickled, or smoked. Caviar (*q.v.*) consists of the eggs, which are stripped from ripe females who are subsequently released. The inner membrane of the sturgeon's swim bladder is used to make isinglass, a very pure form of gelatin used for various industrial purposes. The largest commercial sturgeon fisheries are in southern Russia and Ukraine, though the industry is also carried on in the United States and western Europe. Sturgeons are readily overfished, however, and fishing in some areas is strictly limited.

The common Old World sturgeon (*Acipenser sturio*) occurs from Scandinavia to the Mediterranean. A very similar, closely related form, considered a separate species (*A. oxyrhynchus*) by some authorities, occurs along the east coast of North America. The length of these fishes is generally to about 3 m; weight is to about 227 kg (500 pounds).

*A. guldenstadtii* is one of the most valuable species inhabiting the rivers of Russia and occurs eastward to Lake Baikal. It is about the same size as the common sturgeon and is found particularly in the rivers feeding the Black and Caspian seas. A smaller species, the sterlet (*A. ruthenus*), inhabits the Black and Caspian seas and is a valuable food fish about 0.9 m long. *A. stellatus* occurs in the rivers of the Black and Caspian seas and of the Sea of Azov. It has a long, pointed snout like the sterlet, and its flesh, caviar, and isinglass are highly valued.

The beluga, or hausen (*Huso huso*, or *Acipenser huso*), inhabits the Caspian and Black seas and the Sea of Azov. A large sturgeon, it reaches a length of 7.5 m and a weight of 1,300 kg (2,900 pounds), but its flesh and caviar are less valuable than those of smaller species.

The lake, or rock, sturgeon (*A. fulvescens*) of North America occurs in the Mississippi River valley, Great Lakes, and Canada and may weigh more than 90 kg (200 pounds). The white, Oregon, or Sacramento sturgeon (*A. transmontanus*) occurs on the Pacific coast and is the largest of the North American sturgeons, weighing up to 820 kg (1,800 pounds).

The family Acipenseridae also includes the genus *Scaphirhynchus*, the shovelhead, or shovelnose, sturgeon, with four species distinguished by their long, broad, flat snouts.

**Sturgeon, William** (b. May 22, 1783, Whittington, Lancashire, Eng.—d. Dec. 4, 1850, Prestwich, Lancashire), English electrical engineer who devised the first electromagnet capable of supporting more than its own weight. This device led to the invention of the telegraph, the electric motor, and numerous other devices basic to modern technology.

Sturgeon, self-educated in electrical phenomena and natural science, spent much time lecturing and conducting electrical experiments. In 1824 he became lecturer in science at the Royal Military College, Addiscombe, Surrey, and the following year he exhibited his first electromagnet. The 7-ounce (200-gram) magnet was able to support 9 pounds (4 kilograms) of iron using the current from a single cell.

Sturgeon built an electric motor in 1832 and invented the commutator, an integral part of most modern electric motors. In 1836, the year he founded the monthly journal *Annals of Electricity*, he invented the first suspended coil galvanometer, a device for measuring current. He also improved the voltaic battery and worked on the theory of thermoelectricity. From more than 500 kite observations he established that in serene weather the atmosphere is invariably charged positively with respect to the Earth, becoming more positive with increasing altitude.

**Sturgeon Bay,** city, seat (1851) of Door county, northeastern Wisconsin, U.S. The city is a lake port at the head of Sturgeon Bay, which is an inlet of Green Bay on the western side of the Door Peninsula. The federal government maintains a ship canal, constructed across the peninsula in 1878, connecting Green Bay with Lake Michigan. Sturgeon Bay was settled as a lumbering community in the 1850s and was named for the once-abundant sturgeon in local lake waters. Shipbuilding and cherry processing are the main occupations. The scenic beauty of the area makes the city headquarters of an important tourist trade. Inc. 1883. Pop. (1990) 9,176.

**Sturges, Preston,** original name EDMOND PRESTON BIDEN (b. Aug. 29, 1898, Chicago, Ill., U.S.—d. Aug. 6, 1959, New York, N.Y.), American motion-picture director, screenwriter, and playwright best known for a series of satirical comedies he made in the early 1940s.



Sturges, 1942
AP/Wide World Photos

The son of wealthy socialites, he was adopted by his mother's second husband, Solomon Sturges, and educated in European and American schools. He pursued several jobs as a businessman and inventor before becoming a playwright in the 1920s. After writing the Broadway hits *Strictly Dishonorable* (1929; filmed in 1931 and again in 1951) and *Child of Manhattan* (1931; filmed in 1933), Sturges went to Hollywood, where he soon earned a reputation as a scriptwriter.

*The Great McGinty* (1940), his first picture as a director as well as scriptwriter, won an Academy Award for the best original screenplay. It was the first in a series of distinctive films that satirized such established institutions as Tammany Hall politics, advertising, hero worship, small-town life, the American success story, and the Hollywood studio system. Characterized by quick dialogue and action and memorably drawn minor characters, his popular films included *Christmas in July* (1940), *The Lady Eve* (1941), *Sullivan's Travels* (1942), *The Palm Beach Story* (1942), *The Miracle of Morgan's Creek* (1944), *Hail the Conquering Hero* (1944), and *Unfaithfully Yours* (1948). Although he worked on a few films later, none matched the wit of his comedies of the 1940s, arguably the best produced in Hollywood in this era.

**Stürgkh, Karl, Count** (Graf) **von** (b. Oct. 30, 1859, Graz, Austria—d. Oct. 21, 1916, Vienna), Austrian prime minister (1911–16) whose authoritarian regime was ended by his assassination.

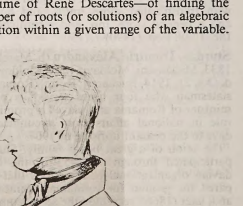
An ultraconservative and clericalist member of the Reichsrat (legislature), Stürgkh strongly opposed the Austrian suffrage reforms of 1907. He was minister of education from 1908 until November 1911, when, amid continuing parliamentary turmoil between Czech and German nationalists, he was appointed Austrian prime minister. Despite his initial success in securing passage of a new military program (1912–13), his relations with the Reichsrat progressively deteriorated. Having dissolved the Bohemian Landtag (provincial assembly) in 1913, he adjourned the Austrian Reichsrat in March 1914 and governed henceforth by decree, until he was shot by the left-wing socialist Friedrich Adler in October 1916 during World War I.

**Sturluson, Snorri** (Icelandic writer): *see* Snorri Sturluson.

**Sturm, Charles-François,** in full JACQUES-CHARLES-FRANÇOIS STURM (b. Sept. 29, 1803, Geneva, Switz.—d. Dec. 18, 1855, Paris, France), French mathematician whose work resulted in Sturm's theorem, an important contribution to the theory of equations.

As tutor of the de Broglie family in Paris (1823–24), Sturm met many of the leading French scientists and mathematicians. In 1826, with the Swiss engineer Daniel Colladon, he made the first accurate determination of the velocity of sound in water and a year later wrote a prizewinning essay on compressible fluids.

Sturm's theorem first appeared in *Mémoire sur la résolution des équations numériques* (1829; "Treatise on Numerical Equations") and provided a complete solution to the problem—one that had been wrestled with since the time of René Descartes—of finding the number of roots (or solutions) of an algebraic equation within a given range of the variable.



Sturm, pencil sketch by Daniel Colladon, 1822; in the Academy of Sciences, Paris
By courtesy of the Archives de l'Academie des Sciences de Paris: photograph, J. Colomb-Gerard, Paris

Published in 1834, Sturm's work on the theory of differential equations of the second order won him prestigious awards in France. He was elected to the Académie in 1836 and became professor of mathematics at the École Polytechnique, Paris, in 1838. Two years later he succeeded Siméon-Denis Poisson in the chair of mechanics in the Faculté des Sciences, Paris. Although primarily an analyst, Sturm made significant contributions to projective geometry and to the differential geometry of curves and surfaces. He also did important work on geometrical optics. Published posthumously, his *Cours d'analyse de l'École Polytechnique*, 2 vol. (1857–63; "Course on Analysis from the École Polytechnique") and *Cours de méchanique de l'École Polytechnique*, 2 vol. (1861; "Course on Mechanics from the École Polytechnique") were widely used, even in the early 20th century.

**Sturm, Der** (German: "The Assault"), a periodical and later a gallery—both established by Herwarth Walden in the early 20th century in Berlin—devoted to the newest trends in art. The first issue of *Der Sturm*, published in 1910 as a weekly for literature and criticism, contained drawings by Oskar Kokoschka; the following year, the works of Die Brücke artists were featured; and in 1912, writings, drawings, and prints by members of the Der Blaue Reiter group appeared. In March 1912, in connection with the 100th issue of *Der Sturm*, Walden opened his Galerie Der Sturm with an exhibition of works primarily by French Fauvists and Der Blaue Reiter artists. The following month he introduced the work of the Italian Futurists to Germany. By the end of 1913 the work of such major artists as Edvard Munch, Georges Braque, Pablo Picasso, Robert Delaunay, Gino Severini, Jean Arp, Paul Klee, and Alexander Archipenko had been exhibited, and Der Sturm's First German Autumn Salon of that year was highly successful.

*Der Sturm* published deluxe portfolios of graphic works by artists such as Kandinsky and Kokoschka, as well as original woodcuts, postcards, picture books, and large colour reproductions of works by gallery artists. By 1918 Der Sturm's activities had been extended into several other areas: Walden initiated the *Sturmabende*, salons devoted to lectures and discussions on the visual arts and poetry; the Sturmschule, a school for theatrical arts, painting, poetry, and music; and the Sturmbühne, an experimental Expressionist theatre.

During the peak of its activity, Der Sturm was the centre of modern art in Berlin. Despite its numerous enterprises, its importance diminished in the 1920s. The gallery closed in 1924, and the periodical (from 1914, a monthly) became a quarterly until it ceased publication in 1932.

**Sturm, Johannes** (b. Oct. 1, 1507, Schleiden, Julich—d. May 3, 1589, Strassburg), German educator whose Latin *Gymnasium* at Strassburg became a model for secondary schools in Protestant countries during the Reformation.

Educated at the school of the Brethren of the Common Life in Liège and at the University of Louvain, where he also taught, Sturm lectured in Paris (1530–36) before being invited to Strassburg to become rector of a new *Gymnasium* there. In 1538 he guided the consolidation of schools into one big *Gymnasium*.

At Strassburg Sturm embraced the Protestant faith and made the curriculum of his schools entirely classical, with only minor attention to religion. He regarded Latin as not only an essential cultural accoutrement but also as necessary preparation for professional careers, in which fluent and elegant Latin and power of expression were prerequisites for success. Sturm's aim was thus education for the real world. The form of classical study—devoted as it was to rhetoric and style in imitation of such ancient orators as Cicero and Demosthenes—was widely copied throughout Germany, as well as in England, although it often degenerated into the study of Latin by rote and the neglect of other subjects. Sturm wrote Latin textbooks and several treatises on educational theory and practice.

**Sturm–Liouville problem,** in mathematics, the determination of the set of values of the constants in the solution of a given second-order differential equation that make the solution satisfy not only the differential equation but also a set of specified auxiliary conditions usually called boundary values (*see* boundary value). The principles of solving this problem were established by the French mathematicians Charles-François Sturm and Joseph Liouville in the 1830s; in the 20th century those principles have been applied in the development of quantum mechanics, as in the solution of the Schrödinger equation and its boundary values.

A simple example of such a problem is finding a solution $y(x)$ to the equation $y'' + c^2y = 0$ such that the function equals zero if $x$ is equal to 0 or some number $a$. The function $y = \sin cx$ satisfies the equation, but it meets the auxiliary conditions only if $c = \pm n\pi/a$, in which $n = 0, 1, 2, \ldots$.

These problems are also called eigenvalue problems and involve more generally the problem of finding a solution of the equation $[p(x)y']' + [q(x) - kr(x)]y = f(x)$ that satisfies the auxiliary conditions $a_1y(a) + a_2y'(a) = 0$ and $a_3y(b) + a_4y'(b) = 0$, in which $a_1$, $a_2$, $a_3$, and $a_4$ are constants. To determine when this equation has a solution, the related homogeneous equation is first considered; *i.e.*, the equation with the function $f(x)$ equal to zero. If the functions $p$, $q$, $r$ satisfy suitable conditions, then, as in the simpler example above, the equation will have a family of solutions, called eigenfunctions, corresponding to certain values of $k$, called eigenvalues. Then, if the value of $k$ in the original nonhomogeneous equation is different from these eigenvalues, the problem will have a unique solution. If $k$ equals one of these eigenvalues, the problem will have either no solution or a whole family of solutions, depending on the properties of the function $f(x)$.

**Sturm und Drang** (German: "Storm and Stress"), German literary movement of the late 18th century that exalted nature, feeling, and human individualism and sought to overthrow the Enlightenment cult of Rationalism. Goethe and Schiller began their careers as prominent members of the movement.

The exponents of the Sturm und Drang were profoundly influenced by the thought of Rousseau and Johann Georg Hamann, who held that the basic verities of existence were to be apprehended through faith and the experience of the senses. The young writers also were influenced by the works of the English poet Edward Young, the pseudo-epic poetry of James Macpherson's "Ossian," and the recently translated works of Shakespeare.

Sturm und Drang was intimately associated with the young Goethe. While a student at Strasbourg, he made the acquaintance of Johann Gottfried von Herder, a former pupil of Hamann, who interested him in Gothic architecture, German folk songs, and Shakespeare. Inspired by Herder's ideas, Goethe embarked upon a period of extraordinary creativity. In 1773 he published a play based upon the 16th-century German knight, *Götz von Berlichingen*, and collaborated with Herder and others on the pamphlet "Von deutscher Art und Kunst," which was a kind of manifesto for the Sturm und Drang. His novel *Die Leiden des jungen Werthers* (1774; *The Sorrows of Young Werther*), which epitomized the spirit of the movement, made him world famous and inspired a host of imitators.

The dramatic literature of the Sturm und Drang was its most characteristic product. Indeed, the very name of the movement was borrowed from a play by Friedrich von Klinger, who had been inspired by the desire to present on the stage figures of Shakespearean grandeur, subordinating structural considerations to character and rejecting the conventions of French Neoclassicism, which had been imported by the critic Johann Christop von Gottsched. With the production of *Die Räuber* (1781; *The Robbers*) by Schiller, the drama of the Sturm und Drang entered a new phase.

Self-discipline was not a tenet of the Sturm und Drang, and the movement soon exhausted itself. Its two most gifted representatives, Goethe and Schiller, went on to produce great works that formed the body and soul of German classical literature.

**Sturmabteilung** (Nazi Germany): *see* SA.

**Sturmer, Boris Vladimirovich** (b. July 28 [July 16, old style], 1848—d. Sept. 3, 1917, Petrograd, Russia), Russian public official, who served as prime minister, minister of the interior, and minister of foreign affairs during World War I.

Before his appointment to the premiership, Sturmer served as master of ceremonies at court, was a department head in the Ministry of the Interior, and held the post of provisional governor of Yaroslavl. On Feb. 2, 1916, while Tsar Nicholas II was at the front with his troops, leaving the administration of the country to his wife, Alexandra, and to her personal advisor, the illiterate Siberian peasant and holy man, Rasputin, the little-known Sturmer was appointed prime minister because of his association with Alexandra and Rasputin. Sturmer did not establish his own policies while in office, had difficulty in grasping the subject of discussion at meetings, and relied heavily on Alexandra and Rasputin, both of whom made the decisions of the office.

In March 1916 Sturmer was also given the key post of minister of the interior, but under his administration the country suffered drastic inflation and a transportation breakdown, which led to severe food shortages. Sturmer simply let matters drift until he was able to be relieved of this post, and he accepted the more prestigious office of minister of foreign affairs (July 21). Sturmer was equally incompetent in this position, however, and he has even been charged with being a German sympathizer; whatever the truth may be, Sturmer undoubtedly aided Germany during World War I by his ineptness as an administrator. He was subject to vociferous attacks by members of the Duma when it met in November 1916, and he began to lose the support of Alexandra and Rasputin. Finally, on Nov. 23, 1916, Sturmer was forced to resign. Taken prisoner by the Bolsheviks in 1917, he died in prison.

**Sturnidae,** songbird family, order Passeriformes, consisting of the starlings, mynas, and oxpeckers, about 107 species of jaunty, aggressive birds distributed worldwide.

Members range in size from 16.5 to 42 centimetres (6.5 to 16.5 inches) long. They have slightly downcurved bills, long, pointed wings, and strong legs and feet. Starlings are typically dark coloured, often with metallic sheen. Some are crested or display wattles or bare patches of skin. They chatter continually while in flight and when roosting, often gathering in spectacular numbers. The widespread common starling (*Sturnus vulgaris*) consumes large numbers of insects but also feeds on grain and small fruits, competing severely with other desirable songbirds. Since their introduction into North America in 1890 (Central Park, N.Y.), they have grown to such large numbers that they are widely regarded as pests in and near cities. The Asian hill mynas (*Gracula re-*

*ligiosa*) are notable talking cage birds. African oxpeckers (*Buphagus*) extract ticks from the hides of large animals. Several starlings are now extinct, among the most curious of which is the mysterious starling (*Aplonis mavornata*), not seen since 1774, when only one specimen was collected somewhere in the Pacific.

The Sturnidae is a well-defined family belonging to the songbird suborder (Passeres).

**Sturt, Charles** (b. April 28, 1795, Bengal, India—d. June 16, 1869, Cheltenham, Gloucestershire, Eng.), Australian explorer whose expedition down the Murrumbidgee and Murray rivers (1829–30) is considered one of the greatest explorations in Australian history. The expedition disclosed extensive areas of land for future development in New South Wales and South Australia.

Educated in England, Sturt entered the British Army at the age of 18 and for the next 13 years saw service in Spain, Canada, France, and Ireland. In 1827 he became military secretary to the governor of New South Wales, Sir Ralph Darling. In 1828–29 Sturt led the first of his major expeditions, tracing the Macquarie, Bogan, and Castlereagh rivers and discovering the Darling River. In his subsequent expedition down the Murrumbidgee he discovered the Murray River and followed it to its source near Adelaide, dealing peaceably with many Aborigines along the way. Exhausted and nearly blinded because of poor diet and overexertion on his trip, he spent 1832–34 recuperating in England, where he wrote *Two Expeditions into the Interior of Southern Australia, 1828–31* (1833). The book led to the choice of South Australia as the site for a new British settlement.

He returned to Australia in 1834 with a 5,000-acre grant of land and later (1844–46) led an expedition north from Adelaide to the edge of Simpson Desert. Although it discovered no fertile land and was eventually driven back by heat and scurvy, his party was the first to penetrate the centre of the continent. After serving briefly as registrar general and colonial treasurer, he again left Australia for England (1847), where he wrote *Narrative of an Expedition into Central Australia* (1849). He settled in England permanently in 1853.

**Sturtevant, Alfred Henry** (b. Nov. 21, 1891, Jacksonville, Ill., U.S.—d. April 5, 1970, Pasadena, Calif.) U.S. geneticist who in 1913 developed a technique for mapping the location of specific genes of the chromosomes in the fruit fly *Drosophila*.

Sturtevant received his Ph.D. degree (1914) from Columbia University. While serving as a researcher at the Carnegie Institution of Washington, D.C. (1915–28), he proved that the mechanism of crossing-over (*i.e.*, the exchange of genes between chromosomes) could be prevented in *Drosophila*. In 1928 he joined the faculty of the California Institute of Technology, where he remained until his death. He was one of the first to warn against the hazards of fallout as a consequence of nuclear bomb testing.

**Sturtian Series,** division of Late Precambrian rocks in south central Australia (the Precambrian began about 3,800,000,000 years ago and ended 570,000,000 years ago).

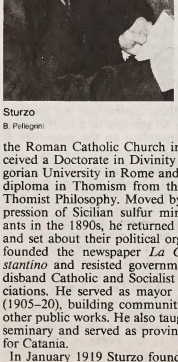
The Sturtian Series, which forms the lower part of the Umberatana Group, is partly interpreted as being of glacial origin from the glacially produced pavements that have been recognized. The Sturtian begins with a boulder-laden horizon that generally overlies quartzites. Tillites, cemented glacial till deposits, occur higher up in the Sturtian sequence and include many glacial erratics seen as striated and faceted boulders of granite, gneiss, quartzite, shale, and limestone. Silty shales that may be laminated or even exhibit glacial varves also occur. The Sturtian thickens to the north and northeast of Adelaide, where it may be as much as 6,000 metres (20,000 feet) thick. Above the glacial deposits of the Sturtian lie blue-gray shales, arkoses, shaly sandstones, siltstones, and dolomites.

The Sturtian Series is the most widespread unit of the Precambrian sedimentary basin in south central Australia, the Adelaide Geosyncline. In the Olary region the Sturtian is intruded by granite igneous masses, whereas in the Everard Ranges basalt flows are found with the tillites. The Sturtian Series is overlain by the Marinoan Series, which similarly includes within it a sequence of glacial deposits.

**Sturzkampfflugzeug** (German aircraft): *see* Stuka.

**Sturzo, Luigi** (b. Nov. 26, 1871, Caltagirone, Sicily—d. Aug. 8, 1959, Rome), Italian priest, public official, and political organizer who founded a party that was a forerunner of the Italian Christian Democrat movement.

Sturzo studied at the seminary of Caltagirone, where he was ordained a priest of



Sturzo
B. Pellegrini

the Roman Catholic Church in 1894. He received a Doctorate in Divinity from the Gregorian University in Rome and an equivalent diploma in Thomism from the Academy of Thomist Philosophy. Moved by the harsh repression of Sicilian sulfur miners and peasants in the 1890s, he returned to Caltagirone and set about their political organization. He founded the newspaper *La Croce di Constantino* and resisted government actions to disband Catholic and Socialist workers' associations. He served as mayor of Caltagirone (1905–20), building community housing and other public works. He also taught at the local seminary and served as provincial councillor for Catania.

In January 1919 Sturzo founded the Partito Popolare Italiano (Italian Popular Party) and became its political secretary. In the elections of November 1919 the new party captured 101 of 508 seats in the Chamber of Deputies. Though he did not accept a post himself, he became a force in the composition of later cabinets. Having refused support to the Fascist regime of Benito Mussolini in October 1922, Sturzo retired to a monastery in July 1923 and went into exile in October 1924.

Sturzo returned to Italy in 1946, when his movement was revived as the Democrazia Cristiana (*q.v.*; Christian Democrat Party). In 1952 the president of Italy appointed him a senator for life.

Sturzo was the author of several major works of Christian social philosophy, including *Church and State* (1939), *The True Life* (1943), *The Inner Laws of Society* (1944), *Spiritual Problems of Our Times* (1945), and *Italy and the Coming World* (1945).

**Stüssi, Rudolf** (d. July 22, 1443, near Zürich), Swiss burgomaster of Zürich, whose expansionist ambitions precipitated the first civil war of the Swiss Confederation.

From several minor appointments, Stüssi rose to the position of burgomaster of Zürich (1430), an office that he retained until his death. In 1436 he forced Zürich into a quarrel with the canton of Schwyz and its chief magistrate, Ital Reding (*q.v.*), over the inheritance of the late count of Toggenburg, Frederick VII. Its claims to the Toggenburg territories thwarted, Zürich invoked economic sanctions against the rival cantons. Hostilities ensued, and Zürich, soundly beaten at Etzel (1439) and Pfäffikon (1440), was forced to withdraw its economic proscriptions.

After eradicating his opposition and securing the general support of his townsmen, Stüssi concluded an alliance with Austria (1442). The confederation demanded the abrogation of this agreement, however, and by May 1443 the cantons were again at war. Stüssi actively participated in the early hostilities but was slain in battle at Sankt Jakob an der Sihl, just outside Zürich.

**stuttering,** also called STAMMERING, or DYSPHEMIA, speech defect affecting the rhythm and fluency of speech and characterized by involuntary repetition of sounds or syllables and the intermittent blocking or prolongation of sounds, syllables, and words.

Stutterers can predict 95 percent of the words over which they will stutter in reading aloud a given passage. Supposedly taking their cue from past difficulties, they anticipate difficulty with certain words, and the avoidance behaviour provoked in this way actually produces the stuttering. Stutterers consistently have difficulty with certain types of words: those beginning with consonants, initial words in sentences, content words (nouns, verbs, adjectives, opposed to function words like pronouns and prepositions), and words of several syllables. Since these are also the types of words that produce hesitation in normal speakers, there seems to be some link between stuttering and normal disfluency (pauses, repetition).

Although stuttering tends to reappear in some families, studies show that the slight hereditary bias is due to a neurological predisposition or to environmental factors rather than to a genetic trait. Stutterers show no organic defect, and the common idea that forcibly changing handedness causes stuttering is a misconception. Rather, any situation in which too much attention is paid to a child's normal speech disfluency seems to produce the imperfections that are so much feared. Thus stuttering tends to appear when a child's parents anxiously overreact to normal pauses and repetition—which may also explain the tendency of the stutterer to be an only child or to have no siblings close in age. Cultural attitudes toward fluency can also increase the likelihood of stuttering; *e.g.*, the Igbo (Ibo) people of West Africa, who prize public-speaking ability, have a rate of stuttering almost three times the world average (about 1 percent of most populations stutter). The fact that five times as many boys as girls stutter in Western culture may be linked to greater performance pressure put on males.

In Roman times, stutterers were thought to be possessed by evil spirits that had to be exorcised. In the Middle Ages the tongue, thought to be the source of the problem, was tortured with hot irons and spices. Today we know that about 80 percent of stutterers recover with no treatment whatsoever, usually in early adulthood or adolescence. Recovery is probably the result of increased self-esteem, acceptance of the problem and consequent relaxation.

**Stuttgart,** *Regierungsbezirk* (administrative district), northeastern Baden-Württemberg *Land* (state), southwestern Germany. Stuttgart

is bordered by Bavaria *Land* to the north and east and the *Regierungsbezirke* of Tübingen to the south and Karlsruhe to the west. The largest of four districts in Baden-Württemberg, it occupies an area of 4,076 sq mi (10,558 sq km) and is coextensive with portions of the larger historic regions of Swabia and Franconia (*qq.v.*). From the 12th century the Württembergs, a local dynasty of counts, gained control over large sections of this territory. The Württemberg lands successively became a duchy, a kingdom, and a republic. In 1952 three post-World War II states of West Germany—Württemberg-Baden, Württemberg-Hohenzollern, and Baden—were merged to form the present *Land* of Baden-Württemberg. Eastern Württemberg-Baden, roughly encompassing the current district of Stuttgart, became the new *Land*'s northeastern *Regierungsbezirk* of Nordwürttemberg. In 1973 an administrative reform altered the boundaries of Nordwürttemberg and changed its name to Stuttgart, after the administrative seat of the district and the largest city and capital of the *Land*.

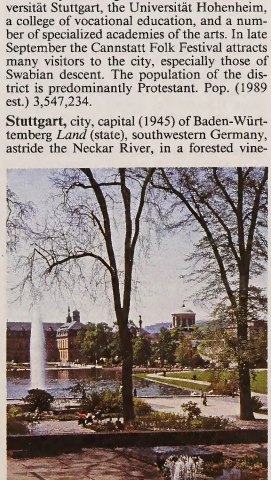
Stuttgart lies in the Neckarland, a region comprising three major physical features: the Gau plateaus, the Keuper sandstone hills, and the Lias foreland. The open lowlands of the Gau plateaus extend from the district's southwestern corner between the Schwarzwald (Black Forest) and the Schwäbische Alb (Swabian Jura) toward the northeast, becoming wider and merging smoothly with the Franconian plateaus of Unterfranken (Lower Franconia). The deep valleys of the north-flowing Neckar River, its tributaries the Enz, Kocher, and Jagst, and the Tauber River divide the region into a series of fertile, loess-covered plains, their landscapes dominated by closely-spaced farm villages surrounded by arable land. The Oberes Gäu, Strohgäu, Zabergäu, and Kraichgau lie west of the Neckar while the Hohenloher Ebene, Taubergrund, and Bauland are located to the east. Sheltered by the uplands of the Schwarzwald, the plains have a relatively dry and warm climate, permitting the growth of sugar beets, hops, tobacco, potatoes, asparagus, and other field vegetables. Wheat, barley, and corn (maize) are also produced but in quantities below maximum potential, given the pattern and scale of regional farmsteads. Few farms are large enough to support full-time farmers, because of centuries of repeated subdivision of landholdings among family heirs. Many landowners are forced to seek employment in nearby industrial towns, farming their fertile fields only on a limited scale.

The Gau plateaus end to the south and east against the escarpment of the Keuper sandstone hills. River valleys have carved the Keuper region into many separate ridges. The Schurwald, Welzheimer Wald, Löwensteiner Berge, Mainhardter Wald, Limpurger Berge, and Waldenburger Berge are located east of the Neckar, and beyond these the Ellwanger Berge form a transition to the Franconian Terrace of Mittelfranken (Middle Franconia). The outlying ranges of the Stromberg and Heuchelberg lie west of the Neckar, and the Schönbuch in the southwest. The hills are almost completely covered with coniferous forests of spruce mixed with beech and oak. The lower slopes along the escarpment are planted in vineyards and orchards, while meadow covers the steep-sided valleys among the hills. The Lias foreland, a belt of open farmland, is situated along the district's southern border between the Keuper hills and the Schwäbische Alb. Fruit and large cabbages used in the manufacture of sauerkraut are local specialty crops. The town of Schwäbisch-Gmünd has a traditional specialization in the manufacture of precious metals and jewelry. Aalen is noted for its famous optical works.

Industry in the district is heavily concentrated in the densely populated valley of the Neckar and along its eastern tributaries, the Fils and Rems rivers. The city of Stuttgart has become the centre of the largest industrial zone in southwestern Germany and a major transportation junction despite its beautiful but inconvenient site. Located in a basin enclosed by the Keuper hills, the city has only one outlet to the Neckar valley, to the northeast. Stuttgart's industries produce motor vehicles, electrical equipment, machinery, precision instruments, and textiles. It is a leading book-publishing centre and supports an extensive fruit and wine trade as well. Heilbronn, located north of Stuttgart on the canalized Neckar River, is the second largest city of the district and manufactures machinery, motor vehicles, and electrical equipment. Heilbronn is the centre of an important wine-producing region and also processes agricultural commodities from the rich Gau plateaus.

The boundary between the Swabian and Franconian cultural regions runs approximately from Heilbronn east to Crailsheim along the northern edge of the wooded Keuper hills. The native population of the district's southern half are Swabians, descendants of the Suebi, a Germanic people who occupied the territory from the 3rd century AD. The Franconians of northern Stuttgart are descendants of the Franks, a Germanic people who settled the region from the early 6th century. Two of three main German dialects in Baden-Württemberg are spoken in Stuttgart, Swabian in the south and Franconian in the north. The predominant rural housing pattern on the Gau plateaus is one of compact villages. Small hamlets and dispersed farmsteads are more common in the forests of the Keuper hills. Farm units generally consist of a single main building housing the living quarters as well as the barn, hayloft, and stables. Higher education in the *Regierungsbezirk* is centred in the city of Stuttgart and includes the Universität Stuttgart, the Universität Hohenheim, a college of vocational education, and a number of specialized academies of the arts. In late September the Cannstatt Folk Festival attracts many visitors to the city, especially those of Swabian descent. The population of the district is predominantly Protestant. Pop. (1989 est.) 3,547,234.

**Stuttgart,** city, capital (1945) of Baden-Württemberg *Land* (state), southwestern Germany, astride the Neckar River, in a forested vine-



The new palace and gardens of the Theater-Anlagen, Stuttgart, Ger.
Archiv für Kunst und Geschichte, Berlin

yard-and-orchard setting in historic Swabia. It lies between the Black Forest on the west and the Swabian Jura to the south. There were prehistoric settlements and a Roman fort in the area of Bad Cannstatt (a suburb), but Stuttgart itself originated as a *Stuotgarten,* a *Gestüt,* or stud farm, set up *c.* 950. A wine industry developed, and Stuttgart received civic rights after passing to the counts of Württemberg in the 13th century. It became the principal residence of the counts *c.* 1320 and after 1482 was successively the capital of the Württemberg county, duchy, kingdom, and *Land.* Prosperity in the 16th century was followed by a decline during the Thirty Years' War (1618–48) and the French invasions of Louis XIV (1681–84), from which it did not recover until the Industrial Revolution in the 19th century caused rapid expansion. The city centre was almost completely destroyed during World War II.

Historic buildings in the city, most of them rebuilt since 1945, include the old castle (13th century; rebuilt 1553–78), housing the Landesmuseum; the new palace (1746–1807); the Rosenstein Palace (1824–29), now the natural history museum; the Gothic St. Leonard's Church (1463–74), of the hall type; and the Stiftskirche (collegiate church), a 12th-century Romanesque basilica completed in the Gothic style (1436–95). Outside the city centre are Solitude Palace (1763–67) to the west, and Hohenheim Palace (1768–85) to the south, now occupied by the College of Agriculture. Examples of modern architecture include the Weissenhof Estate (1927), the town hall (1954–56), the 633-ft (193-m) television tower (1955), and Stuttgarter Liederhall (concert and congress hall, built in 1954–56).

There is a technological college and academies for art, music, and architecture. Stuttgart is the site of the state art gallery, archives, library, observatory, opera, ballet, and the Wilhelma Botanical and Zoological Gardens. Stuttgart University was founded in 1829. The Daimler-Benz, Mercedes-Benz automobile factory (one of the world's oldest) and museum are in the suburb of Untertürkheim. The suburbs of Bad Cannstatt and Berg are health centres with many mineral springs, from which are exported bottled mineral water, and the famous Cannstatter Folk Festival is held in the Cannstatter Wasen (Cannstatt Meadows) every autumn.

An important rail junction on the natural route connecting the Danube with northern Germany and the Rhine, Stuttgart has a port (opened in 1958) and an international airport. It is the centre of the largest industrial zone in southwestern Germany and holds various trade fairs and congresses. Electrical engineering and motor vehicle and machine construction are of primary importance, and textiles, clothing, precision instruments (cameras, optical equipment), beer, luxury wooden and leather goods, shoes, musical instruments, chemicals, and paper are manufactured. Stuttgart is well known as a book centre and has numerous printing works and more than 200 publishing houses. One of the largest wine-producing communes (groups of growers who bring their grapes to a central location for processing and distribution) in Germany, it has an extensive wine and fruit trade. Pop. (1989 est.) 562,658.

**Stuttgart,** city, northern district seat of Arkansas County (the southern seat is De Witt), east central Arkansas, U.S. Settled in 1878 by Lutheran minister Adam Buerkle (born in Stuttgart, Ger.) and his congregation, the city was incorporated in 1889. It became an agricultural and trading centre and was raised to a city of the second class in 1897 and of the first class in 1917. Farm-based industries include rice and soybean milling, sawmilling, and the manufacture of irrigation and farm equipment and fertilizer. The White River National Wildlife Refuge is 28 mi (45

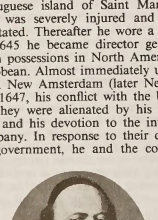
km) southeast, and Stuttgart is well known as a duck-hunting base. The U.S. Fish Farming Experimental Station is nearby. Pop. (1990) 10,420.

**Stuttgart Ballet,** German STUTTGARTER BALLETT, resident ballet company of Stuttgart, Ger., that emerged in the 1960s as an internationally prominent group. The modern Stuttgart Ballet evolved from the royal ballet that resided at the court of the Duke of Württemberg as early as 1609. A municipally supported company under the royal patronage from the 17th through the 19th century, it occasionally attracted such prominent European directors as Jean-Georges Noverre (1760–67). The Stuttgart Ballet of the mid-20th century was a small group of dancers with diverse national backgrounds and training that was fused by John Cranko, director from 1961 until his death in 1973, into a group with an exciting and visually arresting style. The company is especially notable for the highly dramatic interpretation of such classical works as *The Taming of the Shrew* (1969), *Eugene Onegin* (1965), and *Romeo and Juliet* (1962). In 1976 Marcia Haydée was made director of the company.

**Stutthof,** German Nazi concentration and extermination camp located 22 miles (36 km) east of Danzig (Gdańsk), Poland. From 1939 to 1943 it was a forced-labour and transit camp for Jews of Danzig and other areas of northern Poland. In early 1944 all surviving inmates were transferred to the death camp at Auschwitz. Stutthof itself was then enlarged, supplemented with many satellite camps nearby, and remodeled into an extermination facility, mostly for Jewish women sent in from the Baltic countries, Poland, Hungary, and the concentration camps in Germany. Altogether, about 50,000 Jews perished at Stutthof and its satellites from hunger, disease, and gassing in gas chambers.

**Stuyvesant, Peter,** Dutch PETRUS STUYVESANT (b. *c.* 1592, Scherpenzeel, Friesland, Neth.—d. February 1672, near New York, N.Y. [U.S.]), Dutch colonial governor who tried to resist the English seizure of New York.

Son of a Calvinist minister, he began his career in the Dutch West India Company about 1632 and in 1643 became director in the company's colonies of Curaçao, Aruba, and Bonaire. During an expedition against the Portuguese island of Saint Martin, his right leg was severely injured and had to be amputated. Thereafter he wore a wooden leg. In 1645 he became director general of all Dutch possessions in North America and the Caribbean. Almost immediately upon his arrival in New Amsterdam (later New York City) in 1647, his conflict with the burghers began. They were alienated by his despotic methods and his devotion to the interest of the company. In response to their demands for self-government, he and the council in 1647 appointed an advisory board of nine, and in 1653 there was established the first municipal government for the city of New Amsterdam, modeled after the cities of Holland. These concessions proved hollow, for Stuyvesant never ceased to dominate the government. In 1650 he sacrificed a large amount of territory in a settlement of the boundary between New Netherland and Connecticut. But he succeeded in dislodging the Swedes from their settlement in Dutch territory along the Delaware River and in establishing peace with the Indians there. In August 1664, when the burghers refused to aid him, Stuyvesant was forced to surrender New Netherland to the British. According to some historians, the West India Company made him the scapegoat for what actually were defects in company policies. He spent the remainder of his life on his farm, "the Bouwerie" (from which New York City's "Bowery" takes its name).



Stuyvesant, detail of an oil painting on panel by an unknown artist, *c.* 1660–70; in the collection of the New-York Historical Society

By courtesy of the New-York Historical Society

**sty,** also called HORDEOLUM, in medicine, infection of an eyelid gland. Two types are distinguished, the external and the internal sty.

The external sty is an infection, usually with staphylococcus organisms, of a sebaceous gland in the margin of the eyelid. The eye becomes sensitive to light, tears flow copiously, and there is a sensation of a foreign body in the eye. The area of infection is first reddened and then swollen like a pimple or small boil, with a yellow spot in the centre. The breaking of the sty and the discharge of its contents are hastened by application of warm compresses.

An internal sty is a staphylococcic infection of a meibomian gland, one of the modified sebaceous glands that lie close under the lining of the eyelids. These infections are more painful than is the external sty because they are pressed between the eyeball and the fibrous plate—called the tarsal plate—in the lid. The internal sty usually breaks through the lining of the lid, rather than the outer skin, when it discharges. This type of sty is sometimes called a chalazion, although the latter term is usually reserved for a painless swelling of the meibomian gland. This swelling is a cyst—a liquid- or semisolid-filled sac—that is granulomatous; that is, composed of young scar tissue. It sometimes appears without apparent cause and sometimes as an aftereffect of an internal sty.

**Style Moderne** (visual arts): *see* Art Deco.

**stylistics,** study of the devices in languages (such as rhetorical figures and syntactical patterns) that are considered to produce expressive or literary style.

Style has been an object of study from ancient times. Aristotle, Cicero, and Quintilian treated style as the proper adornment of thought. In this view, which prevailed throughout the Renaissance period, devices of style can be catalogued. The essayist or orator is expected to frame his ideas with the help of model sentences and prescribed kinds of "figures" suitable to his mode of discourse.

The traditional idea of style as something properly added to thoughts contrasts with the ideas that derive from Charles Bally (1865–1947), the Swiss philologist. According to followers of Bally, style in language arises from the possibility of choice among alternative forms of expression, as for example, between "children," "kids," "youngsters," and "youths," each of which has a different evocative value. This theory emphasizes the relation between style and linguistics, as does the theory of Edward Sapir, who talked about literature that is form-based (Algernon Charles Swinburne, Paul Verlaine, Horace, Catullus, Virgil, and much of Latin literature) and literature that is content-based (Homer, Plato, Dante, William Shakespeare) and the near untranslatability of the former. A linguist, for example, less bogged down in imagery and meaning, might note the effective placing of dental and palatal spirants in Verlaine's famous:

> Les sanglots longs des violons de l'automne
> Blessent mon coeur d'une langueur monotone,
> Tout suffocant et blême quand sonne l'heure,
> Je me souviens des jours anciens, et je pleure.

The impressionistic "slow, dragging" effect of Edgar Allan Poe's

> On desperate seas long wont to roam

can be made more objective by the linguist's knowledge of the stress contour or intonation. Here the predominance of the stronger primary and secondary stresses creates the drawn-out interminable effect.

Style is also seen as a mark of character. The Count de Buffon's famous epigram, *"Le style est l'homme même"* ("Style is the man himself") in his *Discours sur le style* (1753), and Arthur Schopenhauer's definition of style as "the physiognomy of the mind" suggest that, no matter how calculatingly choices may be made, a writer's style will bear the mark of his personality. An experienced writer is able to rely on the power of his habitual choices of sounds, words, and syntactic patterns to convey his personality or fundamental outlook.

**stylite,** a Christian ascetic who lived standing on top of a column (Greek: *stylos*) or pillar. The first to do this was St. Simeon Stylites (the Elder), who took up residence atop a column in Syria in AD 423. The best known among his imitators were his Syrian disciple St. Daniel (409–493) in Constantinople, St. Simeon Stylites the Younger (517–592) on Mount Admirable near Antioch, St. Alypius (7th century), near Adrianopolis, St. Luke (879–979) at Chalcedon, and St. Lazarus (968–1054) on Mount Galesion near Ephesus. Apart from these saints, of whom Greek biographies exist, various other stylites who lived in Greece and the Middle East were mentioned in ecclesiastical sources. John Moschus (died 619) mentions several in his *Pratum spirituale,* and references to female stylites have also been found.

The practice never spread to the West. Only one abortive attempt was recorded: St. Gregory of Tours in his *Historia Francorum* (late 6th century) described meeting St. Wulfilaicus, then a deacon at Yvoi (near Carignan, Ardennes), who had tried living atop a column but was soon forced by church authorities to descend.

The stylite was permanently exposed to the elements, though he might have a little roof above his head. He stood night and day in his restricted area, usually with a rail around him, and was dependent for his scanty sustenance on what his disciples brought him by ladder. He spent most of his time in prayer but also did pastoral work among those who gathered around his column. A stylite might continue this practice briefly or for a long period; St. Alypius reportedly stayed atop his column for 67 years.

**Stylites, Saint Simeon:** *see* Simeon Stylites, Saint.

**stylolite,** secondary (chemical) sedimentary structure consisting of a series of relatively small, alternating, interlocked, toothlike columns of stone; it is common in limestone, marble, and similar rock. The individual columns never appear singly but occur as a succession of interpenetrations that in cross section make a zigzag suture across the face of the stone. There has been much controversy over their origin, but geologists generally submit to the preponderance of field evidence supporting the theory of secondary origin; that is, that stylolites result from differential chemical solution by groundwater circulating along a parting in hardened rock.

**stylus,** plural STYLI, or STYLUSES, pointed instrument for writing and marking. The stylus was used in ancient times as a tool for writing

on parchment or papyrus. The early Greeks incised letters on wax-covered boxwood tablets using a stylus made of a pointed shaft of metal, bone, or ivory. In the Middle Ages, schoolboys in Europe used similar instruments to write on wooden tablets coated with black or green wax, producing whitish marks that could be erased by rubbing with the rounded end. In modern times, a stylus is used for cutting stencils in duplicating or other reproduction processes and, in the phonograph industry, to cut the original grooves in phonograph records; the needle used to play phonograph records is also called a stylus.

**Styne, Jule,** original name JULIUS KERWIN STEIN (b. Dec. 31, 1905, London, Eng.—d. Sept. 20, 1994, New York, N.Y., U.S.), American songwriter.

The son of Ukrainian Jewish parents, Stein immigrated with them to the United States in 1912. The family settled in Chicago, and Stein, having displayed musical talent from an early age, studied the piano. He began playing piano in nightclubs and with traveling orchestras, and his first hit song was published in 1926. In the early 1930s he changed his name to Jule Styne to avoid confusion with another musical personality named Jules Stein. He moved to New York City in 1934 and in 1937 to Hollywood, where he wrote scores for film musicals. Styne collaborated with the lyricist Sammy Cahn to write popular ballads for Frank Sinatra in the early 1940s, and the two men wrote the film musical *Anchors Aweigh* (1945) and the Broadway stage musical *High Button Shoes* (1947). Styne's next Broadway success was *Gentlemen Prefer Blondes* (1949; filmed 1953), with lyricist Leo Robin. He contributed six songs to a Broadway revival of *Peter Pan* (1954). Styne collaborated with Adolf Green and Betty Comden on the musical *Bells Are Ringing* (1956; filmed 1960) and with lyricist Stephen Sondheim on *Gypsy* (1959; filmed 1962). His last major success on Broadway was *Funny Girl* (1964; filmed 1968), written with lyricist Robert Merrill. *Sugar* (1972) enjoyed a modest success.

Styne's theatrical music was well suited to the talents of such leading ladies as Carol Channing, Mary Martin, Judy Holliday, Ethel Merman, and Barbra Streisand. He wrote or cowrote more than 1,500 songs.

**styrene,** liquid hydrocarbon that belongs to the family of aromatic organic compounds and is important chiefly for its marked tendency to undergo polymerization. Styrene is used in the manufacture of plastics, resins, and rubbers, which are composed of very large molecules (polymers) formed by combination of smaller ones (monomers). It is also used to make polyesters and latex paints.

Pure styrene is clear, colourless, flammable, and slightly toxic; it boils at 145° C (293° F) and freezes at −30.6° C (−23.1° F). Its molecular formula is $C_8H_8$. Its isolation from storax (a natural balsam) and its polymerization were reported before 1850, but its industrial manufacture and utilization were not begun until the late 1930s. It is produced by dehydrogenation of ethylbenzene, most of which is made from ethylene and benzene, both derived from petroleum. Production increased rapidly during World War II because of the importance of styrene as a component of synthetic rubbers; by the late 20th century, more than 9,000,000 metric tons per year were being made.

Free-radical catalysts cause the rapid conversion of styrene into polystyrene (*q.v.*), a plastic widely used in molded or extruded articles. The synthetic rubber called SBR, GR-S, or Buna S is made from mixtures of styrene and butadiene, which react to form a copolymer, the molecules of which contain units of both compounds. Several other monomers (*e.g.*, acrylonitrile) may be copolymerized with styrene to produce useful plastics or resins with qualities superior to that of polystyrene.

**Styria** (Austria): *see* Steiermark.

**Styron, William** (b. June 11, 1925, Newport News, Va., U.S.), American novelist noted for his treatment of tragic themes and his use of a rich, classical prose style.

Styron served in the U.S. Marine Corps before graduating from Duke University, Durham, N.C., in 1947. During the 1950s he was part of the community of American expatriates in Paris. From 1953 he served as advisory editor to the *Paris Review*.



Styron
Nancy Crampton

Styron's first novel, *Lie Down in Darkness* (1951), set in his native tidewater Virginia, tells of a young woman from a loveless middle-class family who fights unsuccessfully for her sanity before committing suicide. His next work, *The Long March* (1956), chronicles a brutal forced march undertaken by recruits in a Marine training camp. The novel *Set This House on Fire* appeared in 1960.

Styron's fourth novel, *The Confessions of Nat Turner* (1967), is an account of a historical incident, a black slave rebellion led by the title character in Virginia in 1831. Based on a transcript of Turner's testimony and told from his point of view, the book portrays a sensitive, intelligent, and kindly man who is denied all normal human happiness because of his degrading enslavement. Embittered and alienated, he undertakes a bloody revolt that ends in his capture and execution. The novel is a tour de force of complex psychological presentation and a vivid evocation of slavery in the United States in the early 19th century. It was awarded a Pulitzer Prize in 1968.

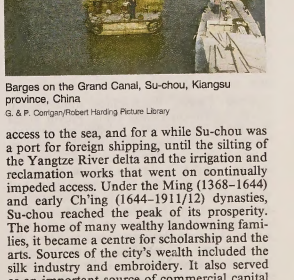
Styron's later works include a play, *In the Clap Shack* (1972), and the novel *Sophie's Choice* (1979; filmed 1982), portraying the growth of a friendship between a young Southern writer and a Polish woman who survived the Nazi death camp Auschwitz. *This Quiet Dust* (1982) is a collection of essays that treat the dominant themes of Styron's fiction. *Darkness Visible* (1990) is a nonfiction account of Styron's struggle against depression.

**Styx,** in Greek mythology, one of the rivers of the underworld. The word *styx* literally means "hateful" and expresses loathing of death. In the epics of Homer, the gods swore by the water of the Styx as their most binding oath; if a god perjured himself, he was rendered insensible for a year and then banished from the divine society for nine years. Hesiod personified Styx as the daughter of Oceanus and the mother of Emulation, Victory, Power, and Might. Later the Styx was identified with the stream now called Mavronéri (Greek: "Black Water") near Nonacris in the Aroania Mountains (near modern Sólos) in Arcadia. The ancients believed that its water was poisonous and would dissolve any vessel containing it except one made of the hoof of a horse or an ass. There is a legend that Alexander the Great was poisoned by Styx water.

**Su-ao,** coastal town and port in I-lan *hsien* (county), northeastern Taiwan. It is situated 13 miles (21 km) southeast of I-lan city, in the southern part of the I-lan plain. Originally a small fishing port with one of the best natural harbours in Taiwan, Su-ao was developed into an international deepwater commercial port in the late 1970s. A railway line was built to Hua-lien city, 55 miles (90 km) down the coast. Cement manufacturing, fish processing, woodworking, food canning, and processing of mica, copper, manganese, and silica mined nearby are Su-ao's major industries. Export-import industries are concentrated at the Lung-te (Lungteh) Industrial District, located 1.7 miles (2.7 km) west of the harbour. Pop. (1992 est.) 51,376.

**Su-chou,** also called WU-HSIEN, Pinyin SUZHOU, or WUXIAN, conventional SOOCHOW, city in Kiangsu *sheng* (province), China. Su-chou controls the Yangtze River delta area north and northeast of the T'ai Lake. The city is situated to the east of the lake, on the southern section of the Grand Canal. It is surrounded by canals on all four sides and is crisscrossed by minor canals. Su-chou is a place of great beauty, with lakes, rivers, ponds, world-famous gardens, and a string of scenic hills along the eastern shore of T'ai Lake. It also lies at the centre of some of the richest agricultural land in China.

The traditional founding date of Su-chou is 514 BC, when a city with the approximate boundaries of the present one was established by the ruler of the state of Wu (Eastern Chou dynasty). Under the Ch'in dynasty (221–206 BC), it became the seat of a county, Wu-hsien, and of the K'uai-chi commandery, which controlled most of modern Kiangsu south of the Yangtze and of Chekiang province. The name Su-chou dates from 589, when the Sui dynasty (581–618) conquered southern China. With the building of the Grand Canal, Su-chou became an administrative and commercial centre for an area that rapidly developed into the major rice-surplus region of China. Under the Sung (960–1279) and the Yüan (1206–1368) dynasties, Su-chou continued to flourish. In the 13th century the Venetian traveler Marco Polo visited it and commented on its splendours. The Sung River and Su-chou Creek gave the city direct



Barges on the Grand Canal, Su-chou, Kiangsu province, China
G. & P. Corrigan/Robert Harding Picture Library

access to the sea, and for a while Su-chou was a port for foreign shipping, until the silting of the Yangtze River delta and the irrigation and reclamation works that went on continually impeded access. Under the Ming (1368–1644) and early Ch'ing (1644–1911/12) dynasties, Su-chou reached the peak of its prosperity. The home of many wealthy landowning families, it became a centre for scholarship and the arts. Sources of the city's wealth included the silk industry and embroidery. It also served as an important source of commercial capital and a finance and banking centre.

From 1860 to 1863, during the Taiping Rebellion of 1850–64, Su-chou was occupied by the Taiping leader Li Hsiu-ch'eng. Although it was one of the few places in which Taiping reform policies seem to have been effectively carried out, the city was, nevertheless, largely destroyed. Although it was restored in the late 19th century, its commercial supremacy was then challenged by nearby Shanghai. Under the Treaty of Shimonoseki (concluded between China and Japan in 1896), it was opened for foreign trade but without significant results. Before World War II the area was adversely affected by foreign competition, and the silk industry, most of which was on a small handicraft scale, was hard hit. At about this time some modern factories manufacturing satins and cotton fabrics were established, and a large electric power plant was set up, but until the outbreak of the Sino-Japanese War in 1937 there was little modern industry. Su-chou was occupied by the Japanese from 1937 to 1945.

The city's first railway, linking Su-chou with Shanghai and with Nanking, was opened in 1908. In 1936 a branch line was built joining this line to the main Shanghai–Hang-chou railway at Chia-hsing. There are also highways to K'un-shan and Ch'ang-shu in the delta, to Shanghai, and to Hang-chou. Much traffic, however, still uses the network of waterways.

The city is a centre of learning; Su-chou University and Su-chou School of Fine Arts were established in the early 20th century, and later the Southern Kiangsu Technical Institute and a special sericulture institute were established. Su-chou gained a reputation in the late 1950s for its training programs for apprentice workers in traditional handicrafts. An iron and steel plant was set up in the 1950s, but there has been little significant development of heavy industry. Silk and cotton textile industries, however, have been reorganized on a large scale.

Su-chou boasts some 150 exquisite gardens with temples, pavilions, and rock sculptures. The Chinese Garden Society, reestablished in 1978, organizes international academic exchanges. Pop. (1999 est.) 845,687.

**Su-chou embroidery,** silk, satin, and other textiles decorated using soft coloured silk threads and produced at or near the city of Su-chou, in Kiangsu Province, China. The Su-chou school is one of the four most famous schools of embroidery in China (the others being centred in Hunan, Kwangtung, and Szechwan provinces). Embroidered book covers unearthed at Su-chou date the production of embroidery there back to the Five Dynasties period (10th century AD), though the school probably extends back to Han-dynasty times. The Su-chou tradition uses many different types of stitching and variable types of threads to realistically depict the forms and textures of flowers, goldfish, cats, dragons, and other pleasing natural objects.

**Su Dongpo** (Chinese author): *see* Su Tung-p'o.

**Su-pei Canal,** Wade–Giles romanization SU-PEI-KUAN-KAI-TSUNG CH'Ü, Pinyin SUBEI GUANGAI ZONG QU, English NORTHERN KIANGSU MAIN IRRIGATION CANAL, canal in Kiangsu Province, China, designed to provide a direct outlet to the sea for the waters of the Huai River, which in medieval times had discharged near the mouth of the modern Kuan River. In 1186 the Huang Ho (Yellow River) changed its course to discharge south of the Shantung Peninsula, thus usurping the lower course of the Huai, which thereafter discharged into Hung-tse Lake and thence southward through a string of lakes and waterways into the Yangtze River near Yang-chou (Kiangsu). In the early years of the 20th century the drainage of the Huai area had become a perennial problem. A canal was constructed in 1934–37 linking Hung-tse Lake with the sea. It was designed not only as a channel for the discharge of floodwaters but also as the main artery of an extensive network of drainage and irrigation channels. In 1938, however, the diversion of the Huang Ho into the Huai caused much further damage. After 1950 the main Su-pei Canal linking the Huai River with the sea was largely rebuilt and was incorporated into a waterway system covering the coastal belt of Kiangsu Province north of the Yangtze, which was designated as the Su-pei Irrigation District.

The new canal, 104 miles (168 km) in length, leaves Hung-tse Lake through a large lock at Hung-tse (Kao-lang-chien) to cross the Grand Canal at Huai-an. There, large locks and sluices controlled the entry to both the northern and southern sections of the Grand Canal, while another lock gave access to the Yün-yen Ho ("Salt Transport Canal"), running northwestward to Lien-yün-kang. The main canal flows into the sea at Liu-to to the east of Pinhai, its mouth being protected by a tidal sluice. Several trunk canals have also been built as main arteries of the irrigation and transport system to the south of the main canal. North of the main Su-pei Canal, there have been extensive repairs and improvements to the Yün-yen Canal, which has a series of new locks and sluices, while the courses of several other rivers in the area have been canalized as well. They now form the main arteries to which a great number of smaller local irrigation and drainage projects have been connected.

**Su Shih,** also spelled SU SHI (Chinese author and artist): *see* Su Tung-p'o.

**Su Ti** (Chinese emperor): *see* Chia-ching.

**Su Tsung** (Chinese emperor): *see* Chang Ti.

**Su Tung-p'o,** Pinyin SU DONGPO, pen name of (Wade–Giles romanization) SU SHIH, or SU SHI (b. Dec. 19, 1036, Mei-shan [now in Szechwan Province], China—d. July 28, 1101, Ch'ang-chou, Che-hsia [now Kiangsu Province]), one of China's greatest poets and essayists, who was also an accomplished painter and calligrapher and a public official.

A member of a literary family, the young Su Tung-p'o performed brilliantly in his official examinations and was rewarded with the first of the many official positions he occupied during his long and distinguished career. While Su was popular with the people of the various provinces in which he industriously served, he sometimes encountered criticism from the frequently changing heads of state. Wang An-shih, prime minister under the Sung emperor Shen Tsung and an accomplished poet himself, banished Su to Huang-chou, Hupeh, in 1079, because of Su's opposition to some of Wang's radical reform measures. Yet, despite his five-year banishment, Su remained friendly to Wang, later exchanging poems with him. He demonstrated this same optimism and lack of bitterness when he was banished by other forces in 1094 to southern Kwang-tung. He was allowed to return to the mainland and was restored to favour and office shortly before his death.

Su Tung-p'o was a leader of Sung-dynasty poets in trying to loosen poetic conventions on form and content, especially in the song form known as *tz'u*. The optimism he demonstrated in his private and political life can be seen also in his verse.

**Suakin** (The Sudan): *see* Sawākin.

**Suakoko,** also spelled SUAKOKOTA, town, central Liberia, western Africa. It is the site of the government's Central Agricultural Experimental Station (1946). Cuttington University College (Episcopalian), which is 3 miles (5 km) northeast, was Liberia's first college to offer a degree in agriculture; its museum houses a notable collection of African art. The Suakoko Leprosarium (leper colony) and Phebe Hospital, which trains nurses, are nearby. The local Kpelle population is mainly engaged in rice farming. Pop. (latest est.) 10,896.

**Suárez, Francisco,** byname DOCTOR EXIMIUS (b. Jan. 5, 1548, Granada, Spain—d. Sept. 25, 1617, Lisbon), Spanish theologian and philosopher, a founder of international law, often considered the most prominent Scholastic philosopher after St. Thomas Aquinas, and the major theologian of the Roman Catholic order, the Society of Jesus (Jesuits).

The son of a wealthy lawyer, Suárez began the study of law in Salamanca in 1561 but left to join the Jesuits in 1564. From 1571 he taught philosophy, in 1580 becoming a theology instructor at the Jesuit college in Rome and later at Alcalá. In 1593 King Philip II of Spain appointed him to teach, and he eventually served as a professor at Coimbra (1597–1616). Holder of a doctorate from Évora (1597), Suárez was an exceptionally erudite and methodical scholar whose works, even in the incomplete Paris edition (1856–78), fill 28 volumes.

His principal study in philosophy is the *Disputationes Metaphysicae* (1597), which was used for more than a century as a textbook at most European universities, Catholic and Protestant alike. In this work, which treats especially the problems of human will and the concept of general versus particular phenomena, Suárez drew upon Aristotle and Aquinas, although he took into consideration the criticisms of other Scholastic philosophers such as Duns Scotus (*c.* 1265–1308) of Britain and Luis de Molina (1535–1600) of Spain. His departures from Aquinas' positions have been considered significant enough to warrant the separate designation of his system as Suárezianism.

At the request of Pope Paul V and others, he wrote apologetic works on the nature of the Christian state. Among them were *De Virtute et Statu Religionis* (1608–09) and *Defensio Fidei Catholicae* (1613), opposing Anglican theologians who defended the claim of kings to rule as God's earthly representatives. This theory, the divine right of kings, was advanced in England at the time by James I, who subsequently burned Suárez' *Defensio* on the steps of St. Paul's Cathedral in London. On the question of man's ability to effect his own salvation by his works, Suárez, in his *De Vera Intelligentia Auxilii Efficacis* (1605, pub. 1655), supported the view of the Congruist movement, which held that God gave man sufficient grace to achieve the virtuous conduct congruent to, or in harmony with, his own will.

Suárez expounded his political theory and philosophy of law in *De Legibus* (1612; "On Laws") as well as in the *Defensio.* Having refuted the divine-right theory of kingly rule, he declared that the people themselves are the original holders of political authority; the state is the result of a social contract to which the people consent. Arguing for the natural rights of the human individual to life, liberty, and property, he rejected the Aristotelian notion of slavery as the natural condition of certain men. He criticized most of the practices of Spanish colonization in the Indies in his *De Bello et de Indis* ("On War and the Indies"). The islands of the Indies he viewed as sovereign states legally equal to Spain as members of a worldwide community of nations.

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**Suárez González, Adolfo** (b. Sept. 25, 1932, Cebreros, near Ávila, Spain), prime minister

of Spain from July 1976 until January 1981 and secretary-general of the National Movement (Francisco Franco's reformed Falange). On taking office, he was, at the age of 43, the youngest Spanish prime minister of the 20th century.

Suárez' father was a minor civil servant, and his mother belonged to the distinguished Cebreros family influential in politics. At the age of 16 he entered the University of Salamanca and at 21 received a degree in law, later obtaining a doctorate cum laude from the University of Madrid. He held various small posts in the provinces, most of them within the National Movement, and later worked with the national radio and television network and became responsible for the first television channel. After serving as civil governor and provincial head of the National Movement in Segovia during 1968–69, he moved back to radio and television as director general.

In March 1975 he was appointed deputy secretary-general of the National Movement and in December became secretary-general, with cabinet rank. Also in 1975, he was founder-member and later president of the Union of the Spanish People, a mildly reformist political association within the National Movement. In June 1976 he strongly defended in the Cortes (parliament) the new law legalizing political parties.

In July 1976 his appointment to head Spain's second government under King Juan Carlos I provoked mixed reactions. Though he was more liberal than the old Francoists, Suárez' position in Franco's National Movement guaranteed at least a measure of loyalty to the Francoist past. In addition, Suárez had links to the powerful Roman Catholic lay organization Opus Dei. Upon gaining office, however, Suárez showed moderation in his policies. He opened political dialogue, challenging Francoist sentiment in the military by legalizing the socialist and communist parties, and he called Spain's first free elections since 1936.

Suárez formed a political party consisting of social democrats and liberals, the Central Democratic Union (Unión Centro Democrático, or UCD). His party won the elections in 1977, and Suárez was elected to a four-year term. His government was increasingly plagued, however, by the push for autonomy by several of Spain's regions and, toward the same end, by heightened terrorist activity on the part of the Basques. Already in 1978 there was strain within Suárez' own party and increasing popular competition from the opposition Spanish Socialist Workers' Party. In elections in 1979, the UCD failed to win an overall majority in the Cortes, and Suárez maintained power only through a vote of confidence. He was compelled to form a fifth Cabinet in September 1980 and gained another vote of confidence only by promising members of the Andalusian socialist party a fully autonomous regional government, which added to the government's loss of popularity nationwide. In addition, Basque terrorism was on the rise: in 1980 there was an average of one political assassination every three days.

Suárez resigned as premier and leader of the UCD in January 1981. In August 1982 he founded a new political party, the Social and Democratic Centre.

**Suassuna, Ariano** (b. June 16, 1927, João Pessoa, Braz.), Brazilian dramatist and fiction writer, the prime mover in the Movimento Armorial ("Armorial Movement") in northeastern Brazil, an intellectual and folkloric group devoted to the discovery and re-creation of the historic roots of Luso-Brazilian culture in that region.

A professor of aesthetics and theory of the theatre, Suassuna became involved in both the craft of writing plays and the administration of theatrical groups. He was a founder of the Student Theatre at the Federal University of Pernambuco and was appointed director of the centre of cultural education there.

Suassuna rehabilitated the medieval Iberian *auto* (morality or mystery play) as a viable theatrical form for use on the 20th-century stage in such works as *Auto da Compadecida* (1955; "Play of Our Lady of Mercy"), *Auto de João da Cruz* (1950; "Play of John of the Cross"), and others. He drew on the tradition established by Gil Vicente in 16th-century Portugal for many of his plays, including *Uma mulher vestida de sol* (1947; "A Woman Dressed in Sunshine"), *Cantam as harpas de Sião* (1948; "The Harps of Zion Sing"), and *Farça da boa preguiça* (1960; "Farce of Good Laziness"). He borrowed from puppet theatre in plays such as *A pena e a lei* (1959; "The Punishment and the Law") and drew widely on northeastern Brazil's popular poetry and musical forms in the creation of a kind of "circus theatre."

Suassuna published one novel, following tenets of the Movimento Armorial, *Romance d'a Pedra do reino e o principe do sangue do vai-e-volta* (1971; "Romance of the Stone of the Kingdom and the Prince of Coming-and-Going Blood"), which incorporates elements of the traditions, still extant in northeastern Brazil, surrounding the belief that King Sebastian of Portugal would return to save his country.

**sub:** *see* submarine.

**Sub-Atlantic Climatic Interval,** division of Holocene chronology (the Holocene Epoch began about 10,000 years ago and continues to the present). The Sub-Atlantic Interval followed the Sub-Boreal Climatic Interval and continues today.

The Sub-Atlantic began about 225 BC (estimated on the basis of radiocarbon dating) and has been characterized by increased rainfall, cooler and more humid climates, and the dominance of beech forests. The fauna of the Sub-Atlantic is essentially modern although severely depleted by human activities. The Sub-Atlantic is correlated with pollen zone IX; sea levels have been generally regressive during this time interval, though North America is an exception.

**Sub-Boreal Climatic Interval,** division of Holocene chronology (the Holocene Epoch began about 10,000 years ago and continues to the present). The Sub-Boreal Climatic Interval followed the Atlantic and preceded the Sub-Atlantic Climatic Interval. The Sub-Boreal, dated by radiocarbon methods, began about 5,100 years ago and ended about 2,200 years ago.

It is correlated with pollen zone VIII, and the climate was warm and dry. The Sub-Boreal forests were dominated by oak and ash and show the first evidence of extensive burning and clearance by humans. Domesticated animals were abundant, as well as natural fauna.

**subacute thyroiditis,** also called GIANT-CELL, PSEUDOTUBERCULOUS, or DE QUERVAIN'S THYROIDITIS: *see* granulomatous thyroiditis.

**subalpine forest:** *see* coniferous forest.

**subarkose,** variety of sandstone in which 5–25 percent of the sand grains are composed of feldspar. *See* arkose.

**Subarnarekhā River,** river in northeastern India, rising in southern Bihār state. The Subarnarekhā (meaning "streak of gold") flows east through a copper-mining region and leaves the Chota Nāgpur plateau by the Hundrugbagh waterfall. Continuing eastward, it flows across West Bengal state to enter the Bay of Bengal after a 290-mile (470-kilometre) course. The Kānchi and Kārkāri rivers are its chief tributaries.

**subatomic particle,** also called ELEMENTARY PARTICLE, any of various self-contained units of matter or energy. More than 200 subatomic particles have been detected so far, and each appears to have an antiparticle, an antimatter counterpart with the identical mass but opposite electric charge, magnetic moment, or spin.

A brief treatment of subatomic particles follows. For full treatment, *see* MACROPAEDIA: Subatomic Particles.

For centuries atoms were commonly regarded as the basic constituents of matter. The discovery of the electron (1897) and of the atomic nucleus (1911) finally established that an atom was actually a composite system composed of a cloud of electrons surrounding a tiny, heavy core. In the early 1930s it was determined that the nucleus itself was composed of smaller particles, namely protons and neutrons. By the early 1970s intensive research revealed that these particles too were made up of even more basic units—quarks. In the late 20th century most physicists believed that quarks, together with another class of subatomic particles known as leptons, constitute the fundamental building-blocks of all matter.

The quarks (and antiquarks) are massive particles that have half-integral spin and carry a fractional electric charge. They come in five, or perhaps six, different varieties. Only two of them, known as "up" and "down," occur in the protons and neutrons of ordinary matter. Three other types of quarks, called "strange," "charmed," and "bottom," exist solely in unstable particles that spontaneously decay (break down) in a few hundred-millionths of a second or less. The sixth type of quark, "top," has not been observed as yet. Particles made up of quarks are known collectively as hadrons. Those such as the proton and neutron that consist of three quarks are called baryons; others formed from a quark with an antiquark are called mesons.

The leptons also are divided into several types, the most familiar of which is the electron. Other, more massive leptons are the muon and the tau. Like the electron, both of these particles have a negative electric charge and half-integral spin. Each of the leptons has an associated neutrino—*i.e.,* electron-, muon-, and tau-neutrino—that possesses no electric charge and possibly no mass. In contrast to quarks, which take part in strong interactions, leptons respond only to electromagnetic, weak, and gravitational forces.

A third major group of subatomic particles consists of bosons. Unlike quarks and leptons, bosons are not building-blocks of matter; rather they transmit the forces of the universe. For example, the "electro-weak" force, the electromagnetic and weak forces in unified form, is maintained through the emission and absorption of photons and of massive particles known as W and Z bosons by interacting leptons and their associated neutrinos. Other bosons include the gluons, which transmit the strong force that binds quarks in hadrons. Gluons are massless, have spin, and travel at the speed of light. Moreover, they can multiply as they travel from one quark to another, thereby increasing the strength of the force they transmit. The larger the number of gluons exchanged among quarks, the stronger the binding force becomes.

**Subayṭilah** (Tunisia): *see* Sufetula.

**Subbiluliuma I:** *see* Suppiluliumas I.

**subbituminous coal,** also called BLACK LIGNITE, dark brown to black coal intermediate in rank between lignite and bituminous coal. Subbituminous coals often have a silky lustre and sometimes are macroscopically indistinguishable from the bituminous variety. The fibrous structure characteristic of lignite is ab-

sent in subbituminous coals, many of which have evolved alternating dull and bright bands similar to those of bituminous coals. Subbituminous coals are much harder than lignites. Although subbituminous coals have relatively low heat value, their sulfur content is low—often less than 1 percent. For this reason, an increasing number of coal-fueled electric-power plants in the United States have turned from bituminous coals to subbituminous coals and lignites, which also have a low sulfur content. *See also* bituminous coal; lignite.

**subduction zone,** oceanic trench area marginal to a continent in which, according to the theory of plate tectonics, older seafloor underthrusts the continental mass, dragging downward into the Earth's upper mantle the accumulated trench sediments. The subduction zone, accordingly, is the antithesis of the mid-oceanic ridge; new seafloor is generated from the upper mantle at the mid-oceanic ridges, spreads laterally outward, and is eventually subducted, or consumed, at the margins of ocean basins.

**Subei Canal** (China): *see* Su-pei Canal.

**subgraywacke,** dark-coloured sedimentary rock that contains from 65 to 95 percent free quartz, in grains 0.06 to 2 mm in diameter, held together by a matrix with a low mud content and often a high carbonate content. Some geologists favour a definition of graywacke (*q.v.*) that permits no more than 75 percent free quartz in the rock, and they thus would class as subgraywackes those rocks with (1) over 25 percent unstable materials (*i.e.*, feldspar and rock fragments), (2) more rock fragments than feldspar, and (3) more voids (open pore spaces) or mineral (often carbonate) cement than clay or mud matrix.

Subgraywackes of the first type occur in thick deposits in great subsiding troughs, where they either dominate the rock sequence or occur as a minor component with less-siliceous graywackes. These rocks are derived from areas with many quartz-rich rocks or areas in which intense chemical weathering eliminates the less-stable materials before the sediment is deposited.

Subgraywackes of the second type constitute more than one-third of the sandstones in the geologic column, occurring in rock sequences of all ages. They commonly consist of rounded and well-sorted grains in layers often inclined to the general plane of bedding. They probably were deposited by density currents (highly turbid, bottom currents) and are derived from areas that contain mainly sedimentary rocks and low-grade metamorphic rocks (altered by low heat and pressure). Because they occur in coal deposits, they may have a partly nonmarine origin; some are thought to have accumulated on coastal floodplains and deltas or similar environments. Mudstones and shales often occur interbedded with these rocks.

**subḥah,** string of Muslim prayer beads whose units (100, 25, or 33) represent the names of God. As the beads (made of wood, bone, or precious stones) are touched one by one, Muslims may recite any of numerous formulas, the most common being "Glory to Allāh." But because prayer may also be recited in the secret of one's heart, a person can multiply his praises of God by merely moving the beads through his fingers while engaged in conversation.

Though the *subḥah* is widely used and is recognized as a sign of piety by most Muslims, others regard its use as pretentious and unnecessary. The Wahhābīyah, a Muslim sect founded in the 18th century, for example, considered the *subḥah* a harmful innovation (*bid'ah*) whose use was consequently forbidden to true believers.

**Subiaco,** ancient (Latin) SUBLAQUEUM, town, Roma *provincia,* Lazio (Latium) *regione,* central Italy. It lies along the Aniene River, 1,345 feet (410 m) above sea level, about 45 miles (73 km) east of Rome. Its ancient name recalls its position below three small lakes where the emperor Nero built a villa. An inundation destroyed the lakes in 1305, and only traces remain of the villa. St. Benedict retired as a hermit (*c.* 494) to a cave, Sacro Speco ("Holy Grotto"), above the lakes; he founded 12 monasteries in the district before departing for Cassino. The Abbey of San Benedetto on the mountain slope has 9th-century frescoes in the Grotta dei Pastori ("Grotto of the Shepherds"). St. Benedict's cave and the lower church of Sacro Speco contain 13th-century frescoes; scenes from the life of Christ by painters of the 13th- and 14th-century Sienese school are in the upper church. The church dedicated to St. Scholastica, St. Benedict's sister, was first built in 981; it was reconstructed in the Gothic style after an earthquake (1228). The first printing press in Italy was established in the Church of Santa Scholastica by the German monks Arnold Pannartz and Conrad Schweinheim in 1464. The town itself is dominated by the Rocca Abaziale (fortress), originally built in 1073. Subiaco preserves its medieval form and owes many of its buildings to Pope Pius VI, who as cardinal was commendatory abbot of the monastery.

The town is an important agricultural centre and has paper mills and stone quarries. Pop. (1990 est.) mun., 9,156.

**Subic Bay,** bay of the South China Sea, southwestern Luzon, Philippines. The bay is located 35 miles (90 km) northwest of the mouth of Manila Bay and extends northward into the Luzon coastline. From 1901 to 1992, on the southeast coast of the bay, the United States operated a naval base, Subic Bay Naval Station, the largest naval installation in the Philippines. Olongapo is the largest settlement in the region. The area suffered heavy damage in World War II; it was taken by the Japanese in 1942 and retaken by Allied forces in 1944. Its proximity to Indochina gave the U.S. naval base a prominent supply and maintenance role in the Vietnam War (1955–75). Rice, corn (maize), and bananas are grown in the area, and there are secondary forests around the bay.

**Subirà, Margarita Xirgu I:** *see* Xirgu, Margarita.

**subjective idealism,** a philosophy based on the premise that nothing exists except minds and spirits and their perceptions or ideas. A person experiences material things, but their existence is not independent of the perceiving mind; material things are thus mere perceptions. The reality of the outside world is contingent on a knower. The 18th-century Anglo-Irish philosopher George Berkeley succinctly formulated his fundamental proposition thus: *Esse est percipi* ("To be is to be perceived"). In its more extreme forms, subjective idealism tends toward solipsism, which holds that *I alone* exist.

**sublimation,** in physics, conversion of a substance from the solid to the vapour state without its becoming liquid. An example is the vaporization of frozen carbon dioxide (dry ice) at ordinary atmospheric pressure and temperature. The phenomenon is the result of vapour pressure and temperature relationships. Freeze-drying of food to preserve it involves sublimation of water from the food in a frozen state under high vacuum. *See also* vaporization; phase diagram.

**sublime,** in literary criticism, grandeur of thought, emotion, and spirit that characterizes great literature. It is the topic of an incomplete treatise, *On the Sublime,* that was for long attributed to the 3rd-century Greek philosopher Cassius Longinus but now believed to have been written in the 1st century AD by an unknown writer frequently designated Pseudo-Longinus.

The author of the treatise defines sublimity as "excellence in language," the "expression of a great spirit," and the power to provoke "ecstasy." Departing from traditional classical criticism, which sought to attribute the success of literary works to their balance of certain technical elements—diction, thought, metaphor, music, etc.—he saw the source of the sublime in the moral, emotional, and imaginative depth of the writer and its expression in the flare-up of genius that rules alone could not produce.

The concept had little influence on modern criticism until the late 17th and 18th centuries, when it had its greatest impact in England. Its vogue there coincided with renewed interest in the plays of William Shakespeare, and it served as an important critical basis for Romanticism.

**Sublime Porte,** also called PORTE, the government of the Ottoman Empire. The name is a French translation of Turkish Bâbıâli ("High Gate," or "Gate of the Eminent"). which was the official name of the gate giving access to the block of buildings in Constantinople, or Istanbul, that housed the principal state departments. Early in the history of the Ottoman Empire, the grand viziers became powerful, but only in the 17th century did they acquire the official residence, Bâbıâli, which became the real centre of government. There, too, were the offices of the foreign ministry and the council of state; hence the application of the term to the government as a whole. In the late 20th century, the buildings were the seat of a provincial governorate.

**submachine gun,** lightweight automatic small-arms weapon chambered for relatively low-energy pistol cartridges and fired from the hip or shoulder. Most types utilize simple blowback actions. Using cartridges of such calibres as .45 inch or 9 mm, they usually have box-type magazines that hold from 10 to 50 cartridges, or occasionally drums holding more rounds. A short-range weapon, the submachine gun is rarely effective at more than 200 yards (180 m). It fires at rates as high as 650 or more rounds per minute and weighs 6 to 10 pounds (2.5 to 4.5 kg).

Developed during World War I, the submachine gun came into great demand during World War II because of the need to increase the individual soldier's firepower at close quarters. The Germans developed the first such weapons, modeling them to some extent after the Italian double-barreled Villar Perosa, or VP, a 1915 innovation that fired so fast it emptied its magazine in two seconds. The Germans identified their weapon, the first true submachine gun, as the MP18, or the Bergmann Muskete. This weapon was first issued in 1918, the last year of World War I. In Britain submachine guns came to be called machine carbines; in Germany, machine pistols; in the United States, submachine guns. The Thompson submachine gun (*q.v.*), or tommy gun, an important American type, was patented in 1920. After 1925 numerous evolutionary models appeared: the Bergmann Model 34 and the Schmeisser 28 II in Germany, Italy's Beretta Model 38, and the Hungarian Model 43. During and after World War II, many new types and models appeared: the British 9 mm Sten gun; the Soviet 7.62 mm PPSh M1941 and PPS M1943; the German Schmeisser MP38 and MP40; the Israeli Uzi submachine gun (*q.v.*); the Czech Model 23; and the American M3, a .45-inch calibre, nine-pound weapon called the "grease gun" because it resembled the device used to grease automobiles.

Typically, expansion gases move a submachine gun bullet forward when the weapon is

fired. The gases also push the heavy bolt back against a spring. The movement extracts and ejects the spent cartridge while the magazine spring pushes the next bullet into place. Holding the trigger down causes the strong spring behind the bolt to maintain its pressure until all the rounds have been used. New models have incorporated many new concepts to reduce weight, increase safety, and simplify maintenance.

**submarine,** a naval vessel capable of operating underwater for sustained periods of time. Submarines played a major role in naval warfare during both world wars. Germany's submarines, called U-boats, were especially important. (*See* U-boat.) Conventionally powered submarines used diesel engines for propulsion while on the surface of the water and battery-powered electric motors for propulsion while submerged. These submarines sank enemy merchant vessels by launching torpedoes at them. Diesel-electric submarines usually traveled on the surface and could operate at high speed for only a few hours while submerged. Although many smaller navies still build conventionally powered submarines, the nuclear-powered submarine, capable of operating at high speeds underwater for months at a time, has become a more important weapon system and is regarded by some naval strategists as the most potent of all naval warships.

A brief treatment of submarines follows. For full treatment, *see* MACROPAEDIA: War, Technology of.

*Construction features.* To operate underwater, a submarine has a strengthened steel hull that protects the crew, machinery, and certain equipment from water pressure. A double-hull technique is generally used, with the space between the inner (pressure) hull and outer hull providing room for water ballast, fuel tanks, and missile-launching tubes. Above the submarine's hull is a conning tower, or sail structure, housing retractable periscopes, radar and radio antennae, and snorkel tubes and providing a platform, or bridge, for the navigating officers and lookouts when the submarine is on the surface.

Normally, the submarine submerges by flooding its water-ballast tanks to attain a neutral buoyancy and then diving by forward motion coupled with the use of small diving planes, somewhat like rotating wings. Most submarines have stern diving planes and a second pair installed on their sail structure or at the bow. To surface, the submarine uses the diving planes and forward motion, supplemented by the expulsion of water from the ballast tanks with compressed air.

*Sensors.* The prime sensors of a submarine are sonars, periscopes, and radars. Submarines employ both passive sonar (sound detection and ranging), which listens for the noises generated by another submarine or a surface ship, and active sonar, which sends out an acoustic pulse that is reflected upon hitting another vessel. The submarine uses sonar for detection of an enemy, for seafloor and under-ice navigation, and for directing torpedoes. The periscope is a viewing tube that can be extended above a submerged submarine in order to scan the surface for other ships. Modern periscopes are about 40 feet (12 m) long and taper to about 1 inch (2.5 cm) in diameter at the top to reduce detection from the surface. Radar is used primarily for navigation in coastal waters.

*Propulsion.* Conventional submarines are fitted with diesel engines for surface propulsion and for recharging the batteries that power the electric motors for propulsion underwater. Diesel-electric submarines periodically raise a snorkel device to draw in air for the diesel engines and crew and to carry away exhaust gases. Once submerged, the diesel engines are shut down, and electric motors are started, turning the same propeller shafts. The electric motors, drawing their energy from the storage batteries, require no combustion and can be used without regard for the submarine's air supply. Electric motors have the additional advantage of being quiet, an important factor in submarine operations.

The power plant of a nuclear-powered submarine consists of an atomic reactor that generates enormous amounts of heat through nuclear fission. The heat is carried by the primary coolant (usually pressurized water) to a steam generator, where the heat is transferred to a secondary water system that creates steam to drive the submarine's turbines. Nuclear-power plants are "refueled" by replacement of the uranium core in their nuclear reactor. The cores now installed in nuclear submarines can propel the ship for distances as great as 400,000 miles (640,000 km) before needing to be replaced.

*Weapons.* The primary weapon of the submarine has traditionally been the torpedo (*q.v.*), a self-propelled underwater missile that is launched from the submarine, travels through the water, and explodes when it hits another vessel. Modern submarines are fitted with internal torpedo-launching tubes 21 inches (53 cm) in diameter and about 21 feet (6.4 m) long. The tubes are horizontal in the bow or amidships, with some submarines also having stern tubes. Each tube has doors at both ends so that the inner door can be opened when the outer door is closed and vice versa, permitting firing and reloading without water entering the submarine. Most torpedoes today are intended for use against other submarines. They either home in on their target acoustically, using self-contained active sonar, or are guided by electronic commands passed to them through a threadlike wire that is paid out behind the torpedo as it travels away from the launching submarine.

Another antisubmarine weapon is the rocket-launched depth bomb. Fired while the craft is submerged, this weapon leaves the water and travels through the air on a ballistic trajectory. The weapon reenters the water an estimated 25 to 30 miles (40 to 48 km) from the launching submarine, and its nuclear warhead detonates, killing any submarine within 1 or 2 miles (1.5 or 3 km).

Underwater-launched cruise missiles are designed for short-range (450 miles [720 km]) use against surface ships or medium-range (1,400 miles [2,500 km]) attack against land targets. The latter type, which includes the U.S. Tomahawk and the Soviet SS-N-21, can carry a nuclear warhead of up to 200 kilotons.

Submarine-launched ballistic missiles (or SLBMs) are strategic weapons intended for use against cities and other fixed land targets. Such missiles are carried only by nuclear-powered submarines, which are called "strategic" submarines to distinguish them from the ship- and submarine-killing "attack" submarines. SLBMs are launched underwater from vertical tubes aft of the sail structure. To accommodate as many as 24 of these weapons, strategic submarines were built larger than most modern cruisers. The U.S. Trident II SLBM had a range of 6,500 nautical miles (12,000 km) and carried up to 14 independently targetable warheads, each containing a 150-kiloton nuclear device. The Soviet SS-N-20 SLBM had a range of 4,500 nautical miles (8,300 km) and carried up to 10 warheads of 100-kiloton strength. Such weaponry armed each modern strategic submarine with more explosive power than was used by all the combatant nations in World War II.

**submarine canyon,** any of a class of narrow, steep-sided valleys cut into continental slopes. Submarine canyons are so called because they resemble river canyons on land.

A brief treatment of submarine canyons follows. For full treatment, *see* MACROPAEDIA: Oceans.

Undersea canyons are found along the slopes of most continental margins. They also occur along the slopes of the Hawaiian Islands and possibly certain other ocean islands. The majority of these V-shaped depressions have steep, rocky walls thousands of metres high. Those of the Grand Bahama Canyon, which are thought to be the highest, rise nearly 5 km (3 miles) from the canyon floor. The walls of the Grand Canyon of the Colorado River, by comparison, measure about 1.6 km (1 mile) high. Most submarine canyons extend only about 48 km (30 miles) or less in length, but a few are more than 320 km (200 miles) long. They usually are many kilometres in width, as, for instance, the Grand Bahama Canyon, which measures 37 km (23 miles) at its widest point.

A relatively large number of submarine canyons are located directly off river canyons of adjacent land areas and may have once been connected to the latter. Yet, in most cases, the characteristics of the submarine variety and those of the nearby land canyons are quite distinct. The submarine canyons, for example, tend to have steeper side slopes, much higher gradients, and considerably narrower floors. Moreover, the drainage pattern of submarine canyons differs from that of their terrestrial counterparts. The submarine canyons have a substantial number of tributaries at their heads but generally do not have as many tributaries in their lower courses as do the land canyons.

There exist at the mouths of many submarine canyons enormous fanlike sediment deposits similar to the alluvial fans associated with many river canyons. The sediments of such a marine fan appear to have been channeled down the canyon by large-scale turbidity currents—*i.e.,* gravity-induced underflows of denser water, known as density currents, in which the density difference is caused by suspended debris.

For years the origin of submarine canyons has been the subject of much debate among investigators. Various ideas have been proposed, but prevailing theory favours subaerial erosion as the starting point for a good number of undersea canyons. Such erosion is thought to have begun with the lowering of sea level during the glaciations of the Pleistocene Epoch (about 1,600,000 to 10,000 years ago). It is perceived, however, that subaerial erosion alone could scarcely have excavated deep canyons that extend down to the seafloor. Evidence seems to suggest that the principal agents responsible for the formation of submarine canyons are marine processes, most notably the erosion and transportation of sediments by turbidity currents activated by the slumping of unconsolidated rock material near the heads of the canyons.

*Where the same name may denote a person, place, or thing, the articles will be found in that order*

**submarine fan,** accumulation of land-derived sediment on the deep seafloor; in configuration, a fan is like the section of a very low cone, with its apex at the lower mouth of a submarine canyon incised into a continental slope. Submarine canyons have steep courses with high walls and funnel occasional dense slurries of water and terrigenous sediment (turbidity currents) to the abyssal seafloor. Upon reaching the base of the submarine canyon, the sudden loss of gradient and confinement lessens the velocity of a turbidity current, and the suspended matter begins to drop out of suspension. Finer and finer particles are deposited as the turbidity current continues to decelerate down the fan. Thus, the sediments

of a submarine fan consist largely of successive layers of sandy material, each of which grades upward into finer material. Submarine fan valleys, with low relief and natural levees, commonly occur on submarine fans, branching outward and downward into distributary channels, which serve to distribute the turbid migrating laterally in much the same way that the distributaries of a river delta do. Several fans may coalesce laterally, forming a continental rise.

**submarine fracture zone,** long, narrow, and mountainous submarine lineation that generally separates ocean-floor ridges that differ in depth by as much as 1.5 km (0.9 mile).

The largest fracture zones, in the eastern Pacific, are several thousand kilometres long and 100 to 200 km (60 to 125 miles) wide and possess several kilometres of vertical relief. The Pacific fracture zones are a complex of ridges and intervening troughs hundreds of kilometres long and tens of kilometres wide. Numerous shorter fracture zones in the Atlantic are associated with the Mid-Atlantic Ridge. In the Atlantic and Pacific oceans, the fracture zones are nearly parallel, trending almost east–west. Indian Ocean bathymetry has not been as well studied, but several north–south fracture zones comparable to the east Pacific features have been delineated.

The ocean floors possess remarkably regular striped patterns of variations in magnetic intensity, displaying a striking mirror-image symmetry across ridge or rise axes. The apparent offsets of ridge crests along fracture zones are duplicated by offsets in the magnetic stripes. Off North America, the Pacific seafloor lacks a mid-oceanic ridge, but there the magnetic stripes also appear offset, by as much as 1,175 km (730 miles) along the Mendocino Fracture Zone. Earthquakes do not occur along fracture zones except where they offset an oceanic ridge or rise axis.

The relationships between fracture zones and magnetic and seismic phenomena can be explained by the theory of plate tectonics (*q.v.*), notably in terms of the mechanism of seafloor spreading. According to this theory, oceanic rises and ridges are centres of spreading along which volcanic material from the Earth's mantle continually rises and is emplaced as successive vertical slabs. As each slab solidifies and cools, the magnetic minerals in the new oceanic crust become magnetized in accordance with the prevailing orientation and alignment of the Earth's fluctuating magnetic field. The newly formed slab is split continuously along the spreading centre, and the halves become integral parts of two rigid plates moving away from each other. Thus, that portion of a fracture zone along an offset ridge axis is a fault boundary between the oppositely moving plates and is called a ridge–ridge transform fault. The differential movement along a transform fault agrees with the fault motions determined by seismic analyses. Differential movement and earthquakes do not occur beyond an offset because the seafloor areas on both sides of the fracture zone in such localities are parts of single lithospheric plates with unified motion.

**submarine gap,** also called ABYSSAL GAP, steep-sided furrow that cuts transversely across a ridge or rise; such a passageway has a steeper slope than either of the two abyssal plains it connects. Grooves known as interplain channels exist in many submarine gaps; the sediments in these channels are continuously graded. The graded sediments, in conjunction with the gradient and the furrowed topography of the gaps, suggest that turbidity currents flow through the gaps, from the higher abyssal plain to the lower. Turbidity currents transport and differentially deposit sedimentary material, while eroding the interplain channels.

**submarine mine,** underwater weapon designed to explode when a target presents itself. *See* mine.

**submarine plateau:** *see* oceanic plateau.

**submarine slump,** in a submarine canyon or on a continental slope, relatively rapid and sporadic downslope composed of sediment and organic debris that has built up slowly into an unstable or marginally stable mass. The greatest documented distance that an individual slump has transported sediment is 120 m (400 feet), in Scripps Canyon off La Jolla, Calif. After an individual slump in a canyon, however, the material tends to continue falling in a series of slumps until the sediment mass attains a lesser, more stable slope. A slumping episode may trigger other slumps farther down the canyon or may create turbid, dense slurries of water and sediment, which flow downslope as turbidity currents.

**submissive behaviour,** form of animal behaviour in which one individual attempts through appeasement displays to avoid injury by a dominant member of its own species. Appeasement displays are commonly found in species that are well armed (*e.g.,* carnivores) and social. The displays, even when performed by adult males, commonly incorporate elements of infantile behaviour (*e.g.,* in wolves, rolling over and begging for food) or of precopulatory behaviour (*e.g.,* in baboons, presenting the buttocks to the dominant animal). Sometimes the submissive animal exposes its most vulnerable spot, such as the throat, to the dominant animal.

Submissive displays, and their calming effect on the dominant animal, have evolved because they prevent fighting that might result in unnecessary injury to members of a social group dependent on each other for their welfare. *See also* dominance hierarchy.

**suboscine,** in general, any bird of the suborders Eurylaimi, Tyranni, and Menurae of the order Passeriformes (perching birds, or passerines) as distinguished from an oscine, or songbird (*q.v.*), a member of the suborder Passeres. The term suboscine implies, perhaps rightly, that birds of this group are more primitive in anatomy and behaviour than the oscines, which are usually considered the most highly specialized of birds.

**Subotica,** Hungarian SZABADKA, town in the autonomous *pokrajina* (province) of Vojvodina in Serbia, Serbia and Montenegro. It lies along the Belgrade–Budapest railway line near the Hungarian border. It is the market centre of the Bačka, a fertile agricultural district in which paprika is a specialty. The town is also an industrial centre, with a large thermal-power station. Leading industries include electrometallurgy, chemicals, and plastics. The town has several advanced vocational schools and economics and law faculties. Subotica was first mentioned in 1391, and it was included in Austria's military frontier after the defeat of the Turks in the late 17th century. In spite of its large population of Hungarian descent, it became part of Yugoslavia in 1918. The town is home to the economics faculty of the University of Novi Sad. Pop. (2002) 99,981.

**subpoena,** formal instrument issued by a court, grand jury, legislative body or committee, or a duly authorized administrative agency, commanding an individual to appear before it at a specific time to give testimony, oral or written, for the party named in the document. The subpoena is used only in common-law countries, but it is similar to the citation or *vocatio in jus* of civil or canon law. A *subpoena duces tecum* commands the recipient to present in court certain evidence, usually documents or papers, that is necessary to the successful resolution of the controversy.

**Subrahmaṇya** (Hindu god): *see* Skanda.

**Subrahmaṇya C., Bharati** (Tamil writer): *see* Bharati, Subrahmaṇya C.

**subsidence,** sinking of the Earth's surface in response to geologic or man-induced causes. When subsidence occurs in great belts, providing troughs for the accumulation of sediments, the resulting features are termed geosynclines; nonlinear subsidence produces basins and irregular depressions. Subsurface solution during cave formation may lead to a series of subsidence features at the ground surface, which, collectively, are termed karst (*q.v.*) topography. Similar effects can be produced by mining or by the extraction of water or petroleum by means of wells. Subsidence also has been produced by the irrigation of virgin areas of alluvial deposits; initial water penetration causes reorientation of constituent particles and a consequent compaction of sediment in the wetted areas. *See also* geosyncline.

**subsidy,** a direct or indirect payment, economic concession, or privilege granted by a government to private firms, households, or other governmental units in order to promote a public objective. Identification of a subsidy is often complicated because of the variety of subsidy instruments, the multiplicity of the objectives they are designed to serve, and the complexity of their effects.

Subsidies to transportation, housing, agriculture, mining, and other industries have been instituted on the grounds that preservation or expansion of these industries, even at a cost to the general public, is in the public interest. Subsidies to the arts, sciences, humanities, and religion have also been instituted in many nations because of the inability of the private economy to support these functions at a level consistent with public policy.

The term also includes grants of money or other aid made by a central government to a local one to promote objectives in which the central government has an interest (*e.g.,* grants-in-aid). More broadly defined, subsidies include welfare payments designed to ameliorate inequalities in the distribution of income and also other governmental programs designed to mitigate the effects of market forces.

Regardless of the form that subsidies take, their purpose is to alter the results created by otherwise free markets and unimpeded competition in a direction considered more consistent with the objectives of public policy. The effect of subsidies is to encourage the growth of subsidized industries relative to industries that do not receive subsidies and thus to alter the uses to which an economy puts its resources.

Subsidies have a long history in all nations. They were extensively employed by governments during the mercantilist period preceding the Industrial Revolution, when it was thought that the accumulation of gold through a favourable balance of trade required the protection of domestic manufacturers. Such protectionist doctrines have often been viewed with skepticism. Nevertheless, protectionism continues as a part of national economic policy in most nations of the world. In nations in which a strong central government influences the price and production policies of domestic industries, the subsidy device is replaced by comprehensive economic planning.

Subsidies are implemented through a variety of financial techniques, such as (1) direct payments in cash or kind, (2) governmental provision of goods or services at prices below the normal market price, (3) governmental purchase of goods or services at prices in excess of the market price, and (4) tax concessions and similar inducements. In addition, there are numerous governmental policies that have subsidy effects, such as regulatory statutes

that soften the full force of competition, policies that require the purchase of goods from favoured producers or nations, and protective wage and price legislation.

A distinction is sometimes made between direct, or visible, subsidies (such as direct payments for ship construction and airline operation), which are easy to identify and measure, and indirect, or concealed, subsidies (such as price ceilings or floors, tariffs, and tax concessions), which are difficult to identify and always difficult to measure. Historically, direct subsidies have been used most widely to promote the development of the transportation industries. All nations have viewed ocean shipping and aviation as important instruments of defense and foreign policy, and the development of land transportation has been considered a prerequisite for domestic economic development. Indirect subsidies arise when governments buy directly from private producers at higher-than-market prices, maintain higher prices through manipulation of markets, provide services to private enterprises at prices below the cost of providing the service, or grant special tax concessions.

Although subsidies are initiated and justified in terms of benefits to the general public, they result in either a higher level of general taxation or higher prices for consumer goods. They may also encourage the preservation of inefficient producers. The test of the desirability of a subsidy hinges on a comparison of the public benefits (which are usually diffuse and difficult to measure) with their costs in terms of higher prices, taxes, and inefficiency.

**subsistence farming,** form of farming in which nearly all of the crops or livestock raised are used to maintain the farmer and his family, leaving little, if any, surplus for sale or trade. Preindustrial agricultural peoples throughout the world have traditionally practiced subsistence farming. Some of these peoples moved from site to site as they exhausted the soil at each location. As urban centres grew, agricultural production became more specialized and commercial farming developed, with farmers producing a sizable surplus of certain crops, which they traded for manufactured goods or sold for cash.

Subsistence farming persists today on a relatively wide scale in various areas of the world, including large parts of sub-Saharan Africa. Subsistence farms usually consist of no more than a few acres, and farm technology tends to be primitive and of low yield.

**substantive dye:** *see* direct dye.

**substitution reaction,** any of a class of chemical reactions in which an atom, ion, or group of atoms or ions in a molecule is replaced by another atom, ion, or group. An example is the reaction in which the chlorine atom in the chloromethane molecule is displaced by the hydroxide ion, forming methanol:

$$CH_3Cl + {}^-OH \rightarrow CH_3OH + Cl^-$$

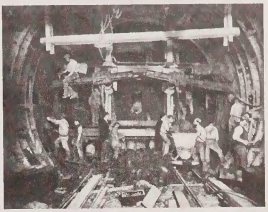
If the chlorine atom is displaced by other groups—such as the cyanide ion ($^-CN$), the ethoxide ion ($C_2H_5O^-$), or the hydrosulfide ion ($HS^-$)—chloromethane is transformed, respectively, to acetonitrile ($CH_3CN$), methyl ethyl ether ($CH_3OC_2H_5$), or methanethiol ($CH_3SH$). Thus an organic compound such as an alkyl halide can give rise to numerous types of organic compounds by substitution reactions with suitable reagents.

Substitution reactions are divided into three general classes, depending on the type of atom or group that acts as the substituent. In one, the substituent is electron-rich and provides the electron pair for bonding with the substrate (the molecule being transformed). This type of reaction is known as nucleophilic substitution. Examples of nucleophilic reagents are the halogen anions ($Cl^-$, $Br^-$, $I^-$), ammonia ($NH_3$), the hydroxyl group, the alkoxy group ($RO^-$), the cyano group, and the hydrosulfide group. In the second type of substitution reaction, the substituent is deficient in electrons, and the electron pair for bonding with the substrate comes from the substrate itself. This reaction is known as electrophilic substitution. Examples of electrophilic species are the hydronium ion ($H_3O^+$), the hydrogen halides (HCl, HBr, HI), the nitronium ion ($NO_2^+$), and sulfur trioxide ($SO_3$). Substrates of nucleophiles are commonly alkyl halides, while aromatic compounds are among the most important substrates of electrophiles. The third class of substitutions involves the reactions of free radicals with suitable substrates. Examples of radical reagents are the halogen radicals and oxygen-containing species derived from peroxy compounds.

**subtropical high,** one of several regions of semipermanent high atmospheric pressure located over the oceans near 35° latitude in both the northern and southern hemispheres of the Earth. The highs, which are apparently of dynamic rather than thermal origin, are most intense and closest to the poles in summer. The circulation around the highs is clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere. There is also, especially on the eastern and equatorward sides of the highs in the lower portions of the troposphere, a component of motion directed across the isobars (lines connecting points of equal atmospheric pressure) toward lower pressure. This low-level divergent motion is compensated by motion toward the centre at high levels and a broad zone of descending air, most noticeable over the eastern half of the highs. The subsiding air warms by compression and, coupled with cooling of the lowest layers overlying the cold ocean currents normally found off the west coasts of the continents, forms a pronounced temperature inversion (warm air over cold), called the trade-wind inversion. The inversion acts as a barrier to vertical convection and is largely responsible for the aridity and high frequency of fog found along the west coasts of the subtropical continents, especially in summer.

**subway,** also called UNDERGROUND, TUBE, or MÉTRO, underground railway system used to transport large numbers of passengers within urban and suburban areas. Subways are usually built under city streets for ease of construction, but they may take shortcuts and sometimes must pass under rivers. Outlying sections of the system usually emerge aboveground, becoming conventional railways or elevated transit lines. Subway trains are usually made up of a number of cars operated on the multiple-unit system.

The first subway system was proposed for London by Charles Pearson, a city solicitor, as part of a city-improvement plan shortly after the opening of the Thames Tunnel in 1843. After 10 years of discussion, Parliament authorized the construction of 3.75 miles (6 km) of underground railway between Farringdon



Workers excavating a "tube" for the London subway, with the help of a tunneling shield, *c.* 1900

Mary Evans Picture Library

Street and Bishop's Road, Paddington. Work on the Metropolitan Railway began in 1860 by cut-and-cover methods—that is, by making trenches along the streets, giving them brick sides, providing girders or a brick arch for the roof, and then restoring the roadway on top. On Jan. 10, 1863, the line was opened using steam locomotives that burned coke and, later, coal; despite sulfurous fumes, the line was a success from its opening, carrying 9,500,000 passengers in the first year of its existence. In 1866 the City of London and Southwark Subway Company (later the City and South London Railway) began work on their "tube" line, using a tunneling shield developed by J.H. Greathead. The tunnels were driven at a depth sufficient to avoid interference with building foundations or public-utility works, and there was no disruption of street traffic. The original plan called for cable operation, but electric traction was substituted before the line was opened. Operation began on this first electric underground railway in 1890 with a uniform fare of twopence for any journey on the 3-mile (5-kilometre) line. In 1900 Charles Tyson Yerkes, an American railway magnate, arrived in London, and he was subsequently responsible for the construction of more tube railways and for the electrification of the cut-and-cover lines. During World Wars I and II the tube stations performed the unplanned function of air-raid shelters.

Many other cities followed London's lead. In Budapest, a 2.5-mile (4-kilometre) electric subway was opened in 1896, using single cars with trolley poles; it was the first subway on the European continent. Considerable savings were achieved in its construction over earlier cut-and-cover methods by using a flat roof

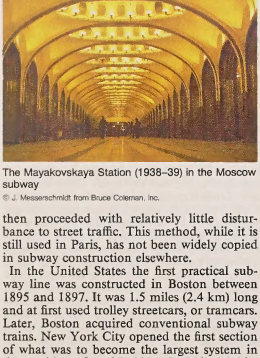


The Metro Center Station in Washington, D.C., subway, opened 1976

Stuart Cohen—Comstock, Inc.

with steel beams instead of a brick arch, and therefore, a shallower trench.

In Paris, the Métro (Chemin de Fer Métropolitain de Paris) was started in 1898, and the first 6.25 miles (10 km) were opened in 1900. The rapid progress was attributed to the wide streets overhead and the modification of the cut-and-cover method devised by the French engineer Fulgence Bienvenue. Vertical shafts were sunk at intervals along the route; and, from there, side trenches were dug and masonry foundations to support wooden shuttering were placed immediately under the road surfaces. Construction of the roof arch



The Mayakovskaya Station (1938–39) in the Moscow subway

© J. Messerschmidt from Bruce Coleman, Inc.

then proceeded with relatively little disturbance to street traffic. This method, while it is still used in Paris, has not been widely copied in subway construction elsewhere.

In the United States the first practical subway line was constructed in Boston between 1895 and 1897. It was 1.5 miles (2.4 km) long and at first used trolley streetcars, or tramcars. Later, Boston acquired conventional subway trains. New York City opened the first section of what was to become the largest system in the world on Oct. 27, 1904. In Philadelphia, a subway system was opened in 1907, and Chicago's system opened in 1943. Moscow constructed its original system in the 1930s.

In Canada, Toronto opened a subway in 1954; a second system was constructed in Montreal during the 1960s using Paris-type rubber-tired cars. In Mexico City the first stage of a combined underground and surface metro system (designed after the Paris Métro) was opened in 1969. In South America, the Buenos Aires subway opened in 1913. In Japan, the Tokyo subway opened in 1927, the Kyōto in 1931, the Ōsaka in 1933, and the Nagoya in 1957.

Automatic trains, designed, built, and operated using aerospace and computer technology, have been developed in a few metropolitan areas, including a section of the London subway system, the Victoria Line (completed 1971). The first rapid-transit system to be designed for completely automatic operation is BART (Bay Area Rapid Transit) in the San Francisco Bay area, completed in 1976. Trains are operated by remote control, requiring only one crewman per train to stand by in case of computer failure. The Washington, D.C., Metro, with an automatic railway control system and 600-foot- (183-metre-) long underground coffered-vault stations, opened its first subway line in 1976. Air-conditioned trains with lightweight aluminum cars, smoother and faster rides due to refinements in track construction and car-support systems, and attention to the architectural appearance of and passenger safety in underground stations are other features of modern subway construction.

**succession** (law): *see* inheritance.

**succinic acid,** also called BUTANEDIOIC ACID, a dicarboxylic acid of molecular formula $C_4H_6O_4$ that is widely distributed in almost all plant and animal tissues and that plays a significant role in intermediary metabolism. It is a colourless crystalline solid, soluble in water, with a melting point of 185–187° C (365–369° F).

Succinic acid was first obtained as a distillation product of amber (Latin: *succinum*), for which it is named. The common method of synthesis of succinic acid is the catalytic hydrogenation of maleic acid or its anhydride, although other methods are being used and investigated. Succinic acid has uses in certain drug compounds, in agricultural and food production, and in manufacturing.

**succubus,** female form of an incubus (*q.v.*).

**succulent,** any plant with fleshy, thick tissues adapted to water storage. Some succulents (*e.g.*, cacti) store water only in the stem and have no leaves or very small leaves, whereas others (*e.g.*, agaves) store water mainly in the leaves. Most succulents have deep or broad root systems and are native to either deserts or regions that have a semiarid season.

Stomata are small mouthlike structures on the surface of plant leaves and stems that allow for the uptake of carbon dioxide from the environment and the loss of water and oxygen to the environment. In succulent plants the stomata behave opposite what is normal; that is, they are closed during the day and open at night. As a result, the loss of water (transpiration) during the hot, dry daytime hours is minimized.

**Suceava,** *judeţ* (county), northeastern Romania, and bounded on the north by Ukraine. The Eastern Carpathian Mountains and the sub-Carpathians occupy the western two-thirds of the county, and the Suceava Plateau lies in the east. The Siret River flows southeastward, marking the county's eastern border, and the Suceava and Bistriţa rivers also drain southeastward. Suceava (*q.v.*) city is the county capital.

Industries in Suceava city and in other towns produce timber, textiles, leather goods, and foodstuffs. Agricultural activities consist of livestock raising and cereal growing. Towns in the county include Fălticeni, Siret, Rădăuţi, and Cîmpulung Moldovenesc. Several monasteries with frescoed exteriors are found in the area. Area 3,303 square miles (8,555 square km). Pop. (1992 prelim.) 700,800.

**Suceava,** city, capital of Suceava *judeţ* (county), northeastern Romania. Founded on a terrace above the right bank of the Suceava River before the 14th century, it was the capital of Moldavia from 1375 until 1565, when the capital was moved to Iaşi. During the reign of Stephen (Ştefan) the Great in the 15th century, Suceava developed as a trading centre and customs point, with many warehouses and a strong citadel. The town began to decline in importance after the Turks ravaged it in the 16th century. In 1775 the Turks ceded Suceava to Austria along with the rest of the Bukovina region, and in 1918 the city was reoccupied by Romania.

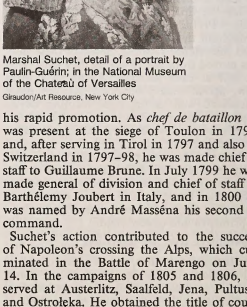
The city's historic monuments include the citadel, which has been excavated; the 14th-century Mirăuţi Church; the 16th-century Church of St. George (with fine frescoes); and the Church of St. Demetrius (with a massive bell tower). The city has a regional museum and library. Suceava's industries include meat processing, timber, and pulp and paper manufacture. Pop. (1992 prelim.) 114,355.

**Sucellus,** powerful and widely worshiped Celtic god; his iconographic symbols were usually his mallet and libation saucer, indicative of his powers of protection and provision. His Irish equivalent seems to have been the Dagda. Sucellus was possibly one of the Gaulish gods who were equated by Julius Caesar with the Roman god Dis Pater, from whom, according to Caesar, all the Gauls believed themselves to be descended. Sucellus was sometimes portrayed with a cask of liquid or with a drinking vessel, which may indicate that he was one of the gods who presided at the otherworld feast. He was also often accompanied by a dog.

**Suchan** (Russia): *see* Partizansk.

**Suchet, Louis-Gabriel,** DUKE (duc) D'ALBUFERA DA VALENCIA (b. March 2, 1770, Lyon, France—d. Jan. 3, 1826, Marseille), marshal of France, one of the most brilliant of Napoleon's generals, most notably as commander of the Aragon armies in the Peninsular War.

The son of a Lyon silk manufacturer, Suchet originally had intended to follow his father's business; but, having in 1792 served as a volunteer in the cavalry of the national guard, he manifested military abilities that secured



Marshal Suchet, detail of a portrait by Paulin-Guérin; in the National Museum of the Chateau of Versailles

Giraudon/Art Resource, New York City

his rapid promotion. As *chef de bataillon* he was present at the siege of Toulon in 1793, and, after serving in Tirol in 1797 and also in Switzerland in 1797–98, he was made chief of staff to Guillaume Brune. In July 1799 he was made general of division and chief of staff to Barthélemy Joubert in Italy, and in 1800 he was named by André Masséna his second in command.

Suchet's action contributed to the success of Napoleon's crossing the Alps, which culminated in the Battle of Marengo on June 14. In the campaigns of 1805 and 1806, he served at Austerlitz, Saalfeld, Jena, Pultusk, and Ostrołęka. He obtained the title of count on March 19, 1808, and soon afterward was ordered to Spain. He annihilated the British army at Maria on June 14, 1809, and on April 22, 1810, he defeated another force at Lerida. Suchet in 1812 conquered Valencia and received the title of Duke d'Albufera da Valencia (1812).

When the tide turned against the French, Suchet defended his conquests step by step until compelled to retire into France. By Louis XVIII he was made a peer of France, but, having rallied to Napoleon during the Hundred Days, he was deprived of his peerage in 1815.

**Suchos** (Egyptian god): *see* Sebek.

**Süchow,** Chinese (Wade-Giles) HSŪ-CHOU, also called T'UNG-SHAN, (Pinyin) XUZHOU, or TONGSHAN, city in northwestern Kiangsu *sheng* (province), China. Its site marks the approximate geographic border between the North China Plain and the Lower Yangtze Plain, the meeting place of wheat and rice as staple crops, respectively.

Süchow is located in the gap in the Shan-

tung Hills that forms a southwestern extension into the North China Plain. Through this gap flows the Fei-huang River, which joins the Ssu River and the Grand Canal, thus providing a water route southeastward to Ch'ing-chiang and the Yangtze River. The gap was utilized by a canal built in the 2nd century BC during the Han dynasty (206 BC–AD 220) to connect Lo-yang (in what is now Honan province) with the lower Huai River valley. The route, known as the Old Pien Canal, was replaced after the construction of the New Pien Canal in 607, which took a route farther southward. Süchow, nevertheless, remained a route centre and a major commercial city until the 12th century.

In this early period it was sometimes known as P'eng-ch'eng—the name of the county established there by the Ch'in dynasty (221–206 BC) in 220 BC. Besides being a transportation centre, it was a city of strategic value. Throughout the T'ang dynasty (618–907) it was a heavily garrisoned stronghold, protecting the vital supply line of the New Pien Canal from invasion by the semi-independent provincial governors of Shantung and Hopeh. During the Five Dynasties (907–960), it was also a hotly contested strategic base in struggles between the dynasties of the northeast and the independent states farther south.

During the 12th century, it declined somewhat until, in 1194, the Huang Ho abandoned its old course north of the Shantung Peninsula to flow through the gap at Süchow and join the old course of the Huai River at Ch'ing-chiang on its way to the sea. This development placed Süchow at the junction between the Huang Ho and the Grand Canal. A new canal, built in 1276 to supply the Mongol capital at Peking, also passed through Süchow. As the Grand Canal and its grain traffic gained in importance from the 14th century onward, Süchow regained its former prosperity. Under the Ch'ing dynasty (1644–1911/12) it was raised to the status of a superior prefecture, Hsü-chou. In the last years of the Ch'ing, like other towns on the Grand Canal, it lost a certain degree of its importance. In the 1850s, moreover, the Huang Ho returned to its old course, removing Süchow's westward waterway link.

In 1912 Süchow was joined by the railway to both Peking and the Yangtze (at Nanching [Nanking]). With the completion of the Lunghai Railway, it also became a rail junction between major east-west and north-south trunk railways. Another rail line runs east to the Yellow Sea port of Lien-yün-kang. In the period before World War II Süchow became a commercial and collecting centre for the agriculture of southwestern Shantung, southeastern Honan, northern Kiangsu, and Anhwei provinces. In 1938, during the Sino-Japanese War (1937–45), it was the site of a desperate battle, and, in the Communist Revolution of 1945–49, it was the site of the greatest and most decisive battle between the Communist and Nationalist armies, in which some 500,000 men were engaged on each side in bloody fighting (November 1948–January 1949) that ended in a Communist victory.

Since 1949 Süchow has developed not only as a regional commercial centre but also as the chief city of a mining district. It is the centre of a rich coalfield, with mines in the immediate vicinity at Hsia-ch'iao, Hsin-ho, Chia-wang, and Han-ch'iao. Süchow's chief industries are machine building, engineering, and cotton textiles. By the early 1970s it had also become the site of an important airport, with regular services to Peng, Shanghai, and Sian in Shensi. Pop. (1999 est.) 1,044,729.

**sucker,** any of the freshwater fishes constituting the family Catostomidae, similar to and closely related to the carp and minnows (Cyprinidae). There are about 80 to 100 species of suckers; except for a few species in Asia, all are North American. Many suckers are almost indistinguishable from minnows, but catostomids may often be recognized by the sucking, usually ventral mouth with protrusible lips.



Sucker (*Catostomus*)
Grant Heilman

Suckers live on the bottom of lakes and slow streams and feed by sucking up invertebrates and plants. Generally rather sluggish fishes, the species vary considerably in size. The lake chubsucker (*Erimyzon sucetta*), for example, is a small species up to 25 cm (10 inches) long; the bigmouth buffalo fish (*Ictiobus cyprinellus*), a large sucker, measures up to 90 cm in length and 33 kg (73 pounds) in weight. Suckers are bony but are fished commercially and to some extent for sport. The various genera are known by such names as hog sucker (*Hypentelium*), buffalo fish (*Ictiobus*), carpsucker (*Carpiodes*), and redhorse, or jumprock (*Moxostoma*).

**suckerfish** (fish): *see* remora.

**Suckert, Kurt Erich:** *see* Malaparte, Curzio.

**sucket fork,** small metal utensil used for eating sweetmeats, or sucket, with a two- or three-pronged fork at one end of the handle and a spoon bowl, usually of teaspoon size, at the other. A sucket fork is mentioned in Edward VI's inventory of 1549, but most of the few surviving English and American examples, which are usually made of silver, date from the late 17th century.

**sucking,** drawing of fluids into the mouth by creating a vacuum pressure in the oral cavity. Mammalian infants rely on this method of food ingestion until they are capable of eating more solid substances. A partial vacuum is created in the oral cavity by retracting the tongue to the back of the mouth. The rear portion of the tongue seals against the roof of the mouth, allowing liquids to be drawn into the front region. When the oral cavity is full, the tongue relaxes, and fluids flow back to the throat to be swallowed.

**sucking louse,** any small, wingless, flat insect of the suborder Anoplura, with more than 400 described species and worldwide distribution. The sucking louse has piercing and sucking mouthparts and lives on blood and tissue fluids of mammals as an ectoparasite (external parasite). The adult sucking louse, or true louse, glues her eggs, or nits, to the host's hair. The young, which resemble adults when they hatch, become sexually mature after several molts. The sucking louse ranges in colour from whitish to yellow and shows distinct host specificity. The presence of related lice on related groups of hosts may evidence parallel evolution of parasites and hosts.

The sucking louse *Pediculus humanus* infests the human race wherever hygienic practices are not maintained. In heavy infestations this insect, which is known as the human louse (*q.v.*), may cause serious skin irritations, but far more serious is its role as a vector of diseases such as typhus, relapsing fever, and trench fever. The pubic louse (*q.v.*) is found in the hair of the armpits, in the eyebrows and beard, and in the pubic region.

The more important sucking lice that attack domestic animals belong to the genera *Haematopinus* and *Linognathus*—*e.g.*, the hog louse, *H. suis;* the short-nosed cattle louse, *H. eurysternus;* the horse louse, *H. asini;* the long-nosed cattle louse, *L. vituli;* and the dog louse, *L. setosus.*

Lindane is an effective lice insecticide, but because it has neurotoxic effects, it must be used with caution. Pyrethrin and its synthetic derivative permethrin are newer treatments that are considered safer and more effective. Poisonous gases, chemical solutions, and heat sterilization are used to delouse clothing. Chemical dips or sprays are used on infested domestic animals. Predatory mites also help to control lice populations.

**suckling,** in mammals, the drawing of milk into the mouth from the nipple or teat of a mammary gland (*i.e.,* breast or udder). In human beings suckling is also referred to as nursing, or breast-feeding. Suckling is the method by which newborn mammals are nourished; it may last only 10–12 days, as in some rodents, or up to two years, as in the walrus. Milk composition may alter during the growth period, relative to the changing nutritional needs of the developing young. The underwater suckling of whales is accomplished by means of special muscles surrounding the teat. When the calf touches the nipple these muscles contract, squirting a jet of milk into its mouth.

The word suckling also denotes an animal that has not yet been weaned. Weaning is the withdrawal of access to milk; this process gradually accustoms the young to accept an adult diet. A mother animal frequently weans her offspring by responding with aggression when the young try to approach her. When the stimulus provided by suckling is withdrawn, lactation (milk production) ceases. *See also* lactation.

**Suckling, Sir John** (b. February 1609, Whitton, Middlesex, Eng.—d. 1642, Paris, France), English Cavalier poet, dramatist, and courtier, best known for his lyrics.

He was educated at Cambridge and inherited his father's considerable estates at the age of



Suckling, oil painting by an unknown artist; in the Ashmolean Museum, Oxford
By courtesy of the Ashmolean Museum, Oxford

18. He entered Gray's Inn in 1627 and was knighted in 1630. He became a prominent figure at court with a reputation for being "the greatest gallant of his time, and the greatest gamester both for bowling and cards"; and he is credited with having invented cribbage. He was a gentleman of the privy chamber to Charles I and a friend of the poets Thomas Carew, Richard Lovelace, and Sir William Davenant. When the war with the Scots broke out in 1639, Suckling raised a troop of soldiers, supplying them with horses at his own

expense, and accompanied Charles I on his ill-fated expedition. The costumes of Suckling's gaudy warriors and the troop's poor performance in the field were the subjects of much ridicule.

In 1641 Suckling took an active part in the plot to rescue the Earl of Strafford from the Tower. When the plot was discovered, Suckling fled to France and is believed to have committed suicide.

Suckling was the author of four plays, the most ambitious of which is the tragedy *Aglaura,* magnificently staged in 1637 and handsomely printed at the author's expense (1638); the best is the lively comedy *The Goblins* (1638). They all contain echoes of Shakespeare and Beaumont and Fletcher.

His reputation as a poet rests on his lyrics, the best of which justifies the description of him as "natural, easy Suckling." He inherited from Donne the tradition of the "anti-platonic" deflation of high-flown love sentiment and uses it with insouciance.

> Out upon it I have loved
> Three whole days together;
> And am like to love three more,
> If it prove fair weather.

He can even be cynically chiding in such songs as this:

> Why so pale and wan, fond lover?
> Prithee, why so pale?
> Will, when looking well can't move her,
> Looking ill prevail?
> Prithee, why so pale?

*A Session of the Poets* (1637; published 1646) is an amusing skit for which he probably took a hint from an Italian work by Traiano Boccalini; it is the prototype of a long line of similar works in the 17th and 18th centuries. His masterpiece is undoubtedly "A Ballad Upon a Wedding," in the style and metre of the contemporary street ballad. Suckling's extant letters are in lively, colloquial prose that anticipates that of the Restoration wits. The first published collection of Suckling's works was *Fragmenta Aurea* (1646; enlarged 1658). The standard edition, 2 vol. (1971), was done by T. Clayton and L.A. Beaurline.

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**Sucksdorff, Arne** (b. Feb. 3, 1917, Stockholm—d. May 4, 2001, Stockholm), Swedish motion-picture director important in the post-World War II revival of the Swedish cinema because of his internationally acclaimed sensitivity in photographing nature. His patiently photographed flowers, insects, birds, and animals are composed into films in which the rhythm of nature is dominant and man is only one of nature's creatures.

Sucksdorff studied natural sciences and then turned to painting at the Reihmann Art School, Berlin, but his main interest was photography. After his first short film, *Augustirapsodi* (1939), won national awards, he was offered a contract by Svensk Filmindustri (1939–53), Sweden's leading studio.

His early shorts were marked by the love of nature that had been traditionally characteristic of the finest Swedish silent films. Outstanding among them were: *Trut* (1944; "The Gull"), an account of a Baltic sea-bird community with the gull as the villain; *Skuggor över snön* (1945; "Shadows over the Snow"), about a bear hunt through the forest; *Människor i stad* (1946; "Symphony of a City"), which won the Academy Award for best short subject; *En kluven värld* (1948; "A Divided World"), set in a Swedish forest on a winter night; *Uppbrott* (1948; "The Open Road"), a study of the life of the Swedish Gypsy; and *Vinden och floden* (1950; "The Wind and the River"), filmed in India.

Sucksdorff wrote, directed, edited, and produced his first feature-length film, *Det stora äventyret* (1953; *The Great Adventure*), the story of life on a Swedish farm, using no professional actors. It further enhanced his reputation, as did such later features as *En djungelsaga* (1957; *The Flute and the Arrow*), *Pojken i trädet* (1961; *The Boy in the Tree*), and *Mit hem är Copacabana* (1965; *My Home is Copacabana*).

**sucrase,** also called INVERTASE, any member of a group of enzymes present in yeast and in the intestinal mucosa of animals that catalyze the hydrolysis of cane sugar, or sucrose, to the simple sugars glucose and fructose.

Granules of sucrase localize in the brush border (a chemical barrier through which food is absorbed) that coats the intestinal villi. If sucrase is absent from the body there is intolerance to sucrose, and other sugars (maltose or lactose) must be substituted for sucrose in the diet to provide adequate nutrition.

**Sucre,** legal capital of Bolivia and capital of Chuquisaca department. Sucre lies in a fertile valley crossed by the Río Cachimayo, at 9,153 feet (2,790 m) above sea level. It was founded in 1539 by the conquistador Pedro de Anzúrez on the site of a Charcas Indian village and has been variously called La Plata (the Spanish colonial name), Charcas, and Chuquisaca (the former indigenous name for the site probably meaning "headquarters of the Charcas"). Many colonial churches survive, including the 17th-century Basílica Metropolitana. In 1561 the city became the capital of Charcas *audiencia* (judicial and military territory of Upper Peru) and in 1609 the seat of an archdiocese. Universidad Boliviana Mayor, Real y Pontificia de San Francisco Xavier (St. Francis Xavier University of Bolivia), one of the oldest in South America, was founded there in 1624.

An early (1809) revolutionary centre, the city became the capital of Bolivia in 1839. The following year it was renamed in honour of Antonio José de Sucre. In 1898 an effort to move the capital to La Paz resulted in a civil war. The outcome was a compromise: Sucre remained the capital in name and law and seat of the Supreme Court, but the executive and legislature moved to La Paz. The museum in the Casa de la Independencia (main plaza) has Bolivia's Declaration of Independence. Roads to Potosí and Cochabamba, a pipeline to the petroleum fields of Camiri, and secondary roads to nearby valleys have made Sucre a commercial and agricultural centre of growing importance. Pop. (2000 est.) 192,238.

**Sucre,** department, northern Colombia, in the Caribbean coastal plain, crossed by the Cauca and San Jorge rivers. It was created in 1966. Except for low hills in the north, the entire department is composed of lowlands. Cattle raising is widespread. Principal crops include rice, corn (maize), bananas, and tobacco. Shrimp trawlers operate in the Gulf of Morrosquillo. There are some cement factories. The Cartagena–Medellín highway traverses Sucre from north to south, passing through Sincelejo (*q.v.*), the departmental capital. Area 4,215 square miles (10,917 square km). Pop. (1997 est.) 749,152.

**Sucre,** state, northeastern Venezuela, bounded north and west by the Caribbean Sea and east by the Gulf of Paria. It is traversed by the northeastern highlands. Despite rugged terrain and excessive dryness in the west, Sucre is one of Venezuela's important agricultural states. Among leading crops are cacao, sweet potatoes, bananas, coconuts, and coffee. Fishing is important in the Caribbean, and an important seafood industry has been developed, particularly in Cumaná (*q.v.*), the state capital and a commercial port and regional industrial centre. Sucre's mineral resources include asphalt from Lake Guanoco, salt from the Península de Araya, and gypsum from near Macuro. Area 4,600 square miles (11,800 square km). Pop. (1997 est.) 799,935.

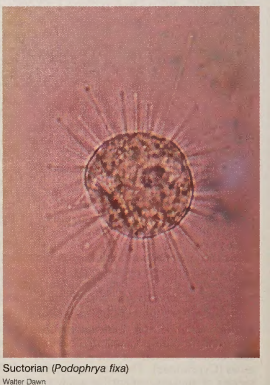
**Sucre, Antonio José de** (b. Feb. 3, 1795, Cumaná, New Granada [now in Venezuela]—d. June 4, 1830, Berruecos, Colom.), liberator of Ecuador and one of the most respected leaders of the Latin American wars for independence from Spain.

At the age of 15 Sucre entered the struggles for independence in Venezuela and Colombia. He displayed great skill at military tactics, and at the age of 26 the Venezuelan leader of Latin American revolt against Spanish rule, Simón Bolívar, appointed him, with the rank of general, to free southern Gran Colombia (now Ecuador) from Spanish control. Leaving Colombia, he marched along the coast to Guayaquil and proclaimed it a protectorate of Colombia. Then he marched to Quito, 10,000 feet (3,000 metres) above sea level, where he defeated the royalist forces on May 21, 1822. Proceeding southeast, with the help of Bolívar and a force of about 5,800 men he won the Battle of Junín, in Colombia (August 1824), and routed a 9,000-man royalist army at Ayacucho, Peru, compelling the Spanish viceroy to withdraw his forces from Peru. A few insubordinates still held Charcas in Upper Peru (now Bolivia); early in 1825 Bolívar ordered Sucre to dislodge them, which he did.

Sucre then set up a Bolivian government under a complicated constitution written by Bolívar, with Sucre as president. Eager to retire to Ecuador, he agreed to serve only two years of the lifetime tenure. He tried to establish a stable government in Bolivia, but he soon became the target of opposition from differing political factions. A local uprising at Chuquisaca in 1828 and an invasion by Peruvian troops caused him to resign the presidency and retire to Ecuador. He was called, however, to defend Gran Colombia against the Peruvians, whom he defeated in 1829. He was called again the following year to preside over the "Admirable Congress" in Bogotá, a last unsuccessful effort to maintain the unity of Ecuador, Colombia, and Venezuela. While returning home, Sucre was assassinated. The assassins were rumoured to be agents of José María Obando (*q.v.*), but no proof was ever found.

**sucrose:** *see* sugar.

**suctorian,** any protozoan of the ciliate order Suctorida, which includes both freshwater and saltwater organisms. Suctorians are extremely widely distributed in nature. The young stage



Suctorian (*Podophrya fixa*)
Walter Dawn

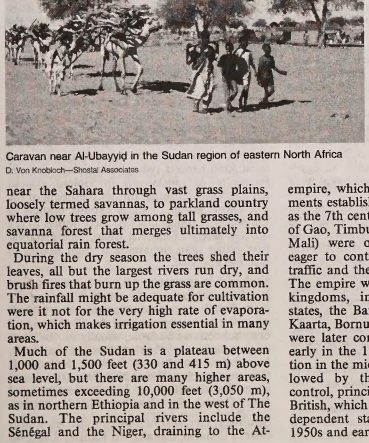
is free-swimming; the adult has no body cilia and is generally nonmotile (permanently attached), with tentacles instead of a mouth for feeding. The tentacles may be distributed over the entire body, as in *Podophrya,* or they may be arranged in discrete areas (*e.g.,* in *Ophryodendron* they are grouped on the ends of "arms").

Adult suctorians attach themselves to an object, generally by means of a noncontractile stalk; they then catch and suck the contents of other ciliates and rotifers with their tentacles. Often the prey becomes paralyzed immediately after capture.

Suctorians produce young by either internal or external budding; most other ciliates, by contrast, reproduce by binary fission. The sexual process of conjugation (interchange of nuclear substance between individuals) is also common among suctorians. A few genera (*e.g., Allantosoma, Endosphaera*) are parasitic on protozoans known as peritrichs. *Cyathodinium* lives in the intestinal tract of guinea pigs.

**Sudan,** the vast tract of open savanna plains extending across Africa between the southern limits of the Sahara (desert) and the northern limits of the equatorial rain forests. The term derives from the Arabic *bilād as-sūdān* ("land of the black peoples") and has been in use from at least the 12th century. The northern reaches of the Sudan comprise the semiarid region known as the Sahel (*q.v.*).

The Sudan extends for more than 3,500 miles (5,500 km) west-to-east across Africa from Cape Verde on the Atlantic to the highlands of Ethiopia and the Red Sea, and between about latitudes 8° and 16° N. It borders the Sahara on the north and extends southward to the forests of West Africa and the Congo River basin. The Sudan's mean annual rainfall varies between 10 inches (250 mm) in the north and 60 inches (1,500 mm) in the south, with the hottest months usually from June to September and with a pronounced, and often very prolonged, dry season. Temperatures are generally high throughout the year. Vegetation ranges from semidesert steppe and thorn scrub



Caravan near Al-Ubayyiḍ in the Sudan region of eastern North Africa
D. Von Knobloch—Shostal Associates

near the Sahara through vast grass plains, loosely termed savannas, to parkland country where low trees grow among tall grasses, and savanna forest that merges ultimately into equatorial rain forest.

During the dry season the trees shed their leaves, all but the largest rivers run dry, and brush fires that burn up the grass are common. The rainfall might be adequate for cultivation were it not for the very high rate of evaporation, which makes irrigation essential in many areas.

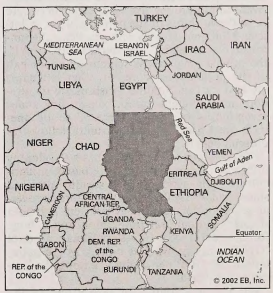
Much of the Sudan is a plateau between 1,000 and 1,500 feet (330 and 415 m) above sea level, but there are many higher areas, sometimes exceeding 10,000 feet (3,050 m), as in northern Ethiopia and in the west of The Sudan. The principal rivers include the Sénégal and the Niger, draining to the Atlantic, and the Nile and its tributaries, which derive much of their water from areas beyond the Sudan region. Lake Chad in the western Sudan is a centre for interior drainage.

The people of the Sudan are predominantly black, and, though these people are primarily Bantu-speaking, there is also a considerable admixture of Arabic- and Berber-speaking peoples, the degree of their influence decreasing westward and southward toward the Gulf of Guinea. Many of the people are Muslims. The density of population is generally low. Livestock raising is a major economic activity, and considerable numbers of people are still (though decreasingly) nomadic or seminomadic, moving with their herds in search of pasturage. Movement across the grasslands is generally uninterrupted, especially during the dry season, and the continuity of a similar environment along the southern boundaries of the Sahara for vast distances has encouraged people to move from the north and east from early times. At first they traveled with the aid of horses and oxen, but migration was greatly expanded and probably accelerated with the introduction of the camel about AD 300, especially as camel caravans were able to cross the Sahara. Thus, the Sudan was linked with the Mediterranean coastlands, whose manufactured articles, together with Saharan salt, were exchanged for the gold, kola nuts, and slaves of Guinea.

From Arab historians something is known of some of the powerful states that were established by military rule, the largest and most enduring of which were associated in the western Sudan with the termini of the desert trade routes. Ancient Ghana was created by Jewish or Berber settlers about AD 300 in the area west of Timbuktu (Tombouctou) in modern Mali, though its greatest years came when it was ruled by the black Soninke (Sarakolé) dynasty. Almoravid attacks in the 11th century reduced its power and led to its replacement by the Mali, or Mandingo, empire, centred on the upper Niger River. Mali in turn was overthrown during the latter part of the 15th century by the expansion of the Songhai, or Gao, empire, which developed from Berber settlements established on the lower Niger as early as the 7th century. In 1591 the Songhai towns of Gao, Timbuktu, and Djenné (all in modern Mali) were occupied by Moroccan troops eager to control both the lucrative caravan traffic and the long-established trade in gold. The empire was replaced by numerous black kingdoms, including the Mossi-Dagomba states, the Bambara kingdoms of Ségou and Kaarta, Bornu, and the small Hausa states that were later conquered by the Muslim Fulani early in the 19th century. European penetration in the mid- and late 19th century was followed by the establishment of political control, principally that of the French and the British, which lasted until the emergence of independent states in the region during the 1950s and early '60s.

On the eastern side of the continent, ancient Egypt's links with the Sudan region were generally strong, notably with Nubia. After the Nubian empire had been overrun by Muslims, it was replaced by kingdoms such as those of Dongola, Darfur, and Sennar. Later there was invasion from Egypt and, in 1899, the establishment of the Anglo-Egyptian condominium. The independent Republic of the Sudan was created in 1956.

**Sudan, The,** officially REPUBLIC OF THE SUDAN, Arabic AS-SŪDĀN, or JUMHŪRĪYAT AS-SŪDĀN, Africa's largest country, located in




The Sudan

northeast Africa. The Sudan is about 1,270 miles (2,040 km) long from north to south and is about 980 miles (1,577 km) at its widest from west to east. It is bordered on the north by Egypt; on the northeast by the Red Sea; on the east by Ethiopia; on the south by Congo (Kinshasa), Uganda, and Kenya; on the west by Chad and the Central African Republic; and on the northwest by Libya. The capital is Khartoum. Area 966,757 square miles (2,503,890 square km). Pop. (2000 est.) 35,080,000.

A brief treatment of The Sudan follows. For full treatment, *see* MACROPAEDIA: Sudan, The.

For current history and for statistics on society and economy, SEE BRITANNICA BOOK OF THE YEAR.

*The land.* The Sudan is composed of an immense plain with the rock desert of the Sahara in the north; an area of undulating sand dunes in the west; and a clay plain with enormous swamps and isolated mountains in the south and central parts. Mount Kinyeti (at 10,456 feet [3,187 m], the highest point in The Sudan) lies along the Uganda border in the south. The Nile River is the country's principal river, meandering through the country from south to north. All streams and rivers of The Sudan drain either into or toward the Nile and its major tributaries.

The Sudan's hot climate ranges from a tropical continental type in the northern desert region to equatorial in the southern part. Annual rainfall varies from almost nothing in the north to more than 57 inches (1,465 mm) in the extreme south where the rainy season lasts eight or nine months (April–November).

Vegetation in The Sudan gradually increases north to south, from the deserts in the north to the semiarid shrublands and savannas of the south-central belt to the tropical rain forests of the far south. Wildlife includes lion, leopard, elephant, giraffe, zebra, hippopotamus, chimpanzee, and numerous varieties of antelope; the tsetse fly is found south of latitude 12° N.

*The people.* The Sudan's population is growing at about the same high rate as that of Africa as a whole. Population density is

low overall, but with much higher densities concentrated along the Nile and its major tributaries and in the national capital area of Khartoum. As a consequence of the high natural rate of increase, the population is predominantly young, with more than two-fifths less than 15 years of age. Birth, death, and infant mortality rates are high. Life expectancy in The Sudan is relatively low by world standards, about 57 years. The principal cities in The Sudan are Khartoum and Omdurman, both situated along the Nile.

The Sudan's ethnic makeup is complex, but certain generalizations can be made. Muslim Arab ethnic groups live in the northern and central two-thirds of the country, while Nilotic and Sudanic peoples who practice either animism or Christianity live in the south. Arabic, the official language, is spoken by about half of the population; scores of other languages are also spoken. Sunnite Muslims are the predominant religious group, constituting about seven-tenths of the population; about one-sixth are Christian, and one-tenth follow traditional beliefs.

*The economy.* The Sudan has a developing mixed economy that is largely based on agriculture. The economy has steadily declined since the late 1970s, when the failure of several ambitious development projects left both stagnant agricultural production and a large foreign debt. The gross national product (GNP) is not growing as rapidly as the population; the GNP per capita is among the lowest in the world.

Agriculture accounts for nearly half of the country's gross domestic product (GDP) and employs almost two-thirds of the workforce. The Sudan has large expanses of arable land, but only about 15 percent of this is under cultivation owing to inadequate water sources and transport difficulties. The Gezira Scheme provides water for the farmlands lying between the White and Blue Niles and is one of the largest irrigation projects in the world. Cotton is the country's chief cash crop and generally accounts for the largest share of exports; some is also used for local textiles. Other important cash crops are peanuts (groundnuts), sesame, and sorghum. The Sudan is also a leading producer of gum arabic, a water-soluble gum that is obtained from acacia trees. The main subsistence crops raised are sorghum and millet, with smaller amounts of wheat, corn (maize), and barley.

Cattle, sheep, camels, and goats are grazed on the semiarid plains and savannas that cover much of the country. Most of the camels and sheep raised are exported to Egypt and other Arab countries. The branches of the Nile are the main sources of fish. Forests cover less than one-fifth of the land, and the northern woodlands have been largely deforested.

The Sudan's manufacturing sector remains relatively small; manufacturing industries account for about one-tenth of the GDP and employ only a tiny proportion of the workforce. Private investment increased after the government in 1980 began to relinquish control of businesses nationalized in 1970–71. The processing of foods, beverages, and tobacco forms the core of the industrial sector, together with cotton-ginning and the production of vegetable oil and soap. Other manufactures include cotton textiles and leather footwear. The Sudan's mineral deposits are largely unexplored and unexploited. The exception is petroleum, which is extracted in significant quantities in the south and exported. Gold is mined commercially.

About half of the country's electricity is generated from hydroelectric plants on the Nile tributaries, and the remainder comes from thermal plants. Railroads were used to transport most freight in the country until the 1970s, when the road network was greatly expanded; roads now carry the majority of the country's freight traffic.

The annual balance of trade has traditionally been quite bad, but oil exports in the early 21st century have created a slight surplus, which has been helped by remittances from workers abroad. Oil accounts for roughly three-fourths of exports, and imports largely consist of machinery and equipment and foodstuffs. China is the country's major trading partner, followed by Japan and Saudia Arabia.

*Government and social conditions.* After attaining independence in 1956, The Sudan experienced periods of unstable and ineffective parliamentary government punctuated by intervals of military rule, notably that of General Gaafar el-Nimeiri (1969–85). After seizing power in 1989, the current military government, which is headed by a Revolutionary Command Council, abolished the National Assembly and all political parties and trade unions. It also dissolved the civilian judiciary and closed all civilian newspapers. The government has announced its intention to turn The Sudan into an Islāmic state, with the country's legal codes changed accordingly. The government faced a lengthy rebellion in the south by the animist and Christian forces of the Sudan People's Liberation Army, as well as conflict in Darfur.

A severe shortage of both health facilities and personnel contributes to the high incidence of such infectious diseases as malaria, gastrointestinal infections, tuberculosis, and venereal disease. Some of the country's health problems are caused by nutritional deficiencies. Housing is inadequate in number, quality, and sanitation, a problem exacerbated by the civil war's creation of large numbers of internal refugees from the south. The Sudan's literacy rate is low, roughly half the population. The educational system provides primary, secondary, and higher-secondary schools. Higher education is available at the University of Khartoum and several other universities. The government broadcasts daily radio programs in Arabic and English, as well as some imported and some domestic television programs.

The Sudan's culture is primarily a synthesis of Islāmic and African traditions. Arabic is the major literary language in The Sudan and has a rich tradition associated with Islām and its scholarship. The best-known Sudanese novelist is Ṭayyib Ṣāliḥ. Music also plays an important role in cultural life, ranging from Arabic tribal songs to traditional recitations of the Qur'ān.

*History.* Hunters and gatherers (*c.* 30,000–20,000 BC) were the earliest known inhabitants of Nubia—*i.e.*, what is now the northern part of The Sudan. By about 3000 BC they had domesticated animals. From the end of the 4th millennium BC, Nubia periodically came under the rule of Egypt, and Nubian culture acquired an Egyptian flavour. From the 11th century BC to the 4th century AD, Nubia was part of the kingdom of Cush (Kush), an Egyptianized Nubian empire that ruled Egypt itself from 713 to 671 BC.

Christian missionaries entered the Sudan during the 6th century AD and converted the three principal kingdoms of the region. These Christian kingdoms subsequently coexisted for a number of centuries with their Muslim Arab neighbours in Egypt. In the period from the 13th to the 15th century, however, increasing numbers of Arab nomads emigrated southward from Egypt into the northern Sudan, causing the collapse of its Christian kingdoms. In about 1500 an Arab confederation brought to an end the southernmost Christian kingdom in the Sudan, that of 'Alwah. Henceforth, the northern half of the Sudan would be home to racially mixed peoples who were for the most part Muslim and Arab. Notwithstanding this fact, much of the central Sudan was ruled from the early 16th to the early 19th century by the Funj, a people who were neither Arab nor, originally, Muslim.

In the early 19th century, Egypt's rulers sought to incorporate the Sudan into a state that would encompass the entire Nile River basin. To accomplish this aim, successive Egyptian military expeditions beginning in 1821 conquered all of the Sudan by 1874 and placed it under Egyptian rule. To encourage European financing of his ambitious plans, Ismā'īl Pasha, the viceroy of Egypt (1863–79), engaged Europeans (including the British general Charles George Gordon) to destroy the extensive slave trade that flourished in the western and southwestern portions of the Sudan. Gordon's zeal aroused Muslim opposition and led to the revolt of Muḥammad Aḥmad (al-Mahdī), who captured Khartoum in 1885 and established a theocracy that lasted until 1898. The power of the Mahdist forces was broken in the latter year by a British army in the Battle of Omdurman.

Having invaded and occupied Egypt in 1882, Britain took over the Sudan in 1898 and subsequently ruled the country in partnership with Egypt. The British tried to develop the Sudan's economy, and in the Nile River basin they pioneered the growing of cotton, which eventually became an important export.

Sudanese nationalism grew throughout the 1930s and '40s. In 1951 Egypt abrogated its agreement with Britain and declared itself the sole ruler of the Sudan. The British and Egyptians subsequently reached an agreement in 1953 to give the Sudan self-government. In elections that year for a Sudanese parliament, the National Unionist Party won a majority, and in 1956 the independent republic of The Sudan was proclaimed.

The history of The Sudan since independence has been marked by short intervals of ineffective parliamentary government (as in the periods 1956–58, 1965–69, and 1986–89) followed by longer periods of military rule. A continuing source of civil conflict has been the attempts of the Muslim majority in the north to impose the authority of the central government on the predominantly animist and Christian population of the southern Sudan.

This tension led the southern Sudanese to actively rebel against the central government in the period from 1963 to 1971 and again from the mid-1980s to the early 21st century. The northern-dominated military government that came to power in 1989 was heavily influenced by Islāmic fundamentalism and was not inclined to accommodate the demands of the rebellious southern regions, but steady international pressure brought both sides to the bargaining table. In 2004 a truce was worked out, but its terms had not been implemented when a new round of civil violence broke out in the country's western Darfur region. Rebels in that area—who were Muslim though not Arab—protested the preference given Arabs by the Arab-dominated government. The latter responded, allegedly, by supporting groups of local Arab herders (who, collectively, were referred to as *janjaweed*) in violent attacks against local denizens, mostly members of the Fur ethnic group. A mass exodus ensued as hundreds of thousands fled their homes to the relative safety of eastern Chad, facing starvation rather than remaining in their homes to face the violence.

**Sudanic languages,** African languages spoken from Ethiopia in the east to Nigeria in the west. Totally unrelated languages were included in the various groupings classified by some early scholars as Sudanic, usually on the basis of geographic or other nonlinguistic grounds. Languages classified as Sudanic include all that are now classified as Nilo-Saharan (as well as a few classified as Hamito-Semitic and Niger-Congo). *See also* Chari-Nile languages.

**Sudbury,** city, seat of Sudbury district, southeastern Ontario, Canada, on Ramsey Lake, 40

miles (65 km) north of Georgian Bay of Lake Huron. It was named for Sudbury, Suffolk, Eng. Its settlement began with the location of a station of the new Canadian Pacific Railway on the site. Copper- and nickel-bearing ores were discovered there in 1883–84 during the railway's construction, and smelting operations got underway in 1888.

Sudbury became the most important mining centre in Canada, with a majority of its population employed in that industry. Huge nickel concentrators and smelters were erected at nearby Copper Cliff and Falconbridge. The city and the surrounding district still produce as much as one-fifth of all the nickel mined in the world and almost all of Ontario's copper. Significant amounts of gold, silver, platinum, cobalt, sulfur, and iron ore are also mined. Other industries include lumber milling, woodworking, machine shops, and brick works.

Mining's importance in the city's economy began to decline in the 1960s relative to such sectors as health care, education, and public administration. Sudbury lies along the Trans-Canada Highway and two transcontinental railways and is the chief service and commercial centre for northern Ontario. It is the site of Laurentian University (1960) and Cambrian College (1966). Inc. town, 1893; city, 1930. Pop. (1996) city, 92,059; metropolitan area, 160,488.

**Sudbury,** town ("parish"), Babergh district, administrative and historic county of Suffolk, England, on the River Stour. An important wool town during the Middle Ages, it has many half-timbered houses and three Perpendicular-style churches. Sudbury was first incorporated in 1554. As the worsted industry declined, silk weaving and coconut matting were introduced. Milling and brewing have also become important. The 18th-century English artist Thomas Gainsborough was born there in a house that is now an art centre. Pop. (1991) 19,512.

**Sudbury,** town (township), Middlesex county, eastern Massachusetts, U.S. Sudbury lies along the Sudbury River, west of Boston, and includes the villages of Sudbury and South Sudbury. Settled in 1638 by Watertown residents and by English colonists, it was named for Sudbury, Suffolk, England. Present-day Sudbury has one of the wealthiest populations in the state. It is the site of a manufacturing and engineering laboratory for the defense contractor Raytheon. In South Sudbury stands the restored Wayside Inn (*c.* 1705), which is the nation's oldest operating inn; it served as the setting for Henry Wadsworth Longfellow's *Tales of a Wayside Inn* (1863). Great Meadows National Wildlife Refuge extends along the river through Sudbury. Inc. 1639. Pop. (2000) 16,841.

**Sudd, as-,** swampy lowland region of south-central Sudan, 200 miles (320 km) wide by 250 miles (400 km) long. It is drained by headstreams of the White Nile, namely the al-Jabal (Mountain Nile) River in the centre and the al-Ghazāl River in the west. The al-Jabal River overflows in the flat, saucerlike clay plain of the Sudd to form innumerable swamps, lagoons and side channels, and several lakes along its course. The river's flow is further slowed by the swamps' luxuriant growths of tall papyrus (Arabic *as-sudd,* "the papyrus"), aquatic grass, and water hyacinth.

The al-Jabal River loses more than half its water in the Sudd through evaporation. The Sudd presents an almost impenetrable barrier to navigation on the river and is only sparsely inhabited by the pastoral Nilotic Nuer people. In the early 1980s construction began on the Jonglei (Junqalī) Canal, which was planned to bypass the Sudd and provide a straight, well-defined channel for the al-Jabal River to flow northward until its junction with the White Nile. But the project, which would have drained the swamplands of the Sudd for agricultural use, was suspended in 1984 because of disruptions arising from the civil war in southern Sudan.

**sudden infant death syndrome** (SIDS), also called CRIB DEATH, or COT DEATH, unexpected death of an apparently well infant. SIDS is of worldwide incidence, and within industrialized countries it is the most common cause of death of infants between two weeks and one year old. In 95 percent of SIDS cases, infants are two to four months old.

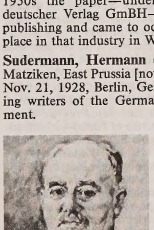
Sudden infant death syndrome occurs almost always during sleep at night. Its cause remains unknown. From the time of its identification, researchers have posited a number of causes—from a theory (popular in the 1960s and since discredited) that SIDS was caused by parental neglect to suggestions that SIDS was triggered by childhood vaccinations, blood disorders, and apnea (a disorder in which breathing is arrested during sleep)—but none has been borne out by further research. A higher incidence of SIDS is seen among premature and low-birth-weight infants, as well as among those born to teenagers, women who smoke heavily, and those who have received poor prenatal care. In the late 1980s researchers began to examine the brain development of infants, theorizing that some abnormality in the process of learning a response to respiratory distress would explain the syndrome.

**Süddeutsche Zeitung** (German: "South German Newspaper"), also called SZ, daily newspaper published in Munich, considered one of the three most influential papers in Germany.

*Süddeutsche Zeitung* was the first paper to be licensed in Bavaria (1945) by the Allied occupation authorities following the end of World War II. The newspaper was founded by Edmund Goldschagg, Franz Joseph Schöningh, and August Schwingenstein as a twice-weekly publication, using the press of the prewar *Münchner Neueste Nachrichten.* With the damaged press rehabilitated and with a former executive of the prewar paper as publishing director, the paper thrived, quickly becoming a national publication. As soon as enough newsprint was available, the paper went to thrice-weekly, and in 1949 daily publication.

*Süddeutsche Zeitung* won readers by its careful and accurate presentation of news and by its forthright stands on sensitive issues. In 1946 it inaugurated a front-page column, "Das Streiflicht" ("The Spotlight"), featuring a concise treatment of an important story. In the 1950s the paper—under the name Süddeutscher Verlag GmBH—moved into book publishing and came to occupy an important place in that industry in West Germany.

**Sudermann, Hermann** (b. Sept. 30, 1857, Matziken, East Prussia [now in Lithuania]—d. Nov. 21, 1928, Berlin, Ger.), one of the leading writers of the German naturalist movement.



Sudermann, detail of an oil painting by Max Slevogt, 1927; in the National Gallery, Berlin

By courtesy of the Staatliche Museen zu Berlin, Germany

Though first apprenticed to a chemist, Sudermann was eventually able to attend the University of Königsberg. After a short period as a tutor in Berlin, he worked as a journalist, then turned to writing novels. *Frau Sorge* (1887; *Dame Care*), dealing with the growing up of a sensitive youth, and *Der Katzensteg* (1889; *Regina*) are the best known of his early novels. He won renown, however, with his plays. *Die Ehre* (Eng. trans., *What Money Cannot Buy*), first performed in Berlin on Nov. 27, 1889, was a milestone in the naturalist movement, although to later critics it seemed a rather trite and slick treatment of class conflicts in Berlin. *Heimat* (performed 1893; Eng. trans., *Magda*) carried his fame throughout the world. It portrays the conflicts of Magda, a celebrated opera singer who returns to confront her past in the narrow, provincial hometown that she left in disgrace.

Sudermann's subsequent problem plays, notably *Glück im Winkel* (1895; *The Vale of Content*), *Morituri* (1896), *Es lebe das Leben!* (1902; *The Joy of Living*), and *Der gute Ruf* (1913; *A Good Reputation*), were almost all successful on the stage of his time, but, because his work is often sentimental and his criticism of contemporary society—a recurrent motif—is generally considered to be superficial, his plays are seldom staged today.

Among Sudermann's other works, the novel *Das hohe Lied* (1908; *The Song of Songs*), a sympathetic study of the downward progress of a seduced girl, and *Litauische Geschichten* (1917; *The Excursion to Tilsit*), a collection of stories dealing with the simple villagers of his native region, are notable. *Das Bilderbuch meiner Jugend* (1922; *The Book of My Youth*) recounts his early years in East Prussia.

**Sudest Island,** also called TAGULA, volcanic island of the Louisiade Archipelago, Papua New Guinea. It lies 175 miles (280 km) southeast of the island of New Guinea, in the southwestern Pacific. The largest island of the archipelago, measuring 50 by 15 miles (80 by 24 km), Sudest has a total land area of 310 square miles (800 square km). Surrounded by a coral reef, the rugged island rises to 2,644 feet (806 m) at Mount Rattlesnake. The island exports copra. Pop. (1990 prelim.) 2,725.

**Sudeten** (German), Czech and Polish SUDETY, system of east-west mountain ranges of northeastern Bohemia and northern Moravia, Czech Republic, bordering on Poland. The system has three subgroups: the West Sudeten range is composed of the Lusatian Mountains, the Jizera Mountains, and the Giant (Krkonoše) Mountains (*qq.v.*); the Middle Sudeten range includes the Orlice Mountains (*q.v.*) and the Broumovské range; the East Sudeten range is composed of the Jeseník Mountains (*q.v.*).

The Sudeten are the broken remnants of an ancient massif; the peaks, such as Sněžka (5,256 feet [1,602 m]) in the Giant Mountains, have flattened summits. Mineral deposits abound, but small workings long have been in decline. Farming is difficult on the rough terrain, and cottage industry and craftsmanship are still prevalent. The textile industry, particularly cotton, is widespread, having originally been located there to take advantage of the fast-flowing rivers; glass and porcelain are local specialties, often for export. The principal towns are Jablonec and Liberec, and tourism is important, particularly in the Giant Mountains.

**Sudetenland,** sections of northern and western Bohemia and northern Moravia, in the vicinity of the Sudeten mountain ranges. The Sudetenland, which had a predominately German population, was incorporated into Czechoslovakia when that new nation's frontiers were drawn in 1918–19. The Sudeten and

other Germans in Czechoslovakia numbered about 3,000,000 in the interwar period. Because of its German majority, the Sudetenland later became a major source of contention between Germany and Czechoslovakia, and in 1938 participants at the Munich Conference, yielding to Adolf Hitler, transferred it to Germany.

The annexation of the Sudetenland by Germany was, to a large degree, prepared by the Sudeten Germans, who—after accepting with great reluctance the Treaty of Saint-Germain, which had placed them under Czechoslovak rule in 1919—responded with increasing approval to the German nationalist, anti-Czech, anti-Semitic propaganda disseminated by the Sudeten German (or Nazi) Party during the mid-1930s. That party, led by Konrad Henlein, exploited the dissatisfaction of unemployed workers in the Sudetenland, where the heavily industrialized economy had come almost to a standstill as a result of the Great Depression. The party also capitalized on discontent over the ethnic discrimination practiced in the region by Czech officials. In the parliamentary elections of May 1935, the party received almost two-thirds of the Sudeten German vote and sent the second largest bloc of representatives to the Czechoslovak Parliament. Afterward, the Sudeten Nazis increased their activities, which were basically aimed at uniting the Sudetenland with Germany and included hostile outbreaks and provocative incidents. They not only succeeded in embarrassing the Czechoslovak government but also convinced Great Britain and France that the situation in the Sudetenland was highly inflammatory and that the Czechoslovak leaders must be persuaded to take extreme action, even ceding the region to Germany, to avoid a war.

The Czechoslovak government responded to the Sudeten Germans' grievances to the satisfaction of the non-Nazi groups (1937) and also acceded (in September 1938) to almost all of Henlein's demands, which were made in April 1938 and called for full autonomy for the Sudetenland and the adoption of a pro-German foreign policy by Czechoslovakia. But the Czech government was unable to reach an accommodation with Hitler (who was using the Sudetenland as a pretext for the eventual takeover of all of Czechoslovakia). Consequently, France and Great Britain arranged to meet with Italy and Germany at Munich (September 29–30), where they issued an ultimatum to Czechoslovakia to cede the Sudetenland to Germany by October 10.

After World War II the Sudetenland was restored to Czechoslovakia, which expelled most of the German inhabitants and repopulated the area with Czechs.

**Sudirohusodo, Mas Ngabehi Wahidin:** *see* Wahidin Sudirohusodo, Mas Ngabehi.

**Sudra,** also spelled SHUDRA, Sanskrit ŚŪDRA, the fourth and lowest of the traditional varnas, or social classes, of Hindu India, traditionally artisans and labourers. The term does not appear in the earliest Vedic literature. In its first application it probably included all conquered peoples of the Indus civilization as they were assimilated as menials to the three-class society of the Brahmans (priests and teachers), Kshatriyas (Kṣatriyas; nobles and warriors), and Vaisyas (merchants). Sudras are not permitted to perform the *upanayana* initiatory rite, which introduces members of the three upper classes to the study of the Vedas (earliest sacred literature) and gives them their status as *dvija* ("twice-born").

The Sudra varna includes a wide spectrum of endogamous status groups with dominant, landowning groups at one end of the scale and near-untouchables at the other. These variations derive from the Hindu belief that certain behaviour patterns and occupations are polluting, a concept that gave rise to a distinction between "clean" and "unclean" Sudra groups; for example, washers, tanners, shoemakers, sweepers, and scavengers were once relegated to untouchability (*see* untouchable). As evidence of group mobility in the caste system, some observers have pointed out that many castes claiming Kshatriya and Vaisya status gradually emerged from the Sudra class. *See also* varna.

**Sudurnesjabaer,** formerly KEFLAVÍK, town, southwestern Iceland, on Reykja Peninsula, overlooking Faxa Bay. It was administratively created when Keflavík merged with the nearby towns of Njardvík and Hafnir in 1994. A fishing port and local market centre, Sudurnesjabaer is the site of an international airport as well as of a U.S. air base, built during World War II and later established as a North Atlantic Treaty Organization base (1951). A paved road 30 miles (48 km) long connects the airfield to Reykjavík. Pop. (1994 est.) 10,347.

**Sue, Eugène,** pseudonym of MARIE-JOSEPH SUE (b. Jan. 26, 1804, Paris, France—d. Aug. 3, 1857, Annecy, Savoy), French author of sensational novels of the seamy side of urban



Sue, engraving by Fuhr
H. Roger-Viollet

life and a leading exponent of the *roman-feuilleton* ("newspaper serial"). His works, although faulted for their melodramatics, were the first to deal with many of the social ills that accompanied the Industrial Revolution in France.

Sue's early experiences as a naval surgeon prompted his first books, several highly coloured sea stories (*e.g., Plik et Plok,* 1831). He also wrote a number of historical novels and worked as a journalist. Having inherited a fortune from his father, Sue became a well-known dandy. His carriage and horses, pack of beagles, and displays of luxury made him the talk of Paris. He was one of the first members of the exclusive French Jockey Club (1834). He depicted contemporary "high life" in *Arthur* (1838) and *Mathilde* (1841). The latter showed socialist tendencies, and Sue turned in this direction in *Les Mystères de Paris* (1842–43; *The Mysteries of Paris*)—which influenced Victor Hugo's *Les Misérables*—and *Le Juif errant* (1844–45; *The Wandering Jew*). Published in installments, these long but exciting novels vastly increased the circulation of the newspapers in which they appeared. Both books display Sue's powerful imagination, exuberant narrative style, and keen dramatic sense. These qualities, along with Sue's realistic and sympathetic depictions of the urban poor, help to compensate for his implausible plots and one-dimensional characters. Sue's other books are less successful.

After participating in the 1848 Revolution, Sue was elected Socialist deputy for the Seine in 1850. He opposed Louis Napoleon's coup d'état in 1851, went into exile at Annecy, Savoy (then independent of France), and remained there until his death.

**sue, standing to** (law): *see* standing to sue.

**Suebi,** also spelled SUEVI, group of Germanic peoples, including the Marcomanni and Quadi, Hermunduri, Semnones, and Langobardi (Lombards). The Alemanni were also part of the Suebi tribal group, which gave its name to the German principality of Swabia.

In the late 1st century AD most of the Suebi lived around the Elbe River. Dislodged by the Huns, some Suebi crossed the Rhine River and in 409 entered Spain, settling mainly in the northwest (Gallaecia). By 447, under their king Rechila, the Suebi had spread over the Roman provinces of Lusitania and Baetica. Although the Suebi entered Spain as pagans, their king Rechiar came to the throne as a Christian in 448. He was later defeated by the Visigoths under Theodoric II in 456. Remnants of the Suebi survived under Maldras (reigned 456–460) and rival kings until about 585, when the kingdom was annexed to the Visigothic state.

**Suess, Eduard** (b. Aug. 20, 1831, London, Eng.—d. April 26, 1914, Vienna, Austria), Austrian geologist who helped lay the basis for paleogeography and tectonics—*i.e.,* the study of the architecture and evolution of the Earth's outer rocky shell.

While an assistant in the Hofmuseum (now the Natural History Museum) in Vienna from 1852 to 1856, Suess published papers on the anatomy and classification of brachiopods and ammonites. In 1857 he published a small book entitled *Die Enstehung der Alpen* ("The Origin of the Alps"). In it he argued that horizontal movements of the lithosphere (the Earth's rocky outer shell), rather than vertical uplift, played the dominant role in creating mountain ranges by folding and thrust faulting. Suess assumed that volcanism (notably magmatic activity) was a consequence of mountain building rather than its cause, as was widely held at that time.



Suess, lithograph by Josef Kriehuber, 1869
By courtesy of the Bild-Archiv, Oesterreichische Nationsbibliothek, Vienna

Suess's *Das Antlitz der Erde* (1883–1909; *The Face of the Earth*), a four-volume treatise on the geologic structure of the entire planet, discusses his theories of the structure and evolution of the lithosphere in greater detail, tracing the ancient changes in the continents and seas necessary to form the modern features of the Earth's surface. Many of the common terms and concepts still in use in tectonics, such as Gondwanaland (a supercontinent that once consisted of South America, Africa, the Arabian Peninsula, India, Australia, and Antarctica) and Tethys (a former equatorial ocean), were first proposed in this book. The work also indicates that Suess was the first to recognize that major rift valleys such as those in East Africa were caused by the extension of the lithosphere.

Suess became professor of paleontology at the University of Vienna in 1856 and professor of geology there in 1861. He developed the plan for a 69-mile (112-kilometre) aqueduct (completed 1873) that brought fresh water from

the Alps to Vienna. He became a member of the Landtag (provincial assembly) of Lower Austria in 1869 and in 1873 entered the lower house of the Reichsrat (national parliament), where for more than 30 years he was a Liberal deputy from Vienna.

**Suetonius,** in full GAIUS SUETONIUS TRANQUILLUS (b. *c.* AD 69, probably Rome [Italy]—d. after 122), Roman biographer and antiquarian whose writings include *De viris illustribus* ("Concerning Illustrious Men"), a collection of short biographies of celebrated Roman literary figures, and *De vita Caesarum* (*Lives of the Caesars*). The latter book, seasoned with bits of gossip and scandal relating to the lives of the first 11 emperors, secured him lasting fame.

Suetonius' family was of the knightly class, or equites. A friend and protégé of the government official and letter writer Pliny the Younger, he seems to have studied and then abandoned the law as a career. After Pliny's death Suetonius found another patron, Septicius Clarus, to whom he later dedicated *De vita Caesarum.* Upon the accession of Emperor Hadrian (117), he entered the imperial service, holding, probably simultaneously, the posts of controller of the Roman libraries, keeper of the archives, and adviser to the emperor on cultural matters. Probably around 121 he was promoted to secretary of the imperial correspondence, but in 122 or somewhat later he was dismissed for the neglect of court formality, after which he presumably devoted himself to literary pursuits.

Most of Suetonius' writings were antiquarian, dealing with such subjects as Greek pastimes, the history of Roman spectacles and shows, oaths and imprecations and their origins, terminology of clothing, well-known courtesans, physical defects, and the growth of the civil service. An encyclopaedia called *Prata* ("Meadows"), a work like the *Natural History* of Pliny the Elder, was attributed to him and often quoted in late antiquity.

Suetonius' *De viris illustribus* is divided into short books on Roman poets, orators, historians, grammarians and rhetoricians, and perhaps philosophers. Very nearly all that is known about the lives of Rome's eminent authors stems ultimately from this work, which survives only in the whole of one section and in the preface and five lives from another section. The lives of Horace, Lucan, Terence, and Virgil, for example, are known from writers who derived their facts from Suetonius.

*De vita Caesarum,* which treats Julius Caesar and the emperors up to Domitian, is largely responsible for that vivid picture of Roman society and its leaders, morally and politically decadent, that dominated historical thought until modified in modern times by the discovery of nonliterary evidence. The biographies are organized not chronologically but by topics: the emperor's family background, career before accession, public actions, private life, appearance, personality, and death. Though free with scandalous gossip, they are largely silent on the growth, administration, and defense of the empire. Suetonius is free from the bias of the senatorial class that distorts much Roman historical writing. His sketches of the habits and appearance of the emperors are invaluable, but, like Plutarch, he used "characteristic anecdote" without exhaustive inquiry into its authenticity.

*De vita Caesarum* is still exciting reading. Suetonius wrote with firmness and brevity. He loved the *mot juste,* and his use of vocabulary enhanced his pictorial vividness. Above all he was unrhetorical, unpretentious, and capable of molding complex events into lucid expression.

**Sueur, Eustache Le** (French painter): *see* Le Sueur, Eustache.

**Suevi** (Germanic people): *see* Suebi.

**Suez,** Arabic AS-SUWAYS, Egyptian port at the head of the Gulf of Suez and at the southern terminal of the Suez Canal. Together with its two harbours, Port Ibrāhīm and Port Tawfīq (Tewfik), and a large portion of the Eastern Desert, Suez constitutes the As-Suways *muḥāfaẓah,* an urban governorate covering an area of 6,888 square miles (17,840 square km).

An ancient trading site, Suez was the location of the Greek town of Clysma, which became the Muslim Kolsum in the 7th century AD. After the Ottoman conquest Suez developed as a naval station. The port later declined until the opening of the Suez Canal in 1869.

Modern Suez remains a naval and trade centre, linked to Cairo, 80 miles (130 km) east, by road and rail. Mainly a transit port, it has petroleum refineries (connected to Cairo by pipeline), canal workshops, and an artificial fertilizer plant. Suez is also a departure point for pilgrimages to Mecca. The closing of the canal after the Arab-Israeli War of 1967 and the Israeli assault on the city in 1973 dealt a severe blow to its economy. With the reopening of the canal in 1975 and the resettlement of refugees, the city returned to prosperity. It became a tax-free industrial zone in 1975 and now has textile and pharmaceutical plants. Pop. (1991 est.) 376,000.

**Suez, Gulf of,** Arabic KHALĪJ AS-SUWAYS, northwestern arm of the Red Sea between Africa proper (west) and the Sinai Peninsula (east) of Egypt. The length of the gulf, from its mouth at the Strait of Jubal to its head at the city of Suez, is 195 miles (314 km), and it varies in width from 12 to 20 miles (19 to 32 km). The gulf is linked to the Mediterranean Sea by the Suez Canal (north) and is an important shipping route. Settlements along the gulf are confined to a few fishing and mining villages. In the 1970s and '80s oil was discovered at numerous locations onshore and offshore in the gulf. On the Sinai coast the harbour of Abū Zanīmah serves the neighbouring Umm Bugma (Bujmah) manganese mines.

**Suez Canal,** Arabic QANĀT AS-SUWAYS, sea-level waterway running north to south across the Isthmus of Suez in Egypt and separating the African continent from Asia.

A brief treatment of the Suez Canal follows. For full treatment, *see* MACROPAEDIA: Africa.

The Suez Canal connects the Mediterranean and Red seas and allows ships to sail directly between the Mediterranean and the Indian Ocean, rather than rounding Africa via the Cape of Good Hope. The canal extends 100 miles (160 km) from Port Said (Būr Sa'īd) on the Mediterranean to the Gulf of Suez in the south, utilizing three intervening lakes, Lake Manzala (Buḥayrat al-Manzilah), Lake Timsah (Buḥayrat at-Timsāḥ), and the Bitter Lakes (al-Buḥayrah al-Murrah). To the west of the canal is the low-lying delta of the Nile River, and to the east is the higher, rugged, and arid Sinai Peninsula.

The Suez Canal was built by the French-owned Suez Canal Company under the leadership of Ferdinand de Lesseps and was completed in 1869 after 11 years' construction. Its ownership remained largely in French and British hands for the next 80 years. In 1956, however, the Egyptian leader Gamal Abdel Nasser nationalized the canal, which was closed twice by the Arab-Israeli Wars, first in the Suez Crisis of 1956–57 and then in 1967–75 as a result of the Six-Day War (1967).

The Suez Canal originally consisted of a channel barely 26 feet (8 m) deep, 72 feet (22 m) wide at the bottom, and 190 feet (58 m) wide at the surface. After successive widenings and deepenings, the canal had a minimum width of 179 feet (55 m) and an uninterrupted depth of almost 40 feet (12 m) at low tide by 1963. The canal is one of the world's most heavily used shipping lanes, with an average of 55 ships using it daily in the late 20th century. Its most important traffic is the tankers carrying petroleum northward from the oilfields of the Persian Gulf to western and central Europe. Coal, ores and metals, and other bulk commodities are also transported northward, while the main southbound traffic consists of cement, fertilizers, fabricated metals, and cereal grains, as well as empty tankers returning to the Persian Gulf. The largest oil tankers (supertankers) are unable to use the canal when fully laden and must round the Cape of Good Hope instead.

**Suez Crisis** (1956), international crisis in the Middle East, precipitated on July 26, 1956, when the Egyptian president, Gamal Abdel Nasser, nationalized the Suez Canal. The canal had been owned by the Suez Canal Company, which was controlled by French and British interests.

The Suez Crisis was provoked by an American and British decision not to finance Egypt's construction of the Aswan High Dam, as they had promised, in response to Egypt's growing ties with communist Czechoslovakia and the Soviet Union. Nasser reacted to the American and British decision by declaring martial law in the canal zone and seizing control of the Suez Canal Company, predicting that the tolls collected from ships passing through the canal would pay for the dam's construction within five years. Britain and France feared that Nasser might close the canal and cut off shipments of petroleum flowing from the Persian Gulf to western Europe. When diplomatic efforts to settle the crisis failed, Britain and France secretly prepared military action to regain control of the canal and, if possible, to depose Nasser. They found a ready ally in Israel, whose hostility toward Egypt had been exacerbated by Nasser's blockage of the Straits of Tirān (at the mouth of the Gulf of Aqaba) and the numerous raids by Egyptian-supported commandos into Israel during 1955–56.

On Oct. 29, 1956, 10 Israeli brigades invaded Egypt and advanced toward the canal, routing Egyptian forces. Britain and France, following their plan, demanded that Israeli and Egyptian troops withdraw from the canal, and they announced that they would intervene to enforce a cease-fire ordered by the United Nations. On November 5 and 6, British and French forces landed at Port Said and Port Fuad and began occupation of the canal zone, but growing opposition at home and in the UN and Soviet threats of intervention put an immediate stop to the Anglo-French action. On December 22 the UN evacuated British and French troops, and Israeli forces withdrew in March 1957.

Nasser emerged from the Suez Crisis a victor and a hero for the cause of Arab and Egyptian nationalism. Israel did not win freedom to use the canal, but it did regain shipping rights in the Straits of Tirān. Britain and France, less fortunate, lost most of their influence in the Middle East as a result of the episode.

**Sufetula,** modern SUBAYṬILAH, or SBEITLA, ancient Roman city 19 miles (31 km) east-northeast of modern Al-Qasrayn, Tunisia. Most likely originating as a fort during the Roman campaigns against the Numidian rebel Tacfarinas (AD 17–24), it became a municipium under the emperor Vespasian (69–79) and a *colonia* under Marcus Aurelius (161–180) or his son Commodus.

At Sufetula, as elsewhere in the interior of Tunisia, Roman skill in the conservation and use of limited water supplies produced an agricultural prosperity, based primarily on olive cultivation, that was not achieved again until modern times. The city was destroyed by the Arabs about AD 646, leaving impressive remains surrounding its forum, including a triumphal arch of the emperor Antoninus Pius (reigned 138–161) and three temples.

**suffocation,** the stoppage or impeding of respiration, as by strangulation, choking on food, or other exclusion of oxygenated air. *See* asphyxia.

**Suffolk,** county of eastern England in East Anglia, bounded in the north by Norfolk, in the west by Cambridgeshire, in the south by Essex, and in the east by the North Sea. Its area is 1,466 square miles (3,797 square km). There are seven districts: Forest Heath and Saint Edmundsbury in the west, Mid Suffolk in the middle, Babergh and Ipswich in the south, and Suffolk Coastal and Waveney on the North Sea coast. From 1888 to 1974 Suffolk was subdivided into two administrative counties, West Suffolk and East Suffolk.

Suffolk exhibits a wide variety of landscapes. The coastline has fine sandy beaches, crumbling cliffs (the former town of Dunwich has been washed into the sea), deep estuaries, and the spit of Orford Ness. The centre of the county has low rolling hills, and in the west rises a chalk ridge covered by broad, hedgeless fields. The northwestern corner of Suffolk, where it borders Norfolk and Cambridgeshire, forms part of the Fenland (*q.v.*) and is below sea level. East of the Fens lies the Breckland (*q.v.*), a region of sand, heath, and long lines of trees planted originally for windbreaks and game cover.

The area prospered from early times. Prehistoric flint mines have been found in Breckland. The Mildenhall silver treasure, now on display in the British Museum, dates from the Roman period. During Anglo-Saxon times Suffolk formed part of the kingdom of East Anglia; the wealth of the kings of this period is indicated in the Sutton Hoo ship burial discovered near Woodbridge. The county's medieval prosperity, which lasted until the 18th century, was based largely upon the woolen cloth industry and is reflected in the many large village churches such as those at Lavenham, Blythburgh, and Southwold. The villages of Lindsey and Kersey gave their names to specific wool fabrics.

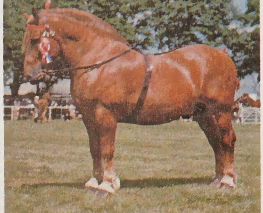
Since the 18th century, agriculture has been Suffolk's major economic activity. The most important crops are cereals, sugar beets, and vegetables; food processing is a significant industry. Newmarket in the west is famous for its racing stables, and the county was formerly known for its Suffolk draft horses, also called Suffolk Punch. Lowestoft is a fishing port, and the coast is dotted with holiday resorts. The entry of the United Kingdom into the European Community brought rapid port development at Ipswich. Pop. (1988 est.) 638,600.

**Suffolk,** city, southeastern Virginia, U.S., at the head of navigation of the Nansemond River, near the Great Dismal Swamp, immediately west of the cities of Portsmouth and Chesapeake. In 1974 it merged with the former Nansemond county to form a single administrative unit that extends southward to the North Carolina border.

Settled in 1720, the town was early known as Constant's Warehouse after John Constant, who established a tobacco business there; it was chartered in 1742 and renamed by the colonial legislature for Suffolk, Eng. The town was burned by British forces in 1779 and was destroyed by fire in 1837 but was soon rebuilt. During the American Civil War it fell to Federal troops in 1862 and was attacked by Confederate general James Longstreet in April 1863.

Now an important centre for the marketing and processing of peanuts, Suffolk also handles tea and manufactures bricks, paper, wood products, and farm machinery. Fishing and boating facilities are available in six local lakes and in Great Dismal Swamp. Inc. town, 1808; city, 1910. Pop. (1990) 52,141.

**Suffolk,** also called SUFFOLK PUNCH, smallest draft-horse breed, which originated in Suffolk, Eng. Descended from the medieval "great horse," the Suffolk is an old breed that has



Suffolk
Sally Anne Thompson—EB Inc.

probably had less crossing with other lines than most draft breeds. All registered Suffolks in Britain and North America trace their lineage to "Crisp's Horse" (born 1768). Suffolks are unusually compact and rotund, with thick, short necks, legs, and backs; they are docile but powerful. They stand 15.2 to 16.2 hands (about 62 to 66 inches, or 157 to 168 cm) high and weigh from 1,600 to 2,000 pounds (725 to 900 kg). The coat is always chestnut-coloured.

The Suffolk Horse Society of Great Britain was organized in 1880. That same year the breed was imported to the United States.

**Suffolk,** breed of medium-wool, dark-faced, hornless sheep developed in England during the years 1800 to 1850 by mating Norfolk horned ewes with Southdown rams. Suffolks are prolific, early maturing sheep with excellent mutton carcasses. They are energetic, and the whole carriage is alert, showing stamina and quality. The breed is not desirable for wool production. The fleeces are short in staple and light in weight, and they have black fibres. Introduced into the United States in 1888, the Suffolk is a popular lamb producer throughout the country, including the rangeland.

**Suffolk,** EARLS AND DUKES OF, titled English nobility of several creations, most notably in the families Ufford, de la Pole, Brandon, and Howard, grouped below chronologically and indicated by the symbol •.

**•Suffolk, Robert de Ufford, 1st Earl of,** LORD UFFORD (b. Aug. 9/10, 1298—d. Nov. 4, 1369), leading English soldier and statesman during the reign of Edward III of England.

The 1st Earl's father, Robert (1279–1316), who was summoned to Parliament as a baron in 1309, was the son of Robert de Ufford, twice justiciar of Ireland in Edward I's reign. The young Robert took part in the arrest of Roger Mortimer, Earl of March, at Nottingham Castle in October 1330 and thereafter became one of Edward III's most trusted commanders and councillors; he was one of six new earls created by Edward III in 1337.

Suffolk fought at Crécy (1346) and Poitiers (1356) and served in almost every campaign in France between 1340 and 1360. His son and heir, William de Ufford (1339–82), the 2nd earl, died without surviving issue, and the earldom became extinct.

**•Suffolk, William de la Pole, 1st Duke of,** MARQUESS OF SUFFOLK, EARL OF PEMBROKE, EARL OF SUFFOLK (b. Oct. 16, 1396, Cotton, Suffolk, Eng.—d. May 2, 1450, near Dover, Kent), English military commander and statesman who from 1443 to 1450 dominated the government of the weak king Henry VI (ruled 1422–61 and 1470–71). He was popularly, although probably unjustly, held responsible for England's defeats in the late stages of the Hundred Years' War (1337–1453) against France.

When his father, Michael de la Pole, 2nd Earl of Suffolk, was killed fighting the French at the Battle of Agincourt in 1415, William succeeded to the earldom of Suffolk. He served in all the French campaigns of King Henry V from 1417 to 1422 and became one of the most trusted generals of Henry VI. In 1428 Suffolk was made commander in chief of the English army in France, but on June 12, 1429, he was defeated and taken prisoner by Joan of Arc at Jargeau. Upon being ransomed, he held his former command until recalled to England late in 1431.

During the next decade Suffolk served as a royal councillor and emissary. He acquired considerable influence in the government by joining the faction of Henry Cardinal Beaufort, which dominated the king, and, after Beaufort's retirement in 1443, Suffolk became Henry VI's chief adviser. In an effort to end the war, he secured a two-year truce in 1444, but he enraged his countrymen by ceding the provinces of Maine and Anjou to France. Nevertheless, he was created Duke of Suffolk in 1448, and this marked the height of his power.

Suffolk's downfall came after the English treacherously captured Fougères—probably with his approval—in March 1449, thereby reopening hostilities. Soon the French recaptured almost all of Normandy. Parliament laid the blame for the disaster on Suffolk, and with great reluctance the king banished the duke from the realm for five years. Suffolk left England on May 1, 1450, but he was intercepted in the English Channel by some of his enemies and beheaded. He died without surviving issue, and his titles became extinct.

**•Suffolk, Charles Brandon, 1st Duke of,** VISCOUNT LISLE (b. *c.* 1484—d. Aug. 24, 1545, Guildford, Surrey, Eng.), brother-in-law of the English king Henry VIII and a prominent courtier during his reign.

His father, William Brandon, died fighting for Henry Tudor (later King Henry VII) in 1485. A large, athletic man, young Brandon was about the only member of Henry VIII's entourage capable of standing up to Henry VIII in a tournament. He proved his personal courage in the 1513 campaign against France (for which he received a viscountcy), but, when he was later given military commands (1523 and 1542–44), he displayed only incompetence.

In February 1514, Henry made Brandon Duke of Suffolk. Early the following year Suffolk was sent to Paris to promote a match between Henry's sister Mary and King Francis I of France; instead Suffolk married her himself, thereby incurring the danger of being accused of treason. Henry's wrath was apparently assuaged by his chief minister, Thomas Cardinal Wolsey, and the duke soon returned to royal favour. Nevertheless, in 1529 Suffolk helped overthrow Wolsey, and for several years thereafter he appeared to be among the dominant members of the king's council, though he was a man devoid of the qualities of leadership. He welcomed the demise of Anne Boleyn. Suffolk's granddaughter, Lady Jane Grey, was titular queen of England for nine days following the death of King Edward VI in 1553.

**•Suffolk, Henry Grey, Duke of,** 3RD MARQUESS OF DORSET, LORD FERRERS OF GROBY, LORD HARINGTON, LORD BONVILLE (b. *c.* 1517—d. Feb. 23, 1554, London), father of Lady Jane Grey; his opposition to Queen Mary I of England and his

role in the Thomas Wyat Rebellion led to his execution.

The son of Thomas Grey, 2nd marquess of Dorset, he succeeded to the marquessate in 1530 and, in 1534, with the approval of King Henry VIII, married Frances Brandon, who would be the sole surviving heiress of the 1st duke of Suffolk in the Brandon line. Though well-educated and a committed Protestant, Dorset was a weak and ambitious man. He belonged to the party of John Dudley, duke of Northumberland, and was created duke of Suffolk on Oct. 11, 1551. He supported Northumberland's attempt to make his daughter Lady Jane Grey queen in July 1553, but he was quick to abandon her cause when the plot failed, and he was pardoned by Queen Mary. His opposition to the queen's plans for her Spanish marriage involved him in Sir Thomas Wyat's Rebellion in 1554; the dukedom again became extinct after his trial for treason and his execution on Tower Hill.

**• Suffolk, Thomas Howard, 1st earl of,** LORD HOWARD OF WALDEN (b. Aug. 24, 1561—d. May 28, 1626, London, Eng.), an English commander during the attack of the Spanish Armada and in other forays against the Spanish during the reign of Elizabeth I. He was also a councillor in the reign of James I.

Howard was the second son of the 4th duke of Norfolk. He commanded the expedition on which Sir Richard Grenville and the *Revenge* were lost (1591), and he held commands in the Cadiz and Islands voyages (1596–97). Created Lord Howard of Walden in 1597 and earl of Suffolk in July 1603, he was lord chamberlain of the royal household from 1603 to 1614 and lord high treasurer from 1614 to 1618, when he was deprived of his office on a charge of misappropriating money. He was tried in the Star Chamber and was heavily fined and imprisoned briefly in the Tower of London.

Suffolk's second wife was Catherine (d. 1663), a woman whose avarice was partly responsible for her husband's downfall. She shared his trial and was certainly guilty of taking bribes from Spain. One of his three daughters was the notorious Frances Howard, who instigated the poisoning of poet and essayist Sir Thomas Overbury.

**Suffolk Coastal,** district, county of Suffolk, southeastern England, occupying an area that borders the North Sea to the east for about 32 miles (51 km). Suffolk Coastal is a low-lying district containing rolling hills in the interior north and west. The area bordering the sea has sand and gravel beaches, crumbling cliffs, and estuaries frequented by rare bird species. Directly inland the landscape is forested, especially in the south between the towns (parishes) of Woodbridge, the district seat, and Aldeburgh. The north-coastal parishes of Walberswick, Dunwich, and Aldeburgh were prosperous local ports several hundred years ago. Erosion of the cliffs by waves, however, has washed away much of these towns. Artists, bird-watchers, and sailing enthusiasts visit the area, and music lovers attend the annual (since 1948) Aldeburgh Festival, founded by the locally born composer Benjamin Britten.

Felixstowe, Suffolk Coastal's largest town, lies at the district's southern tip and developed as a seaside resort in the 19th century. By the late 20th century its amusement park and beaches remained popular, but it had also become one of Great Britain's most important containerization ports. Ferry service connects Felixstowe to Zeebrugge, Belgium. Cereals, sugar beets, cattle, and pigs are raised inland. The Sizewell nuclear power station is located in the district. Area 344 square miles (891 square km). Pop. (1992 est.) 111,300.

**Suffolk Resolves** (Sept. 9, 1774), in U.S. colonial history, most famous of many meetings vigorously protesting the Intolerable Acts enacted by the British Parliament the same year. Because representative provincial government had been dissolved in Massachusetts, delegates from Boston and neighbouring towns in Suffolk county met at Dedham and later at Milton to declare their refusal to obey either the acts or the officials responsible for them. They urged fellow citizens to cease paying taxes or trading with Britain and to undertake militia drill each week. Passed unanimously, the resolves were carried by Paul Revere to Philadelphia, where they were endorsed by the First Continental Congress.

**suffrage,** in representative government, the right to vote in electing public officials and adopting or rejecting proposed legislation.

The history of the suffrage, or franchise, is one of gradual extension from limited, privileged groups in society to the entire adult population. Nearly all modern governments have provided for universal adult suffrage. It is regarded as more than a privilege extended by the state to its citizenry; it is rather thought of as an inalienable right that inheres to every adult citizen by virtue of citizenship. In democracies it is the primary means of ensuring that governments are responsible to the governed.

The basic qualifications for suffrage are similar everywhere, although there are minor variations from country to country. Usually only the adult citizens of a country are eligible to vote there, the minimum age varying from 18 to 25 years. Most governments insist also on the voter's affiliation to a certain locality or constituency. The insane, certain classes of convicted criminals, and those punished for certain electoral offenses are generally barred from the suffrage.

Before the evolution of universal suffrage, most countries required special qualifications of their voters. In 18th- and 19th-century Britain, for instance, there was a property or income qualification, the argument being that only those who had a stake in the country should be allowed a voice in its public affairs. At one time, only men qualified for the suffrage. Many newly independent countries of Asia and Africa, during the transition from colony to self-government, had a literacy qualification for the suffrage. Some countries limit it to certain racial or ethnic groups. Thus, for example, South Africa, at one time, and the Old South of the United States did not permit their black populations to vote.

**suffrage, woman:** *see* woman suffrage.

**Suffren de Saint-Tropez, Pierre André de** (b. July 13, 1729, Saint-Cannat, France—d. Dec. 8, 1788, Paris), French admiral, noted for his daring tactics, who fought the British in Indian waters during the American Revolutionary War.

A Knight of Malta, Suffren de Saint-Tropez served under Admiral C.H. d'Estaing in America and was sent to assist French military operations in India in 1781. In a remarkable series of engagements with British Admiral Sir Edward Hughes off the coasts of India and Ceylon in 1782–83, he disregarded textbook rules and tried, with varying success, to teach his captains to isolate groups of enemy vessels and thus destroy a squadron piecemeal.

**Ṣūfism,** also spelled ṢŪFIISM, mystic Islāmic belief and practice in which Muslims seek to find divine love and knowledge through direct personal experience of God. Ṣūfism consists of a variety of mystical paths that are designed to ascertain the nature of man and of God and to facilitate the experience of divine love and wisdom in the world.

A brief treatment of Ṣūfism follows. For full treatment, *see* MACROPAEDIA: Islām, Muḥammad and the Religion of.

The Arabic term *ṣūfī* ("mystic") derives from *ṣuf,* "wool," probably in reference to the woolen garments worn by early Islāmic ascetics. Ṣūfism as an organized movement arose among pious Muslims as a reaction against the worldliness of the early Umayyad period (AD 661–750). Yearning for a personal union with God, the mystics found the externalities of the law, divorced from a personal theology, very unsatisfactory and increasingly asserted a way (*ṭarīqah,* "path") and a goal (*ḥaqīqah,* "reality") alternative to those of the Sharīʿah, or traditional law. Ṣūfism similarly opposed its intuitionism (*maʿrifah,* "interior knowledge") to the rational deductions of formal theology.

The mainstream of the Ṣūfīs strove to remain within orthodoxy and declared that the observance of the Sharīʿah was indispensable; indeed, from the early period they had attempted to develop a scheme of partly antithetical and partly complementary categories (*e.g.,* "annihilation and restoration"; "intoxication and sobriety") to achieve a synthesis of the external and the internal. But the opposition of these two aspects continued to be emphasized. During the late 12th and early 13th centuries, under the influence of speculative mysticism, Ibn al-ʿArabī produced a system that created a complete chasm between the law and Ṣūfism. In societies, such as Islāmic India, that had a strong pre-Islāmic heritage of mysticism, this chasm became much wider. Ṣūfism developed into dervish orders, which emphasized emotionalism and hypnotic and ecstatic states and which remained influential until very recent times.

The importance of Ṣūfism in the history of Islām is incalculable. The flowering of Ṣūfī literature, especially mystical love poetry, represents a golden age among the Arabic, Persian, Turkish, and Urdu languages. And it was largely through the efforts of Ṣūfī missionaries that Islām was extended into India, Central Asia, Turkey, and sub-Saharan Africa.

Numerous Ṣūfī orders and suborders existed in the late 20th century, each characterized by variations in certain basic practices. A primary spiritual technique of Ṣūfism is *dhikr,* the recitation of the name of God or of certain Qurʾānic phrases. Through discipline and the gift of grace, the "wayfarer" seeks to loosen the bonds of his lower self until they are severed altogether, enabling the soul to experience the true reality (*ḥaqīqah*) toward which it naturally aspires.

**sugar,** any of numerous sweet, colourless, water-soluble compounds present in the sap of seed plants and the milk of mammals and making up the simplest group of carbohydrates. (*See also* carbohydrate.) The most common sugar is sucrose, or table sugar, which is commercially produced in large amounts—more than 100 million metric tons per year—and is almost entirely used as food. Its chemical formula is $C_{12}H_{22}O_{11}$.

A brief treatment of sugar follows. For full treatment, *see* MACROPAEDIA: Food Processing.

Almost all sucrose is extracted from sugarcane and sugar beets by a milling process (shredding the plants, pressing out the juice, and extracting the residues with water) or by a diffusion process (separating the sugar from the finely cut plants by dissolving it in hot water or juice). The combined liquids are clarified, concentrated through evaporation, and then seeded to induce crystallization of the sugar. Refined granulated sugar, an unusually pure commercial product, is 99.9 percent sucrose. Confectioner's (powdered, or icing) sugar is pulverized sucrose, ordinarily mixed with 3 percent starch or approximately 1 percent calcium phosphate to prevent caking.

Other sources of sucrose include the sugar maple tree, the date palm, and honey. Chemists have identified numerous other sugars; only a few are commercially produced, including glucose (also called dextrose)

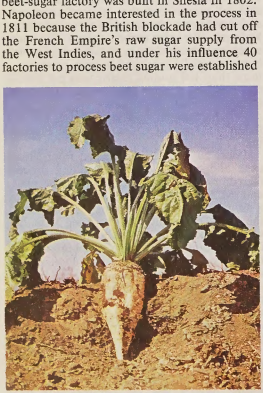
and fructose (or levulose), which occur in fruits and honey; invert sugar, a combination of glucose and fructose that is formed synthetically from sucrose; maltose (or malt sugar), produced in the malting of barley; and lactose (or milk sugar), the only common sugar of animal origin.

**Sugar Act** (1764), in U.S. colonial history, British legislation aimed at ending the smuggling trade in sugar and molasses from the French and Dutch West Indies and at providing increased revenues to fund enlarged British Empire responsibilities following the French and Indian War. Actually a reinvigoration of the largely ineffective Molasses Act of 1733, the Sugar Act provided for strong customs enforcement of the duties on refined sugar and molasses imported into the colonies from non-British Caribbean sources. The act thus granted a virtual monopoly of the American market to British West Indies sugar planters. Early colonial protests at these duties were ended when the tax was lowered two years later. The protected price of British sugar actually benefited New England distillers, though they did not appreciate it. More objectionable to the colonists were the stricter bonding regulations for shipmasters, whose cargoes were subject to seizure and confiscation by British customs commissioners and who were placed under the authority of the Vice-Admiralty Court in distant Nova Scotia if they violated the trade rules or failed to pay duties. Owing to this act, the earlier clandestine trade in foreign sugar, and thus much colonial maritime commerce, were severely hampered.

**sugar apple:** *see* sweetsop.

**sugar beet,** variety of beet (*Beta vulgaris*) that is second only to sugarcane as the major source of the world's sugar. Sugar beets can be grown in temperate or cold climates in Europe, North America, and Asia and thus within the densely populated, well-developed areas where much of the product is consumed. In contrast, sugarcane can be grown only in tropical or subtropical regions.

The sugar beet was grown as a garden vegetable and for fodder long before it was valued for its sugar content. Sugar was produced experimentally from beets in Germany in 1747 by the chemist Andreas Marggraf, but the first beet-sugar factory was built in Silesia in 1802. Napoleon became interested in the process in 1811 because the British blockade had cut off the French Empire's raw sugar supply from the West Indies, and under his influence 40 factories to process beet sugar were established in France. The industry temporarily collapsed after Napoleon's fall but recovered in the 1840s. Beet-sugar production then increased rapidly throughout Europe; by 1880 the tonnage had overtaken that of cane sugar. Beet sugar now accounts for almost all sugar production in continental Europe and for almost one-third of total world production. Major producers with the highest sugar yields are France, Germany, the United Kingdom, The Netherlands, and the United States.



Sugar beet (*Beta vulgaris*)
Grant Heilman

Sugar beets are grown from seed, typically sown early in the spring. Sucrose, a product of photosynthesis, is stored in the root, which can grow to 1–2 kg (2.2–4.4 pounds) and can contain from 8 to 22 percent sucrose by weight. The plants are harvested in the late autumn, the leaves and root crowns being shorn off before the roots are lifted by machine. Beet yields range from 15 to 115 metric tons per hectare (5 to 50 tons per acre).

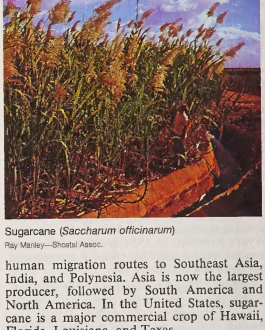
**Sugar Bowl,** American collegiate football game played on New Year's Day (with some exceptions) in New Orleans, La. The first game was played in 1935, eight years after it had been conceived by Colonel James M. Thomson and Fred J. Digby of the *New Orleans Item.* Supporters of the game raised $30,000 by subscription, and Tulane University allowed its stadium to be used at no charge. The Sugar Bowl moved to the Louisiana Superdome in 1976. At that time the champion team of the Southeastern Conference (SEC) became the host team of the Sugar Bowl. From 1998 the Sugar Bowl was part of the Bowl Championship Series, and hosted the national championship game every four years (beginning in 2002). In other years the Sugar Bowl continued its ties with the SEC.

**Sugar Loaf,** Portuguese PÃO DE AÇÚCAR, landmark peak overlooking Rio de Janeiro and the entrance of Guanabara Bay, in southeastern Brazil. Named for its shape, the conical, granite peak (1,296 feet [395 m]) lies at the end of a short range between Rio de Janeiro and the Atlantic Ocean. At its base is the fortress of São João. A cable car runs from its summit to the adjacent Urca Hill, near the foot of which is the Praia Vermelha Campus of the Federal University of Rio de Janeiro.

**sugar maple** (*Acer saccharum*), also called HARD MAPLE, or ROCK MAPLE, large tree in the maple family (Aceraceae), native to eastern North America and widely grown as an ornamental and shade tree. It is a commercially important source of maple syrup (*q.v.*), maple sugar, and hardwood lumber useful in furniture manufacture and flooring. Some trees develop special grain patterns such as bird's-eye maple (with dots suggesting eyes of birds) and curly and fiddleback maple, with wavy and rippled grain, respectively. The sugar maple may grow to a height of 40 m (130 feet). It has a dense crown of leaves, which turn various shades of gold to scarlet in fall. Its three- to five-lobed leaves appear after the greenish yellow flowers of spring. The fruits are paired samaras, or keys. Smooth grayish bark on the trunk and branches gradually furrows with age. The leaf of the sugar maple is the national emblem of Canada.

Several varieties of sugar maples are available; their leaf crowns may be columnar, oval, or pyramidal in shape, with dark green to yellowish leaves. Among those considered subspecies are Rocky mountain sugar maple (*A. saccharum grandidentatum*), chalk maple (*A. saccharum leucoderme*), and black maple (*A. saccharum nigrum*).

**sugarcane** (*Saccharum officinarum*), giant, thick, perennial grass of the Gramineae family cultivated in tropical and subtropical regions worldwide for its sweet sap, which is a major source of sugar and molasses. Sugarcane probably originated in what is now New Guinea, its cultivation spreading along the human migration routes to Southeast Asia, India, and Polynesia. Asia is now the largest producer, followed by South America and North America. In the United States, sugarcane is a major commercial crop of Hawaii, Florida, Louisiana, and Texas.



Sugarcane (*Saccharum officinarum*)
Ray Manley—Shostal Assoc.

The plant grows in clumps of solid stalks with regularly spaced nodes or joints, with a bud at each node. The graceful, sword-shaped leaves are similar to those of the corn plant. The sheath folds around the stem, protecting the bud. Mature canes may be 3–6 m (10–20 feet) tall and 2.5–7.5 cm (1–3 inches) in diameter. The colour of the stalk ranges from almost white to yellow to deep green, purple, red, or violet.

The sugarcane plant is susceptible to more than 60 diseases, none of which occurs worldwide. Regional varieties are bred to resist specific types of disease, and extensive breeding programs continue to produce new varieties suitable to the major sugarcane-producing areas of the world.

For commercial production, sugarcane propagation is conducted vegetatively (asexually); sections of stalk, each containing a node, are planted. The crop requires at least 1,500 mm (60 inches) of rainfall or irrigation per year and a minimum of nine months to mature. Cane is harvested in the cooler months in North America; in Cuba, Hawaii, Colombia, and other prime areas, it is harvested year-round. Most of the world's cane is cut by hand, using machetes, although mechanical harvesting has increased steadily since it was introduced in Louisiana in the 1940s.

The sugar content of sugarcane ranges from 7 to 18 percent by weight. Cane yields range from 35 to 190 metric tons per hectare (15 to 85 tons per acre). About 75 million metric tons of raw sugar are produced from sugarcane each year in factories in the cane-growing areas. Molasses, the syrup remaining after sugar is crystallized out of the juice, is used to make rum and is a feed for farm animals. The residual cane fibre, called bagasse, is often burned as a fuel for the cane factory; it is also sold as a filler for paper and particleboard.

**sugarplum tree** (*Lagunaria patersoni*), plant of the mallow family (Malvaceae), native to Australia and grown in warm temperate regions as an ornamental. Because of its shapely growth and regularly spaced branches, it is sometimes grown along avenues. The tree grows to about 15 m (50 feet) in height and has alternate oval or oblong leaves. The pale pink flowers are about 6 cm (2.5 inches) across.

**Sugawara Michizane,** posthumous name TENJIN (b. 845, Japan—d. March 26, 903, Dazaifu, Japan), Japanese political figure and scholar of Chinese literature of the Heian period, who was later deified as Tenjin, the patron of scholarship and literature.

Sugawara was born into a family of scholars, and as a boy he began studying the Chinese classics. After passing the civil-service exami-

nation in 870 he entered the Japanese court as a scholar and poet. In 886 he was appointed governor of Sanuki Province (modern Kagawa prefecture) on the island of Shikoku.

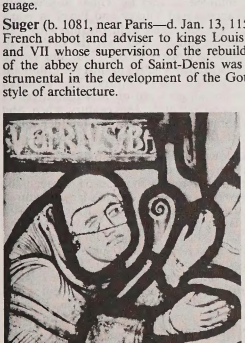
Sugawara returned to Kyōto in 890. He was promoted to a succession of important posts by the emperor Uda, who sought to use him to counterbalance the influence of the powerful Fujiwara family. By 899 he was made minister of the right (*udaijin*), the second most important ministerial position, by Uda's son, the emperor Daigo. Daigo, however, favoured the Fujiwara, and in 901 Fujiwara Tokihira, Sugawara's rival, convinced the emperor that Sugawara was plotting treason. Sugawara was banished from the capital by being appointed to an administrative post on the island of Kyushu.

Following Sugawara's death there two years later, a series of calamities—storms, fires, and violent deaths—were attributed to his vengeful spirit. To placate the spirit, Sugawara was posthumously reinstated to high rank and later was deified. His writings include a history of Japan and two volumes of Chinese poetry.

A major festival honouring Tenjin is held annually on July 25 at the Temman Shrine in Ōsaka. There are also numerous local shrines throughout Japan at which schoolchildren buy amulets for luck during the period of school entrance examinations in the spring.

**Sugbuhanon language:** *see* Cebuano language.

**Suger** (b. 1081, near Paris—d. Jan. 13, 1151), French abbot and adviser to kings Louis VI and VII whose supervision of the rebuilding of the abbey church of Saint-Denis was instrumental in the development of the Gothic style of architecture.



Suger, detail of a stained glass window, 12th century; in the abbey church of Saint-Denis, Fr.
Archives Photographiques, Paris

Suger was born of peasant parents. As a child he showed unusual intelligence, and in 1091 he was brought to the nearby abbey of Saint-Denis (the patron saint of France) to be educated by the monks. His closest friend and schoolmate at the abbey was Louis Capet, a boy his age. This boy became King Louis VI in 1108. Suger became secretary to the abbot Adam of Saint-Denis and a close adviser to the king.

As secretary to Abbot Adam, Suger made various diplomatic missions to Henry Beauclerc of Normandy, who was also King Henry I of England and the son of William the Conqueror. Suger was greatly impressed by the strong, orderly administration of the Norman ruler, which contrasted with the chaotic feudalism in France.

Saint-Denis, shrine of the saint who had supposedly brought Christianity to Gaul, was an object of great veneration. Suger saw its destiny and that of the French crown as permanently related. He believed that by stressing and enlarging the king's role as vassal of Saint-Denis he could unite the king and his nobles under an idea they could mutually believe in. Suger also saw that the king could and should be protector of the peasants and the middle class.

In 1122 Suger was elected abbot of Saint-Denis. He had a chance shortly thereafter to test his theory of the cementing power of the symbolic theory of Saint-Denis. In 1124 Holy Roman Emperor Henry V invaded lands ruled by King Louis VI. Louis rode into battle carrying the Oriflamme, the banner of Saint-Denis, which normally rested in the church along with the relics of the saint. As a result of his (and Suger's) appeal to the nobility's veneration for the saint, he was followed by a larger army of nobles than had ever previously pledged their allegiance to him or to his father. The army of Louis and the Oriflamme were so formidable that Henry V retreated without battle.

Although Suger was not an ascetic but a reasonable and humane man in a time of violent extremes, he guided the monks of Saint-Denis back into a life of greater piety and religious observation than they had known under Abbot Adam. In Adam's administration the monks had gained notoriety for behaving in an excessively secular fashion. Suger corrected this situation at the urging of Bernard, abbot of Clairvaux. Suger cooperated in this and many other matters with Bernard, who was a close adviser to the pope and the greatest spiritual leader in Europe at the time. He could be a powerful enemy or ally, and Suger chose to be his ally.

After King Louis's death in 1137, his successor, Louis VII, rejected Suger's role as principal adviser, and Suger concentrated all of his efforts for the next five years on completing the rebuilding of the church of Saint-Denis, which had fallen into decay. It is believed that he was the inspiration behind many of the architectural innovations employed in the project, which include an original use of the pointed (rather than round) arch and the ribbed vault and extensive use of stained glass, including a rose window in the façade.

In 1142 Louis seized lands belonging to his most powerful vassal, Thibaut, count of Champagne. Civil war resulted. The support of the powerful Thibaut had always been vital to the French monarchy, and the young king was making war ferociously and irrationally. Suger stepped in as an active adviser to Louis VII, as he had always done with his father, and negotiated a peace treaty between Thibaut and Louis. The treaty was signed at the dedication ceremony of the church of Saint-Denis, an architectural marvel.

As penance for the many lives that he had taken during the war with Thibaut, Louis VII was urged by Bernard of Clairvaux to lead a crusade to free the Holy Land from the Muslims. Suger was strongly opposed to this and tried unsuccessfully to change the king's mind. For the first time Suger stood in opposition to the wishes of the weak, young king as well as those of Bernard and the pope.

On June 11, 1147, Louis and Queen Eleanor departed on the Second Crusade. Louis left his crown with Abbot Suger, who was appointed regent in his absence. The Crusade was a disastrous loss, but at home Suger governed well, despite the great financial drain on the funds at his disposal. He devised new and fairer means of taxation, passed laws preventing deforestation, and suppressed a revolt by a group of nobles who planned to make Robert, count of Dreux and brother of Louis VII, king in his absence. When in 1149 Louis returned from the Crusade, many believed that Suger would not return the crown, but they were proved wrong.

In 1150 Suger himself, with Bernard, made plans for another crusade. But in 1150, before it was begun, Suger fell ill with malaria. He died in January 1151. (A.F.R.)

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**suggestion,** in psychology, process of leading a person to respond uncritically, as in belief or action. The mode of suggestion, while usually verbal, may be visual or may involve any other sense. The suggestion may be symbolic. For instance, a person who is allergic to roses may develop an attack of asthma from looking through a seed catalog. Suggestion, or suggestibility, plays a significant role in collective behaviour, especially in social unrest, and it constitutes the central phemonenon of hypnosis (*q.v.*).

**Suggs, Louise** (b. Sept. 7, 1923, Atlanta, Ga., U.S.), American golfer who was twice president of the Ladies' Professional Golfers' Association (LPGA) and winner of 50 LPGA tournaments.

As an amateur noted for her excellent form, Suggs won the British Ladies' tournament in 1948, only the second American to do so. Her other amateur victories included the Western Amateur (three times) and the U.S. Women's Amateur. She was named to the Curtis Cup team in 1948, the year she turned professional.

Suggs won the U.S. Women's Open in 1949 (a record 14 strokes ahead of Babe Zaharias) and 1952 and finished second five times. She also won the U.S. LPGA tournament in 1957, winning the Vare trophy in that same year for low stroke average, and led the LPGA in tournament winnings in 1953 and 1960. Three times she won the Titleholders championship and the North and South tournament. She was LPGA president in 1956 and 1957. After 1961 she restricted her appearances on the circuit but continued to appear until 1980. Suggs wrote *Golf for Women* (1960).

**Suhag** (Egypt): *see* Sawhāj.

**Ṣuḥār,** also spelled SOHAR, town and port, northern Oman. It is situated about 120 miles (190 km) northwest of Muscat on the al-Bāṭinah coast of the Gulf of Oman. Ṣuḥār's origins are prehistoric; it is located near the sites of several ancient copper mines, some possibly dating back to 2500 BC. The town became an early outpost of the Islāmic religion, possibly during the lifetime of the Prophet Muḥammad. It developed into a prosperous and well-known port and during the 10th century was said to be the largest and most important city in the Arab world. The port declined in importance following successive invasions first by the Persians and then by the Portuguese. Dates, ghee, dried limes, cowhides, and goatskins are exported from the modern port. A paved coastal road runs between Muscat and Ṣuḥār. Pop. (1993) 84,300.

**Suharto** (b. June 8, 1921, Kemusu Argamulja, Java, Dutch East Indies [now Indone-

sia]), second president of Indonesia (from 1967), noted for his conservatism, nationalism, and his anticommunist policies. Like many Javanese, he used only his given name.

After graduating from high school and working briefly as a bank clerk, Suharto joined the Dutch colonial army and then, after the Japanese conquest in 1942, switched to a Japanese-sponsored defense corps, receiving training as an officer. With Japan's surrender he fought in the guerrilla forces seeking inde-



Suharto
AP/Wide World Photos

pendence from the Dutch; by the time that Indonesia became a republic, in 1950, he was a lieutenant colonel. During President Sukarno's flirtations with communism in the 1960s, the army became strongly anticommunist. Suharto, now a major general, led the army in putting down an allegedly communist coup d'état on Sept. 30, 1965, and directed the purge of communists and leftists in public life, which triggered nationwide massacres of communists.

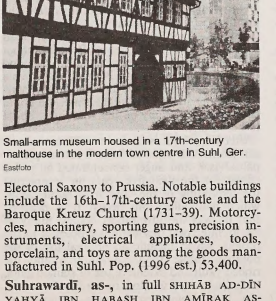
Suharto took control of the Indonesian government on March 12, 1966, though Sukarno remained nominal president for another year. In March 1967 the Consultative Congress appointed Suharto acting president, and in March 1968 it elected him to a five-year term as president. He instituted a policy he called the New Order, relying on the help of American-educated economists to reinvigorate the Indonesian economy. Western investment was encouraged, and oil production expanded. Suharto was repeatedly reelected without opposition; his regime remained authoritarian, despite the country's growing stability. Civil liberties were restricted. In 1998 nationwide protests arose against cronyism and corruption involving him, his children, and his close friends, and he was forced to resign in May.

**Sühbaatar,** also spelled SŪCHBAATAR, or SŪKHBAATAR, town, northern Mongolia, situated about 160 miles (260 km) north-northwest of the capital Ulaanbaatar at the confluence of the Orhon and Selenga rivers. Sühbaatar was founded in 1940 at the head of navigation on the Selenga. The town is named after the Mongolian revolutionary leader Damdiny Sühbaatar. It was connected to Ulaanbaatar by railway in 1949 and later became a railway terminus for travel to Russia. The town is a trade and industrial centre, with an agricultural college and a thermoelectric station. A flour mill, match factory, distillery, rolling-stock repair depot, and building and woodworking combines are located there. Pop. (1998 est.) 22,300.

**Sühbaatar, Damdiny,** Sühbaatar also spelled SŪKHBAATAR, or SUKEBATOR (b. Feb. 2, 1893, Tsetsen-Khan, Mongolia—d. Feb. 22, 1923, Urga [now Ulaanbaatar]), cofounder and leader of the Mongolian People's Revolutionary Party, who was the major force in the founding of the communist Mongolian People's Republic.

Sühbaatar joined the army as a young man, trained as a machine gunner, and received the honorific title Baatar ("Hero") for fighting against pro-Japanese forces. After demobilization, he trained to become a typesetter but soon became involved in politics, organizing a group of revolutionaries known as the Dzüünharaa Circle in 1919, which in the following year united with the group led by Choibalsan. In 1920 he visited Russia and in 1921 organized the People's Army to oppose the defeated anti-Bolshevik forces that were occupying northern Mongolia under the command of Baron Ungern-Sternberg. The People's Army defeated the Chinese in March 1921, captured Urga (now called Ulaanbaatar) on July 6, and established a permanent government on July 10. Sühbaatar became the first minister of war in the new government.

**Suhl,** city, Thuringia *Land* (state), central Germany, situated on the Lauter River, in the Thüringer Forest. First mentioned in 1239, it was chartered in 1527. In 1815 it passed with



Small-arms museum housed in a 17th-century malthouse in the modern town centre in Suhl, Ger.
Eastfoto

Electoral Saxony to Prussia. Notable buildings include the 16th–17th-century castle and the Baroque Kreuz Church (1731–39). Motorcycles, machinery, sporting guns, precision instruments, electrical appliances, tools, porcelain, and toys are among the goods manufactured in Suhl. Pop. (1996 est.) 53,400.

**Suhrawardī, as-,** in full SHIHĀB AD-DĪN YAḤYĀ IBN ḤABASH IBN AMĪRAK AS-SUHRAWARDĪ, also called AL-MAQTŪL, or SHAYKH AL-ISHRĀQ (b. *c.* 1155, Suhraward, near Zanjān, Iran—d. 1191, Ḥalab, Syria), mystic theologian and philosopher who was a leading figure of the illuminationist school of Islāmic philosophy, attempting to create a synthesis between philosophy and mysticism.

After studying at Eṣfahān, a leading centre of Islāmic scholarship, as-Suhrawardī traveled through Iran, Anatolia, and Syria. Influenced by mystical teachings, he spent much time in meditation and retreat, and in Ḥalab (modern Aleppo) he favourably impressed its ruler, Malik aẓ-Ẓāhir, son of Saladin. His teachings, however, particularly the pantheistic overtones of his mystical doctrines, aroused the opposition of the established and orthodox *'ulamā'* ("men of learning"), who persuaded Malik aẓ-Ẓāhir to have him put to death. The appellation al-Maqtūl ("the Killed") meant that he was not to be considered a *shahīd* ("martyr").

As-Suhrawardī wrote voluminously. The more than 50 separate works that were attributed to him were classified into two categories: doctrinal and philosophical accounts containing commentaries on the works of Aristotle and Plato, as well as his own contribution to the illuminationist school; and shorter treatises, generally written in Persian and of an esoteric nature, meant to illustrate the paths and journeys of a mystic before he could achieve *ma'rifah* ("gnosis," or esoteric knowledge).

Influenced by Aristotelian philosophy and Zoroastrian doctrines, he attempted to reconcile traditional philosophy and mysticism. In his best-known work, *Ḥikmat al-ishrāq* ("The Wisdom of Illumination"), he said that essences are creations of the intellect, having no objective reality or existence. Concentrating on the concepts of being and non-being, he held that existence is a single continuum that culminates in a pure light that he called God. Other stages of being along this continuum are a mixture of light and dark.

As-Suhrawardī also founded a mystical order known as the Ishrāqīyah. The Nūrbakhshīyah order of dervishes (itinerant holy men) also traces its origins to him.

**Suhrawardīyah,** Muslim order of mystics (Ṣūfīs) noted for the severity of its spiritual discipline, founded in Baghdad by Abū Najīb as-Suhrawardī and developed by his nephew 'Umar as-Suhrawardī. The order's ritual prayers (*dhikr*) are based upon thousands of repetitions of seven names of God, identified with seven "subtle spirits" (*laṭā'if sab'ah*) which in turn correspond to seven lights.

The main order became concentrated in Afghanistan and the Indian subcontinent, while other branches moved westward. The orthodox Khalwatīyah, also strictly disciplined, was founded in Iran by 'Umar al-Khalwatī, then spread into Turkey and Egypt in many branches. The Ṣafawīyah, organized by Ṣafī od-Dīn, at Ardabīl, Iran, gave rise to the Iranian Ṣafavid dynasty (1502–1736) and several Turkish branches active against the Ottomans early in the 16th century. The Algerian Raḥmānīyah grew out of the Khalwatīyah in the second half of the 18th century, when 'Abd ar-Raḥmān al-Ghushtulī, the founder, made himself the centre of Khalwatī devotion.

**Sūi,** town, Balochistān province, southern Pakistan, located northeast of Jacobābād. It rose to importance in 1950–51 through the discovery of one of the world's largest natural-gas deposits. Operations began in 1955 with the laying of pipelines to provide a cheap source of fuel and power for industries in Hyderābād, Karāchi, and Sukkur. Lines were extended to Multān (1958), Lahore, Faisalābād (formerly Lyallpur), and Hatār (1970). Besides generating power, Sūi gas is used for fertilizer production and as a basis for Pakistan's growing petrochemical industry. Pop. (1981 prelim.) 5,000.

**Sui** DYNASTY, Pinyin SUI (AD 581–618), short-lived Chinese dynasty that unified the country after four centuries of fragmentation in which North and South had gone quite different ways. The Sui also set the stage for and began to set in motion an artistic and cultural renaissance that reached its zenith in the succeeding T'ang dynasty. Its capital was at Ch'ang-an.

The first Sui emperor, Yang Chien, known by his posthumous name Wen-ti, was a high official of the Chou dynasty, and, when that reign dissolved in a storm of plots and murders, he managed to seize the throne and take firm control of North China; by the end of the 580s he had won the West and South and ruled over a unified China. He established uniform institutions of government throughout the country and raised a corps of skilled and pragmatic administrators. He reestablished Confucian rituals last used in government by the Han dynasty. He sought and won the support of men of letters, and he fostered Buddhism. He promulgated a penal code and administrative laws that were simpler, fairer, and more lenient than those of the predecessor Chou. He conducted a careful census, a practice long lost in chaos, and simplified the taxation. He made his army into

a system of militias that was self-supporting when the country was not at war.

The second emperor, Yang Ti, completed the integration of southern China into the empire, emphasized the Confucian classics in an examination system for public employment, and built a second capital at Lo-yang in the east. He engaged in great construction projects, including a vast canal system.

The relations of the Sui with the Turks in the west deteriorated; and, when wars in Korea to exact tribute failed, the short regime collapsed in a welter of rebellions. Yang Ti was murdered in 617, and his successor, Kung Ti, reigned only a year.

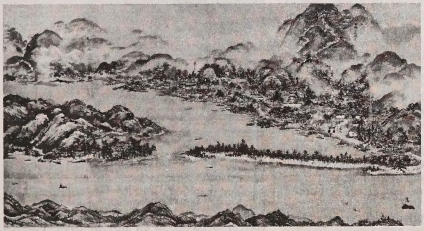
The architecture of the Sui was dominated by the great Yü-wen K'ai, who designed a vast capital city at Ch'ang-an that was six times the size of the modern city of Sian at the same site. Painters came from all over the country seeking patronage at the Sui court. The dynasty established the course of nurture of the arts that was embraced by the succeeding T'ang dynasty (*q.v.*). Because of the brevity of the Sui reign and the consonance of its arts with those of the T'ang, the arts of the two dynasties are often treated together.

**suiboku-ga,** also called SUMI-E, Japanese monochrome ink painting, a technique first developed in China during the Sung dynasty (960–1274) and taken to Japan by Zen Buddhist monks in the mid-14th century. Although generally content to copy Chinese models, early Japanese artists also excelled in the field of portraiture and figure painting. *Suiboku-ga* reached its height in the Muromachi period (1338–1573) with such masters as Sesshū Tōyō, whose landscapes were uniquely Japanese, and Sesson Shūkei, who worked in the far northeast of Japan.

The bold use of black ink strokes and washes allowed *suiboku-ga* artists to eliminate from their paintings all but the essential character of their subject, an aim closely related to the purward suicide hardened toward the end of the empire. Jews committed suicide rather than submit to ancient Roman conquerors or to Crusading knights. Buddhist monks and nuns have committed suicide by self-immolation as a form of social protest. The Japanese custom of seppuku (*q.v.*; also called hara-kiri), or self-disembowelment, was long practiced as a ceremonial rite among samurai. Japan's use of kamikaze suicide bombers during World War II was a precursor to the suicide bombing that emerged in the late 20th century as a form of terrorism, particularly among Islāmic extremists (*see* September 11 attacks) and among secular nationalists such as Sri Lanka's Liberation Tigers of Tamil Eelam (*q.v.*). Members of new religious movements, notably the Peoples Temple (Jonestown, Guyana, 1978) and Heaven's Gate (San Diego, Calif., U.S., 1997), have committed mass suicide.

Since the Middle Ages, Western society has used first canonic and later criminal law to combat suicide. Changes in the legal status of suicide, however, have had little influence on the suicide rate. Beginning after the French Revolution of 1789, criminal penalties for attempting suicide were abolished in European countries. But many of these countries and numerous U.S. states also adopted laws against helping someone to commit suicide. Some communities around the world have sought to legalize physician-assisted suicide for the terminally ill, and euthanasia is openly practiced in such countries as Colombia and The Netherlands. This movement has renewed discussions concerning the morality of suicide and the role of physicians who treat terminally ill patients.

The permissiveness of and the alienation experienced in modern society may be partly responsible for an increase in suicidal acts. There is now a greater readiness to understand rather than to condemn suicide, but a tendency to conceal suicidal acts still persists.



"Ama-no-Hashidate," portion of a hand scroll in the *suiboku-ga* style by Sesshū, ink and faint colour on paper, *c.* 1502–05, Muromachi period; in the Kyōto National Museum

By courtesy of the Kyoto National Museum

suit of Zen Buddhism. Although *suiboku-ga* was popular well into the Tokugawa period (1603–1867), it soon lost its spontaneity and became formalistic in style.

**suicide,** the act of intentionally taking one's own life. Because this definition does not specify the outcome of such acts, it is now customary to distinguish between fatal suicide and attempted, or nonfatal, suicide.

Throughout history, suicide has been both condemned and condoned by various societies. It is generally condemned by Islām, Judaism, and Christianity, and suicide attempts are punishable by law in many countries. The Brahmans of India, however, tolerate suicide; suttee, the theoretically voluntary suicide of an Indian widow, was highly praised at one time, though it is now outlawed. In ancient Greece, convicted criminals were permitted to take their own lives, but the Roman attitude toward suicide was ambivalent. Stoics praised it as a means of escape from pain, while Epicureans condemned it as a cowardly act.

A fatal suicide tends to cause grief and guilt among loved ones who may feel that they could have prevented it. If the act is nonfatal, it can serve as an appeal for help and may give rise to efforts at reparation. Conscious or unconscious expectation of these responses is a factor underlying many suicidal acts.

A number of theories have been developed to explain the causes of suicide. Psychological theories emphasize personality and emotional factors, while sociological theories, such as those posited by French sociologist Émile Durkheim, stress the influence of social and cultural pressures on the individual. Social factors such as bereavement, loneliness, and the alienation and ennui of modern urban life as well as mental disorders and physical illness have been found to be positively correlated with suicide rates. The decline of suicide rates in wartime has been related to the turning of aggression toward the common enemy and away from oneself. The greater closeness of human relations in wartime also tends to reduce the social isolation that is regarded as the most important cause of suicide.

No single approach can be expected to succeed in substantially reducing the incidence of suicide, but early recognition and treatment of mental disorders is an important deterrent. Centres and organizations for the prevention of suicide can be found in many countries. Most of them are not under medical direction, though all have medical consultants. Around-the-clock telephone hot lines provide counseling for lonely and desperate individuals in need of support. There is evidence that this kind of service may help to avert suicidal acts.

**suid,** any member of the family Suidae, hoofed mammals, order Artiodactyla, including the wild and domestic pigs. Suids are stout



Red river hogs (*Potamochoerus porcus porcus*)

Yitzhak—Raphoto/Photo Researchers

animals with small eyes and coarse, sometimes sparse hair. All have muzzles ending in a rounded cartilage disk used to dig for food. Some species have tusks. Suids are omnivorous and usually gregarious. Females bear litters of 2 to 14 young; gestation is four to five months. Domestic pigs are found worldwide; wild species are native to the Old World.

For more information on suid species and groups, *see* babirusa; boar; bush pig; pig; swine; warthog.

**Suid-Afrika:** *see* South Africa.

**Suid-Afrikaanse Nationale Kunsmuseun** (Capetown): *see* South African National Gallery.

**Suidger** (pope): *see* Clement II.

**Suiko,** in full SUIKO TENNŌ (b. 554, Yamato, Japan—d. April 15, 628, Yamato), first reigning empress of Japan in recorded history, the wife of the emperor Bidatsu (reigned 572–585) and the daughter of the emperor Kimmei.

Bidatsu was succeeded on the throne by Emperor Yōmei, but when the latter died after a short reign, a feud erupted between the Soga clan and the Mononobe and Nakatomi families over the succession. The Soga clan was victorious, and the emperor Sushun, whose mother had been a Soga, succeeded to the throne. Sushun proved too independent, however, and Soga Umako, the head of the Soga family, had Sushun murdered in 592, replacing him on the throne with the empress Suiko, who was Sushun's younger sister and Umako's own niece. Suiko's reign represented a great break with tradition, for although Japan had in legend been ruled by several women,

in recent centuries the ruling line had been male; moreover, several sons of Bidatsu could have been chosen for the throne.

Because the Soga family were ardent Buddhists, Buddhism became established in Japan during Suiko's reign. Other aspects of Chinese civilization were also introduced, owing mainly to the efforts of Crown Prince Shōtoku, whom Umako appointed regent for Suiko. Chinese and Korean craftsmen were brought to Japan, the Chinese calendar was introduced, the Chinese bureaucratic system replaced the old Japanese system of purely hereditary awards and ranks, and the total supremacy of the emperor was recognized.

**Suir, River,** river in Ireland, rising in the Devil's Bit Mountains and flowing south across the lowland of County Tipperary through Thurles to the foot of the Knockmealdown Mountains. There it receives the Tar and bends through an elbow-shaped loop to flow north around the western edge of the Comeragh Mountains. The river then enters a long west–east valley guarded on the south by the Comeraghs and limestone lowlands on the north. In the 1760s the river was made navigable to Clonmel, but the tidal limit is Carrick-on-Suir. Finally the river broadens into an estuary and passes through Waterford. A little farther east, after a course of 114 mi (183 km), the Suir is joined by the Barrow and the Nore. All three rivers enter the wide estuarine bay known as Waterford Harbour.

**Suisse:** *see* Switzerland.

**suit,** in dress design, matching set of clothes consisting, for example, of a coat, vest, and trousers. The shift in Western masculine attire from the doublet (*q.v.*) to the present-day suit began in 1666 at the courts of Louis XIV of France and Charles II of England. The reformed style consisted of a long coat with wide, turned-back sleeves and a row of buttons down the front, some of which were left unbuttoned to reveal a vest (later called a waistcoat in England), an undergarment almost identical to the coat.

At first the vest had long sleeves that showed below the turned-back sleeves of the coat, then they were dispensed with entirely. Neither coat nor vest had a collar or lapels. To complete the new mode, tight-fitting breeches were worn with stockings gartered below the knee. By 1670 this type of suit had become the firmly established style for men and was worn with no essential change until the end of the 18th century. From the time of the French Revolution until well into the 19th century, a man's suit consisted of a short, fitted waistcoat (called *veston* in France); below-knee-length breeches or long trousers; and a long outer coat. A top hat was worn with it. By the 1830s, breeches were worn as compulsory court attire and by the elderly and the unfashionable, and long trousers by everyone else.The prototype of today's suit appeared in 1860 as the "lounge suit," which was for informal wear and consisted of long trousers; a waistcoat, or vest (often elaborately decorated); and a short coat. The desire on the part of the middle class for gentlemanly clothes led to great conformity in men's suits; since the 19th century men's fashions have remained more or less static.

Women's suits became very popular in the second half of the 19th century for cycling, riding, and the like. The "tailor-made" costume was developed during the 1880s and was used for sports and morning wear. It continued to evolve and was worn a good deal during the first decade of the 20th century. When women began to work outside the home after World War I, they adopted the tailor-made form of suit, which consisted of a skirt and jacket. In the second half of the 20th century, women began to wear matching jackets and trousers (pants suits), which were popularized by the trend toward an egalitarian society.

**Suita,** city, Ōsaka Urban Prefecture (*fu*), Honshu, Japan, situated on the Yodo-gawa (Yodo River), on the northern border of Ōsaka city. Suita developed as a river port and post town in the early Tokugawa era (1603–1867). Industrialization began in the late 19th century when a large beer brewery was established. Other industries include metal, chemical, and pulp manufactures. Suita is best known for its large railway freight yard, which was opened in 1923. The city housed the World Trade Exposition in 1970. Pop. (1995) 342,760.

**suite,** in music, group of self-contained instrumental movements of varying character, usually in the same key. During the 17th and 18th centuries, the period of its greatest importance, the suite was comprised principally of dance movements. In the 19th and 20th centuries the term also referred more generally to a variety of sets of instrumental pieces, mainly in forms smaller than those of the sonata, and included selections for concert performance of incidental music to plays (*e.g.*, Georges Bizet's *L'Arlésienne* suite, composed 1872) and ballet music (*e.g.*, Peter Ilich Tchaikovsky's *Nutcracker* suite, 1892).

The suite of related dance movements originated in the paired dances of the 14th–16th centuries, such as the pavane and galliard or the basse danse and saltarello. Often the same theme would be treated in different metre and tempo in the two dances. In the 16th and 17th centuries German composers often arranged three or four dances as a unified musical entity, an early example being Johann Hermann Schein's *Banchetto musicale* (published 1617), a collection of suites of five dances for five viols.

In France the trend was to publish suites for lute or keyboard that were simply collections of as many as 17 or 18 pieces, almost always dances, in the same key. The French composers gradually transformed the dances into elegant, refined compositions, and the individual dance genres developed distinctive musical traits. Usually the French composers gave their pieces fanciful or evocative titles, as in the ordres (suites) of François Couperin (*e.g.*, the allemande *L'Auguste* from Ordre I of his first book of harpsichord music).

French composers also introduced other dance types in addition to the four that by the early 18th century had become usual—the allemande, courante, sarabande, and gigue (*qq.v.*), in that order. This basic grouping had been established in Germany in the late 17th century after Johann Jakob Froberger began to include a gigue either before or after the courante in the then common German arrangement of allemande, courante, sarabande. Froberger's publisher later reordered the dances in the sequence that became standard.

By the mid-18th century the use of additional movements (galanteries), such as gavottes, bourrées, and minuets, and even of an air (a lyrical movement not deriving from a dance), was common, as was a variously entitled introductory movement; *e.g.*, prelude, overture, fantasia, sinfonia. Examples of such expansions of the basic four movements include J.S. Bach's *English Suites, French Suites,* and *Partitas* (partita was a common German term for "suite").

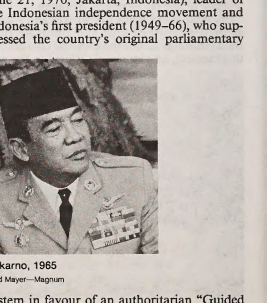
Outside France and Germany the order and selection of dances tended to be less standardized. In Italy suites for chamber ensemble or orchestra were commonly termed sonata da camera (chamber sonata). Particularly in Germany another type of suite also developed in the late 17th and early 18th centuries. Derived from selections of dances and preceded by an overture in the French style, from the operas and ballets of the French composer Jean-Baptiste Lully, it included dances then modern rather than the four traditional dance types, which by then, abstracted and refined, had lost their immediate dance character. Because of their opening movement, suites of this type were often called *ouvertures.* Examples include the collections *Florilegia* (1695; 1698) of Georg Muffat and J.S. Bach's four *Ouvertures* for orchestra.

**Šuja** (Russia): *see* Shuya.

**Sukabumi,** also spelled SOEKABOEMI, *kotamadya* (city) and *kabupaten* (regency), Jawa Barat *propinsi* (West Java province), Java, Indonesia, located 50 mi (80 km) south of Jakarta at the foot of Gunung (mount) Pangrango. It is linked with Bogor and Jakarta to the northwest and with Bandung to the east by road and railway. The population is mostly Javanese, with some admixture of Balinese; Islām is the dominant religion. The language is Bahasa Indonesia. Rubber plantations occupy the surrounding hill, and the city is a trading and transshipment centre for locally produced agricultural commodities, including rice, corn (maize), cassava, and copra. Industries produce textiles, machinery, processed food, and milled rice. Crafts include wood carving, batik printing, kris (Indonesian dagger) making, plaiting, and mat and basket making. Located at an altitude of 1,970 ft (600 m), Sukabumi is a health resort visited by Indonesian and foreign tourists. Pop. (1995 est.) city, 125,766; regency, 1,517,657.

**Sukarnapura** (Indonesia): *see* Jayapura.

**Sukarno,** also spelled SOEKARNO (b. June 6, 1901, Surabaja, Java, Dutch East Indies—d. June 21, 1970, Jakarta, Indonesia), leader of the Indonesian independence movement and Indonesia's first president (1949–66), who suppressed the country's original parliamentary



Sukarno, 1965
Fred Mayer—Magnum

system in favour of an authoritarian "Guided Democracy" and who attempted to balance the Communists against the army leaders. He was deposed in 1966 by the army under Suharto.

*Early life and education.* Sukarno was the only son of a poor Javanese schoolteacher, Raden Sukemi Sosrodihardjo, and his Balinese wife, Ida Njoman Rai. Originally named Kusnasosro, he was given a new and, it was hoped, more auspicious name, Sukarno, after a series of illnesses. Known to his childhood playmates as Djago (Cock, Champion) for his looks, spirits, and prowess, he was as an adult best known as Bung Karno (*bung,* "brother" or "comrade"), the revolutionary hero and architect of *merdeka* ("independence").

Sukarno spent long periods of his childhood with his grandparents in the village of Tulungagung, where he was exposed to the animism and mysticism of serene rural Java. There he became a lifelong devotee of *wajang,* the puppet shadow plays based on the Hindu epics, as animated and narrated by a master puppeteer, who could hold an audience spellbound through an entire night. As a youth

of 15, Sukarno was sent to secondary school in Surabaja and to lodgings in the home of Omar Said Tjokroaminoto, a prominent civic and religious figure. Tjokroaminoto treated him as a cherished foster son and protégé, financed his further education, and eventually married him off at age 20 to his own 16-year-old daughter, Siti Utari.

As a student Sukarno chose to excel mainly in languages. He mastered Javanese, Sundanese, Balinese, and modern Indonesian, which, in fact, he did much to create. He also acquired Arabic, which, as a Muslim, he learned by study of the Qur'ān; Dutch, the language of his education; German; French; English; and, later, Japanese. In Tjokroaminoto's home he came to meet emerging leaders who spanned the rapidly widening national political spectrum, from feudal princelings to fugitive communist conspirators. The eclectic syncretism of the Tjokroaminoto ménage, like the romance and mysticism of *wajang,* imprinted itself indelibly upon Sukarno's mind and personality. He was later to treat nation-making as a heroic theatrical, in which the clash of irreconcilable men and ideas could be harmonized through sheer poetic magic—his own.

Endowed with commanding presence, radiant personality, mellifluous voice, vivid style, a photographic memory, and supreme self-confidence, Sukarno was obviously destined for greatness. In 1927 in Bandung, where he had just acquired a degree in civil engineering, he found his true calling in oratory and politics. He soon revealed himself as a man of charisma and destiny.

*Indonesian independence.* For his challenge to colonialism Sukarno spent two years in a Dutch jail (1929–31) in Bandung and more than eight years in exile (1933–42) on Flores and Sumatra. When the Japanese invaded the Indies in March 1942, he welcomed them as personal and national liberators. During World War II the Japanese made Sukarno their chief adviser and propagandist and their recruiter for labourers, soldiers, and prostitutes. Sukarno pressured the Japanese to grant Indonesia its independence and, on June 1, 1945, made the most famous of many celebrated speeches. In it he defined the Pantjasila, or Five Principles (nationalism, internationalism, democracy, social prosperity, and belief in God), still the sacrosanct state doctrine. When the collapse of Japan became imminent, Sukarno at first wavered. Then, after being kidnapped, intimidated, and persuaded by activist youths, he declared Indonesia's independence (Aug. 17, 1945). As president of the shaky new republic, he fueled a successful defiance of the Dutch, who, after two abortive "police actions" to regain control, formally transferred sovereignty on Dec. 27, 1949.

From his revolutionary capital in Jogjakarta, Sukarno returned in triumph to Jakarta on Dec. 28, 1949. There he established himself, his collection of paintings, and his voluptuous retinue in the splendid palace of the Dutch governors-general. He proceeded to preside urbanely over a spectacle that was at once diverting and disturbing. His increasingly numerous and outspoken critics maintained that Sukarno inspired no coherent programs of national organization and administration, rehabilitation, and development, such as were quite clearly necessary. He seemed instead to conduct a continuous series of formal and informal audiences and a nightly soiree of receptions, banquets, music, dancing, movies, and *wajang.* Indonesian politics became increasingly frenzied, with Sukarno himself engaged in devious maneuvers that made stabilization impossible. The Indonesian economy foundered while Sukarno encouraged the wildest of extravagances. To be sure, the nation scored impressive gains in health, education, and cultural self-awareness and self-expression. It achieved, in fact, what Sukarno himself most joyously sought and acclaimed as "national identity," an exhilarating sense of pride in being Indonesian. But this achievement came at a ruinous cost.

After "dreaming" in late 1956 of "burying" the feuding political parties in Indonesia and thus achieving national consensus and prosperity, Sukarno dismantled parliamentary democracy and destroyed free enterprise. He ordained "Guided Democracy" and "Guided Economy" for the achievement of Manipol-Usdek and Resopim-Nasakom—arcane acronyms symbolizing policies but signifying dictatorship.

Sukarno's personal and political excesses, as epitomized eventually by his neo-Marxist, crypto-communist ideology and his infamous cabinet of 100 corrupt and cynical ministers, induced a continuous state of national crisis. Sukarno narrowly escaped recurrent attempts at assassination, the first in 1957. Regional insurrections broke out in Sumatra and Sulawesi in 1958. Inflation escalated the cost-of-living index from 100 in 1958 to 18,000 in 1965 and on up wildly to 600,000 in 1967. In 1963, after shouting repeatedly "To hell with your aid" (1950–65 total: U.S. $1,000,000,-000), Sukarno all but broke with the United States. After having exacted U.S. $1,000,000,-000 in Soviet armaments and other items, he next affronted Moscow.

On Jan. 20, 1965, Indonesia formally withdrew from the United Nations because the latter supported Malaysia, which Sukarno had vowed to "crush" as "an imperialist plot of encirclement." Yet, until 1965, Sukarno was still able to stir the Indonesian masses to near-hysterical belligerency. Millions of Indonesians sang and shouted his slogans and acclaimed Sukarno as "Great Leader of the Revolution," "Lifetime President" (his official title), oracle and warrior of the Nefo—his acronym for the "New Emerging Forces"—in violent conflict with Nekolim—the neocolonialism, capitalism, and imperialism of the "doomed" Western powers.

*The coup of 1965.* The nation was shocked and shaken out of its trance by a coup on Sept. 30, 1965, in which Sukarno himself was clearly implicated. A clique of communist and military conspirators caused six top Army generals to be kidnapped, tortured, mutilated, and murdered. They seized a few key urban points and proclaimed a new revolutionary regime. General Suharto, the commander of the Jakarta garrison, swiftly reversed the coup. There ensued an oblique contest for power between Suharto and Sukarno while some 300,000 or more communists and alleged communists were being slaughtered. As the nation recoiled in horror, activist youths demanded the political demise of Sukarno, the Sukarnoists, and Sukarnoism and the total reform and reorganization of the state. On March 11, 1966, Sukarno was obliged to delegate wide powers to Suharto, who subsequently became acting president (March 1967) and then president (March 1968), as Sukarno sank into disgrace and dotage.

Sukarno died at the age of 69 of a chronic kidney ailment and numerous complications. Suharto decreed a quick and quiet funeral. Nevertheless, at least 500,000 persons, including virtually all of Jakarta's important personages, turned out to pay their last ambivalent respects. The next day another 200,000 assembled in Blitar, near Surabaja, for the official service followed by burial in a simple grave alongside that of his mother. The cult and ideology of Sukarnoism were proscribed until the late 1970s, when the government undertook a rehabilitation of Sukarno's name. His autobiography, *Sukarno,* was published in 1965.

(W.A.Ha.)

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**Sukenik, Eliezer,** in full ELIEZER LIPA SUKENIK (b. Aug. 12, 1889, Białystok, Pol., Russian Empire—d. Feb. 28, 1953, Jerusalem, Israel), Polish-born Israeli archaeologist who identified the antiquity of the Dead Sea Scrolls.

Sukenik settled in Palestine in 1912 and was drawn to archaeology while studying at the Hebrew Teachers Seminary and the French Biblical and Archaeological School at Jerusalem. After earning degrees at the University of Berlin (A.B., 1923) and Dropsie College, Philadelphia (Ph.D., 1926), he returned to Palestine. He became associated with the Hebrew University as field archaeologist (1926), subsequently becoming lecturer (1935) in and then professor (1938) of the archaeology of Palestine. He was also director of the Museum of Jewish Antiquities.

Sukenik's numerous excavations and investigations led to remarkable discoveries. He found remnants of an important Hyksos fortification at Tell Jerishe and directed the clearance of the Third Wall in Jerusalem (1925–27), later publishing, with L.A. Mayer, *The Third Wall of Jerusalem* (1930). Sukenik's publication *The Ancient Synagogue of Beth Alpha* (1932) made famous the mosaic pavement he had unearthed there and expanded the frontiers of the history of Jewish art. Sukenik's keen interest in numismatics led to his identification of the oldest Jewish coins of the period of Persian domination. His familiarity with the script of the epitaphs of the Jewish necropolis in Jerusalem, dating from the last century (*c.* 30 BC–AD 70) of the Second Temple, enabled him to recognize that the scrolls found in the first Qumran cave in 1947 dated from that same period. His book *The Dead Sea Scrolls of the Hebrew University* was published posthumously in 1955.

**Sukhāvatī** (Sanskrit: "Pure Land"), in Mahāyāna Buddhism, the Western Paradise of the Buddha Amitābha, described in the Pure Land sutras (*Sukhāvatī-vyūha-sūtras*). According to followers of the Pure Land sects, which are widespread throughout East Asia, rebirth in Sukhāvatī is ensured by invoking the name of Amitābha (*q.v.*), particularly at the moment of death. No woman, however virtuous, may enter Sukhāvatī until she has first attained masculinity through rebirth. Sukhāvatī is expressively described in the Pure Land sutras as being a joyous world, soft and glowing, filled with the music of birds and the tinkling of trees adorned with precious jewels and garlands of golden bells. Amitābha sits on a lotus in the midst of a terraced pond, attended by the bodhisattvas ("buddhas-to-be") Avalokiteśvara and Mahāsthāmaprāpta. The newly dead enter into lotus buds, which unfold when the occupants have become entirely purified. They remain eternally in this land of bliss until the time of their final enlightenment. *See also* Pure Land Buddhism.

**Sukhomlinov, Vladimir Aleksandrovich** (b. Aug. 4 [Aug. 16, New Style], 1848—d. Feb. 2, 1926, Berlin, Ger.), Russian general and minister of war who was largely responsible for Russia's premature and unprepared entry into World War I.

Sukhomlinov took part in the Russo-Turkish war as a cavalry commander (1877–78) and was head of the officers' cavalry school in St. Petersburg from 1886 to 1897, being promoted to general in 1898. He was Russian war minister from 1909 to 1915, and it was under him that the Russian orders for mobilization were given at the outbreak of World War I. At the time of Austria's ultimatum to Serbia, Sukhomlinov assured the government of the combat readiness of Russian troops.

The partial mobilization soon revealed the demoralized and unequipped state of the nation's armed forces. As the war progressed, Russian combat operations were increasingly hampered by shortages of arms, ammunition, and other war matériel, but Sukhomlinov continued to insist that the army was adequately supplied. In June 1915 the thoroughly discredited Sukhomlinov was dismissed and replaced by the able General A.A. Polivanov.

Despite Sukhomlinov's close ties with the tsar, public sentiment ran high and charges of malfeasance, corruption, and treason were brought against him by the Duma. He was arrested in April 1916, freed in October at the tsar's instigation, and rearrested after the Revolution by the provisional government. At his trial in the autumn of 1917, he was found guilty and sentenced to life imprisonment at hard labour. He was freed by an amnesty granted by the Bolsheviks and went to Finland and later to Germany, where he composed his memoirs, *Erinnerungen,* published in 1924.

**Sukhothai,** town and historical capital of a former kingdom of north-central Thailand. It is one of Thailand's earliest and most important historical settlements. Originally a provincial town within the Angkor-based Khmer empire, Sukhothai in the 13th century gained



Buddhist sanctuary, 13th century, Sukhothai, Thailand
Hermann Schlenker—Photo Researchers

its independence and became established as the capital of the first united and independent Tai state in what is now Thailand's Chao Phraya River basin, or Central Plain. The kingdom's third ruler, King Ramkhamhaeng (reigned *c.* 1279–*c.* 1298), extended Sukhothai's hegemony north into what is now Laos, west to the Andaman Sea, and south onto the Malay Peninsula. The ancient town is reported to have had some 80,000 inhabitants. Its architectural development began under Ramkhamhaeng and reached its peak in the latter part of the 14th century, when most of Sukhothai's monasteries were built. After 1351, when Ayutthaya was founded as the capital of a powerful rival Tai dynasty, Sukhothai's imperial influence began to wane, and in 1438 the town was conquered and incorporated into the Ayutthaya kingdom. Sukhothai is thought to have been abandoned in the late 15th or early 16th century.

In the 1970s the government of Thailand, with the help of the United Nations Educational, Scientific and Cultural Organization (UNESCO), undertook the restoration of the ancient site of Sukhothai, which includes several temples (wats), reliquary monuments (*chedis,* or stupas), ornamental ponds, and statues of Buddha. The result, the Sukhothai Historical Park, containing about 27 square miles (70 square km) of parkland and lying some 300 miles (450 km) north of Bangkok, was opened in the late 1980s.

The modern city of Sukhothai lies on the Yom River about 8 miles (13 km) by road from the historical area, in a sparsely populated rice-growing region. It supports textile milling, woodworking and metalworking, fishing, and the manufacture of clothing and food products. Pop. (1998 est.) 19,794.

**Sukhothai style,** one of the canonical styles for Buddha icons developed probably in the Tai kingdom of Sukhothai (modern Thai-



Head of Buddha, bronze, Sukhothai style, late 14th–early 15th century
Collection William H. Wolff, New York

land), beginning in the 14th century. To retain the greatest spiritual potency, Buddha icons in Tai temples had to resemble as closely as possible an original prototype that according to tradition had been made during the lifetime of the Buddha. As the first of at least three major successive efforts by Tai kings to establish an "authentic" canon for the icons, the Sukhothai style was followed by the U Thong and the lion types.

The most direct influence on Sukhothai style was the art of Sri Lanka (Ceylon), which was a stronghold of Theravāda Buddhism and the only available source of a pure canonical image that was worthy of copying. Buddhism had long since declined in India.

The Sukhothai Buddha is composed of sinuous curves and cylindrical forms, creating a boneless, weightless elegance. The various portions of the body follow abstract ideals based on analogy with natural forms, such as shoulders like an elephant's trunk, a torso like a lion, and a nose like a parrot's beak. The face and features are elongated, and the brows, eyes, nose, and mouth are a series of strongly marked curves. The head typically bears a flamelike protuberance above a cranial bump, which is believed by the faithful to contain an extra brain cavity. The Buddhas are typically either seated in the half-lotus posture with right hand performing the earth-touching gesture or walking with one foot forward and the right hand raised to the chest. The so-called walking Buddha is a Tai creation and did not exist in India as a canonical type.

The Sukhothai image remained the most popular in Thailand and was a chief influence on the later U Thong style.

**Sukhoy,** officially OKB IMENI P.O. SUKHOGO, formerly OKB-51, Russian aerospace design bureau that is the country's second most important producer of jet fighters after MiG (*q.v.*). Sukhoy is part of a partially state-owned conglomerate of design bureaus and production plants known as AVPK Sukhoy (Aviation Military-Industrial Complex Sukhoy). Headquarters are in Moscow.

The foundation of the present-day organization dates to 1953, when the Soviet government allowed Pavel O. Sukhoy to reassemble his World War II-era aircraft-design team into a new independent design bureau; the following year his group was given the designation OKB-51. In the 1950s and '60s OKB-51 planned and built a series of new supersonic jet fighters, including the swept-wing Su-7 and delta-wing Su-9. These two aircraft were extensively modified over the years and used in vast numbers by the U.S.S.R. and other Warsaw Pact countries. Sukhoy improved the Su-9 series into the Su-11 and Su-15 fighter-interceptor series for service with the Soviet air defense forces.

After Sukhoy's death in 1975, his name was added to that of the bureau, which became commonly known as OKB Sukhoy, or Sukhoy. In the 1970s and early '80s the design bureau produced the variable-wing Su-24 multirole aircraft and the Su-25 close-support aircraft. Perhaps the best-known Sukhoy design was the Su-27 (first flown 1977), a versatile long-range, air-superiority fighter.

In the 1990s Sukhoy introduced a number of new aircraft. Its Su-34 fighter-bomber began replacing the Su-24, while the redesigned Su-39 ground-attack aircraft began substituting for its older Su-25 variant. Its fifth-generation, multirole S-37 Berkut air-superiority fighter (first flown 1997), had state-of-the-art electronics, forward-swept wings, and thrust vector control. In competition with MiG for the international market, Sukhoy also continued to develop the lightweight Su-54 fighter. In 1997 the Russian government formed AVPK Sukhoy by combining the design bureau with its production plant and several other affiliates.

**Sukhumi** (city, Georgia): *see* Sokhumi.

**sukiyaki,** in Japanese cuisine, a dish of beef and vegetables prepared in the *nabemono* (one-pot) style. It is a fairly recent addition to Japanese cuisine. Because Buddhist law forbade the killing of quadrupeds for food, beef came into the Japanese diet only after sustained contact with the West began in the 1860s. Sukiyaki is cooked at the table in a shallow iron pot over charcoal or another portable heat source. Thin slices of beef are browned in oil, and a sauce of stock, soy sauce, and sugar is added. Tofu, shiitake mushrooms, onions, *shirataki* (a noodlelike food), and vegetables are then added and quickly cooked. Individual morsels may be dipped into beaten raw egg before being eaten.

**Sukkoth,** also spelled SUKKOT, SUCCOTH, SUKKOS, SUCCOT, OR SUCCOS, Hebrew SUKKOT ("Huts," or "Booths"), singular SUKKA, also called FEAST OF TABERNACLES, OR FEAST OF BOOTHS, a Jewish autumn festival of double thanksgiving that begins on the 15th day of Tishri (in September or October), five days after Yom Kippur, the Day of Atonement. It is one of the three Pilgrim Festivals of the Old Testament.

The Bible refers to *ḥag ha-asif* ("Feast of the Ingathering," Exodus 23:16), when grains and fruits were gathered at the harvest's end, and to *ḥag ha-sukkot* ("Feast of Booths," Leviticus 23:34), recalling the days when the Israelites lived in huts (*sukkot*) during their years of wandering in the wilderness after the Exodus from Egypt. The festival is characterized by the erection of huts made of branches and by the gathering of four species of plants, with prayers of thanksgiving to God for the fruitfulness of the land. As part of the celebration, a sevenfold circuit of the synagogue is made with the four plants on the seventh day of the festival, called by the special name Hoshana Rabba ("Great Hosanna").

The eighth day is considered by some a separate festival and called Shemini Atzeret ("Eighth Day of the Solemn Assembly"). In Israel the eighth day also commemorates the



Interior of a *sukka* during the Sukkoth festival; engraving after a drawing by Bernard Picart, 1722
The Bettmann Archive

completion of the annual cycle of readings from the Torah (the first five books of the Bible) and is called Simḥat Torah ("Rejoicing of the Law"). Outside Israel, Simḥat Torah is celebrated independently on the following day. *See also* Shemini Atzeret; Simhath Torah.

**Sukkur,** city, Sind Province, southeastern Pakistan. The city lies on the west bank of the Indus River, connected with Rohrī on the opposite bank by a cantilever bridge. Midstream between the two cities is the strategic island fortress of Bukkur. The old town contains many historic tombs and mosques, including the Mīr Maʿṣūm Shāh Minaret (*c.* AD 1607). The newer part of Sukkur lies on low, bare limestone ridges that slope down to the river. It was incorporated as a municipality in 1862. There are rail and trunk-road connections with Quetta, Multān, and Karāchi. An industrial and trade centre, it has biscuit, cigarette, oil, lime, and cement factories, and cotton, silk, thread, and flour mills; boatbuilding is also significant. The Sukkur Industrial Trading Estate was established in the 1950s with facilities for processing local products, such as wool, oilseeds, and hides. The city has several government colleges affiliated with the University of Sind.

The surrounding region is a vast alluvial plain broken only occasionally by low limestone hills. Large salt patches (*kalar*) occur in the north, while the Thar Desert lies to the east. Leatherware, earthenware, and metalware and the working of cotton cloth and silk are common handicrafts; pipe bowls, snuff-boxes, and scissors are also made there. The Sukkur Barrage (completed 1932), nearly 1 mile (1.6 km) long, crosses the Indus River 3 miles (4.8 km) below Sukkur Gorge and feeds irrigation canals. The system serves an area of wheat, cotton, rice, oilseed, and fruit cultivation. Aror, just east of Sukkur, is the site of the capital of a Hindu Brahman dynasty that flourished just prior to the Muslim invasion *c.* AD 712. Pop. (1998) 329,176.

**Sukulumbwe** (people): *see* Ila.

**Sukuma,** Bantu-speaking people inhabiting the area of Tanzania south of Lake Victoria between Mwanza Gulf and the Serengeti Plain. By far the largest group in Tanzania, they are culturally and linguistically very similar to the Nyamwezi just south of them.

The Sukuma have a mixed economy based largely on subsistence agriculture, though many also keep cattle. Millet, sorghum, and corn (maize) are the staple crops; cotton was added as a cash crop in recent times.

Descent, inheritance, and succession to office are usually patrilineal; however, the office of chief passes to one of the former chief's sister's sons, while the children of a woman married without bride-price inherit from her family instead of from their father's. General polygyny prevails; bride-price is required, with cattle the preferred medium of exchange. The Sukuma live in compact villages ranging from half a dozen to 100 homesteads.

The Sukuma have been organized into small independent chiefdoms for more than 200 years. Historically, the *ntemi* ("chief") was advised by a group of hereditary councillors and ruled through hereditary village headmen. In 1946 the chiefdoms united in a federation that later operated as a unit under the government of Tanzania. Traditional religion mainly involved communicating with and propitiating ancestral spirits.

**Sula,** Indonesian KEPULAUAN SULA, Dutch SOELA EILANDEN, chain of islands, Maluku Utara *kabupaten* (regency), Maluku *provinsi* (province), Indonesia, east of central Celebes and between the Molucca Sea (north) and Banda Sea (south). Three large islands, Taliabu (the largest), Mangole, and Sanana (or Sulabesi), and several smaller ones make up the chain. The area of this group is about 1,875 square miles (4,850 square km). Taliabu and Mangole are separated by the narrow Capalulu Strait and are mountainous, thickly forested, and thinly populated. Taliabu has mountains rising to 3,796 feet (1,157 m). Sanana is well-populated and cultivated. The resemblance between the birds of the Sulas and those of Buru Island to the southeast have suggested to naturalists the possible existence of a land bridge at one time.

The islands produce timber for shipbuilding, and the inhabitants are good navigators. Damar, a resin, is collected in the forests. Rice, corn (maize), tobacco, and sugarcane are cultivated, principally on Sanana. The sago palm forms the staple food for Taliabu and Mangole. An inferior grade of coal is found on Sanana. The people weave sarongs and plait mats.

The inhabitants of the Sulas resemble those of Buru and Seram and may be of Malayo-Polynesian stock from eastern Celebes. Most are animists, but the Muslim population is increasing. Sanana, on that island's northeastern coast, is the chief town, port, and residence of the islands' local administrator; it was once the haunt of pirates. Lekitobi in the southwest is the chief town on Taliabu; Auponhia, also in the southwest, is the chief town of Mangole. The Sulas were once part of the sultan of Ternate's territory and came under Dutch influence in 1683. Pop. (1997 est.) 112,688.

**Sulaimān Range,** mountain mass in central Pakistan, extending southward about 280 miles (450 km) from the Gumal Pass to just north of Jacobābād, separating the North-West Frontier Province and Punjab from Baluchistan. Its heights gradually decrease toward the south, with summits averaging 6,000–7,000 feet (1,800–2,100 m), the highest being the twin peaks (30 miles [48 km] from the Gumal Pass) called Takht-i-Sulaimān, or Solomon's Throne, which legend connects with Solomon's visit to Hindustān; the higher of the peaks, at 18,481 feet (5,633 m), is the site of a *ziyārat* (shrine) visited annually by many pilgrims. The range's eastern face dips steeply to the Indus River, but on the west the range declines more gradually. Juniper and edible pines abound in the north and olives in the centre, but vegetation is scarce in the south. The Ghāt, Zao, Chūhar Khel Dhana, and Sakhī Sarwar are the principal passes in the north. In the south, west of Dera Ghāzi Khān, lies the hill station of Fort Munro (6,303 feet [1,921 m]).

**Sulawesi** (Indonesia): *see* Celebes.

**Sulawesi Selatan,** English SOUTH CELEBES, *provinsi* (province), central and southwestern Celebes, Indonesia, bounded by the Flores Sea on the south, Makassar Strait on the west, Bone Gulf on the east, and the provinces of Sulawesi Tengah (Central Celebes) on the north and Sulawesi Tenggara (Southeast Celebes) on the northeast. It covers an area of 28,101 square miles (72,781 square km) and includes the islands of Selayar, Tambolongang, Kalao, Tanahjampea (Batu), Bonerate, and Kalaotoa to the south in the Flores Sea.

Prior to the arrival of Islām in the 16th century, the area was governed by a number of small states divided between two related ethnic groups, the Makasarese and the Buginese. About 1530 the Makasarese state of Gowa emerged as the most powerful state, and the king of Gowa adopted Islām in 1605. The Dutch established a trading post at Makasar (now Ujung Pandang) in 1609. This led to warfare with Gowa and to an alliance between the Dutch and the Buginese prince, Arung Palakka, king of Bone (now Watampone). The Gowa king was defeated in 1667, and, thus, the Dutch position was consolidated. In the 18th century (*c.* 1700–65), Arung Singkang, a descendent of the Buginese royal family of Wojo, rose to power and continued the warfare with Makasar. The Makasarese attacked the Mataram kingdom of eastern Java in 1675, and the Dutch promised help to Amangkurat I, the ruler of Mataram. The Makasarese were finally expelled from eastern Java in 1779. The British occupied southwestern Celebes (1810–16) during the Napoleonic Wars. The Makasarese attacked the British in 1814 and 1816. Some of the southern Celebes states refused to recognize Dutch suzerainty in 1817, when Celebes reverted to the Dutch. The state of Bone was defeated by the combined forces of the Dutch and the Makasarese in 1825. The Java War began in 1825, and subsequent rebellions broke out here and there in Indonesia, including in the southern Celebes state of Makasar. The Dutch eventually emerged victorious during 1858–60 and extended their rule over the whole of Indonesia. The Japanese occupied Celebes during World War II. The states of southern Celebes supported the newly proclaimed Republic of Indonesia in 1945. The Dutch, meanwhile, included Celebes in the new state of East Indonesia that they created in 1945. Clashes occurred between Dutch and Republican troops in Makasar in 1950, and, with the defeat of the Dutch, Celebes became part of the Republic of Indonesia.

A north–south chain of mountains surmounted by volcanic cones and broken midway by the Tempe Lake valley runs the length of the province. Pegunungan (moun-

tains) Tineba and Takolekaju from the northern part of the chain run parallel to each other, cover most of the northern half of the province, and have steep-sided rift valleys between them. The highest peak in the Celebes group of islands is Mount Rantekombola, rising to 11,335 feet (3,455 m) in the north-central part of the province. The northern mountain chain decreases in width toward its southern extremity, south of Danau Tempe. Streams including the Walanae, Sadang, Karama, Kobo, Kalaena, Koladu, and Kongkong flow down the western and eastern slopes of the mountains and across narrow coastal lowlands. The mountains are covered by dense equatorial forests of teak, oak, banyan, ironwood, and pine; the forests thin out at higher altitudes. The streams are bordered by gallery forests. The principal means of livelihood are agriculture and deep-sea fishing. The products include rice, corn (maize), copra, coffee, spices, vegetable oil, teak, rattan, sugarcane, soybeans, and sweet potatoes. Industries mill rice and produce cement, beverages, chemicals, rubber goods, processed coffee, palm oil, woven cloth, paper, metalware, carved wood, and mats and baskets. Silver, tin, nickel, and iron ore are mined. Roads run almost parallel to the western and eastern coasts. Ujung Pandang (the provincial capital), Majene, Makale, Palopo, Parepare, Singkang, and Watampone (Bone) are the chief towns. The population consists mostly of Buginese and Makasarese. Pop. (2000) 8,059,627.

**Sulawesi Tengah,** English CENTRAL CELEBES, *propinsi* (province), consisting of the northeastern peninsula, the north-central part of Celebes island, and a part of the northernmost peninsula, Indonesia. It is bounded by the Makassar Strait to the west, the Celebes Sea to the north, the Gulfs of Tomeni to the northeast and Tolo to the east, and the provinces of Gorontalo to the northeast, Sulawesi Tenggara (Southeast Celebes) to the southeast, and Sulawesi Selatan (South Celebes) to the southwest. It includes the Togian Islands in the Gulf of Tomini and the Banggai and Bowokan island groups in the Gulf of Tolo.

The central area, like the rest of Celebes, had Indian settlements from the 2nd century AD and was part of the Buddhist and Hindu empires that ruled Indonesia until the arrival of Islām at the beginning of the 16th century. Subsequently, a number of Muslim states, including Makasar (now the city of Ujung Pandang) and Bone (now Watampone), ruled the island at the beginning of the 17th century. The Makasarese state of Gowa emerged as one of the most powerful and brought nearly all of Celebes under its control. Its chief rivals were the state of Bone and the Dutch (who had entered the region in 1609). The Dutch conspired with the Buginese of Bone (led by Arung Palakka) and succeeded in overthrowing Gowa. Arung Palakka emerged in 1668–69 as the most powerful ruler in the island; internecine warfare, however, paved the way for the gradual extension of the Dutch hegemony. Celebes, briefly occupied by the British in 1810–16, reverted to the Dutch in 1817. Although rebellions against the Dutch broke out, they were crushed, and Dutch colonial supremacy was firmly established by 1860. The Japanese occupied the islands during World War II (1942–45), and, after the war, Sulawesi Tengah was included in the Dutch-sponsored state of East Indonesia until the formation of the Republic of Indonesia in 1950.

The general topography is mountainous, marked by volcanic cones including Mounts Malino (8,015 feet [2,443 m]), Ogoamas (9,557 feet [2,913 m]), and Nokilalaki (10,863 feet [3,311 m]). Extensive uplifting, faulting, and subsidence have formed deep valleys and gorges, particularly in north-central Celebes, where there are a number of lakes, including Lake Poso. The coastal lowlands are discontinuous and relatively narrow. There are extensive coral reefs in the Gulfs of Tomini and Tolo. Rapid, perennial streams include the Palu, Poso, Lanang, and Bongka. Luxuriant tropical rainforests (with many ferns) cover most of the area up to 1,000 feet (300 m) in elevation, and dense forests of teak, sal, and ironwood occur at higher elevations. Agriculture is the principal means of livelihood; its products include rattan, resin, sugarcane, copra, and rice. Ironwood and ebony are also important. Industries include wood carving and rice milling and the manufacture of pharmaceuticals and mats and baskets, and the extraction of palm oil. Transport is by river and road (mainly located along the coasts). Palu (the provincial capital), Poso, and Luwuk have airports and, together with Douggala, Kolonodale, and Tolitoli, are the important towns. Area 24,586 square miles (63,678 square km). Pop. (2000) 2,218,435.

**Sulawesi Tenggara,** English SOUTHEAST CELEBES, *propinsi* (province), southeastern arm of Celebes, Indonesia. It is bounded by the Gulf of Bone to the west, the Banda Sea to the east and south, and the provinces of Sulawesi Selatan (South Celebes) to the northwest and Sulawesi Tengah (Central Celebes) to the northeast. It includes the islands of Wowoni, Buton (Butung), Muna, and Kabaena and the Tukangbesi island group in the Flores and Banda seas.

The area was part of the Buddhist Śrivijaya Empire of Sumatra until the 14th century and of the Majapahit Empire of eastern Java until the close of the 15th century. The southern Celebes states of Makasar (now the city of Ujung Pandang) and Bone (now Watampone) subsequently controlled the region, and the rulers of these and other smaller states on the island converted to Islām at the beginning of the 16th century. The Dutch established trading posts on the island in 1609. The emergence of rivalry between Makasar and Bone led to intermittent wars and the eventual defeat of Bone. In 1660 Arung Palakka from Bone rebelled but was defeated and took refuge on the Pulau (island) Butung off the eastern coast. The Dutch, in support of Arung Palakka, defeated the Makasarese state of Gowa. Arung Palakka became the ruler of Bone, controlling most of southeastern Celebes. He had extended his power over the other smaller states of the island by the time of his death in 1696. The 18th century was dominated by continuing military rivalry between the Makasarese and Buginese states, with Dutch intervention in their wars. By the end of the 18th century the Dutch had established colonial supremacy over Makasar and Bone. Temporary occupation by the British (1810–16) encouraged the state of Bone to rebel against the Dutch in 1825; this resistance was not crushed until 1860. Southeastern Celebes was occupied by the Japanese during World War II and was part of the state of East Indonesia created by the Dutch in 1946. It was incorporated into the Republic of Indonesia in 1950.

The Tanggeasinua and Mekongga mountains are parallel ranges in the northwestern part of the province, the latter rising to an elevation of 9,117 feet (2,779 m) at Mount Mekongga, a volcanic peak. Rift valleys with steep sides are common. The low-lying eastern and western coastal margins are comparably narrow. The Lalinda, Lasolo, and Sampara are the major rivers and drain eastward. The offshore islands of Muna and Buton (to the southeast) have a general elevation of about 3,300 feet (1,000 m). The uplands of the province are covered with dense forests of teak, pine, rattan, and oak; tall grasses, shrubs, and bamboo grow in the river valleys. The principal means of livelihood is agriculture, and the chief products include rice, sugarcane, and coffee. Resin, rattan, and timber are also important. Industries are wood carving, mat and basket making, food processing, printing, leather working, rice milling, and gold and silver filigree working. Inland transport is primarily by river. Kendari, the provincial capital, has an airport; Lawow, Bone, Baubau, and Kolaka are the chief towns. The Buginese are the main ethnic group and account for most of the population. Area 14,726 square miles (38,140 square km). Pop. (2000) 1,821,284.

**Sulawesi Utara,** English NORTH CELEBES, *propinsi* (province), north-northeastern Celebes, Indonesia, bounded by Sulawesi Tengah (Central Celebes) province to the west, the Celebes Sea to the north, the Molucca Sea to the east, and the Gulf of Tomini to the south. It includes the Talaud and Sangihe groups of islands in the Celebes Sea. The provincial capital is Manado. In 2000 the western portion of the province was split off to form the province of Gorontalo, with its capital at Gorontalo city.

Celebes formed part of the Buddhist Śrivijaya Empire of Palembang (Sumatra) until the 14th century, when it passed under the rule of the Hindu Majapahit Empire of eastern Java. With the gradual disintegration of the Majapahit Empire toward the end of the 15th century, many kingdoms such as Gorontalo, Limboto, and other smaller Minahasa states were established in the region. The southern Celebes state of Gowa, ruled by the Makasarese, adopted Islām in 1605 and extended its sovereignty over these states. The Dutch, who had arrived on Celebes in 1609 and built a fort at Manado in 1658, attacked Gowa with the help of the Buginese of Bone (now called Watampone) and defeated Gowa in 1669. The Dutch subsequently established other trading and military posts in northern Celebes. During the 18th-century wars between the Makasarese and the Buginese, the states in northern Celebes survived as Dutch protectorates. The British took over the island in 1810–16. The refusal of the southern Celebes states to accept Dutch colonial sovereignty after the island reverted to the Dutch in 1817 led to prolonged warfare that ended with a Dutch victory in 1860. Unsuccessful sporadic resistance continued until colonial Dutch rule was firmly established in 1905. After Japanese occupation (1942–45) during World War II, Celebes formed part of the Dutch-sponsored state of East Indonesia until it was incorporated into the Republic of Indonesia in 1950.

Most of the province is mountainous, with extensive uplifting and faulting, and has many active volcanoes, notably Mount Soputan. Mount Klabat on the Minahasa Peninsula rises to an elevation of 6,634 feet (2,022 m). The coastal lowlands are narrow, the soils are fertile, and there are coral reefs offshore. The uplands are drained by many fast-flowing streams, including the Milango and Marsa. The highlands are covered with rainforests of oak, chestnut, and conifers; hillsides have teak and a dense ground cover of grasses and shrubs. Agriculture is the principal occupation, and rice, coffee, sugarcane, nutmeg, and coconuts are grown. Riverine fish are dried and salted for export. Industries produce processed food, beverages, leather goods, milled rice, carved wood, mats and baskets, and palm oil. Nickel and iron are mined, and ebony is processed. Roads run mostly parallel to the northern seacoast, and Manado is linked with Amurang, Tondano, Kotamobagh, Limboto, and Gorontalo city. The population is made up of Minahasan (Menadonese), many of whom are Christians. Area Sulawesi Utara, 5,897 square miles (15,273 square km); Gorontalo, 4,716 square miles (12,215 square km). Pop. (2000) Sulawesi Utara, 11,649,655; Gorontalo, 835,044.

**Sulaweski, Laut** (Pacific Ocean): *see* Celebes Sea.

**Sulayḥid** DYNASTY (1047–1138), Muslim dynasty nominally subject to the Fāṭimid caliph in Egypt, responsible for restoring Ismā'īlism (an extremist Islāmic sect) in Yemen.

The Sulayḥid family was brought to power by 'Alī ibn Muḥammad (reigned 1047–67), who, through his association with the Fāṭimid *dā'ī* (propagandist) in the area, established a state in the mountains of Yemen. Within 20 years he displaced the Najāḥids, north of Yemen in the Tihāmah coastlands; the Zaydī *imāms* in Ṣan'ā', north Yemen (1063); and the Ma'nids of Aden, southeast of Yemen (1064). In the Hejaz (northwest coast of Arabia), once the stronghold of the Mūsāwid *sharīfs* (descendants of Muḥammad), 'Alī set up the Hāshimid *sharīfs* (1063), who were to rule Mecca until the 1920s. By the end of the 11th century, however, al-Mukarram Aḥmad (reigned 1067–84), 'Alī's son, saw the Sulayḥid possessions begin to diminish: the Najāḥids reappeared in the north, while in the south, Aden was given to the Zuray'ids, a related dynasty also of Ismā'īlī persuasion. Late in his reign Aḥmad transferred effective control of the principality to his wife, as-Sayyidah Arwā. The Fāṭimids recognized her as suzerain of the kings of the Yemen until her death in 1138, when Yemen passed into Zuray'id hands.

**Sulaymānīyah, as-**, town and *muḥāfaẓah* (governorate), northeastern Iraq, one of three *muḥāfaẓat* (governorates) making up the Kurdish Autonomous Region. The town, which is the capital of the *muḥāfaẓah*, lies on the Tānjarō river and on the lower slopes of the Azmar Dāgh range; it experiences severe temperature extremes in summer and winter. The town was founded in 1781 by a local ruler, who named it for the then pasha of Baghdad. As-Sulaymānīyah is a trade centre for local farm products, and through it passes trade between Baghdad and Tabriz, Iran. Most of the inhabitants are Kurds, and it is a centre of Kurdish nationalism.

As-Sulaymānīyah *muḥāfaẓah,* which is entirely mountainous, lies on the Iranian border and is part of the historic region of Kurdistan. Tobacco, fruit, and cereals are grown, and livestock raising is important. There is a tobacco-processing plant in as-Sulaymānīyah, built since the 1974 Law of Autonomy. The University of Sulaymānīyah opened in 1968 with instruction in Kurdish, Arabic, and English. It has faculties in engineering, agriculture, the arts, science, and medicine. A technical institute for medical technology was founded in 1973. In the late 1970s the *muḥāfaẓah* had several hospitals, health centres, and branch health clinics. The *muḥāfaẓah* was the scene of much fighting between rival Kurdish factions and Iraqi government troops following the 1990-91 Persian Gulf War. Area *muḥāfaẓah* 6,573 square miles (17,153 square km). Pop. (1987) town, 364,096; (1991 est.) *muḥāfaẓah,* 1,124,200.

**sulcus, cerebral:** *see* cerebral fissure.

**Suleja,** formerly ABUJA, town and traditional emirate, Niger State, central Nigeria. The town is situated on the Iku River, a minor tributary of the Niger at the foot of the Abuchi Hills, and lies at the intersection of several roads.

The emirate's wooded savanna area of about 1,150 square miles (2,980 square km) originally included four small Koro African chiefdoms that paid tribute to the Hausa kingdom of Zazzau. After warriors of the Fulani *jihād* (holy war) captured Zaria (Zazzau's capital, 137 mi [220 km] north-northeast) in about 1804, Muhammman Makau, *sarkin* ("king of") *Zazzau,* led many of the Hausa nobility to the Koro town of Zuba (6 mi [10 km] south). Abu Ja (Jatau), his brother and successor as *sarkin Zazzau,* founded Abuja town in 1828, began construction of its wall a year later, and proclaimed himself the first emir of Abuja. Withstanding Zaria attacks, the Abuja emirate remained an independent Hausa refuge. Trade with the Fulani emirates of Bida (to the west) and Zaria began in Emir Abu Kwaka's reign (1851–77), but when Abuja's leaders disrupted the trade route between Lokoja (100 mi southsoutheast) and Zaria in 1902, the British occupied the town. Alluvial tin mining began in Emir Musa Angulu's reign (1917–44). Discoveries of sculptures of the Nok culture (flourished *c.* 900 BC–AD 200), both at Suleja town and in the Makabolo River bed, have helped prove the influence of Nok on the notable Yoruba art of Ife.

The traditional emirate, with its predominant Gbari (Gwari) and Koro population, is headed by a Hausa emir who retains an advisory role. In the administrative reorganization of 1976, Abuja town became the headquarters of a local government council. The town was renamed Suleja in the late 1970s after construction began on the nearby urban area of the Federal Capital Territory of Nigeria. The new federal capital adopted the name of Abuja.

Suleja is well known as an exporter of Gbari pottery. Cotton weaving and dyeing, with locally grown indigo, and mat making are traditional activities, but farming remains the chief occupation. Local trade is primarily in agriculture products. In addition to the noted Pottery Centre, the town is the site of a government secondary school and a hospital. Pop. (1991) town, 105,075.

**Süleyman** (Turkish), English SULEIMAN, SOLIMAN, or SOLYMAN, name of Ottoman sultans grouped below chronologically and indicated by the symbol •.

• **Süleyman I,** byname SÜLEYMAN THE MAGNIFICENT, OR THE LAWGIVER, Turkish SÜLEYMAN MUHTEŞEM, or KANUNI (b. November 1494/April 1495—d. Sept. 5/6, 1566, near Szigetvár, Hung.), sultan of the Ottoman Empire from 1520 to 1566, who not only undertook bold military campaigns that enlarged his realm but also oversaw the development of what came to be regarded as the most characteristic achievements of Ottoman civilization in the fields of law, literature, art, and architecture.



Süleyman I, detail of an engraving of a panel by Pieter Coecke van Aelst showing a procession through Istanbul, 1533

By courtesy of the trustees of the British Museum

*Early life and reign.* Süleyman was the only son of Sultan Selim I. He became *sancak beyi* (governor) of Kaffa in the Crimea during the reign of his grandfather Bayezid II and of Manisa in western Asia Minor in the reign of Selim I.

Süleyman succeeded his father as sultan in September 1520 and began his reign with campaigns against the Christian powers in central Europe and the Mediterranean. Belgrade fell to him in 1521 and Rhodes, long under the rule of the Knights of St. John, in 1522. At Mohács, in August 1526, Süleyman broke the military strength of Hungary, the Hungarian king, Louis II, losing his life in the battle.

The vacant throne of Hungary was now claimed by Ferdinand I, the Habsburg archduke of Austria, and by John (János Zápolya), who was *voivode* (lord) of Transylvania, and the candidates of the "native" party opposed to the prospect of Habsburg rule. Süleyman agreed to recognize John as a vassal king of Hungary, and in 1529, hoping to remove at one blow all further intervention by the Habsburgs, he laid siege to Vienna. Difficulties of time and distance and of bad weather and lack of supplies, no less than the resistance of the Christians, forced the Sultan to raise the siege.

The campaign was successful, however, in a more immediate sense, for John was to rule thereafter over most of Hungary until his death, in 1540. A second great campaign in 1532, notable for the brilliant Christian defense of Güns, ended as a mere foray into Austrian border territories. The Sultan, preoccupied with affairs in the East and convinced that Austria was not to be overcome at one stroke, granted a truce to the archduke Ferdinand in 1533.

The death of John in 1540 and the prompt advance of Austrian forces once more into central Hungary drove Süleyman to modify profoundly the solution that he had imposed in the time of John. His campaigns of 1541 and 1543 led to the emergence of three distinct Hungarys—Habsburg Hungary in the extreme north and west; Ottoman Hungary along the middle Danube, a region under direct and permanent military occupation by the Ottomans and with its main centre at Buda; and Transylvania, a vassal state dependent on the Porte and in the hands of John Sigismund, the son of John Zápolya.

Between 1543 and 1562 the war in Hungary continued, broken by truces and with few notable changes on either side; the most important was the Ottoman capture of the Banat of Temesvár (Timişoara) in 1532. After long negotiations a peace recognizing the status quo in Hungary was signed in 1562.

*The campaigns against Persia.* Süleyman waged three major campaigns against Persia. The first (1534–35) gave the Ottomans control over the region of Erzurum in eastern Asia Minor and also witnessed the Ottoman conquest of Iraq, a success that rounded off the achievements of Selim I. The second campaign (1548–49) brought much of the area around Lake Van under Ottoman rule, but the third (1554–55) served rather as a warning to the Ottomans of the difficulty of subduing the Şafavid state in Persia. The first formal peace between the Ottomans and the Şafavids was signed in 1555, but it offered no clear solution to the problems confronting the Ottoman sultan on his eastern frontier.

The naval strength of the Ottomans became formidable in the reign of Sultan Süleyman. Khayr ad-Dīn, known in the West as Barbarossa, became *kapudan* (admiral) of the Ottoman fleet and won a sea fight off Preveza, Greece (1538), against the combined fleets of Venice and Spain, which gave to the Ottomans the naval initiative in the Mediterranean until the Battle of Lepanto in 1571. Tripoli in North Africa fell to the Ottomans in 1551. A strong Spanish expedition against Tripoli was

crushed at Jarbah (Djerba) in 1560, but the Ottomans failed to capture Malta from the Knights of St. John in 1565. Ottoman naval power was felt at this time even as far afield as India, where a fleet sent out from Egypt made an unsuccessful attempt in 1538 to take the town of Diu from the Portuguese.

The later years of Süleyman were troubled by conflict between his sons. Mustafa had become by 1553 a focus of disaffection in Asia Minor and was executed in that year on the order of the Sultan. There followed during 1559–61 a conflict between the princes Selim and Bayezid over the succession to the throne, which ended with the defeat and execution of Bayezid. Süleyman himself died while besieging the fortress of Szigetvár in Hungary.

*Domestic achievements.* Süleyman surrounded himself with administrators and statesmen of unusual ability, men such as his grand viziers (chief ministers) Ibrahim, Rüstem, and Mehmed Sokollu. 'Ulamā' (specialists in Islāmic law), notably Abū al-Su'ūd (Hoca Çelebi) and Kemalpaşazade, made the period memorable, as did the great Turkish poet Bāki and the architect Sinan. Süleyman built strong fortresses to defend the places he took from the Christians and adorned the cities of the Islāmic world (*e.g.*, Mecca, Damascus, and Baghdad) with mosques, bridges, aqueducts, and other public works. In general, Süleyman completed the task of transforming the previously Byzantine city of Constantinople into Istanbul, a worthy centre for a great Turkish and Islāmic empire. (V.J.P.)

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**• Süleyman (İbrahim) II** (b. April 15, 1642, Constantinople [Istanbul, Tur.]—d. June 23, 1691, Edirne, Ottoman Empire [now in Turkey]), Ottoman sultan (1687–91) who, despite his short reign and 46 years of enforced confinement before he succeeded his brother Mehmed IV, was able to strengthen the Ottoman state through internal reforms and reconquests of territory.

The army mutiny that had brought Süleyman to the throne and deposed his brother continued violently through the early part of his reign, and the Ottomans suffered a series of military defeats in the Balkans. In 1689, however, a member of the Köprülü family, which earlier in the century had given Turkey two outstanding viziers (ministers), came to power; Fazıl Mustafa Paşa became grand vizier, reestablished order, drove the Austrians out of Bulgaria and Transylvania, and retook Belgrade and Niš in 1690. Süleyman, allowing Fazıl Mustafa a free hand in the government, succeeded in introducing reforms to lighten the tax burden and to improve the condition of his Christian subjects.

**Süleyman Çelebi,** also called SÜLEYMAN OF BURSA (b. Bursa, Ottoman Empire [now in Turkey]—d. 1429, Bursa), one of the most famous early poets of Anatolia.

Süleyman appears to have been the son of an Ottoman minister, Ahmed Paşa, who served in the court of Sultan Murad I. Süleyman became a leader of the Khalwatiyah dervish order and then imam (religious leader) to the court of the Ottoman sultan Bayezid I (1389–1402). After Bayezid's death, Süleyman took the position of imam in a mosque in Bursa.

Süleyman's most famous and only surviving work is the great religious poem *Mevlûd-i Nebi*, or *Mevlûd-i Peygamberi* ("Hymn on the Prophet's Nativity," Eng. trans., 1943, reprint, 1957).

The *Mevlûd*, as it is more commonly called, tells the story of the Prophet Muḥammad's birth, life, and death; his miracles; and his journey to heaven. Written in simple 15th-century Ottoman Turkish style, it is a work inspired with religious fervour and is often recited at religious ceremonies, particularly funerals in present Turkey. It is chanted during the celebrations of the Prophet's birthday.

**sulfa drug,** in full SULFONAMIDE DRUG, sulfa also spelled SULPHA, any member of a group of synthetic antibacterial drugs containing the sulfanilamide molecular structure, and including sulfanilamide, sulfadiazine, sulfapyridine, sulfathiazole, and other substances.

The antibacterial effects of sulfonamides were first observed in 1932, when Gerhard Domagk, a German bacteriologist and pathologist, noted the effects of Prontosil (*q.v.*, a red dye) on streptococcal infections in mice. French investigators were first to prove that sulfonamide was the active principle in the dye. American researchers later helped create a rational basis for sulfonamide chemotherapy. Sulfonamides were the first chemical substances that were systematically used to cure and prevent bacterial infections in humans.

They are bacteriostatic drugs; *i.e.*, they inhibit the growth and multiplication of bacteria but do not kill them. They act by interfering with enzyme systems essential to normal metabolic and growth patterns of bacteria. Although more than 5,000 sulfa drugs have been prepared and tested, fewer than 20 continue to have therapeutic value because resistant strains of bacteria have developed.

Sulfa drugs are assigned to four groups based on the rapidity with which they are absorbed and excreted. The most common side effects of sulfa drugs include nausea, vomiting, and mental confusion. Other side effects include fever, skin eruptions, anemia, leukopenia, and irritation of the liver or kidneys. More potent antibacterial drugs have largely replaced the sulfa drugs. They are still used, however, in the treatment of urinary tract infection.

**sulfadiazine,** also spelled SULPHADIAZINE, synthetic drug belonging to the sulfonamide group and used in medicine to treat microbial infections, particularly those involving the urinary and gastrointestinal tracts. Since its introduction into medicine in the early 1940s, sulfadiazine has become the most widely used sulfonamide drug; it has few side effects and a broad spectrum of activity. Sulfadiazine is administered orally or by intravenous injection, either alone or in combination with other drugs. A commonly used preparation combining sulfadiazine with two closely related sulfonamides, sulfamerazine and sulfamethazine, is trisulfapyrimidines (triple sulfas). The use of such mixtures of sulfonamides reduces the incidence of side effects, which include loss of appetite, nausea, and skin rashes.

**sulfamidochrysoidine** (drug): *see* Prontosil.

**sulfanilamide,** also spelled SULPHANILAMIDE, also called PARA-AMINOBENZENESULFONAMIDE, sulfonamide drug and the parent compound to which many other sulfonamide drugs are structurally related. Sulfanilamide is an important antimicrobial agent effective in treating infections caused by such bacteria as *Streptococcus, Staphylococcus, Salmonella,* and *Coccidia.*

Although synthesized in 1908, sulfanilamide was only much later found to be the active metabolite, or therapeutically active breakdown product, of Prontosil (*q.v.*), the first sulfonamide drug used in medicine (early 1930s). Sulfanilamide itself was used orally and topically (as in the application to open wounds) beginning in the 1940s. Since the introduction of less toxic derivatives, however, it is now used only in veterinary medicine. Among other sulfonamide drugs derived from sulfanilamide are sulfadiazine, sulfamerazine, sulfamethazine, sulfathiazole, sulfisoxazole, and Sulfasuxidine.

Sulfanilamide and its close relatives inhibit the growth of susceptible microorganisms by preventing the formation of folic acid, a member of the B-group of vitamins present in all living cells. Most bacteria make their own folic acid from simpler starting materials; humans and other higher animals, however, must obtain folic acid in the diet. Thus, these sulfonamides can inhibit the growth of invading microorganisms without harming the host.

The first clue to the mode of action of the sulfonamides was provided in 1939, when a substance was discovered in yeast that antagonized the antibacterial effect of sulfanilamide; *i.e.*, the substance suppressed the inhibition of the synthesis of folic acid in bacteria. In 1940 this substance was identified as *para*-aminobenzoic acid, which closely resembles sulfanilamide in structure. In fact, sulfonamides exert their antimicrobial effect by preventing the synthesis of folic acid by microorganisms by displacing *para*-aminobenzoic acid.

Bacteria become increasingly resistant to the sulfonamides upon repeated exposure to them. These agents inhibit the growth and multiplication of bacteria; with the body's defense mechanism, they act to control infection. When the action of the sulfonamides is interfered with by pus or chemicals, such as procaine or *para*-aminobenzoic acid, strains of bacteria resistant to sulfonamide action emerge and survive.

In an attempt to circumvent the low solubility and high toxicity of sulfonamides and to decrease their tendency to induce undesirable effects in hypersensitive persons, sulfonamide mixtures have been compounded. Highly soluble sulfonamides—mixtures that are more soluble than equivalent amounts of individual members of the mixture—are effective in the prevention and treatment of obstruction of the kidney that is caused by certain sulfonamides when used alone in large doses.

**sulfate,** also spelled SULPHATE, any of numerous chemical compounds related to sulfuric acid, $H_2SO_4$. One group of these derivatives is composed of salts containing the sulfate ion, $SO_4^{2-}$, and positively charged ions such as those of sodium, magnesium, or ammonium; a second group is composed of esters, in which the hydrogen atoms of sulfuric acid have been replaced by carbon-containing combining groups such as methyl ($CH_3$) or ethyl ($C_2H_5$).

**sulfate mineral,** sulfate also spelled SULPHATE, any naturally occurring salt of sulfuric acid. About 200 distinct kinds of sulfates are recorded in mineralogical literature, but most of them are of rare and local occurrence. Abundant deposits of sulfate minerals, such as barite and celestite, are exploited for the preparation of metal salts. Many beds of sulfate minerals are mined for fertilizer and salt preparations, and beds of pure gypsum are mined for the preparation of plaster of paris.

All sulfates possess an atomic structure based on discrete insular sulfate ($SO_4^{2-}$) tetrahedra, *i.e.*, ions in which four oxygen atoms are symmetrically distributed at the corners of a tetrahedron with the sulfur atom in the centre. These tetrahedral groups do not polymerize, and the sulfate group behaves as a single negatively charged molecule, or complex. Thus, sulfates are distinct from the silicates and borates, which link together into chains, rings, sheets, or frameworks.

Sulfate minerals can be found in at least four kinds: as late oxidation products of preexisting sulfide ores, as evaporite deposits, in circulatory solutions, and in deposits formed by hot water or volcanic gases. Many sulfate minerals occur as basic hydrates of iron, cobalt, nickel, zinc, and copper at or near the source of preexisting primary sulfides. The sulfide minerals, through exposure to weathering and circulating water, have undergone oxidation in which the sulfide ion is converted

to sulfate and the metal ion also is changed to some higher valence state. Noteworthy beds of such oxidation products occur in desert regions, such as Chuquicamata, Chile, where brightly coloured basic copper and ferric iron sulfates have accumulated. The sulfate anions generated by oxidation processes may also react with calcium carbonate rocks to form gypsum, $CaSO_4 \cdot 2H_2O$. Sulfates formed by the oxidation of primary sulfides include antlerite, brochantite, chalcanthite, anglesite, and plumbojarosite.

Soluble alkali and alkaline-earth sulfates crystallize upon evaporation of sulfate-rich brines and trapped oceanic salt solutions. Such brines can form economically important deposits of sulfate, halide, and borate minerals in thick parallel beds, as the potash deposits at Stassfurt, Ger., and the southwestern United States. Many of the sulfate minerals are salts of more than one metal, such as polyhalite, which is a combination of potassium, calcium, and magnesium sulfates.

Sulfate minerals common in evaporite deposits include anhydrite, gypsum, thenardite, epsomite, glauberite, kainite, kieserite, mirabilite, and polyhalite.

Groundwater carrying sulfate anions reacts with calcium ions in muds, clays, and limestones to form beds of gypsum. The massive material is called alabaster or plaster of paris (originally found in the clays and muds of the Paris basin). If such beds become deeply buried or metamorphosed (altered by heat and pressure), anhydrite may form by dehydration of the gypsum.

Numerous sulfates, usually simple, are formed directly from hot aqueous solutions associated with fumarolic (volcanic gas) vents and late-stage fissure systems in ore deposits. Noteworthy examples include anhydrite, barite, and celestite.

**Sulfate minerals**

| name formula | colour | lustre | Mohs hardness | specific gravity | habit | fracture or cleavage | refractive indices | crystal system space group | remarks |
|---|---|---|---|---|---|---|---|---|---|
| alum $KAl(SO_4)_2 \cdot 12H_2O$ $NH_4Al(SO_4)_2 \cdot 12H_2O$ $NaAl(SO_4)_2 \cdot 12H_2O$ | colourless; white | vitreous | 2–2½ ~3 1½ | 1.8 1.7 1.6 | columnar or granular massive | conchoidal fracture | $n = 1.453–1.466$ $n = 1.436–1.448$ $n = 1.456–1.469$ | isometric Pa3 | sweetish, astringent taste |
| alunite $KAl_3(SO_4)_2(OH)_6$ | white; grayish, yellowish, reddish, reddish brown | vitreous | 3½–4 | 2.6–2.9 | granular to dense massive | conchoidal fracture | $\omega = 1.572$ $\varepsilon = 1.592$ | hexagonal R3m | strongly pyroelectric |
| alunogen $Al_2(SO_4)_3 \cdot 18H_2O$ | white; yellowish or reddish | vitreous to silky | 1½–2 | 1.8 | fibrous masses and crusts | one perfect cleavage | $\alpha = 1.459–1.475$ $\beta = 1.461–1.478$ $\gamma = 1.884–1.931$ | triclinic | sharp, astringent taste |
| anglesite $PbSO_4$ | colourless to white; often tinted gray, yellow, green, or blue | adamantine to resinous or vitreous | 2½–3 | 6.4 | granular to compact massive; tabular or prismatic crystals | one good, one distinct cleavage | $\alpha = 1.868–1.913$ $\beta = 1.873–1.918$ $\gamma = 1.884–1.931$ | orthorhombic Pnma | often fluorescent |
| anhydrite $CaSO_4$ | colourless to bluish or violet | vitreous to pearly | 3½ | 3.0 | granular or fibrous massive; concretionary (tripestone) | two perfect, one good cleavage | $\alpha = 1.567–1.580$ $\beta = 1.572–1.586$ $\gamma = 1.610–1.625$ | orthorhombic Amma | |
| antlerite $Cu_3(SO_4)(OH)_4$ | emerald to blackish green; light green | vitreous | 3½ | 3.9 | thick tabular crystals | one perfect cleavage | $\alpha = 1.726$ $\beta = 1.738$ $\gamma = 1.789$ | orthorhombic Pnam | |
| barite $BaSO_4$ | colourless to white; also variable | vitreous to resinous | 3–3½ | 4.5 | usually in tabular crystals; rosettes (desert roses); massive | one perfect, one good cleavage | $\alpha = 1.633–1.648$ $\beta = 1.634–1.649$ $\gamma = 1.645–1.661$ | orthorhombic Pnma | diamagnetic; often thermoluminescent and phosphorescent; sometimes fluorescent under ultraviolet light; forms solid solution series toward celestite, in which Sr replaces Ba |
| botryogen $MgFe(SO_4)_2OH \cdot 7H_2O$ | light to dark orange red | vitreous | 2–2½ | 2.1 | reniform, botryoidal, or globular aggregates | one perfect, one good cleavage | $\alpha = 1.523$ $\beta = 1.530$ $\gamma = 1.582$ | monoclinic $P2_1/n$ | iron is in the +3 oxidation state |
| brochantite $Cu_4SO_4(OH)_6$ | emerald to blackish green; light green | vitreous | 3½–4 | 4.0 | prismatic to hairlike crystal and crystal aggregates; granular massive; crusts | one perfect cleavage | $\alpha = 1.728$ $\beta = 1.771$ $\gamma = 1.800$ | monoclinic $P2_1/a$ | |
| caledonite $Cu_2Pb_5(SO_4)_3CO_3(OH)_6$ | deep verdigris green or bluish green | resinous | 2½–3 | 5.8 | coating of small elongated crystals | one perfect cleavage | $\alpha = 1.815–1.821$ $\beta = 1.863–1.869$ $\gamma = 1.906–1.912$ | orthorhombic Pnmm | |
| celestite $SrSO_4$ | pale blue; white, reddish, greenish, brownish | vitreous | 3–3½ | 4.0 | tabular crystals; fibrous massive | one perfect, one good cleavage | $\alpha = 1.618–1.632$ $\beta = 1.620–1.634$ $\gamma = 1.627–1.642$ | orthorhombic Pnma | forms solid solution series toward barite, in which Ba replaces Sr; sometimes fluorescent and thermoluminescent |
| chalcanthite $CuSO_4 \cdot 5H_2O$ | various shades of blue | vitreous | 2½ | 2.3 | short prismatic crystals; granular masses; stalactites and reniform masses | conchoidal fracture | $\alpha = 1.514$ $\beta = 1.537$ $\gamma = 1.543$ | triclinic $P\bar{1}$ | metallic, nauseating taste |
| coquimbite $Fe_2(SO_4)_3 \cdot 9H_2O$ | pale violet to deep purple | vitreous | 2½ | 2.1 | prismatic and pyramidal crystals; granular massive | | $\omega = 1.536$ $\varepsilon = 1.572$ | hexagonal | astringent taste |

**sulfathiazole,** also spelled SULPHATHIAZOLE, synthetic drug formerly used in the treatment of bacterial infections. In the mid-1940s sulfathiazole was the most widely used of the sulfa drugs, but the introduction of less toxic sulfa drugs and, later, of penicillin and other antibiotics had by 1969 almost completely displaced sulfathiazole from use against systemic infections. It remained useful in veterinary medicine for combatting diseases due to staphylococcus, streptococcus, pasteurella, and shigella.

**sulfation,** also spelled SULPHATION, in chemistry, any of several methods by which esters or salts of sulfuric acid (sulfates) are formed. The esters are commonly prepared by treating an alcohol with sulfuric acid, sulfur trioxide,

chlorosulfuric acid, or sulfamic acid. The term sulfation often connotes a deleterious effect; an example is the accretion on statuary of unsightly films resulting from the action of airborne oxides or sulfur on calcium minerals in the stone. Another undesirable process called sulfation is the accumulation of a crystalline form of lead sulfate on the plates of lead–acid storage batteries.

**sulfide,** also spelled SULPHIDE, any of three classes of chemical compounds containing the element sulfur. Inorganic sulfides are ionic compounds containing the negatively charged sulfide ion $S^{2-}$; these compounds may be regarded as salts of the very weak acid hydrogen sulfide (*q.v.*). Several inorganic sulfides are important ores of such metals as lead, copper, and zinc. Organic sulfides, sometimes called thioethers, are compounds in which a sulfur atom is covalently bonded to two organic groups. Organic phosphines react with sulfur to form phosphine sulfides, in which a sulfur atom is linked to the phosphorus by a bond that has both covalent and ionic properties.

**sulfide mineral,** sulfide also spelled SULPHIDE, any member of a group of compounds of sulfur with one or more metals. Most of the sulfides are simple structurally, exhibit high symmetry in their crystal forms, and have many of the properties of metals, including metallic lustre and electrical conductivity. They often are strikingly coloured and have a low hardness and a high specific gravity.

The composition of the sulfide minerals can be expressed with the general chemical formula $A_mS_n$, in which $A$ is a metal, S is sulfur, and $m$ and $n$ are integers, giving $A_2S$, $AS$, $A_3S_4$ and $AS_2$ stoichiometries. The metals that occur most commonly in sulfides are iron, copper, nickel, lead, cobalt, silver, and zinc, though about fifteen others enter sulfide structures.

Almost all sulfide minerals have structural arrangements that belong to six basic types, four of which are important. These arrangements are close-packing combinations of metal and sulfur, governed by ionic size and charge.

The simplest and most symmetrical of the four important structural types is the sodium chloride structure, in which each ion occupies a position within an octahedron consisting of six oppositely charged neighbours. The most common sulfide crystalling in this manner is galena (PbS), the ore mineral of lead. A type of packing that involves two sulfide ions in each of the octahedral positions in the sodium chloride structure is the pyrite structure. This is a high-symmetry structure characteristic of the iron sulfide, pyrite ($FeS_2$O). The second distinct structural type is that of sphalerite (ZnS), in which each metal ion is surrounded by six oppositely charged ions arranged tetrahedrally. The third significant structural type is that of fluorite, in which the metal cation is surrounded by eight anions; each anion, in turn, is surrounded by four metal cations. The reverse of this structure—the metal cation surrounded by four anions and each anion surrounded by eight metal cations—is called the antifluorite structure. It is the arrangement of some of the more valuable precious metal tellurides and selenides among which is hessite ($Ag_2Te$), the ore mineral of silver.

**Sulfate minerals** (continued)

| name formula | colour | lustre | Mohs hardness | specific gravity | habit | fracture or cleavage | refractive indices | crystal system space group | remarks |
|---|---|---|---|---|---|---|---|---|---|
| epsomite $MgSO_4 \cdot 7H_2O$ | colourless; aggregates are white | vitreous; silky to earthy (fibrous) | 2–2½ | 1.7 | fibrous or hair-like crusts; woolly efflorescences | one perfect cleavage | $\alpha = 1.430–1.440$<br>$\beta = 1.452–1.462$<br>$\gamma = 1.457–1.469$ | orthorhombic $P2_12_12_1$ | weakly diamagnetic; salty and bitter taste; effloresces in dry air |
| glauberite $Na_2Ca(SO_4)_2$ | gray; yellowish | vitreous to slightly waxy | 2½–3 | 2.75–2.85 | tabular, dipyramidal, or prismatic crystals | one perfect cleavage | $\alpha = 1.515$<br>$\beta = 1.535$<br>$\gamma = 1.536$ | monoclinic $P\frac{2}{c}$ | slightly salty taste |
| gypsum $CaSO_4 \cdot 2H_2O$ | colourless; white, gray, brownish, yellowish (massive) | subvitreous | 2 (a hardness standard) | 2.3 | elongated tabular crystals (some 5 ft long; others twisted or bent); granular or fibrous masses; rosettes | one perfect cleavage | $\alpha = 1.515–1.523$<br>$\beta = 1.516–1.526$<br>$\gamma = 1.524–1.532$ | monoclinic $A\frac{2}{a}$ | |
| halotrichite $FeAl_2(SO_4)_4 \cdot 22H_2O$ | colourless to white | vitreous | 1½ | 1.7 (pick) to 1.9 (halo) | aggregates of hairlike crystals | conchoidal fracture | pick halo<br>$\alpha = 1.475–1.480$<br>$\beta = 1.480–1.486$<br>$\gamma = 1.483–1.490$ | monoclinic $P\frac{2}{m}$ | forms solid solution series with pickeringite in which Mg replaces Fe; astringent taste |
| jarosite $KFe_3(SO_4)_2(OH)_6$ | ochre yellow to dark brown | subadamantine to vitreous; resinous on fracture | 2½–3½ | 2.9–3.3 | minute crystals; crusts; granular or fibrous massive | one distinct cleavage | $\omega = 1.820$<br>$\varepsilon = 1.715$ | hexagonal R3m | strongly pyroelectric |
| kainite $KMgSO_4Cl \cdot 3H_2O$ | colourless; gray, blue, violet, yellowish, reddish | vitreous | 2½–3 | 2.2 | granular massive; crystalline coatings | one perfect cleavage | $\alpha = 1.494$<br>$\beta = 1.505$<br>$\gamma = 1.516$ | monoclinic $C\frac{2}{m}$ | bitter, salty taste |
| kieserite $MgSO_4 \cdot H_2O$ | colourless; grayish white, yellowish | vitreous | 3½ | 2.6 | granular massive, intergrown with other salts | two perfect cleavages | $\alpha = 1.520$<br>$\beta = 1.533$<br>$\gamma = 1.584$ | monoclinic $C\frac{2}{c}$ | |
| linarite $PbCuSO_4(OH)_2$ | deep azure blue | vitreous to subadamantine | 2½ | 5.3 | elongated tabular crystals, either singly or in groups | one perfect cleavage; conchoidal fracture | $\alpha = 1.809$<br>$\beta = 1.839$<br>$\gamma = 1.859$ | monoclinic $P\frac{2_1}{m}$ | |
| mirabilite $Na_2SO_4 \cdot 10H_2O$ | colourless to white | vitreous | 1½–2 | 1.5 | short prisms; lathlike or tabular crystals; crusts or fibrous masses; granular massive | one perfect cleavage | $\alpha = 1.391–1.397$<br>$\beta = 1.393–1.410$<br>$\gamma = 1.395–1.411$ | monoclinic $P\frac{2_1}{a}$ | cool taste, becoming salty and bitter |
| plumbojarosite $PbFe_6(SO_4)_4(OH)_{12}$ | golden brown to dark brown | dull to glistening or silky | soft | 3.7 | crusts, lumps, compact masses of microscopic hexagonal plates | one fair cleavage | $\omega = 1.875$<br>$\varepsilon = 1.786$ | hexagonal R3m | talclike feel |
| polyhalite $K_2Ca_2Mg(SO_4)_4 \cdot 2H_2O$ | colourless; white or gray; often salmon pink from included iron oxide | vitreous to resinous | 3½ | 2.8 | fibrous to foliated massive | one perfect, cleavage | $\alpha = 1.547$<br>$\beta = 1.560$<br>$\gamma = 1.567$ | triclinic | |
| thenardite $Na_2SO_4$ | colourless; reddish, grayish, yellowish, or yellow brown | vitreous to resinous | 2½–3 | 2.7 | rather large crystals; crusts, efflorescences | one perfect, one fair cleavage | $\alpha = 1.464–1.471$<br>$\beta = 1.473–1.477$<br>$\gamma = 1.481–1.485$ | orthorhombic Fddd | |

**Sulfide minerals**

| name<br>formula | colour | lustre | Mohs hardness | specific gravity | habit or form | fracture or cleavage | refractive indices or polished section data | crystal system<br>space group | remarks |
|---|---|---|---|---|---|---|---|---|---|
| argentite<br>$Ag_2S$ | blackish lead-gray | metallic | 2–2½ | 7.2–7.4 | cubic or octahedral crystals, often in groups; arborescent or hairlike massive | subconchoidal fracture | faintly anisotropic | isometric<br>Im3m | has an orthorhombic polymorph |
| arsenopyrite<br>FeAsS | silver-white to steel-gray | metallic | 5½–6 | 6.1 | cubic or dodecahedral crystals having rough or curved faces; granular or compact massive | one distinct cleavage | strongly anisotropic | monoclinic<br>$P2_1/c$ | thermoelectrically both positive and negative |
| bornite<br>$Cu_5FeS_4$ | copper-red to pinchbeck-brown, tarnishing quickly to iridescent purple | metallic | 3 | 5.1 | prismatic crystals; columnar, granular, or compact massive | uneven fracture | isotropic in part; pinkish brown | isometric<br>Fd3m | |
| calaverite<br>$AuTe_2$ | brass-yellow to silver-white | metallic | 2½–3 | 9.0–9.4 | bladed, lath-like, or prismatic crystals; massive | subconchoidal to uneven fracture | distinctly anisotropic; creamy white | monoclinic<br>$C\frac{2}{m}$ or C2 | |
| chalcocite<br>$Cu_2S$ | blackish lead-gray | metallic | 2½–3 | 5.5–5.8 | short prismatic or thick tabular crystals; massive | conchoidal fracture | weakly anisotropic | orthorhombic | |
| chalcopyrite<br>$CuFeS_2$ | brass-yellow, often tarnished and iridescent | metallic | 3½–4 | 4.1–4.3 | compact massive; tetragonal crystals | uneven fracture | weakly anisotropic; often shows lamellar and polysynthetic twinning | tetragonal<br>I42d | |
| cinnabar<br>HgS | cochineal-red to brownish or lead-gray | adamantine to metallic | 2–2½ | 8.1 | rhombohedral, tabular, or prismatic crystals; massive; earthy coatings | one perfect cleavage | $\omega = 2.756–2.905$<br>$\varepsilon = 3.065–3.256$ | hexagonal<br>$C3_12$ or $C3_22$ | |
| cobaltite<br>CoAsS | silver-white to red; steel-gray or grayish-black | metallic | 5½ | 6.3 | cubic or pyritohedral crystals with striated faces | one perfect cleavage | | isometric<br>Pa3 | thermoelectrically both positive and negative |
| covellite<br>CuS | indigo-blue; highly iridescent brass-yellow or deep red | sub-metallic to resinous (crystals); subresinous to dull (massive) | 1½–2 | 4.6–4.8 | massive; rarely in hexagonal plates | one highly perfect cleavage | strongly anisotropic | hexagonal<br>$P\frac{6_3}{m}mc$ | |
| cubanite<br>$CuFe_2S_3$ | brass- to bronze-yellow | metallic | 3½ | 4.0–4.2 | thick tabular crystals; massive | conchoidal fracture | anisotropic | orthorhombic<br>Pcmn | strongly magnetic |
| domeykite<br>$Cu_3As$ | tin-white to steel-gray; tarnishes yellowish brown, becoming iridescent | metallic | 3–3½ | 7.2–7.9 | reniform or botryoidal masses | uneven fracture | isotropic | isometric<br>I43d | usually intimately intergrown with algodonite |
| dyscrasite<br>$Ag_3Sb$ | silver-white; usually tarnished lead-gray, yellowish, blackish | metallic | 3½–4 | 9.7–9.8 | foliated or granular massive | two distinct cleavages | weakly anisotropic | orthorhombic<br>Pmm | |
| galena<br>PbS | lead-gray | metallic | 2½–3 | 7.6 | cubic crystals; cleavable masses | one perfect cleavage | isotropic | isometric<br>Fm3m | |
| greenockite<br>CdS | various shades of yellow and orange | adamantine to resinous | 3–3½ | 4.9 | earthy coating | conchoidal fracture | $\omega = 2.431–2.506$<br>$\varepsilon = 2.456–2.529$ | hexagonal<br>C6mc | |
| krennerite<br>$AuTe_2$ | silver-white to light brass-yellow | metallic | 2–3 | 8.6 | short prismatic crystals | one perfect cleavage | strongly anisotropic; creamy white | orthorhombic<br>Pma2 | |
| linnaeite<br>$Co_3S_4$ | light gray to steel- or violet-gray, tarnishing to copper-red or violet-gray | brilliant metallic (when fresh) | 4½–5½ | 4.5–4.8 | octahedral crystals granular to compact masses | uneven to subconchoidal fracture | isotropic | isometric<br>Fd3m | forms series with several other Co, Ni sulfides with the general chemical formula: $(Co, Ni)_3(Co,Ni,Fe,Cu)S_4$ |
| loellingite<br>$FeAs_2$ | silver-white to steel-gray | metallic | 5–5½ | 7.4–7.5 | prismatic or pyramidal crystals; massive | uneven fracture | fairly strongly anisotropic | orthorhombic<br>Pnnm | |
| marcasite<br>$FeS_2$ | tin-white, deepening with exposure to bronze-yellow | metallic | 6–6½ | 4.9 | tabular or pyramidal crystals; spear-shaped or cockscomb-like crystal groups | one distinct cleavage | strongly anisotropic and pleochroic; creamy white, light yellowish white, and rosy white | orthorhombic<br>Pnnm | pyrite is its isometric polymorph |
| maucherite<br>$Ni_{11}As_8$ | reddish platinum-gray, tarnishing copper-red | metallic | 5 | 8.0 | tabular crystals | uneven fracture | weakly anisotropic; pinkish gray | tetragonal<br>$P4_12_12$ or $P4_32_12$ | |
| metacinnabar<br>HgS | grayish-black | metallic | 3 | 7.65 | tetrahedral crystals; massive | subconchoidal to uneven fracture | isotropic; grayish white; shows lamellar twinning | isometric<br>F43m | becomes cinnabar at 400–550° C |

**Sulfide minerals** (continued)

| name<br>formula | colour | lustre | Mohs hardness | specific gravity | habit or form | fracture or cleavage | refractive indices or polished section data | crystal system<br>space group | remarks |
|---|---|---|---|---|---|---|---|---|---|
| millerite<br>NiS | pale brass-yellow, tarnishing iridescent gray | metallic | 3–3½ | 5.3–5.7 | very slender to capillary crystals in radiating groups, sometimes interwoven | two perfect cleavages | strongly anisotropic | hexagonal<br>R3m or R3̄m | |
| molybdenite<br>$MoS_2$ | lead-gray | metallic | 1–1½ | 4.6–4.7 | hexagonal tablets; foliated massive, in scales | one perfect cleavage | very strongly anisotropic and pleochroic; white | hexagonal<br>$C_{6/m}^{6}mc$ | greasy feel; soils paper |
| niccolite<br>NiAs | pale copper-red, tarnishing gray to blackish | metallic | 5–5½ | 7.8 | reniform massive; also branching | no cleavage | strongly anisotropic | hexagonal<br>$C_{6/m}^{6}mc$ | |
| orpiment<br>$As_2S_3$ | lemon-yellow, golden-yellow, brownish-yellow | resinous; pearly on cleavages | 1½–2 | 3.5 | foliated, fibrous, or columnar massive; reniform or botryoidal masses; granular | one perfect cleavage | $\alpha = 2.4$<br>$\beta = 2.81$<br>$\gamma = 3.02$ | monoclinic<br>$P_{2/n}^{2}$ | |
| pentlandite<br>$(Fe,Ni)_9S_8$ | light bronze-yellow | metallic | 3½–4 | 4.6–5.0 | granular aggregates | conchoidal fracture | isotropic | isometric<br>Fm3m | nonmagnetic |
| pyrite<br>$FeS_2$ | pale brass-yellow | splendent to glistening metallic | 6–6½ | 5.0 | cubic, pyritohedral, or octahedral crystals with striated faces; massive | conchoidal to uneven fracture | isotropic; creamy white | isometric<br>Pa3 | thermoelectrically both positive and negative; paramagnetic; electrical conductor; gives off sparks when struck by steel |
| pyrrhotite<br>$Fe_{1-x}S$<br>($x = 0–0.2$) | bronze-yellow to pinchbeck-brown, tarnishing quickly | metallic | 3½–4½ | 4.6–4.7<br>4.8 (troilite) | granular massive; sometimes platy or tabular crystals | uneven to subconchoidal fracture | strongly anisotropic | hexagonal<br>$C_{6/m}^{6}mc$ | magnetic; troilite has chemical composition near FeS |
| realgar<br>AsS | aurora-red to orange-yellow | resinous to greasy | 1½–2 | 3.5–3.6 | short, striated prismatic crystals; granular or compact massive; incrustations | one good cleavage, three less so | $\alpha = 2.486–2.538$<br>$\beta = 2.602–2.684$<br>$\gamma = 2.620–2.704$ | monoclinic<br>$P_{n}^{2_1}$ | transparent when fresh; on exposure it disintegrates to a yellow powder |
| rickardite<br>$Cu_4Te_3$ | purple-red | metallic | 3½ | 7.5 | massive | irregular fracture | strongly anisotropic and ∝ pleochroic | | |
| skutterudite<br>$(Co,Ni)As_3$ | tin-white and silver-gray | metallic to bright metallic | 5½–6 | 6.1–6.9 | convex or warped, cubic or octahedral crystals; dense to granular massive | conchoidal fracture | isotropic; gray, creamy, or golden white; strong reflectivity | isometric<br>Im3 | thermoelectrically both positive and negative |
| sphalerite<br>ZnS | brown, black, yellow; also variable | resinous to adamantine | 3½–4 | 3.9–4.1 | tetrahedral or dodecahedral crystals, often with curved faces; cleavable masses | one perfect cleavage | $n = 2.320–2.517$ | isometric<br>F43m | pyroelectric; sometimes triboluminescent; fluorescent under ultraviolet light and X-rays; becomes wurtzite, which is hexagonal at 1,020° C |
| stannite<br>$Cu_2FeSnS_4$ | steel-gray to iron-black | metallic | 4 | 4.3–4.5 | granular massive | uneven fracture | anisotropic | tetragonal<br>I42m | |
| stibnite<br>$Sb_2S_3$ | lead- to steel-gray tarnishing blackish | metallic | 2 | 4.6 | aggregates of needle-like crystals; crystals are easily bent or twisted | one perfect cleavage | $\alpha = 3.184–3.204$<br>$\beta = 4.036–4.056$<br>$\gamma = 4.293–4.313$<br>white; strongly anisotropic | orthorhombic<br>Pbnm | transparent to infrared |
| stromeyerite<br>CuAgS | dark steel-gray, tarnishing blue | metallic | 2½–3 | 6.2–6.3 | pseudohexagonal prisms; compact massive | subconchoidal to conchoidal fracture | strongly anisotropic | orthorhombic | |
| sylvanite<br>$(Au,Ag)Te_2$ | steel-gray to silver-white | brilliant metallic | 1½–2 | 8.1–8.2 | short prismatic, thick tabular, or bladed crystals | one perfect cleavage | strongly anisotropic and pleochroic; creamy white; shows polysynthetic twinning | monoclinic<br>$P_{c}^{2}$ | |
| tetradymite<br>$Bi_2Te_2S$ | pale steel-gray, tarnishing dull or iridescent | metallic | 1½–2 | 7.1–7.5 | foliated to granular massive; bladed crystals | one perfect cleavage | weakly anisotropic; white; sometimes shows a graph-like intergrowth | hexagonal<br>R3, R32, or R3̄m | thermoelectrically positive; soils paper |
| umangite<br>$Cu_3Se_2$ | dark cherry-red, tarnishing quickly to violet-blue | metallic | 3 | 5.6 | small grains; fine-grained aggregates | uneven fracture | strongly anisotropic; dark red-violet; apparently uniaxial | | |
| wurtzite<br>ZnS | brownish-black | resinous | 3½–4 | 4.0–4.1 | pyramidal crystals; fibrous or columnar massive; concentrically banded crusts | one easy cleavage | $\omega = 2.330–2.356$<br>$\varepsilon = 2.350–2.378$ | hexagonal<br>$P6_3mc$ | inverts to sphalerite, which is isometric |



(Top) Argentite from Freiberg, Ger., (centre) pyrite from Butte, Mont., (bottom) stibnite from Arnsberg, Ger.

By courtesy of (top, bottom) the Field Museum of Natural History, Chicago, (centre) Joseph and Helen Guetterman Collection: photographs, John H. Gerard—(top, bottom) EB Inc.

In virtually all of the sulfides, bonding is covalent, but some have metallic properties. The covalent property of sulfur allows sulfur-sulfur bonds and the incorporation of $S_2$ pairs in some sulfides such as pyrite. Several sulfides, including molybdenite ($MoS_2$) and covellite (CuS), have layer structures. Several rare sulfide varieties have the spinel (*q.v.*) structure.

Phase relations of sulfides are particularly complex, and many solid state reactions occur at relatively low temperatures (100–300° C [212–572° F]), producing complex intergrowths. Particular emphasis has been placed on the experimental investigation of the iron-nickel-copper sulfides because they are by far the most common. They also are important geologic indicators for locating possible ore bodies and provide low-temperature reactions for geothermometry.

Sulfides occur in all rock types. Except for dissemination in certain sedimentary rocks, these minerals tend to occur in isolated concentrations which make up mineral bodies such as veins and fracture fillings or which comprise replacements of preexisting rocks in the shape of blankets. Sulfide mineral deposits originate in two principal processes, both of which have reducing conditions: (1) separation of an immiscible sulfide melt during the early stages of crystallization of basic magmas; and (2) deposition from aqueous solutions at temperatures in the 300–600° C (572–1,112° F) range and at relatively high pressure. The sulfide deposits formed as a result of the first process include mainly pyrrhotites, pyrites, pentlandites, and chalcopyrites. Most others occur because of the latter process. Weathering may act to concentrate dispersed sulfides.

Sulfide minerals are the source of various precious metals, most notably gold, silver, and platinum. They also are the ore minerals of most metals used by industry, as for example antimony, bismuth, copper, lead, nickel, and zinc. Other industrially important metals such as cadmium and selenium occur in trace amounts in numerous common sulfides and are recovered in refining processes.

For the more common sulfide minerals and their physical properties, *see* the Table.

**sulfite process,** sulfite also spelled SULPHITE, chemical process for the manufacture of paper pulp that employs an acid bisulfite solution to soften the wood material by removing the lignin from the cellulose. Sulfite cooking liquor used in the process consists of free sulfur dioxide obtained by the burning of sulfur or by the roasting of iron pyrites, dissolved in water at a concentration of four to eight percent, with from two to three percent in the form of bisulfite. The sulfite digestion of the wood material is normally carried out as a batch process in a pressure vessel that consists of a steel shell possessing an acid-resistant lining. *See also* kraft process.

**sulfobromophthalein clearance test** (medicine): *see* Bromsulphalein test.

**sulfonamide,** also spelled SULPHONAMIDE, any member of a class of chemical compounds, the amides of sulfonic acids. The class includes several groups of drugs used in the treatment of bacterial infections, diabetes mellitus, edema, hypertension, and gout.

The bacteriostatic sulfonamide drugs, often called sulfa drugs, include sulfanilamide (*q.v.*) and numerous compounds closely related to it. Other groups of sulfonamide drugs have been developed by exploiting observations made during clinical evaluation of sulfanilamide derivatives. Examples of these drugs are probenecid (*q.v.*), introduced as an agent for intensifying the action of penicillin but now principally used in treating gout; acetazolamide and furosemide, which are diuretics; and tolbutamide (*q.v.*), a hypoglycemic. Chlorothiazide and hydrochlorothiazide are effective both as diuretics and in reducing blood pressure.

Sulfonamides are oily liquids or crystalline solids that are almost always prepared by the reaction of a sulfonyl chloride with ammonia or an amine, most commonly in the presence of caustic alkali.

The first sulfonamide drug, introduced in 1932, was a red azo dye called Prontosil (*q.v.*). As new sulfonamides were synthesized, more effective and less toxic agents were discovered. Some, which are not absorbed, can be administered orally to treat specific localized infections in the gastrointestinal tract. Others are absorbed slowly or excreted slowly and therefore are longer acting.

All the sulfonamides are capable of causing drug intoxication (poisoning), and some patients are hypersensitive to them. The commonest side effects are nausea, vomiting, and mental confusion. The signs of hypersensitivity are fever and skin eruptions. Signs of intoxication include anemia, which results from destruction of red blood cells, and leukopenia, which results from the destruction of white blood cells. Irritation of the kidneys and obstruction of the free flow of urine are undesirable reactions that can be prevented.

**sulfonation,** also spelled SULPHONATION, in chemistry, any of several methods by which sulfonic acids are prepared. Important sulfonation procedures include the reaction of aromatic hydrocarbons with sulfuric acid, sulfur trioxide, or chlorosulfuric acid; the reaction of organic halogen compounds with inorganic sulfites; and the oxidation of certain classes of organic sulfur compounds, particularly thiols or disulfides.

**sulfone,** also spelled SULPHONE, any of a family of organic sulfur compounds in which two carbon-containing combining groups are linked to the group $SO_2$. The best known members of the family are the polysulfone (*q.v.*) resins and several drugs used in the treatment of leprosy.

**sulfonic acid,** sulfonic also spelled SULPHONIC, any of a class of organic acids containing sulfur and having the general formula $RSO_3H$, in which R is an organic combining group. The sulfonic acids are among the most important of the organic sulfur compounds; the free acids are widely used as catalysts in organic syntheses, while the salts and other derivatives form the basis of the manufacture of phenolic compounds, detergents, water-soluble dyes, sulfonamide pharmaceuticals, and ion-exchange resins. The aromatic sulfonic acids are particularly useful as intermediates or starting materials in synthesis.

The aromatic sulfonic acids are obtained generally by treating aromatic compounds with concentrated sulfuric acid, the process being called sulfonation (*q.v.*). Because the acids are frequently used in the form of their sodium salts, sulfonation is usually followed by neutralization with sodium hydroxide or sodium carbonate. Such operations are conducted on a manufacturing scale in the preparation of the sodium salts of benzenesulfonic acid for the manufacture of phenol, those of alkylated benzenesulfonic acids used as synthetic detergents, and that of anthraquinonesulfonic acid used in the manufacture of alizarin and other dyes.

The aliphatic sulfonic acids are generally less important and more difficult to prepare than the aromatic sulfonic acids. Among the various methods used to prepare aliphatic sulfonic acids are the oxidation of other organic sulfur compounds and the reaction of alkyl halides and metallic sulfites.

**sulfosalt,** also spelled SULPHOSALT, any of an extensive group of minerals, mostly rare species, marked by some of the most complicated atomic and crystal structures known to inorganic chemistry. They conform to the general composition $A_nB_pX_n$, in which $m$, $n$, and $p$ are integers; $A$ may be lead, silver, thallium, or copper; $B$ may be antimony, arsenic, bismuth, tin, or germanium; and $X$ may be sulfur or selenium. Formerly it was believed that the sulfosalts were salts of complex hypothetical thioantimonic or thioarsenic acids (*e.g.*, $HSbS_2$, $H_{18}As_8S_{15}$, $H_3AsS_3$), but X-ray diffraction analyses indicate that the atomic structures of many sulfosalts are based on structural fragments of simpler compounds such as galena (lead sulfide; PbS) blocks and stibnite (antimony trisulfide; $Sb_2S_3$) sheets. No encompassing theory has been evolved to rationalize many of these curious compounds. The complexity of many of the structures evidently results from their having crystallized at low temperatures and the consequent high degree of ordering of the metal atoms. Syntheses of such compositions at higher temperature usually result in structures simpler than the complicated low-temperature forms.

Although sulfosalts are much rarer than the sulfide minerals with which they are often associated, some localities are truly remarkable for the variety of species encountered. At the Lengenbach Mine in Switzerland, for example, more than 30 distinct species have been recognized, 15 of which are not found elsewhere. Most sulfosalts have formed at low temperature in open cavities, usually in association with copper–zinc–arsenic sulfide ores. Very often they occur in cavities of calcite and dolomite, as at the Lengenbach Mine. Most are lead gray in colour with a metallic lustre, brittle (rarely malleable), crystalline, and difficult to tell apart without recourse to X-ray diffraction and electron microprobe analyses. The thallium-bearing sulfosalts often are deep red and transparent, as sometimes are the sulfosalts of silver.

Although under exceptional circumstances some sulfosalts may constitute silver ores (*i.e.,* proustite, pyrargyrite, and stephanite), and other species have constituted ores of silver (in minor amounts), mercury, arsenic, and antimony (*i.e.,* boulangerite, livingstonite, enargite, and tennantite-tetrahedrite), their economic importance is trivial. Aside from mineralogical curiosities, the sulfosalts are of interest because their electronic properties are related to those of semiconductors.

**sulfoxide,** also called SULPHOXIDE, any of a class of organic compounds containing sulfur and oxygen and having the general formula ($RR'$) SO, in which R and $R'$ are a grouping of carbon and hydrogen atoms. The sulfoxides are good solvents for salts and polar compounds.

The best-known sulfoxide is dimethyl (or methyl) sulfoxide (DMSO), which is prepared by aerial oxidation of dimethyl sulfide (a by-product of paper manufacture) in the presence of nitrogen dioxide. DMSO is used as a solvent in a wide variety of industrial processes, including the manufacture of polyacrylonitrile fibres, the extraction of aromatic hydrocarbons from refinery streams, the manufacture of certain pesticides, for industrial cleaning, and for paint stripping. It is also used as a solvent for drugs and antitoxins applied topically. The last use is based on its remarkable ability to penetrate animal tissues.

Dimethyl sulfoxide is a colourless and odourless liquid, boiling at 189° C (372° F). It is miscible in all proportions with water, alcohol, and most organic solvents.

**sulfur,** also spelled SULPHUR (S), nonmetallic chemical element belonging to the oxygen family (Group VIa of the periodic table), one of the most reactive of the elements.

A brief treatment of sulfur follows. For full treatment, *see* MACROPAEDIA: Chemical Elements: *Oxygen group elements.*

Known to the ancients (in Genesis it is called brimstone), sulfur was first classified as an element in 1777 by Antoine Lavoisier. It is estimated to be the ninth most abundant element in the universe. In the form of sulfides, sulfates, and elemental sulfur, the element constitutes about 0.03 percent of the Earth's crust. After oxygen and silicon, it is the most abundant constituent of minerals.

*Occurrence, properties, and uses.* Native or free sulfur occurs chiefly in volcanic or sedimentary deposits. The former are located throughout the world; the latter are especially common along the U.S. coastal region of Texas and Louisiana. Coal, petroleum, and natural gas contain sulfur compounds. Sulfur-containing ores include such sulfides as pyrite (iron disulfide), galena (lead sulfide), cinnabar (mercury sulfide), sphalerite (zinc sulfide), and chalcopyrite (copper iron sulfide), as well as such sulfates as gypsum (calcium sulfate) and barite or heavy spar (barium sulfate).

Where deposits of sulfur are located in salt domes, as they are along the coast of the Gulf of Mexico, the element is recovered by the Frasch process (*q.v.*). This process has made sulfur of a high purity (up to 99.9 percent pure) available in large quantity and has helped establish sulfur as one of the four most important basic chemical commodities. Wells are drilled from 60 to 600 m (200 to 2,000 feet) into the sulfur formation and then lined with a 6-inch (15-centimetre) pipe in which an air pipe and a water pipe of smaller diameter are concentrically placed. Superheated water, injected into the circular space between three- and six-inch pipes, penetrates the cap rock through holes on the bottom of the pipe. As the sulfur melts, it settles to the bottom of the deposit. From there it is pumped to the surface by applying air pressure through the central pipe. Several such wells operate under the ocean floor in the Gulf of Mexico. The sulfur is collected in reservoirs, or sumps, and from there transferred to vats or bins to solidify for storage and stockpiling. Vats may contain as much as 300,000 tons of sulfur.



Sulfur crystals from Sicily (greatly enlarged)
By courtesy of the Illinois State Museum; photograph, John H. Gerard

About 4,000,000 tons of sulphur are recovered in the United States each year from natural gas, petroleum refinery gases, pyrites, and smelter gases from the processing of copper, zinc, and lead ores. In most cases sulfur is separated from other gases as hydrogen sulfide and then converted to elemental sulfur by the Claus process, which involves the partial burning of hydrogen sulfide to sulfur dioxide, with subsequent reaction between the two to yield sulfur. Another important source is the sulfur dioxide emitted into the atmosphere by coal-fired steam power plants. In the early 1970s techniques to collect this sulfur dioxide and convert it into usable sulfur were developed.

Pure sulfur is a tasteless, odourless, brittle solid that is pale yellow in colour, a poor conductor of electricity, and insoluble in water. The element exists in several different forms, the two most important being the orthorhombic (often called rhombic) and monoclinic crystalline modifications. Rhombic sulfur, which is stable at room temperature, includes the common roll sulfur (or brimstone), flowers of sulfur (a finely divided form obtained by sublimation of vapour directly to a solid upon cooling), and much natural sulfur. Monoclinic, or prismatic, sulfur, which is obtained when liquid sulfur is cooled slowly, consists of long, needlelike crystals. It is stable be-

**Sulfosalts**

| name formula | colour | lustre | Mohs hardness | specific gravity | habit | fracture or cleavage | refractive indices or polished section data | crystal system space group | remarks |
|---|---|---|---|---|---|---|---|---|---|
| argyrodite $Ag_8GeS_6$ | bluish to purplish black; steel gray when fresh | metallic | 2½ | 6.1–6.3 | crystals and crystal aggregates; crusts; compact masses | conchoidal to uneven fracture | violet gray white; isotropic (canfieldite) or weakly pleochroic (argyrodite) | isometric Im3m | forms a solid solution series with canfieldite in which tin replaces germanium in the molecular structure |
| bournonite $PbCuSbS_3$ | steel gray to iron black | metallic | 2½–3 | 5.8–5.9 | prismatic to tabular crystals; crystal aggregates; granular to compact masses | subconchoidal to uneven fracture | white; weakly anisotropic and very weakly pleochroic | orthorhombic $Pnm2_1$ | |
| enargite $Cu_3AsS_4$ | gray black to iron black | metallic | 3 | 4.4–4.5 | tabular crystals; granular masses | one perfect cleavage | gray to light rose brown; strongly anisotropic; weakly pleochroic | orthorhombic $Pnm2_1$ | |
| polybasite $(Ag,Cu)_{16}Sb_2S_{11}$ | iron black | metallic | 2–3 | 6.0–6.2 | tabular crystals; massive | uneven fracture | gray white; moderately anisotropic; weakly pleochroic | monoclinic $C_m^2$ | |
| proustite $Ag_3AsS_3$ | scarlet vermillion | adamantine | 2–2½ | 5.6 | prismatic crystals; compact masses | one distinct cleavage | $\omega = 2.979–3.088$ $\varepsilon = 2.711–2.792$ | hexagonal R3c | |
| pyrargyrite $Ag_3SbS_3$ | deep red | adamantine | 2½ | 5.8 | prismatic crystals; compact masses | one distinct cleavage | $\omega = 3.084$ $\varepsilon = 2.881$ | hexagonal R3c | |
| stephanite $Ag_5SbS_4$ | iron black | metallic | 2–2½ | 6.2–6.3 | prismatic to tabular crystals; disseminated grains; compact masses | subconchoidal to uneven fracture | strongly anisotropic | orthorhombic Cmc2 | |
| tetrahedrite $(Cu,Fe,Zn,Ag)_{12}Sb_4S_{13}$ | flint gray to iron or dull black | metallic | 3–4½ | 4.6–5.1 | tetrahedral crystals; granular to compact masses | subconchoidal to uneven fracture | gray to olive brown; isotropic | isometric I43m | forms a solid solution series with tennantite in which arsenic replaces antimony in the molecular structure |

tween 96° C (205° F) and 119° C (246° F), but at room temperature it changes slowly to the rhombic form. When hot molten sulfur is cooled suddenly (as by pouring it into cold water), it forms a soft, sticky, elastic, noncrystalline mass called amorphous, or plastic, sulfur. Although the rhombic and monoclinic forms are highly soluble in carbon disulfide, amorphous sulfur is not.

*Compounds.* Sulfur forms compounds in oxidation states −2 (sulfide, $S^{2-}$), +4 (sulfite, $SO_3^{2-}$), and +6 (sulfate, $SO_4^{2-}$). It combines with nearly all elements. An unusual feature of some sulfur compounds results from the fact that sulfur is second only to carbon in exhibiting catenation—*i.e.,* the bonding of an atom to another identical atom. This allows sulfur atoms to form ring systems and chain structures. The more significant sulfur compounds and compound groups are as follows.

One of the most familiar sulfur compounds is hydrogen sulfide, also known as sulfureted hydrogen, or stinkdamp, $H_2S$, the colourless, extremely poisonous gas responsible for the characteristic odour of rotten eggs. It is produced naturally by the decay of organic substances containing sulfur and is often present in vapours from volcanoes and mineral waters. Large amounts of hydrogen sulfide are obtained in the removal of sulfur from petroleum. It is used extensively in chemical laboratories as an analytical reagent.

All the metals except gold and platinum combine with sulfur to form inorganic sulfides. Such sulfides are ionic compounds containing the negatively charged sulfide ion $S^{2-}$; these compounds may be considered as salts of hydrogen sulfide. Some inorganic sulfides are important ores of such metals as iron, nickel, copper, cobalt, zinc, and lead.

Several oxides are formed by sulfur and oxygen; the most important is the heavy, colourless, poisonous gas sulfur dioxide, $SO_2$. It is used primarily as a precursor of sulfur trioxide, or sulfur(VI) oxide, $SO_3$, and thence sulfuric acid, $H_2SO_4$. It is also utilized as a bleach and an industrial reducing agent. Other noteworthy applications include its use in food preservation and for fruit ripening. *See also* sulfur oxide.

Sulfur forms a wide variety of compounds with halogen elements. In combination with chlorine it yields sulfur chlorides such as disulfur dichloride, $S_2Cl_2$, a corrosive, golden-yellow liquid used in the manufacture of chemical products. It reacts with ethylene to produce mustard gas, and with unsaturated acids derived from fats it forms oily products that are basic components of lubricants. With fluorine, sulfur forms sulfur fluorides, the most useful of which is sulfur hexafluoride, $SF_6$, a gas employed as an insulator in various electrical devices. Sulfur also forms oxyhalides, in which the sulfur atom is bonded to both oxygen and halogen atoms. When such compounds are named, the term thionyl is used to designate those containing the SO unit and the term sulfuryl for those with $SO_2$. Thionyl chloride, $SOCl_2$, is a dense, toxic, volatile liquid used in organic chemistry to convert carboxylic acids and alcohols into chlorine-containing compounds. Sulfuryl chloride, $SO_2Cl_2$, is a liquid of similar physical properites utilized in the preparation of certain compounds that contain sulfur, chlorine, or both.

Sulfur forms some 16 oxygen-bearing acids. Only four or five of them, however, have been prepared in the pure state. These acids, particularly sulfurous acid and sulfuric acid, are of considerable importance to the chemical industry. Sulfurous acid, $H_2SO_3$, is produced when sulfur dioxide is added to water. Its most important salt is sodium sulfite, $Na_2SO_3$, a reducing agent employed in the manufacture of paper pulp, in photography, and in the removal of oxygen from boiler feedwater. Sulfuric acid (*q.v.*) is one of the most valuable of all chemicals. Prepared commercially by the reaction of water with sulfur trioxide, the compound is used in manufacturing fertilizers, pigments, dyes, drugs, explosives, detergents, and inorganic salts and esters.

The organic compounds of sulfur constitute a diverse and important subdivision of organic substances. Some examples include the sulfur-containing amino acids (*e.g.,* cysteine, methionine, and taurine), which are key components of hormones, enzymes, and coenzymes. Significant, too, are the synthetic organic sulfur compounds, among them numerous pharmaceuticals (sulfa drugs, dermatological agents), insecticides, solvents, and agents such as those used in preparing rubber and rayon.

| | |
|---|---|
| atomic number | 16 |
| atomic weight | 32.064 |
| melting point | |
| rhombic | 112.8° C (235° F) |
| monoclinic | 119° C (246° F) |
| boiling point | 444.6° C (832° F) |
| density (at 20° C [68° F]) | |
| rhombic | 2.07 g/cm³ |
| monoclinic | 1.96 g/cm³ |
| oxidation states | −2, +4, +6 |
| electron configuration | 2–8–6 or $1s^2 2s^2 2p^6 3s^2 3p^4$ |

**sulfur bacterium,** plural SULFUR BACTERIA, any of a diverse group of microorganisms capable of metabolizing sulfur and its compounds and important in the sulfur cycle (*q.v.*) in nature. Some of the common sulfur substances that are used by these bacteria as an energy source are hydrogen sulfide ($H_2S$), sulfur, and thiosulfate (sulfate ion, $S_2O_3^{2-}$). The final product of sulfur oxidation is sulfate ($SO_4^{2-}$).

*Thiobacillus,* widespread in marine and terrestrial habitats, oxidizes sulfur, producing sulfates useful to plants; in deep ground deposits it generates sulfuric acid, which dissolves metals in mines but also corrodes concrete and steel. *Desulfovibrio desulfucans* reduces sulfates in waterlogged soils and sewage to hydrogen sulfide, a gas with the rotten egg odour so common to such places. *Thiothrix,* common in sulfur springs and in sewage, and *Sulfolobus,* confined to sulfur-rich hot springs, transform hydrogen sulfide to elemental sulfur.

Many species in the families Chromatiaceae (purple sulfur bacteria) and Chlorobiaceae (green sulfur bacteria) utilize energy from light in an oxygen-free environment to transform sulfur and its compounds to sulfates.

**sulfur-bottom whale:** *see* blue whale.

**sulfur butterfly,** member of the cosmopolitan insect family Pieridae (order Lepidoptera) that also includes the white and the orange-tip butterflies. Adults have a wingspan of 35 to 60 mm (1.5 to 2.5 inches). Sexual and seasonal dimorphism in pattern and colour occur in many species. The pupae are attached to a twig by a posterior spine and a girdle of silk.

The sulfurs are generally bright yellow or orange. Some species have two colour patterns; *e.g., Colias eurytheme* is usually orange with black wing margins, but some females are white with black margins. The larvae feed on clover and may seriously damage crops.

**sulfur cycle,** circulation of sulfur in various forms through nature. Sulfur occurs in all living matter as a component of certain amino acids. It is abundant in the soil in proteins and, through a series of microbial transformations, ends up as sulfates usable by plants.

Sulfur-containing proteins are degraded into their constituent amino acids by the action of a variety of soil organisms. The sulfur of the amino acids is converted to hydrogen sulfide ($H_2S$) by another series of soil microbes. In the presence of oxygen, $H_2S$ is converted to sulfur and then to sulfate by sulfur bacteria. Eventually the sulfate becomes $H_2S$.

Hydrogen sulfide rapidly oxidizes to gases that dissolve in water to form sulfurous and sulfuric acids. These compounds contribute in large part to the "acid rain" that can kill sensitive aquatic organisms and damage marble monuments and stone buildings.

**sulfur dye,** any of a group of sulfur-containing, complex synthetic organic dyes applied from an alkaline solution of sodium sulfide (in which they dissolve) to cellulose, where they become substantive to the fibre. On exposure to air, the dyes in the fibre are oxidized back to their original insoluble form. Sulfur dyes are fast to washing, perspiration, and light but have poor resistance to chlorine bleach. Most colours are available, especially subdued and deep shades, rich blacks, and navy, but not bright red and orange.

**sulfur oxide,** any of several compounds of sulfur and oxygen, the most important of which are sulfur dioxide ($SO_2$) and sulfur trioxide ($SO_3$), both of which are manufactured in huge quantities in intermediate steps of sulfuric acid manufacture. The dioxide is the acid anhydride (a compound that combines with water to form an acid) of sulfurous acid; the trioxide is the acid anhydride of sulfuric acid.

Sulfur dioxide is a heavy, colourless, poisonous gas with a pungent, irritating odour familiar as the smell of a just-struck match. Occurring in nature in volcanic gases and in solution in the waters of some warm springs, sulfur dioxide usually is prepared industrially by the burning in air or oxygen of sulfur or such compounds of sulfur as iron pyrite or copper pyrite. Large quantities of sulfur dioxide are formed in the combustion of sulfur-containing fuels; in the second half of the 20th century, measures to control atmospheric pollution by this compound were widely adopted. In the laboratory the gas may be prepared by reducing sulfuric acid ($H_2SO_4$) to sulfurous acid ($H_2SO_3$), which decomposes into water and sulfur dioxide, or by treating sulfites (salts of sulfurous acid) with strong acids, such as hydrochloric acid, again forming sulfurous acid.

Sulfur dioxide can be liquefied under moderate pressures at room temperatures; the liquid freezes at −73° C (−99.4° F) and boils at −10° C (+14° F) under atmospheric pressure. Although its chief uses are in the preparation of sulfuric acid, sulfur trioxide, and sulfites, sulfur dioxide also is used as a disinfectant, a refrigerant, a bleach, and a food preservative, especially in dried fruits.

Sulfur trioxide is a colourless compound that exists at room temperature either as a volatile liquid or in any of three allotropic solid forms. The liquid boils at 44.6° C (112° F) and solidifies at 16.83° C (62° F); the most stable of the solid forms melts at 62° C (144° F). Formed by the reaction of sulfur dioxide and oxygen in the presence of catalysts, sulfur trioxide fumes vigorously in contact with moist air and dissolves in water, liberating much heat and forming sulfuric acid. Solutions of the trioxide in sulfuric acid are called fuming sulfuric acid, or oleum. Like sulfuric acid, sulfur trioxide is a very powerful dehydrating agent, is very corrosive, and is very reactive chemically.

Other oxides of sulfur include the monoxide (SO), sesquioxide ($S_2O_3$), heptoxide ($S_2O_7$), and tetroxide ($SO_4$). The monoxide is formed as an unstable colourless gas by an electric discharge in a mixture of sulfur dioxide and sulfur vapour at low pressure; upon cooling, it condenses to an orange-red solid that decomposes slowly to sulfur and sulfur dioxide. The sesquioxide, formed by dissolving sulfur in liquid sulfur trioxide, is a blue-green solid stable only below 15° C (59° F). The heptoxide and the tetroxide, unstable compounds that melt at about 0° C (32° F), are formed by an electric discharge in a mixture of sulfur dioxide or trioxide and oxygen.

**sulfuric acid,** sulfuric also spelled SULPHURIC ($H_2SO_4$), also called OIL OF VITRIOL, or HYDROGEN SULFATE, dense, colourless, oily, corrosive liquid; one of the most important of all chemicals, prepared industrially by the reaction of water with sulfur trioxide (*see* sulfur oxide), which in turn is made by chemical combination of sulfur dioxide and oxygen either by the contact process (*q.v.*) or the chamber process (*q.v.*). In various concentrations the acid is used in the manufacture of fertilizers, pigments, dyes, drugs, explosives, detergents, and inorganic salts and acids, as well as in petroleum refining and metallurgical processes. In one of its most familiar applications, sulfuric acid serves as the electrolyte in lead–acid storage batteries.

Pure sulfuric acid has a specific gravity of 1.830 at 25° C (77° F); it freezes at 10.37° C (50.7° F). When heated, the pure acid partially decomposes into water and sulfur trioxide; the latter escapes as a vapour until the concentration of the acid falls to 98.3 percent. This mixture of sulfuric acid and water boils at a constant temperature of 338° C (640° F) at one atmosphere pressure. Sulfuric acid is commonly supplied at concentrations of 78, 93, or 99 percent.

Sulfuric acid is a very strong acid; in aqueous solutions it ionizes completely to form hydronium ions ($H_3O^+$) and hydrogen sulfate ions ($HSO_4^-$). In dilute solutions the hydrogen sulfate ions also dissociate, forming more hydronium ions and sulfate ions ($SO_4^{2-}$). In addition to being an oxidizing agent, reacting readily at high temperatures with many metals, carbon, sulfur, and other substances, concentrated sulfuric acid is also a strong dehydrating agent, combining violently with water; in this capacity, it chars many organic materials, such as wood, paper, or sugar, leaving a carbonaceous residue.

The term fuming sulfuric acid, or oleum, is applied to solutions of sulfur trioxide in 100 percent sulfuric acid; these solutions, commonly containing 20, 40, or 65 percent sulfur trioxide, are used for the preparation of organic chemicals.

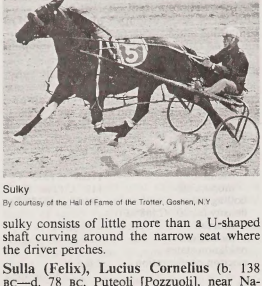
**Sulitelma,** Norwegian SULITJELMA, Lappish SULLI ČIELBMA, mountain range in Lapland extending for 30 mi (48 km) along the Swedish–Norwegian border. It rises to 6,279 ft (1,914 m), is permanently snow-clad, and gives rise to several glaciers, notably the 10-mile-long Blåmannsisen, which extends north from the Norwegian village of Sulitjelma.

**Suliyavongsa,** also spelled SOULIGNAVONGSA (b. 1613—d. 1694), Lao king of Lan Xang during its golden age of prosperity, who welcomed the first European visitors to Laos.

Suliyavongsa came to the throne in 1637 at a time of dynastic conflict and instability and authoritatively restored peace and delimited Lan Xang's frontiers with its neighbours. Dutch visitors to his capital, Vientiane, in the 1640s, and Italian Jesuits in the 1660s, described a vigorous, powerful, and prosperous kingdom. Suliyavongsa's execution of his crown prince for a romantic indiscretion left the kingdom without an immediate heir to the throne, and Lan Xang soon was divided between rival claimants.

**sulky,** originally a light, open, one-horse, four-wheeled vehicle with its single seat for only one person fixed on its shafts. It is thought to have been invented in the early 19th century by an English physician and was supposedly named for his sulkiness in wishing to sit alone. The sulky was adapted to two wheels and widely used in the United States by doctors and others who had to travel extensively by themselves.

Today the sulky is used primarily in harness racing. Of light metal construction, the racing



Sulky
By courtesy of the Hall of Fame of the Trotter, Goshen, N.Y.

sulky consists of little more than a U-shaped shaft curving around the narrow seat where the driver perches.

**Sulla (Felix), Lucius Cornelius** (b. 138 BC—d. 78 BC, Puteoli [Pozzuoli], near Naples), victor in the first full-scale civil war in Roman history (88–82 BC) and subsequently dictator (82–79), who carried out notable constitutional reforms in an attempt to strengthen the Roman Republic during the last century of its existence. In late 82 he assumed the name Felix in belief in his own luck.

*Life.* Sulla was the son of a politically unimportant patrician family. He early showed a taste for luxury and aspired to a political career, which he began in 107 BC, under the command of Gaius Marius, as a quaestor (financial magistrate) in Africa in the war against King Jugurtha of the Numidians. His spectacular capture of Jugurtha by trickery marked the start of his feud with Marius. Although Marius continued to use Sulla in the war against the invading Cimbri, in 103 BC his jealousy became obvious, and Sulla transferred to the service of Marius' co-commander.

After service as a Roman praetor (one of the chief magistrates) in 94 BC, Sulla fought in the Social War (90–89 BC), the struggle of Rome's Italian allies to obtain Roman citizenship. He became one of the two consuls—the highest office in the republic—in 88 and was placed in command of the war against King Mithradates VI of Pontus in Asia Minor. By his marriage—his fourth—to Caecilia Metella in 88 BC, he formed important alliances. But Marius, through his alliance with the tribune Publius Sulpicius Rufus of the popular party, succeeded in being appointed commander instead. Sulla marched on Rome, Sulpicius was killed, and Marius escaped.

In 88 Sulla set off for Greece in charge of the war against Mithradates. By the spring of 87 most of Greece was in his power, and after a long siege he captured Athens in 86. Mithradates' general was pursued into Boeotia and finally defeated in two battles in 86.

At a meeting in 85 between Sulla and Mithradates at Dardanus on the Hellespont, the latter accepted a punitive treaty. Order was restored in Asia and Greece, and Mithradates became a vassal of the Romans again. In the summer of 83, Sulla, after a lengthy stay in Athens, returned to Brundisium in southern Italy with 40,000 men and enormous plunder.

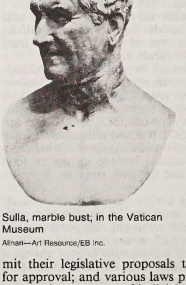
During his absence Sulla had been declared a public enemy by the ruling popular party. His laws were repealed, his house was destroyed, and his family and friends fled to join him in Greece. In 86 the former consul Lucius Valerius Flaccus was sent to replace Sulla in the Asian command. But Sulla's luck did not desert him; Flaccus was murdered by his lieutenant.

From Brundisium, Sulla began his march on Rome, joined by opponents of the popular regime. Through most of the ensuing civil war Sulla was opposed by the consuls Gnaeus Papirius Carbo and the younger Marius (whose father had died in 86). Sulla's victory of Colline Gate in the northern environs of Rome and the fall of Praeneste at the end of 82 ended the war, which was followed by massacres and proscriptions.

Sulla was appointed dictator under the Lex Valeria (Valerian law), which vested constituent, legislative, military, and judicial power in him, without, however, for the first time in Rome's history, limiting the duration of his dictatorship.

The state was reorganized and the new legislation enacted in 81, at the start of which year (January 27–28) Sulla celebrated his victory over Mithradates. In the speech delivered at the close of the ceremony, he chose for himself the name of Felix (Epaphroditos in Greek documents).

By his extensive program of constitutional reform he intended mainly to reestablish the supremacy of the Senate in the Roman state, and many of his reforms did indeed survive to the end of the republic. Of value were the increase of the number of courts for criminal trials; a new treason law, Lex Cornelia Majestatis, designed to prevent insurrection by provincial governors and army commanders; the requirement that the tribunes had to sub-



Sulla, marble bust; in the Vatican Museum
Alinari—Art Resource/EB Inc.

mit their legislative proposals to the Senate for approval; and various laws protecting citizens against excesses of judicial and executive organs.

At the beginning of 79, Sulla resigned and withdrew to the neighbourhood of Puteoli in Campania. This action caused a sensation in Rome; many different explanations have been given, starting with the classical writers. Most commonly accepted is the view that Sulla's resignation was an act of honesty by a man who had pledged to step down as soon as his reforms had been carried out. Henceforth a private citizen, he continued to write his memoirs. Active to his very last days, Sulla was struck down by a fever in the spring of 78. He left behind two children by Metella and a posthumous daughter by his fifth wife, Valeria.

*Assessment.* Sulla, a soldier and a politician, a dictator and a reformer, and a man of contradictions in an age of contradictions, is the subject of contradictory opinions expressed by both classical and modern writers. The classical writers of Sulla's time or shortly thereafter found it difficult to form an opinion of him; they noted the discrepancy of the Sulla "who follows up good beginnings with evil deeds." Generally their attitude was a negative one, with references to despotism, slavery, cruelty, and inhumanity, and the absence of any principle of good government. The opinions held by modern writers cover a spectrum

ranging from Sulla the enigma (because of his resignation), to Sulla the monarch, to Sulla the honest reformer.

Sulla was the exponent of a decadent patriciate that tried everything in its power to save itself by instituting reforms that, while not without democratic aspects, lacked inner vitality. From the long-term perspective Sulla's actions seem meaningless; but viewed in their historical context they are justified by the transitional character—both in its military and political aspect—of his age. Inspired by a glorious past, interpreting an extremely volatile present, and heralding a future faithful to tradition, Sulla played a historical role, conclusively shaping and epitomizing the republican ideal shortly before it became submerged. But he was mistaken about the significance of his reforms: he was a temporary dictator because he wanted no one else who might follow him to become a dictator for life; yet by his example he unwittingly paved the way for Julius Caesar. (E.Va.)

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**Sullana,** capital of Sullana province, in Piura department, northwestern Peru, situated on the Río Chira, in the coastal desert. Founded (*c.* 1821) at the time of Peru's independence from Spain and given town status in 1826, Sullana is an important commercial centre in one of Peru's major cotton-growing areas. With the channelling of the Río Chira, the annual flow of which is the largest of all Peruvian coastal rivers, cultivation of cotton began in the early 20th century. Acreage has been greatly expanded since the completion, in 1967, of additional irrigation works. Cinchona bark is also gathered in the Sullana area. The city has cotton gins and cotton-seed-oil mills. Products are trucked for export through the port of Paita, 47 mi (75 km) west. Sullana is linked to Piura, the departmental capital, 28 mi south, by the Pan-American Highway. Pop. (1981) city, 89,037; (1981 prelim.) province 194,991.

**Sullivan, Anne** (teacher): *see* Macy, Anne Sullivan.

**Sullivan, Sir Arthur (Seymour)** (b. May 13, 1842, London—d. Nov. 22, 1900, London), composer who, with W.S. Gilbert, established the distinctive English form of the operetta. Gilbert's satire and verbal ingenuity were matched so well by Sullivan's unfailing melodiousness, resourceful musicianship, and sense of parody that the works of this unique partnership won lasting international acclaim.

Sullivan was the son of an Irish musician who became bandmaster at the Royal Military College; his mother was of Italian descent. He joined the choir of the Chapel Royal and later held the Mendelssohn Scholarship at the Royal Academy of Music, London, where he studied under Sir W. Sterndale Bennett and Sir John Goss. He continued his studies at the Leipzig Conservatory.

In 1861 he became organist of St. Michael's, London, and in the following year his music to *The Tempest* achieved great success at the Crystal Palace. Then followed his *Kenilworth*



Sir Arthur Sullivan, detail of a portrait by John Millais, 1888; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

cantata (1864); a ballet, *L'Île enchantée*, produced at Covent Garden (where Sullivan was organist for a time); a symphony and a cello concerto; the *In Memoriam* and the *Overtura di Ballo* overtures; and numerous songs.

Sullivan's first comic opera was his setting of Sir Francis Cowley Burnand's *Cox and Box* (1867). An operetta, the *Contrabandista*, also on a libretto by Burnand, was produced in the same year. *Thespis* (1871), the first work in which Sullivan collaborated with Gilbert, met with little success when produced at the Gaiety Theatre. It was Richard D'Oyly Carte, then manager of the Royalty Theatre, who brought the two men together again in 1875; the result was *Trial by Jury*, which was originally put on as an afterpiece to an Offenbach operetta; it won instant popularity and ran for more than a year.

Carte thereupon formed the Comedy Opera Company, with a view to presenting full-length operettas by Gilbert and Sullivan. The first of these, *The Sorcerer* (1877), was followed by *H.M.S. Pinafore* (1878), whose eventual success was phenomenal, and *The Pirates of Penzance* (1879, New York City; 1880, London).

During the run of *Patience* (1881), Carte transferred the production to his newly built Savoy Theatre, where the later operettas were presented. These were *Iolanthe* (1882), *Princess Ida* (1884), *The Mikado* (1885), *Ruddigore* (1887), *The Yeomen of the Guard* (1888), and *The Gondoliers* (1889). The collective works of Gilbert and Sullivan became known as the "Savoy Operas."

From time to time, Sullivan protested against the artificial nature of Gilbert's plots; this led to a disagreement between them that came to a head when Sullivan supported Carte in a minor business dispute. Sullivan wrote his next opera, *Haddon Hall* (1892), to a libretto by Sydney Grundy. Subsequent collaboration with Gilbert, in *Utopia Limited* (1893) and *The Grand Duke* (1896), did not reach their former standard. Sullivan completed three other operettas: *The Chieftain* (1895), largely an adaptation of *Contrabandista*; *The Beauty Stone* (1898), with a libretto by Sir Arthur Wing Pinero and J. Comyns Carr; and *The Rose of Persia* (1889), with Basil Hood, who also wrote the libretto for *The Emerald Isle*, which was left unfinished by Sullivan and completed by Edward German.

Sullivan's more classical compositions included *The Prodigal Son* (1869), *The Light of the World* (1873), *The Martyr of Antioch* (1880), *The Golden Legend* (1886), and the "romantic opera" *Ivanhoe*, written for the opening of the Royal English Opera House built by Carte in 1891. They were not maintained in the repertory, though they were acclaimed in their day. He also wrote many hymn tunes, including "Onward! Christian Soldiers," and his song "The Lost Chord" attained great popularity.

In 1876 Sullivan accepted the principalship of the National Training School for Music (later the Royal College of Music), which he held for five years; he was active as a conductor, particularly at the Leeds Festivals from 1880 to 1898. He was knighted in 1883.

**Sullivan, Ed,** byname of EDWARD VINCENT SULLIVAN (b. Sept. 28, 1901, New York City—d. Oct. 13, 1974, New York City), master of ceremonies of a popular early U.S. television variety program first known as "Toast of the Town" (1948–55) and later as "The Ed Sullivan Show" (1955–71). Presenting diverse kinds of entertainment acts, "The Ed Sullivan Show" was telecast by the Columbia Broadcasting System (CBS). Sullivan was noted—and teased—for his terse way of introducing guest performers; his usually reserved manner won him the sobriquet "the Great Stone Face."

The son of a New York City customs inspector, Sullivan started in journalism as a sportswriter. He joined the New York *Daily News* in 1932 and became a Broadway columnist for that paper. He became known for his talent at discovering and publicizing interesting new performers. CBS hired him after photographing him at work as master of ceremonies of a promotional Harvest Moon ball sponsored by the *Daily News*. On the first "Toast of the Town" show he introduced a concert pianist, a boxing referee, and a singing fireman, as well as such celebrities as the composer and librettist Richard Rodgers and Oscar Hammerstein II and the comedians Dean Martin and Jerry Lewis. The program was enormously popular for more than two decades.

**Sullivan, Harry Stack** (b. Feb. 21, 1892, Norwich, N.Y., U.S.—d. Jan. 14, 1949, Paris), U.S. psychiatrist who developed a theory of psychiatry based on interpersonal relationships. He believed that anxiety and other psychiatric symptoms arise in fundamental conflicts between the individual and his human environment and that personality development also takes place by a series of interactions with other people. He made substantial contributions to clinical psychiatry, especially the psychotherapy of schizophrenia, and suggested that the mental functions of schizophrenics, though impaired, are not damaged past repair and can be recovered through therapy. Possessing an extraordinary ability to communicate with schizophrenic patients, he described their behaviour with clarity and insight unrivalled at that time.

Sullivan received his M.D. from the Chicago College of Medicine and Surgery in 1917. At St. Elizabeth's Hospital in Washington, D.C., he came under the influence of the psychiatrist William Alanson White, who extended the principles of Sigmund Freud's psychoanalysis to the severely ill, hospitalized psychotic, rather than restricting them to the more functional neurotics treated by most Freudian analysts of the time. In his interviews with schizophrenic patients, Sullivan's uncommon ability in psychoanalysis first became evident.

While engaged in clinical research at the Sheppard and Enoch Pratt Hospital, Towson, Md. (1923–30), Sullivan became acquainted with the psychiatrist Adolf Meyer, whose practical psychotherapy emphasized psychological and social factors, rather than neuropathology, as the basis for psychiatric disorders. As research director at Pratt from 1925 to 1930, Sullivan showed that it is possible to understand schizophrenics, no matter how bizarre their behaviour, with sufficient contact. He interpreted schizophrenia as the result of disturbed interpersonal relationships in early childhood; by appropriate psychotherapy, Sullivan believed, these sources of behavioral disturbance could be identified and eliminated. Developing his ideas further, he applied them

to the organization of a special ward for the group treatment of male schizophrenics (1929). During the same period, he first introduced his concepts into graduate psychiatric training through lectures at Yale University and elsewhere.

After 1930 Sullivan devoted himself chiefly to teaching and elaborating his ideas, working with social scientists such as the anthropologist Edward Sapir. He extended his early concept of schizophrenia to a theory of personality, arguing that both normal and abnormal personalities represent enduring patterns of interpersonal relationships, thus giving the environment, in particular the human social environment, the major role in personality development. Sullivan argued that the individual's self-identity is built up over the years through his perceptions of how significant people in his environment regard him. Different stages in the course of behavioral development correspond to different ways of interacting with others. To the infant, the most significant person is its mother; anxiety results from disturbances in the maternal relationship. The child then develops a mode of behaviour that tends to lessen this anxiety, establishing the personality characteristics that will prevail in adulthood.

Sullivan helped to found the William Alanson White Psychiatric Foundation in 1933 and the Washington (D.C.) School of Psychiatry in 1936, and after World War II he helped establish the World Federation for Mental Health. He also founded (1938) and served as editor of the journal *Psychiatry*. During the later years of his life he more fully articulated his ideas in *The Interpersonal Theory of Psychiatry* (1953), *The Fusion of Psychiatry and Social Science* (1964), and other works. After his death Sullivan's theory of personality and his psychotherapeutic techniques had a continually growing influence, particularly in American psychoanalytic circles.

**Sullivan, John** (b. Feb. 17, 1740, Somersworth, N.H.—d. Jan. 23, 1795, Durham, N.H., U.S.), early U.S. political leader and Revolutionary War officer who won distinction for his defeat of the Iroquois Indians and their Loyalist allies in western New York (1779).

An attorney, Sullivan was elected to the New Hampshire provincial congress (1774) and served at the First Continental Congress,



John Sullivan, detail of a lithograph
By courtesy of the Library of Congress, Washington, D.C.

in Philadelphia, the same year. In June 1775 he was appointed brigadier general in the Continental Army and aided in the siege of Boston. The following year he was ordered to Canada to command the retreating American troops after the death of their commander at the disastrous Battle of Quebec (Dec. 31, 1775). Sullivan shortly rejoined Gen. George Washington and, after being promoted to major general, participated in the Battle of Long Island (August 1776), where he was taken prisoner. Exchanged in December, he led the right column in Washington's successful attack on Trenton, N.J. (December 1776), but a night attack on Staten Island in August was unsuccessful.

In 1779 Sullivan was commissioned to lead an expedition in retaliation for British-inspired Indian raids in the Mohawk Valley of New York. With 4,000 troops he routed the Iroquois and their Loyalist supporters at Newtown, N.Y. (near present Elmira), burning their villages and destroying their crops. He thus earned the thanks of Congress (October 1779), but ill health forced him to resign from military service soon afterward.

Sullivan continued in public service for 15 years, however; as a delegate to the Continental Congress (1780–81), state's attorney general (1782–86), New Hampshire governor (1786–87, 1789), presiding officer of the state convention that ratified the federal Constitution (1788), and U.S. district judge (1789–95).

**Sullivan, John Florence** (U.S. entertainer): *see* Allen, Fred.

**Sullivan, John L(awrence),** byname THE GREAT JOHN L., OF THE BOSTON STRONG BOY (b. Oct. 15, 1858, Roxbury, Mass., U.S.—d. Feb. 2, 1918, Abington, Mass.), U.S. professional boxer, one of the most popular heavyweight champions and a symbol of the bareknuckle era of boxing.

Sullivan began to fight professionally in 1878 after briefly studying at Boston College. On



John L. Sullivan
UPI—EB Inc.

Feb. 7, 1882, at Mississippi City, Miss., he knocked out Paddy Ryan in the ninth round of a bareknuckle fight for the heavyweight championship. His 75-round knockout of Jake Kilrain at Richburg, Miss., July 8, 1889, was the last heavyweight title bout under London Prize Ring (bareknuckle) rules. In his only championship defense under the Queensberry rules, Sullivan was knocked out by James J. Corbett in 21 rounds in New Orleans, Sept. 7, 1892.

Although Sullivan is generally considered to have been world heavyweight champion, some boxing historians regard him as a U.S. champion only. His only international match of consequence was with the English pugilist Charley Mitchell at Chantilly, Oise, Fr., March 10, 1888; it ended as a draw after 39 rounds. In addition, Sullivan declined to fight the great Australian Negro heavyweight Peter Jackson. From 1878 to 1905 Sullivan had 35 bouts, winning 31, 16 by knockouts.

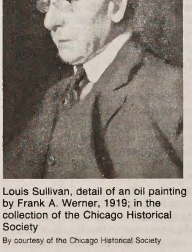
Sullivan's blustering personality and fabled strength gained him a great following. As champion he earned more than $1,000,000 but dissipated it all. A hard drinker during his ring career, he later became an advocate of prohibition and delivered many lectures on the subject.

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**Sullivan, Louis (Henry)** (b. Sept. 3, 1856, Boston—d. April 14, 1924, Chicago), architect, regarded as the spiritual father of modern U.S. architecture and identified with the aesthetics of early skyscraper design. His more than 100 works in collaboration (1879–95) with Dankmar Adler include the Auditorium Building, Chicago (1866–89); the Guaranty Building, Buffalo (1894–95; now Prudential Building); and the Wainwright Building, St. Louis, Mo. (1890–91). Frank Lloyd Wright apprenticed for six years with Sullivan at the firm. In independent practice from 1895, Sullivan designed the Schlesinger & Mayer department store (1899–1904; now Carson Pirie Scott & Co.), Chicago. His *Autobiography* was published shortly before he died.

*Early years.* Louis was born of Patrick, a dancing master, and Adrienne Françoise (List) Sullivan. His Irish-born father and Swiss-born mother had emigrated to the United States in 1847 and 1850, respectively, and were married in 1852. Their older son, Albert Walter, was born in 1854. Sullivan attended public schools in the Boston area and spent summers on his grandparents' farm in nearby South Reading. When his parents moved to Chicago in 1869, Sullivan stayed behind with his grandparents and later with neighbours, commuting to school in Boston.

In September 1872 he entered Massachusetts Institute of Technology, which had the first architectural school in the United States (founded 1865). Sullivan was an impatient architectural student and left at the end of the year with thoughts of studying at the École des



Louis Sullivan, detail of an oil painting by Frank A. Werner, 1919; in the collection of the Chicago Historical Society
By courtesy of the Chicago Historical Society

Beaux-Arts in Paris or of being an apprentice to an architect. He discussed his ideas in New York City with Richard Morris Hunt, one of the fashionable architects of the day and the first American to study architecture at the Beaux-Arts. Hunt suggested he work with the Philadelphia firm of Furness and Hewitt. Sullivan was hired, staying for several months until work dwindled in the economic panic of 1873. In November he left for Chicago and

was soon employed in the architectural office of a prominent figure in the development of the style of the Chicago School, William Le Baron Jenney. The office foreman, John Edelmann, became his friend.

The idea of studying in Paris persisted, however, and in July 1874 he sailed for Europe. Sullivan worked hard to pass the difficult entrance examinations for the Beaux-Arts, although after he was accepted he proved to be a restless and erratic student. He made a brief excursion to Florence and Rome. A romantic young man with sideburns, he affected a certain swagger in dress. During the single year he remained in Paris, he was attached to the atelier of the architect Émile Vaudremer.

*Work in association with Adler.* Back in Chicago in June 1875, Sullivan worked briefly as a draftsman for a number of firms. One such job was for the recently formed firm of Johnston and Edelmann. It was John Edelmann who made the momentous introduction of Sullivan to his future partner, Dankmar Adler. In 1879 Sullivan joined Adler's office and in May 1881, at the age of 24, became a partner in the firm of Adler and Sullivan, Architects. Their 14-year association produced more than 100 buildings, many of them landmarks in the history of U.S. architecture.

Sullivan's brilliance as a designer was complemented by Adler's business ability, his tact with clients, and his knowledge of technical matters, especially acoustics. After coming to Chicago in 1861, Adler had worked as a draftsman, and he returned to the city after serving in the Civil War. In 1871 he formed a successful partnership with Edward Burling that lasted until 1879. As an independent architect Adler designed Central Music Hall in Chicago (1879), which was the prototype of theatres later designed by the firm of Adler and Sullivan. Adler was a consultant on acoustics and in his later years was a writer on the technical and legal aspects of architecture.

Although Adler and Sullivan did substantial residential work, it was in their commercial work that they made their art-historic contribution. Most of their buildings were in Chicago, where the commercial expansion of the 1880s resulted in many commissions.

The early years of the Adler and Sullivan practice did not result in buildings of lasting interest, however. It was the commission in 1886 to design the Auditorium Building in Chicago that marked the first period of Sullivan's design maturity. This project was a curious combination of a hotel and office block wrapped in a U-shape around a 3,982-seat auditorium for opera. Completed in December 1889, it is a 10-story-high building of granite and limestone with a 17-story tower. The noble arcaded exterior is very simple in profile, has little ornament, and owes much to the architect H.H. Richardson's design for the Marshall Field Wholesale Store, then recently completed in Chicago. The interior, however, is lavishly decorated with relief ornament and coloured stencilled patterns, all of which brought forth Sullivan's great talent for designing ornamentation. The interior of the auditorium (restored 1967) is particularly opulent and features gilded plasterwork and countless electric light bulbs. The decoration, which is dazzling and properly theatrical, owes nothing to historical eclecticism. The astonishingly effective acoustical design of the auditorium was the work of Adler, who was also responsible for all structural and mechanical aspects of the building.

Even before the auditorium proper was complete, the Adler and Sullivan firm moved to offices on the 16th floor of the tower, then the highest office suite in Chicago. It was there that the young Frank Lloyd Wright spent six years as apprentice to Sullivan. Wright left in 1893 after a quarrel with Sullivan, and it was not until 1914 that the friendship was renewed. He always acknowledged, however, the influence of Sullivan in shaping his work and ideas.

The 10-story Wainwright Building in St. Louis is the most important skyscraper designed by Sullivan. Unlike the Auditorium Building, the exterior walls of which are solid masonry and load bearing, it is of steel frame throughout, an idea advanced by William Le Baron Jenney in 1883–85 in Chicago. Jenney and others were unable to give visual expression to the height of a tall building and often resorted to unsuitable historical styles. Sullivan, however, took the problem in hand and made his design a "proud and soaring" unity. He gave his building a two-story base, above which the vertical elements are stressed and the horizontals, being recessed, are minimized. These vertical rhythms are capped by a deep decorative frieze and a projecting cornice. The 16-story Guaranty (now Prudential) Building in Buffalo by Adler and Sullivan is similar except that its surface is sheathed in decorative terra-cotta instead of red brick. Both buildings are among the best of Adler and Sullivan's work.

The 1893 Columbian Exposition held in Chicago was a great disappointment to Louis Sullivan. The opportunity to design an international fair with imagination was passed over in favour of a loose adaptation of Classical architecture. The spectacle of an ensemble of these all-white buildings was an enormous success with the public. The Adler and Sullivan contribution was the Transportation Building, which stood apart and was painted in various strong colours as if in protest. It was a long, low arcaded building with a large polychromed archway entrance (the so-called Golden Door). Not all visitors were impressed by the neo-Roman grandeur of the fair. André Bouilhet, a delegate representing a Parisian decorative-arts union, praised the originality of the Transportation Building. Furthermore, he arranged for a small exhibit in Paris of Sullivan's work, including a plaster cast of the Golden Door and some photographs of his taller buildings. The exhibit later went to Russia and Finland. This European recognition, however, did not allay Sullivan's bitterness. He considered the Exposition a rejection of the progressive architecture that he saw developing in the Midwest. "The damage wrought by the World's Fair," he wrote, "will last for half a century from its date, if not longer. It has penetrated deep into the constitution of the American mind." It is with this event that Sullivan ended the *Autobiography of an Idea* (1924), his account of his career and his architectural theories.

*Later work.* The economic depression that began in 1893 severely curtailed commissions. With a lucrative offer as designer and agent for the Crane Elevator Company, Adler reluctantly decided in 1895 to withdraw from architecture. Sullivan reacted badly, accusing Adler of disloyalty. Adler's new job proved unsatisfactory, and he decided to return to architecture six months later. His offer to reestablish the firm was unwisely refused by Sullivan, and Adler opened his own office in another part of the Auditorium Building, where he practiced until his death in 1900.

In 1895, proud and optimistic, Sullivan began to practice by himself. His temperament was unsuited, however, to the handling of all of the phases of architectural practice. New work was slow in coming. George Grant Elmslie, whom he had hired in 1889 at the age of 18, remained a loyal employee. Nevertheless, he was aware of Sullivan's shortcomings:

> He could be arrogant and unnecessarily decisive . . . prone to give advice where not needed, to good clients . . . he lost many jobs because he would not compromise his ideals, nor play fast and loose with vital conceptions of what was fitting for the purpose intended.

A simple tabulation of Sullivan's 20 commissions during the last 30 years of his life indicates the near collapse of his practice.

Among the few major commissions Sullivan received was the one for the Schlesinger & Mayer department store in Chicago, occupied by Carson Pirie Scott & Co. since 1904. Two connecting units were built between 1899 and 1904, and a third unit was added in 1906 by Daniel H. Burnham and Co., largely following Sullivan's original design. In contrast to the vertical emphasis of the Wainwright and Guaranty buildings, which are offices, the design for this department store stresses the horizontal. Particularly notable are the rectangular "Chicago windows"—each a large fixed pane flanked by movable sash windows. The elegant simplicity of the upper floors is in contrast to the lavish decoration of the first two, which have windows that were treated as display windows, with the architectural decoration forming rich picture frames. This cast-iron ornament is based on a combination of geometric and stylized floral forms. Much of it is thought to have been designed by Elmslie, in emulation of Sullivan's style. In any case, the decoration of the Carson Pirie Scott & Co. store, particularly the ornament over the main entrance, represents the height of Sullivan's achievement as a designer of architectural ornamentation. Only the decorative panels that once surrounded Sullivan's Gage Building in Chicago were a match for its decorative exuberance.

Greater plastic richness and a heightened subjectivity are apparent in Sullivan's work after 1895. His 12-story Bayard (now Condict) Building in New York City was embellished with molded terra-cotta and cast-iron ornament.

As his flourishing years with Adler became a provoking memory, Sullivan grew lonely and difficult. He became estranged from his brother Albert, who was a successful official of the Illinois Central railroad and who also lived in Chicago. The middle-aged Sullivan became something of a recluse, seeking solace in writing and in visits to his winter cottage in Ocean Springs, Miss. His marriage in 1899 to Margaret Davies Hattabough did little to bring lasting happiness; they were separated in 1906 and divorced in 1917 without having had children. With declining income, Sullivan moved to progressively cheaper hotels in an effort to economize. By 1909 a lack of commissions reduced him to desperate straits; he was forced to sell his library and household effects. Perhaps an equal loss was the departure that year of Elmslie, his assistant for 20 years, who went to join forces in Minneapolis with William Gray Purcell, an architect who had worked briefly for Sullivan in 1903.

Particularly noteworthy projects undertaken in his last years were seven banks in a number of small Midwestern towns, beginning with the National Farmers' (now Security) Bank in Owatonna, Minn. Sullivan's work habits had become erratic, and it is known that this particular design is primarily the work of Elmslie. It has a simple cube form pierced on two sides by large arched windows. Its walls of red sandstone and brick, which convey a sense of security, are ornamented by bands of coloured mosaic and blue-green glazed terra-cotta. The balance between simple form and decoration in this structure has been much admired. The square interior was designed in harmony with the exterior: semicircular murals appear opposite the two arched windows.

Another attractive bank design is that of the Merchants' National Bank in Grinnell, Iowa (1914). Like the Owatonna bank, it has a relatively austere form, relieved by imaginative, intricate ornament. The facade is embellished with a spectacular decorative frame for the circular window above the entrance. Sullivan's

last commission was the facade for the Krause Music Store in Chicago (1922).

Sullivan had to abandon his Auditorium tower suite in 1918 for a small second-floor office. In 1920 he had no office at all and was reduced to living in one bedroom, being supported by friends. His workplace came to be a desk in the office of a Chicago terra-cotta company, where he was able to complete two significant projects: the writing of his *Autobiography* and the completion of 19 plates for *A System of Architectural Ornament According with a Philosophy of Man's Powers* (1924). He died a week after he had received published copies of these two works. Sullivan was buried in Graceland Cemetery in Chicago, next to the graves of his parents and within sight of the Getty and Ryerson Tombs, which he had designed. Later, a modest stone was erected by friends. Much later, in 1946, the American Institute of Architects awarded him its Gold Medal.

*Assessment.* Sullivan was a spokesman for the reform of architecture, an opponent of historical eclecticism, and did much to remake the image of the architect as a creative personality. His own designs are characterized by richness of ornament. His importance lies in his writings as well as in his architectural achievements. These writings, which are subjective and metaphorical, suggest directions for architecture, rather than explicit doctrines or programs. Sullivan himself warned of the danger of mechanical theories of art.

Sources of Sullivan's ideas have been traced to the mid-19th-century writings of two Americans, the sculptor Horatio Greenough and the essayist Ralph Waldo Emerson, as well as to the English naturalist Charles Darwin. Darwin's writings on evolution, particularly on organic growth, left their mark on European writers on architecture and, in turn, on Sullivan's own thinking. The French architect César-Denis Daly, for example, in an essay reprinted in a Chicago architectural journal, stated that

> each style of architecture . . . being born of the intellectual and moral forces of a human society . . ., has become naturally the expression of a certain civilization . . . The adoption by one age of a style . . . other than that which it has itself created, is hence in itself a false principle.

Out of such inquiries into the nature of style came Sullivan's own famous dictum "form follows function," a phrase that should not lead one to conclude that Sullivan believed that a design should be a mechanistic visual statement of utility. Rather, he believed that architecture must evolve from and express the environment in addition to expressing its particular function and its structural basis. It has been said that Sullivan was the first American architect to think consciously of the relationship between architecture and civilization.

The skyscraper was central to both Sullivan's writing and his practice, and it is on this subject that his thought is most concise. His preskyscraper commercial buildings in Chicago, such as the Rothschild Store and Troescher Building, show a conscious clarification and opening up of the facade. This simplification is carried into his "skyscrapers," the Wainwright and the Guaranty, which are conceived as "a single, germinal impulse or idea" that permeates "the mass and its every detail with the same spirit." The exceptional clarity of Sullivan's designs has lost some of its impact because contemporary architecture has in part absorbed his ideas. Sullivan considered it obvious that the design of a tall office building should follow the functions of the building and that, where the function does not change, the form should not change. Unfortunately, Sullivan's most dramatic skyscraper design, the Fraternity Temple (1891), intended for Chicago, was never built. This was to be a symmetrical structure with bold step-back forms and a soaring 35-story central tower.

Sullivan was just as much a revolutionary in his ornament as he was in his use of plain surfaces and cubic forms. His ornament was not based on historical precedent but rather upon geometry and the stylized forms of nature. Although his early ornament has some links to that of the Gothic Revival style and to the Queen Anne style, his mature ornament, seen best in his works at the turn of the century, is indisputably his own. It stands as a curious yet unrelated parallel to Art Nouveau ornamentation in Europe. Crisp yet fluid, tightly constructed yet exuberant, these designs remind one of Sullivan's feeling that architecture should not only serve and express society but also illuminate the heart.

Sullivan's own *Autobiography of an Idea* (1924) and *Kindergarten Chats* (published serially in 1901–02) are indispensable for a grasp of his architectural theory. The 1947 Wittenborn edition of the latter, *Kindergarten Chats and Other Writings* (rev. 1918), includes eight additional essays by Sullivan and a bibliography. (H.F.K.)

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**Sullivan, Mick,** byname of MICHAEL SULLIVAN (b. Jan. 12, 1934, Dewsbury, Yorkshire, Eng.), British rugby player who during his career (1954–64) played in 48 Test or World Cup matches for Great Britain and in three matches for England.

Sullivan appeared in three World Cup games (1954, 1957, and 1960) and toured Australia in 1958 and 1962. In 1958 he scored 38 tries (touchdowns), a record for a British tour. Sullivan debuted with Huddersfield in 1954 and joined Wigan (Lancashire) in 1957. He left Wigan in 1961 for St. Helens and finished his career in Yorkshire, with the York and Dewsbury teams.

**Sullivant, William Starling** (b. Jan. 15, 1803, Columbus, Ohio, U.S.—d. April 30, 1873, Columbus), botanist who was the leading American bryologist of his time. His studies of bryophytes (mosses and liverworts) formed the basis for further investigations of these plants in the United States.

Sullivant was educated at Ohio University (Athens) and Yale College. On his father's death in 1823, he assumed the management of family properties in Ohio, interrupting his education to become a surveyor and practical engineer. About 10 years later he became interested in botany and wrote his first work, *A Catalog of Plants, Native and Naturalized, in the Vicinity of Columbus, Ohio* (1840). His fundamental studies of the mosses and liverworts were published in *The Musci and Hepaticae East of the Mississippi River* (1856). These plants suited Sullivant's inclination for fine detail and scrupulous accuracy, and he produced elaborate illustrations for his works. Though his own collecting expeditions were limited to the United States, he received many plant specimens from Cuba, Venezuela, and the North and South Pacific. His most important work, *Icones Muscorum* (1864), dealt with the mosses of eastern North America. His name is commemorated by the genus *Sullivantia,* discovered by him in Ohio.

**Sullom Voe,** petroleum terminal and port in the north of Mainland, Shetland Islands, Scotland. The largest facility of its kind in Europe, Sullom Voe was handling 75 percent of Great Britain's petroleum supplies by the late 1970s. Crude oil flows through two underwater pipelines from North Sea oil fields located about 100 miles (160 km) northeast of the Shetland Islands to onshore pipeline terminals at Sullom Voe, where huge tankers are loaded. The construction of the terminal and associated port and storage facilities, power station, and processing plant to separate gas from crude oil was the largest civil-engineering project in western Europe since World War II and one of the key achievements in the Scottish offshore petroleum industry.

**Sully, Maximilien de Béthune, Duke** (duc) **de,** also called MARQUIS DE ROSNY (b. Dec. 13, 1560, Mantes, France—d. Dec. 22, 1641, Villebon), French statesman who, as the trusted minister of King Henry IV, substantially contributed to the rehabilitation of France after the Wars of Religion (1562–98).

The son of François de Béthune, Baron de Rosny, he was brought up as a Huguenot and was sent at an early age to the court of Henry of Navarre (later Henry IV of France). Taken by Henry to Paris in 1572, he barely escaped death during the massacre of Protestants on St. Bartholomew's Day. During the civil wars Rosny (as he was then called) served Henry both in battle and as a special agent and was wounded in the Battle of Ivry (1590) during Henry's struggle for the French crown. He helped to arrange Henry's marriage to Marie de Médicis (1600) and to negotiate the Peace of Savoy (1601). In 1603 he served as ambassador extraordinary to King James I of England. Although for political reasons he urged Henry to become a Roman Catholic, he refused to change his own religion.

Rosny, who became director of the king's Council of Finance in 1596, seems to have been sole superintendent of finances by 1598. As such, he stopped various abuses in tax collecting, including the raising of money by provincial governors on their own authority. He also abolished some superfluous public offices. It was he, moreover, who in 1604 sponsored the adoption of the *paulette,* or "annual right" (*droit annuel,* suggested by the financier Charles Paulet), which assured the state of a predictable revenue, although at the cost of making government offices hereditary. Under this system, officeholders, by paying annually one-sixtieth of the sum that they had originally paid for their office, could secure the right to transfer it at will.

Rosny's power eventually eclipsed that of the chancellor, Pompone de Bellièvre, who stood for the old tradition of the French monarchy. Rosny was indeed "the king's man," subordinating private and particular interests to the authority of the state. Rosny's loyalty was copiously rewarded with offices. In 1606 he was created Duke de Sully and a peer of France.

Sully encouraged agriculture and stock raising, urged the free circulation of produce, checked the destruction of forests, promoted road building and the draining of marshland, and planned a great canal system (the Briare Canal was actually started). He strengthened the military forces and directed the construction of frontier defense works.

Sully's political role practically came to an end with the assassination of Henry IV in 1610. Though Marie de Médicis, as regent for Louis XIII, at first retained him in her council, his colleagues were restive under his domineering leadership, and in January 1611 the queen accepted his resignation. He spent the rest of his life in retirement, writing his *Mémoires,* otherwise known as the *Économies royales* (1638). These memoirs are remarkable for their often-reprinted account of the "Great Design," which Sully attributes to Henry IV and which was a European confederation, or "Christian republic," to be established after the defeat of Austria and Spain.

**Sully, Thomas** (b. June 19, 1783, Horncastle, Lincolnshire, Eng.—d. Nov. 5, 1872,

Philadelphia), one of the finest U.S. portrait painters of the 19th century.

Sully's parents moved to the United States in 1792, settling in Charleston, S.C. He was a pupil of Gilbert Stuart in Boston (1807) and



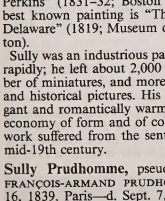
"Lady with a Harp: Eliza Ridgely," oil painting by Thomas Sully, 1818; in the National Gallery of Art, Washington, D.C.

By courtesy of the National Gallery of Art, Washington, D.C., gift of Maude Monell Verleson

of Benjamin West in London (1809) and was influenced by the portrait artist Sir Thomas Lawrence. After 1810 he made Philadelphia his home, although in 1838 he visited London to paint a full-length portrait of the young Queen Victoria for the Society of the Sons of St. George of Philadelphia. His masterpiece in portraiture is "Col. Thomas Handasyd Perkins" (1831–32; Boston Athenaeum); his best known painting is "The Passage of the Delaware" (1819; Museum of Fine Arts, Boston).

Sully was an industrious painter who worked rapidly; he left about 2,000 portraits, a number of miniatures, and more than 500 subject and historical pictures. His paintings are elegant and romantically warm, emphasizing an economy of form and of colour, but his later work suffered from the sentimentality of the mid-19th century.

**Sully Prudhomme,** pseudonym of RENÉ-FRANÇOIS-ARMAND PRUDHOMME (b. March 16, 1839, Paris—d. Sept. 7, 1907, Châtenay, Fr.), French poet who was a leading member of the Parnassian movement, which sought to restore elegance, balance, and aesthetic standards to poetry, in reaction to the excesses of Romanticism.



Sully Prudhomme
H. Roger-Viollet

Prudhomme studied science at school but was forced by an eye illness to renounce a scientific career. His first job was as a clerk in a factory office, which he left in 1860 to study law. In 1865 he began to publish fluent and melancholic verse inspired by an unhappy love affair. *Stances et poemes* (1865) contains his best known poem, *Le vase brisé* ("The Broken Vase"). *Les Épreuves* (1866; "Trials"), and *Les Solitudes* (1869; "Solitude") are also written in this first, sentimental style.

Prudhomme later renounced personal lyricism for the more objective approach of the Parnassians, writing poems attempting to represent philosophical concepts in verse. Two of the best known works in this vein are *La Justice* (1878; "Justice") and *Le Bonheur* (1888; "Happiness"), the latter an exploration of the Faustian search for love and knowledge. Prudhomme's later work is sometimes obscure and shows a naive approach to the problem of expressing philosophical themes in verse. He was elected to the French Academy in 1881 and was awarded the first Nobel Prize for Literature in 1901.

**Sulman, Henry Livingstone** (b. Jan. 15, 1861, London—d. Jan. 31, 1940, Croydon, Surrey, Eng.), British metallurgist, one of the originators of the froth flotation process for concentrating ores preliminary to the extraction of metal.

After graduation from University College, London, Sulman served as chemist or manager for various chemical plants in Bristol and London. In 1898 he entered into partnership with H.F.K. Picard as metallurgical consultants in London. Sulman was the inventor or co-inventor of several processes for the extraction of gold, including treatment with cyanogen bromide, before introducing, in conjunction with Picard, the froth flotation process.

**Sulmona,** Latin SULMO, town, L'Aquila province, Abruzzi region, central Italy, situated in the valley of the upper Pescara River, surrounded by mountains, southwest of Pescara. Originating as Sulmo, a town of the Paeligni (an ancient Italic people), it was later a Roman possession and was the birthplace of the 1st-century Roman poet Ovid. The capital of the independent province of Abruzzi under the Hohenstaufen emperors, it passed to the Kingdom of Naples in the 13th century and was noted for its goldsmiths in the 14th and 15th centuries. Pope Innocent VII was born at Sulmona. The most notable buildings are the church (rebuilt after an earthquake in 1706) and palace of the Annunziata (present building begun 1415), housing the civic museum. Other landmarks include an aqueduct (1256) that supplied water to the Fonte del (fountain of) Vecchio (1474), the 15th-century church of Sta. Maria della Tomba, and the remains of the Romanesque church of S. Francesco della Scarpa.

A rail junction and trade centre for agricultural products, Sulmona is known for confectionery (sugared almonds) and manufactures wrought iron articles. Pop. (1981 prelim.) mun., 24,016.

**sulph-, sulpho-** (combining form): *see under* sulf-, sulfo-.

**sulphate, sulphide, sulphur, etc.:** *see under* sulfate, sulfide, sulfur, etc., except as below.

**sulphides** (glass): *see* crystallo ceramie.

**Sulpicius Rufus, Publius** (b. *c.* 124 BC—d. 88, Lavinium, Latium), Roman orator and politician whose attempts, as tribune of the plebs, to enact reforms against the wishes of the Senate led to his downfall and the restriction of the powers of the tribunes.

In order to qualify for the tribunate, Sulpicius had to renounce his patrician status. Elected to this office for 88 BC, he introduced several laws: (1) to distribute among the 35 tribes freedmen and the Italians newly enfranchised as a result of the Social War; (2) to unseat all senators who were more than 2,000 denarii in debt; (3) to recall all men exiled without proper trial; and (4) to transfer the command in the war against Mithradates VI of Pontus from Lucius Cornelius Sulla, the Senate's nominee, to Gaius Marius.

Sulpicius probably wanted chiefly to champion the new Italian citizens, but to do this he needed broad support. Hence, his other three measures were designed to obtain the backing of Marius and of the privileged equites class. Sulpicius is said to have organized a group of 100 young equites and a large bodyguard of 3,000 armed men; violence broke out in the Forum between these forces and the senatorial faction.

After the measures were passed, the consul Sulla, who had headed an army in Campania, marched on Rome and took the city. Marius and Sulpicius fled and were declared outlaws. Sulpicius was caught and killed at Lavinium. His laws were declared "passed by force," hence invalid. Although his enemies depicted him as a revolutionary demagogue, he may have been a moderate reformer forced (as Cicero implies) by circumstances to go to greater lengths than he had originally intended. He was renowned for his oratory, but his speeches have not been preserved.

**Sulpicius Rufus, Servius** (b. *c.* 106 BC—d. 43), Roman jurist who wrote nearly 180 treatises on law. While none of them are extant, many are referred to in the works of other authors that are excerpted in the Digest of Justinian I.

After studying rhetoric with Cicero and deciding that he could not become an outstanding orator, Sulpicius turned to the law. In 63 he was a candidate for the consulship, but was defeated by Lucius Licinius Murena, whom he subsequently accused of bribery. Murena was successfully defended in the suit by Cicero. Sulpicius became consul in 51. During the Civil War between Julius Caesar and Pompey's faction (49–46), he decided after considerable hesitation to support Caesar, who made him proconsul of Achaea in 46. He died while on a mission from the Senate to Mark Antony.

Of two letters from Sulpicius to Cicero that are preserved (Cicero, *Ad familiares*, iv, 5 and 12), the former is the famous letter of consolation on the death of the great orator's daughter Tullia.

**Sulpicius Severus** (b. *c.* 363, Aquitania, Gaul—d. *c.* 420), early Christian ascetic, a chief authority for contemporary Gallo-Roman history, who is considered the most graceful writer of his time.

Well trained as a lawyer, Sulpicius was baptized in about 390 with Paulinus (later bishop of Nola). After the early death of his wife, he devoted himself, with the encouragement of his lifelong friends, Paulinus and Martin of Tours, to local church building and to life as a literary recluse in Aquitania. In ascetic retirement he was interested in the Western Church, especially the monasticism recently introduced in Gaul. His correspondence includes 13 extant letters addressed to him by Paulinus.

Although the 5th-century biographer Gennadius refers to Sulpicius as a priest of suspect orthodoxy who was not in good relations with the Gaulish bishops, St. Augustine of Hippo and St. Jerome make friendly references to him. He is sometimes confused with Bishop St. Sulpicius Severus of Bourges (d. 591).

Sulpicius' most famous work is the *Vita S. Martini,* the first draft of which was written before Martin's death in 397, but supplementary matter relating to Martin is added in all his

subsequent versions, including three authentic letters. In 400 he wrote *Chronica*, 2 vol., (*c.* 402–404), sacred histories from the Creation to his own time but omitting the Gospels; the latter part is a valuable contemporary document, especially for the tragic history of the Priscillianists, followers of an unorthodox Trinitarian doctrine teaching that the Son differs from the Father only in name. The *Dialogi* (404) are a literary masterpiece in which the relative merits of Martin's monastery (at Marmoutier, near Tours) are debated by one of its inmates with a traveller recently returned to Aquitania from the ascetics of the North African desert, while Sulpicius presides and prompts the speakers.

Nearly half of Sulpicius' works are devoted to the life of Martin, of whom he was a disciple and his most famous hagiographer. B. Peebles' English translations of selected works of his are in *The Fathers of the Church* (1949). An English translation of *Dialogi* and three letters may be found in *The Western Fathers*, edited by C. Dawson (1954).

**sultan,** Arabic SULṬĀN, originally, according to the Qur'ān, moral or spiritual authority; the term later came to denote political or governmental power and from the 11th century was used as a title by Muslim sovereigns. Maḥmūd of Ghazna (reigned AD 998–1030) was the first Muslim ruler to be called sultan by his contemporaries, and under the Seljuqs of Anatolia and Iran it became a regular title. Thereafter it was frequently conferred on sovereigns by the caliph (titular head of the Muslim community) and came to be used throughout the Islāmic world.

**Sultan Kudarat,** province, southwestern Mindanao, Philippines. It has an area of 1,656 sq mi (4,288 sq km) and is one of three new provinces into which the former Cotabato province was divided in 1973. It is bounded on the south by South Cotabato (created earlier), on the east by Davao del Sur, and on the north by the newly created Maguindanao and North Cotabato provinces. On the west it fronts the Moro Gulf of the Celebes Sea. Its western highlands (the Kulaman Plateau) rise to an elevation of 6,247 ft (1,904 m). Central Sultan Kudarat is drained to the northwest by the Buluan River (a tributary to the Mindanao River), flowing out of Lake Buluan, one of the larger lakes in Mindanao. To the east are the Alip Mountains.

The region became part of a Muslim stronghold in the 15th century and remained an independent sultanate until 1850. The highlands are forested, and in the valleys rice, corn (maize), coconuts, abaca (Manila hemp), and bananas are grown. The population consists mostly of Muslims (Moros) and Roman Catholic Visayans; Cotabato Manobo people inhabit the Kulaman Plateau. Isulan, the provincial capital, is located near the south central border of the province. Pop. (1990) 435,905.

**Sulṭān Muḥammad** (fl. 16th century, Ṣafavid Iran), one of the greatest of Persian painters and the most notable artist of the Ṣafavid school at Tabrīz.

During the period 1495–1522 Sulṭān Muḥammad was probably the leading exponent of the Turkmen school of painting current in western Iran under the White Sheep and Black Sheep Turkmens. This school was marked by dynamic verve, illogical perspectives, concealed grotesques, violent colours, and a strong tendency to see excess as a source of virtue. This Dionysiac style was well suited to the fervent temperament of Shāh Esmā'īl I. Yet in 1522, when the aged painter Behzād of Herāt came to reside at the court with several of his disciples, Sulṭān Muḥammad began to



"The Court of the Gayumars," miniature (from Ferdowsi's *Shāh-nāmeh*) by Sulṭān Muḥammad; in the Metropolitan Museum of Art, New York City

By courtesy of the Metropolitan Museum of Art, New York, Collection of Arthur A. Houghton, Jr.

be influenced by the balanced, harmonious, and humane school of Herāt. The result was a magnificent blend of all the best elements of Persian painting. Sulṭān Muḥammad also found the perfect patron, the young shāh Ṭahmāsp I, son of Esmā'īl, who took painting lessons from him. No doubt Ṭahmāsp's predilection for Herāt painting also influenced the work of Sulṭān Muḥammad.

During the period 1520–38 Sulṭān Muḥammad worked along with the other court artists on the great *Shāh-nāmeh* of Ṭahmāsp. With Shaykh-zādeh, a pupil of Behzād, he illustrated a *Dīvān* of Ḥāfiz and a *Dīvān* of the Turkish poet Mīr 'Alī Shīr Navā'ī in 1526 and 1527. He also worked (1539–43) on the *Khamseh* of Neẓāmī, illustrated for Shāh Ṭahmāsp. Soon after this the Shāh turned away from painting, convinced that it was a frivolous and irreligious diversion, and though some of the Shāh's relatives continued to act as patrons, Sulṭān Muḥammad seems to have painted no more. His son, Mīrzā 'Alī (Muḥammadī), already a notable artist, became one of the leading painters of the next generation.

Sulṭān Muḥammad's style was diverse, and he was considered a master by his contemporaries. In composition, colour, draftsmanship, verve, wit, and profundity he is clearly one of the greatest painters of the Islāmic world, on a par with Behzād.

**Sultanabad ware,** Islāmic ceramics produced at Sultanabad (modern Soltānābād, Iran) that reached its peak as a style in the 13th and 14th centuries. Favourite types were *minai* (a method that preserved colours through firing), lustreware, faience in green and dark blue tones, often with molded ornamentation, and tiles richly decorated in lustre.

**Sultānpur** (India): *see* Kulu.

**Sultānpur,** formerly KUSAPURA, or KUSHBHAWANPUR, town, administrative headquarters of Sultānpur district, Uttar Pradesh state, northern India, on the Gomati River, southeast of Lucknow. Sultānpur has existed since ancient times; it was destroyed and rebuilt repeatedly before passing under the rule of Muslim sultans. The Muslim town was destroyed in 1857, and the present settlement arose as a British military outpost. It is primarily an agricultural trade centre.

Sultānpur district, 1,708 sq mi (4,424 sq km) in area, comprises a stretch of alluvial plain on both sides of the Gomati River. Wheat, rice, and barley are grown. Pop. (1991 prelim.) town, 76,567; district, 2,558,698.

**Sulu,** province, northern Sulu Archipelago, Philippines. Located between the Sulu Sea to the northwest and the Celebes Sea to the southeast, the province stretches southwestward from Basilan Island south of the tip of the Zamboanga Peninsula toward the Tawitawi island group and Borneo; it consists of approximately 3,000 scattered and somewhat isolated islands and islets. Sulu province contains four of the archipelago's seven main island groups, including Jolo, Samales, Tapul, and Pangutaran; the others, to the southwest and west, were split off as Tawitawi province in 1973. The islands of Sulu vary in shape and size and have a total land area of 1,670 sq mi (2,688 sq km). Jolo island is the largest in the province, and Jolo town is the provincial capital. Lying far outside the typhoon belt, the province has a climate particularly suitable for growing a wide variety of crops. Rice, corn (maize), coconuts, bananas, and abaca (Manila hemp) are the principal crops. Abaca and coconuts are exported to Zamboanga; tropical fruits are cultivated for home consumption. The economy is primarily dependent upon agriculture and marine resources. The only large-scale industry in the province is deepsea fishing. Jolo and Siasi are the primary ports, and the Sulu Sea the principal fishing grounds. Pearl fishing was important, and shells and black coral abound in the waters of the province. Agriculture and related industries—such as rice milling; processing of copra, abaca, and fish; and preliminary processing of shell products—are sources of income. Cottage industries are highly developed and include boatbuilding, tool and weapon making, textile weaving, and the design of utensils and decorative goods in brass, bronze, gold, and silver combined with shell and coral. Mining and forestry in Sulu province are potential industries that have not been developed. Transportation relies on several national seaports and airports; roads are few, constructed of macadam, and of poor quality. The archipelago is inhabited principally by Samal-speaking Muslims. Pop. (1990) 469,971.

*Articles are alphabetized word by word, not letter by letter*

**Sulu Archipelago,** archipelago comprising hundreds of volcanic and coral islands and numerous rocks and reefs in the southwestern Philippines. A double island chain, it extends



Forested islets in the Sulu Archipelago, Sulu Sea, Philippines

Ted Spiegel—Rapho/Photo Researchers

170 mi (270 km) southwest from Basilan Island off southwestern Mindanao and ends near the eastern shores of Sabah (Malaysia). The islands, the most important of which are Jolo (*q.v.*), Tawitawi, Sanga Sanga, Sibutu, Siasi, and Cayayan Sulu, form a rampart between the Sulu (northwest) and Celebes (southeast)

seas. Occupying a land area of 1,038 sq mi (2,688 sq km), they are thickly forested, and their fertile soils support some rice, cassava, coconuts, and fruit. Marine-based activities, however, are the economic mainstay. Administratively, the islands comprise Sulu and Tawitawi (*qq.v.*) provinces.

The Sulu "sea world" has had a tempestuous history. Its people have been characterized by a fierce sense of cultural and political independence. The islanders were converted to the Muslim faith by the missionary adventurer Abu Bakr in the mid-15th century. He married a local princess, inherited the title of sultan, and turned his island principality into a regional Muslim state. The Spaniards never subdued the inhabitants, whom they called Moros; they were a fiercely independent people whose culture was a meeting ground for sea traders, shell and coral producers, fishermen, pirates, and slave traders. The Moros had extensive regional contacts and raided areas as far away as Malaysia and northern Luzon.

The Moros were subjugated after a series of U.S. campaigns (1899–1913), during which John J. Pershing (later commander in chief of the U.S. forces in World War I) first distinguished himself as an officer. The archipelago was treated as a separate unit under the U.S. administration, and civil government came into force in 1914. In March 1915 the reigning sultan abdicated his civil powers, retaining only his rights as head of the Islāmic faith, but sporadic fighting continued between government forces and outlaw bands. In 1940 the Sultan ceded the Sulus to the Philippines, but as recently as 1962 he claimed sovereignty over the Malaysian state of Sabah (northern Borneo).

Resistance to civil authority continues in the form of illegal trade, and there has been an increase in piracy. The islands, with their myriad coves and hidden passages, are a haven for smugglers, who transport goods in small craft from Sabah to Luzon and Mindanao.

The Sulu islands' culture is primarily one of the sea; only Jolo has a significant agricultural economy. There are several pearl beds in the group, and marine resources include button shell, mother-of-pearl, coral, shark fins, bêche-de-mer (sea cucumbers), turtle shells, turtle eggs, and sponges. The Turtle Islands in the west are the centre of turtle fisheries. This marine wealth has not been tapped on an organized basis and remains a subsistence economic activity, usually supplemented by small-scale agriculture. Rice must be imported. There are no significant mineral resources, and forest industries are not developed.

The largest ethnic groups are the Tau Sug, who live on the coast in pile-built villages, and the Samal, who formerly lived on boats or chose a shoreline environment but who have increasingly settled inland. The largest settlements are Jolo (the chief port), Siasi, Sitangkai, and Talipaw (Jolo island). Pop. (1990) 941,266.

**Sulu Sea,** portion of the western North Pacific. It is bounded by northeastern Borneo on the southwest, the southwestern islands of the Philippines, including Palawan, on the west and northwest, Busuanga and Mindoro on the north, Panay and Negros on the east, and Mindanao and the Sulu Archipelago on the southeast. About 490 mi (790 km) from north to south and 375 mi east to west, with a surface area of 100,000 sq mi (260,000 sq km), it fills a downfaulted block, in some places almost 18,400 (5,600 m) deep, the edges of which are seen in the bordering islands. A fracture line, bisecting the sea from northeast to southwest, is evidenced by the coral atolls of the Cagayan Islands, the Tubbataha Reefs, and the volcanic Cagayan Sulu group.

The Sulu Sea was long the stronghold of the Sulu Archipelago's Moro pirates. Punitive campaigns, started by the Spanish in the mid-19th century and terminated by U.S. troops in 1906, broke the power of the Moros. The sea is now extensively used for interisland trade. Fishing is important and marine products include pearls, pearl shells, bêche-de-mer, shark fins, and turtle eggs.

**Sulzberger, Arthur Ochs,** byname PUNCH (b. Feb. 5, 1926, New York City), U.S. newspaper publisher who directed *The New York Times* through an era in which many innovations in production and editorial management were introduced.

Sulzberger was educated at private schools and, after U.S. Marine Corps service (1944–46) in the Pacific during World War II, at Columbia University, where he earned a B.A. degree in English and history in 1951. A grandson of Adolph S. Ochs (1858–1935), who made *The New York Times* a successful paper after acquiring it in 1896, and the son of Arthur Hays Sulzberger (1891–1968), publisher of the *Times* from 1935 to 1961, Arthur Ochs Sulzberger became president and publisher of the *Times* in 1963 at the age of 37. He had spent a dozen years in preparation for that responsibility. In 1952 he worked for the *Times* as a cub reporter. After a year he went to *The Milwaukee Journal,* where he worked as a reporter and on the state and local news desks. He returned to the *Times* for experience on its foreign desk and as a London correspondent. He also worked out of the Paris and Rome bureaus. In 1955 he came home as assistant to the publisher and then became assistant treasurer. In 1963 Sulzberger's brother-in-law, Orvil E. Dryfoos, who had been publisher for several years, died and young Sulzberger succeeded him.

Sulzberger worked to strengthen the reputation of the *Times* as one of the great newspapers of the world, while also modernizing and streamlining the organization of its staff. In 1964 he unified the daily *New York Times* and the Sunday edition, which had been separate, and he later broadened the paper's editorial scope in such areas as religion, science, and women's news.

**Sulzer, Salomon,** original name SALOMON LOEWY (b. March 30, 1804, Hohenems, Austria—d. Jan. 17, 1890, Vienna), Austrian Jewish cantor, considered the most important composer of synagogue music in the 19th century.

Sulzer was trained in cantorial singing from childhood, studying in Austria and Switzerland and travelling in France. In 1820 he was appointed cantor at Hohenems and served there for five years, during which time he modernized the liturgy and introduced choral music to the service. Called to Vienna as chief cantor in 1825, he embarked on the major task of reforming and reorganizing the musical parts of the liturgy and publishing collections of newly harmonized traditional tunes, for which he earned the sobriquet "father of modern synagogue music" and the respect of such composers as Franz Liszt, Robert Schumann, and Franz Schubert. An important publication was *Shir Zion* (1840–66; "Song of Zion"), a comprehensive collection of music for the sabbath, festivals, and holy days, for cantor, choir, and congregational responses with optional organ accompaniment. The musical style was a compromise between traditional chant (for the cantor) and Protestant-like settings for choir; the congregational responses were simple and not unlike Gregorian chant.

Sulzer also wrote secular pieces and as a singer was particularly noted for his performances of Schubert's songs. Highly honoured throughout Europe in his lifetime, his influence is strongly felt in 20th-century synagogue music.

**Sulzer, William** (b. March 18, 1863, Elizabeth, N.J., U.S.—d. Nov. 6, 1941, New York City), U.S. political leader, Democratic governor of New York (1913) who was impeached and removed from office as a result of his quarrel with the Tammany Hall Democratic political machine.

Admitted to the bar in New York (1884), Sulzer entered politics as a Democrat affiliated with Tammany Hall. He served in the New York Assembly (1889–94) and in the U.S. House of Representatives (1895–1912), and in 1912 he was elected governor of New York with the support of the Tammany organization. Soon after he took office, however, an intraparty fight between Sulzer and Tammany boss Charles F. Murphy led to Sulzer's impeachment on charges that were ambiguous and referred to conduct prior to his election as governor. The state senate convicted him and removed him from office (Oct. 18, 1913) in an action that has been described as a political lynching and is widely regarded as a blatant example of the misuse of the impeachment process for political or partisan purposes. He was elected to the state Assembly in a special election (Nov. 4, 1913), but did not thereafter hold public office and engaged in the practice of law until his death.

**sumac,** any of certain species of shrubs and small trees belonging to the genus *Rhus,* in the cashew family (Anacardiaceae), native to temperate and subtropical zones. All sumacs have a milky or resinous sap, which in a few species can cause a contact dermatitis. Used in the past as a source of dyes, medicines, and beverages, sumacs are now valued as ornamentals, soil binders, and cover plants. The sumacs grown for landscape use display a graceful habit, spectacular fall colour, or colourful fruit clusters.



Smooth, or scarlet, sumac (*Rhus glabra*)
Joan E. Rahn—EB Inc.

The smooth, or scarlet, sumac (*R. glabra*), native to the eastern and central U.S., is the most common. It grows to a height of 6 metres (20 feet), with an open, flattened crown and a few stout spreading branches. A cultivated variety has much dissected, fernlike leaves. Somewhat taller is the staghorn, or velvet, sumac (*R. typhina*), up to 9 m, named for the dense or velvety covering on new twigs. Its fall foliage is orange-red to purple. It also has a variety with finely cut leaves.

Poison sumac, or poison elder (*R. vernix,* or in some classifications, *Toxicodendron vernix*), is an attractive narrow shrub or small tree native to swampy acidic soil of eastern North America. It has whitish waxy berries on loose hanging stalks, unlike the upright reddish, fuzzy fruit clusters of other sumacs.

The clear sap, which blackens on exposure to air, is extremely toxic for many people.

The smaller sumacs are the shining, winged, or dwarf sumac (*R. copallina*) and the lemon, or fragrant, sumac (*R. aromatica*). The former is often grown for its shiny leaves, the leaflets of which are connected by ribs along the axis, and showy reddish fruits. The fragrant sumac has three-parted leaves, scented when bruised; it forms a dense low shrub useful in landscaping.

The Sicilian sumac (*R. coriaria*), from the Mediterranean region, is cultivated as a source of tannin in southern Italy.

**Sumanguru** (fl. 13th century), West African ruler who conquered several small western Sudanese states and molded them into a sizable, if short-lived, empire. Because he was primarily a war leader, his rule did little to restore prosperity and political stability to the western Sudan, which had been disrupted by years of warfare among rival kingdoms after the decline of the Ghana empire.

Little is known with certainty about Sumanguru's life. Before he began his career of conquest, he was ruler of the kingdom of Kaniaga (located in what is today southwestern Mali), inhabited by the Susu (or Soso) people. After conquering many small states to the north and west, most of them former tributaries of Ghana, he captured (*c.* 1203) Kumbi, the capital of the Ghana empire.

By capturing Kumbi, Sumanguru no doubt hoped to gain control of the rich trans-Saharan trade, carried on for centuries between Ghana and the Muslim states of North Africa. Soon after Sumanguru's conquest, however, Soninke (native peoples of Ghana) and North African merchants abandoned Kumbi and established other trading centres at Jenne (now Djénné) and Walata (or Oualata). These soon replaced the former Ghanaian capital as main centres of trade in the Sudan.

Sumanguru is depicted in oral traditions as a cruel and ruthless tyrant. Some historians attribute these traits as a probable cause for the exodus of traders from Kumbi. His inability to maintain law and order and his enthusiastic adherence to the traditional religion of the Susu probably contributed as well to the disaffection of the predominantly Muslim merchant class. Whatever the reasons for the merchants' departure, his failure to establish control over trade in the Sudan was no doubt a major factor in the rapid decline of his empire.

In the 1230s Sumanguru's power was challenged by the kingdom of Kangaba, to the south, whose people, the Mandingo, objected to Susu suzerainty. In the Battle of Kirina (near present Koulikoro in the Republic of Mali) *c.* 1235, the Mandingo, led by Sundiata, defeated Sumanguru. Power in the western Sudan then passed to Kangaba, forming the nucleus of a new Sudanese empire, Mali.

**Sumarokov, Aleksandr Petrovich** (b. Nov. 25 [Nov. 14, old style], 1717, St. Petersburg—d. Oct. 12 [Oct. 1, O.S.], 1777, Moscow), Russian Neoclassical poet and dramatist, director of the first permanent theatre in St. Petersburg (1756–61) and author of several comedies and nine tragedies, including an adaptation of *Hamlet* (1748).

Influenced by French Neoclassical drama, Sumarokov transplanted the conventions of the French theatre to dramas dealing with Russian history. This earned him the flattering epithet "Racine of the North." In his tragedies, which usually had happy endings, he portrayed conflicts between love and duty; his comedies were satires on ignorance and provincialism. His lyric poetry is still read, although his plays are not. A high-minded aristocrat, he took the responsibilities of the nobility seriously and published a journal, *Trudolyubivaya pchela* (1759; "The Industrious Bee"), in which he exposed corrupt officials and the abuses of serfdom. He retired in Moscow when he lost the favour of Catherine II and died in poverty.

**Sumatera Barat,** English WEST SUMATRA, *propinsi* (province), west-central Sumatra, Indonesia, fronting the Indian Ocean to the west and bounded by the provinces of Sumatera Utara (North Sumatra) to the north, Riau to the northeast, Jambi to the southeast, and Bengkulu to the south. It includes the islands of Siberut, Pagai Utara, and Pagai Selatar and the Sipura islands, all in the Mentawai group, located in the Indian Ocean across Mentawai Strait from central Sumatra.

Western Sumatra, long inhabited by Minangkabau peoples, was settled by Indian immigrants beginning in the 2nd century AD and subsequently became part of the Buddhist Śrivijaya Empire that flourished in southern Sumatra beginning in the 7th century. With the decline of the Śrivijaya Empire in the 14th century, the Hindu-Malay kingdom of Minangkabau was established, with Pariangang as its capital. The Minangkabau king converted to Islām in the 16th century. The Dutch entered the region in 1596 and began to establish a firm foothold in western Sumatra. In the early 19th century, control of the island passed temporarily to the British. The Dutch managed to reestablish themselves in the area after intervening on behalf of the Minangkabau royal family during the civil war known as the Padri War (1821–38). Dutch rule was then imposed throughout Minangkabau (roughly coextensive with what is now West Sumatra province).

The Japanese occupied Sumatra during World War II. After the war, Indonesian nationalists declared the formation of the Republic of Indonesia, and after a period of intense anticolonial struggle, Sumatera Barat, together with the rest of Sumatra, was incorporated into the Republic of Indonesia in 1950. The province was a seat of rebellion against the Sukarno government in early 1958, and the Revolutionary Government of the Indonesian Republic was formed in Sumatera Barat with its headquarters at Bukittingi. The rebellion was crushed by Indonesian forces in mid-1958 after aerial attacks on Padang and Bukittingi.

The Barisan Mountains run northwest-southeast and are flanked by lowlands on the southern half and by swamps on the northern half of the western coast. The Padang (Minangkabau) highlands on the eastern side of the mountains extend almost to the eastern boundary of the province. The mountain system consists of several parallel ridges surmounted by numerous active and extinct volcanoes, including Mount Talang (8,520 feet [2,597 m]), Mount Marapi (9,485 feet [2,891 m]), and Mount Kerinci (12,468 feet [3,800 m]). Freshwater swamp forests are found at many places along the coast. The lowland rainforests of pine, teak, and mahogany extend to the hilly upland region. The mainstay of the economy is agriculture producing rice, corn (maize), cassava, tea, coffee, rubber, pepper, tobacco, coconuts, and soybeans. Industries process foods and make cement, beverages, textiles, rubber goods, chemicals, and transport equipment. Roads run the length of the province, and railway lines cross the central part. Padang is the provincial capital. Minangkabau, Gayo-Ala, and Batak peoples are represented in the population, as are a small number of Indians and Chinese. Area 16,560 square miles (42,889 square km). Pop. (2000) 4,328,200.

**Sumatera Selatan,** English SOUTH SUMATRA, *propinsi* (province), southern Sumatra, Indonesia, bounded by the provinces of Lampung to the south, Bengkulu to the west, and Jambi to the north. Palembang is the provincial capital and largest city. The islands of Bangka and Billiton (Belitung) lie to the east across the Karimata Strait; formerly part of Sumatera Selatan, these and associated islands were made into the separate province of Bangka-Belitung in 2000.

There is mention in Chinese chronicles of the kingdom of Kantoli (early 6th century), with its capital at Palembang. Southern Sumatra became part of the Buddhist Śrivijaya Empire at Palembang that rose to power in the last quarter of the 7th century. Buddhist rule was replaced by the Hindu Majapahit Empire of eastern Java after the defeat of King Parameswara in 1377. The Majapahit Empire continued until the beginning of the 16th century. The Islām kingdom at Palembang bore the brunt of Dutch and British attempts at colonial domination in the early 19th century. Dutch rule over that state was firmly established in 1823. The Japanese occupied the province during World War II. It became part of the Republic of Indonesia in 1950.

The southern portion of the Barisan Mountains extends along the western border of Sumatera Selatan and is surmounted by volcanic cones with an average elevation of 8,000 feet (2,400 m), including Mount Dempo (10,364 feet [3,159 m]) and Mount Resagi (7,323 feet [2,232 m]). The highlands descend rapidly to a wide plain that is separated from the northeastern coast by a belt of swamps as much as 150 miles (240 km) wide. Sluggish and swollen rivers, including the Musi, Komering, and Ogan rivers, have brought down huge quantities of eroded materials from the western highlands to form the freshwater and tidal swamps that open out into estuaries along the coast. The low-lying central plains are largely covered with swamp forests, and the seaward margins have mangrove swamps. The mountains are forested with oak, laurel, fern, conifers, and teak.

Agriculture is the mainstay of the economy, and the principal products include rubber, timber, coffee, tea, resin, spices, cinchona bark (for quinine and quinidine), rattan, pepper, corn (maize), and soybeans. Fruits and vegetables are also grown. Industries produce processed food, beverages, processed tobacco, textiles, carved wood and furniture, paper, leather and rubber goods, chemicals, nonmetallic mineral products, metal goods, machinery, and electrical and transport equipment. A chemical fertilizer plant and oil refineries are located at Palembang. Roads and the railway are located principally on the central lowlands and along the foot of the Barisan Mountains and link Baturaja, Perabumulih, Muaraenim, Lahat, and Lubuk Linggau with Palembang. The population is made up of Minangkabau, Batak, Redjong-Lampong, Bantamese, and Javanese peoples. There are also a few Indians and Chinese. Area 35,940 square miles (93,083 square km). Pop. (2000) 6,899,675.

**Sumatera Utara,** English NORTH SUMATRA, *propinsi* (province), northern Sumatra, Indonesia, bounded by the Indian Ocean to the west, the Strait of Malacca to the east, the semiautonomous province of Aceh to the north and northwest, and the provinces of Sumatera Barat (West Sumatra) to the south and Riau to the south and southeast. It covers an area of 28,412 square miles (73,587 square km) and includes the Indian Ocean islands of Nias, Mursala, and Pini and the Batu group.

The area formed part of the Buddhist Śrivijaya Empire of Palembang in the 7th century and, later, of the Hindu Majapahit Empire of eastern Java, which lasted until the early 16th century. With the arrival of Islām and the establishment of the sultanate of Aceh in the latter half of the 16th century, northern Sumatra became part of the Aceh kingdom and was the site of battles between the Sultan of Aceh and the sultans of southern Sumatra. Rivalry between the British and the Dutch

during the 17th and 18th centuries and the surrender of British interests in Sumatra to the Dutch in 1871 led to complete control of the province by the Dutch by 1903. Following Japanese occupation during World War II, Sumatera Utara was incorporated into the Republic of Indonesia in 1950. Political unrest in the province and requests for greater autonomy were suppressed by the Indonesian government in 1956.

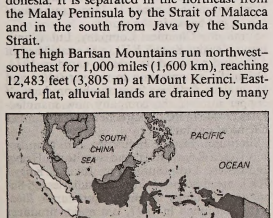
The Batak Plateau of the Barisan Mountains runs northwest–southeast, covers about two-thirds of the province, and is surmounted by both active and extinct volcanic cones, including Mount Sinabung (8,041 feet [2,451 m]), Mount Sibayak (6,870 feet [2,094 m]), and Mount Sorikmerapi (7,037 feet [2,145 m]). Near the centre of the plateau, at an elevation of 2,985 feet (910 m), is Lake Toba, with its Samosir Island. Samosir Island, 27 miles (44 km) long and 12 miles (19 km) wide, is linked with the western shore of the lake by a narrow man-made isthmus. The plateau is flanked on the southwestern side by coastal lowlands with swamps to the north and south. Flat lowlands extend northeastward from the plateau's northeastern side, and a wide belt of swampland covers the southeastern part of the province. The coastal regions, deeply indented by estuaries, are where most of the lowland settlements are situated. The Asahan River drains Lake Toba from its southeastern shore, and the Barumun, Bila, and Kuala rivers also descend from the eastern slopes of the plateau and flow into the Strait of Malacca. The Gadis River drains the western slopes into the Indian Ocean.

The plateau is covered by tropical rain forests of teak, ironwood, and banyan and by mixed subtropical forests including oak, maple, walnut, and laurel. Bamboo is common in the uplands. The coastal regions are covered with tidal and freshwater swamp forests, including a mangrove belt several miles wide. Agriculture, based on shifting cultivation, dominates the economy and produces rice, cassava, tobacco, rubber, palm oil, sisal, tea, coffee, pepper, and fruits and vegetables. Industries process foods and tobacco and produce beverages, textiles, carved wood, leather and rubber goods, chemicals, metal goods, machinery, and transport equipment.

Roads and the railway run parallel to the northeastern coast. Medan (the provincial capital), Tanjungbalai, Tebingtinggi, Binjai, Pematangsiantar, and Sibolga are the chief towns. The population is mainly Achinese, Batak, and coastal Malay. There are also Chinese and Indians. Pop. (1995 est.) 11,114,667.

**Sumatra,** Indonesian SUMATERA, one of the Greater Sunda Islands and the second largest island (about 182,859 square miles [473,606 square km], including adjoining islands) of Indonesia. It is separated in the northeast from the Malay Peninsula by the Strait of Malacca and in the south from Java by the Sunda Strait.

The high Barisan Mountains run northwest–southeast for 1,000 miles (1,600 km), reaching 12,483 feet (3,805 m) at Mount Kerinci. Eastward, flat, alluvial lands are drained by many rivers; the Hari River, navigable for 300 miles (480 km), is the longest. Lake Toba, with an area of 500 square miles (1,300 square km), is the largest of many mountain lakes.



Sumatra

Sumatra's climate is hot, except in the highlands, and extremely moist. Vegetation includes the *Pinus merkusii,* the huge flower *Rafflesia,* myrtles, bamboo, rhododendrons, orchids, and such trees as palm, oak, chestnut, ebony, ironwood, camphorwood, sandalwood, and rubber-producing types. The island's animal life includes orangutan, various apes, elephant, tapir, tiger, the one-horned rhinoceros, gibbon, tree shrew, flying lemur, wild boar, and civet cat.

Sumatrans belong to the Oceanic branch of the Mongoloid race and the Austronesian (Malayo-Polynesian) language family. The Achinese inhabit northwestern Sumatra; the Gajo and Alas, the mountainous northcentral area; the Batak, around and south of Lake Toba; and the Minangkabau (the largest ethnic group), the Padang highlands. South of Padang along the western coast live the Redjang and Lebong mountain people and the Lampung coastal dwellers. The Malays, a coastal and riverine people dominating the eastern coast and the wide southern plains, speak the lingua franca of the archipelago, the basis for the Indonesian national language. The Minangkabau and the Batak have been most receptive to Western-style education. Most Sumatrans are Muslims, though some are Christians and animists.

The principal cities are Palembang, Medan, and Padang. Some 90 percent of the population is rural, with the highest density being around Medan in northeastern Sumatra. Colonization from Java to relieve its overcrowding has taken place in the Lampung province in southern Sumatra. The island is subdivided into seven *provinsi* ("provinces")—Sumatera Utara (North Sumatra), Jambi, Riau, Sumatera Barat (West Sumatra), Sumatera Selatan (South Sumatra), Bengkulu, and Lampung—and Aceh *daerah istimewa* (special district).

Sumatrans have at times expressed dissatisfaction at not receiving a greater financial return from the central government; insurrections and other regional movements have taken place. Agricultural products grown for export are rubber, tobacco, tea, coffee, palm oil, ramie fibre, sisal, copra, betel nuts, kapok, peanuts (groundnuts), and pepper. The highland areas of Sumatera Utara grow vegetables for export. Subsistence crops include corn (maize), root crops, vegetables, and rice. About one-third of Indonesia's timber comes from Sumatran forests, which also yield various oils and fibres. Sumatra and adjacent islands also have reserves of petroleum, natural gas, tin, bauxite, coal, gold, silver, and other minerals. The Umbilin coalfield near Sawahlunto covers about 40 square miles (105 square km). Another, older coalfield is at Bukit Asen, while newer resources are being developed at localities in Sumatera Selatan. The Dumai area of Riau province has some of the most productive oil wells in Indonesia; other areas have been developed at Palembang and Pangkalan Brandan. Road networks are fairly good in northeastern Sumatra, the Padang highlands, and southern Sumatra, but mountain trails and rivers are used elsewhere. The northwest–southeast Sumatra Highway was completed in the 1980s. Three separate and unconnected railway systems operate in northern, central, and southern Sumatra. An Indonesian airline serves the major cities.

The influence of the Śrivijaya kingdom in Palembang in the 11th century reached most of Sumatra, as well as other island and mainland regions. In 1377 Śrivijaya's capital fell to the Javanese Majapahit empire, and the kingdom never recovered in Sumatra. The European powers, first the Portuguese, then the Dutch and English, traded with, warred against, and established forts among the coastal Sumatran principalities beginning in the 16th century. Anglo-Dutch treaties in 1824 and 1871 revoked English claims in Sumatra, and, through economic exploitation and administrative skills, the Dutch slowly opened the interior to their authority throughout the 19th century. Aceh (Atjeh) was brought only grudgingly under Dutch control in the early 20th century after 30 years of war. Sumatra was occupied by Japan in World War II and in 1950 became part of the Republic of Indonesia. Pop. (1995 est.) island (including adjacent smaller islands), 40,969,000.

**Šumava** (central Europe): *see* Bohemian Forest.

**Sumba,** Dutch SOEMBA, also called SANDALWOOD, island, one of the Lesser Sunda Islands, Nusa Tenggara Timur *provinsi* ("province"), Indonesia, in the Indian Ocean across the Sumba Strait from Flores and west of Timor across the Savu Sea. With an area of 4,306 square miles (11,153 square km), Sumba has mountains up to 4,000 feet (1,220 m) but no volcanoes; its rivers are largely unnavigable. The annual rainfall of about 64 inches (1,625 mm) results in light forestation and much grassland, which feeds the fine Sandalwood breed of horse and the Ongole cattle, both more common in the east. Sumba's woven cloth is famous for its design. Corn (maize) is the main crop, but rice, coffee, fruit, tobacco, coconuts, and vegetables are grown, and copra is exported; paddy rice is more common in the western half of the island. Most inhabitants are animists, though some are Muslims and Christians. Polygamy is fairly common among the upper classes.

Forests of sandalwood, now mostly depleted, attracted attention to the island in the 17th century. Treaties with the Dutch were concluded in 1756 and again between 1845 (when the first Dutch official came to reside on the island) and 1874, but difficulties persisted with the inhabitants because of piracy and slave raids. The chief town is Waingapu, located on the northern coast; it has a good anchorage and an airport. Waikabubak is the administrative centre for the western part of the island, and Waikelo, in the northwest, is the chief port for that area. Pop. (1999 est.) 528,600.

*Consult the* INDEX *first*

**Sumbawa,** Dutch SOEMBAWA, island of the Lesser Sunda Islands, Nusa Tenggara Barat *provinsi* ("province"), Indonesia. Sumbawa, 5,965 square miles (15,448 square km) in area, has several deeply cut bays producing numerous peninsulas and the excellent harbour of Bima. The island is very mountainous, with rocky coasts and only a few small plains. Volcanic Mount Tambora (9,354 feet [2,851 m]) erupted in 1815, killing 50,000 persons and causing 35,000 more to emigrate. Because of shifting cultivation followed by grazing, large areas of the island are now covered only by thornbush. Agriculture consists of wet rice cultivation and the raising of corn (maize), beans, tubers, and some coffee and copra; cattle, goats, and horses are raised, partly for export. Sumbawa town has an airport, and a fair-weather road links it to the other main towns, Besar and Bima.

The inhabitants are of Malay stock, with the people in the west closely related to the Sasak of Lombok and those of Bima in the east much like the Makasarese in language and customs; Papuan, or Oceanic Negroid, traits are strong in the eastern interior. Islām is the prevailing religion. Once part of the Javanese

Majapahit kingdom, the Sumbawanese nobility in 1674 signed agreements with the Dutch that gave the Dutch East India Company some power over the island. In World War II it was occupied by Japan. Pop. (1999 est.) 417,900.

**Šumen** (city, Bulgaria): *see* Shumen.

**Sumer,** site of the earliest known civilization, located in the southernmost part of Mesopotamia between the Tigris and the Euphrates rivers, in the area that later became Babylonia and is now southern Iraq from around Baghdad to the Persian Gulf.

A brief treatment of Sumerian civilization follows. For full treatment, *see* MACROPAEDIA: Mesopotamia, The History of Ancient.

Sumer was first settled between 4500 and 4000 BC by a non-Semitic people who did not speak the Sumerian language. These people now are called proto-Euphrateans or Ubaidians, for the village Al-Ubaid, where their remains were first discovered. The Ubaidians were the first civilizing force in Sumer, draining the marshes for agriculture, developing trade, and establishing industries, including weaving, leatherwork, metalwork, masonry, and pottery. After the Ubaidian immigration to Mesopotamia, various Semitic peoples infiltrated their territory, adding their cultures to the Ubaidian culture, and creating a high pre-Sumerian civilization.

The people called Sumerians, whose language became the prevailing language of the territory, probably came from around Anatolia, arriving in Sumer about 3300 BC. By the 3rd millennium BC the country was the site of at least 12 separate city-states: Kish, Erech, Ur, Sippar, Akshak, Larak, Nippur, Adab, Umma, Lagash, Bad-tibira, and Larsa. Each of these states comprised a walled city and its surrounding villages and land, and each worshiped its own deity, whose temple was the central structure of the city. Political power originally belonged to the citizens, but, as rivalry between the various city-states increased, each adopted the institution of kingship. An extant document, *The Sumerian King List,* records that eight kings reigned before the great Flood.

After the Flood, various city-states and their dynasties of kings temporarily gained power over the others. The first king to unite the separate city-states was Etana, ruler of Kish (*c.* 2800 BC). Thereafter, Kish, Erech, Ur, and Lagash vied for ascendancy for hundreds of years, rendering Sumer vulnerable to external conquerors, first the Elamites (*c.* 2530–2450 BC) and later the Akkadians, led by their king Sargon (reigned 2334–2279 BC). Although Sargon's dynasty lasted only about 100 years, it united the city-states and created a model of government that influenced all of Middle Eastern civilization.

After Sargon's dynasty ended and Sumer recovered from a devastating invasion by the semibarbaric Gutians, the city-states once again became independent. The high point of this final era of Sumerian civilization was the reign of the 3rd dynasty of Ur, whose first king, Ur-Nammu, published the earliest law code yet discovered in Mesopotamia.

After 1900 BC, when the Amorites conquered all of Mesopotamia, the Sumerians lost their separate identity, but they bequeathed their culture to their Semitic successors, and they left the world a number of technological and cultural contributions, including the first wheeled vehicles and potter's wheels; the first system of writing, cuneiform; the first codes of law; and the first city-states.

**Sumerian language,** the oldest written language in history, spoken in southern Mesopotamia during the 3rd millennium BC. It was written in the cuneiform system. Language scholars have not been able to prove the relationship of Sumerian to any other known language.

A brief treatment of the Sumerian language follows. For full treatment, *see* MACROPAEDIA: Languages of the World: *Language isolates.*

The history of Sumerian may be divided into four periods: Archaic Sumerian, Old (or Classical) Sumerian, New Sumerian, and Post-Sumerian. Archaic Sumerian is attested from about 3100 to about 2500 BC. It is represented by texts of business and administrative character and by school texts. Archaic Sumerian is still very poorly understood. Old Sumerian lasted from about 2500 to 2300 BC and is represented mainly by records of the early rulers of Lagash. These early records of Lagash include business, legal, and administrative texts, votive inscriptions, and letters. This form of Sumerian is much better understood by scholars.

During the New Sumerian period the Semitic Akkadians took over the political hegemony of Babylonia. The use of the Akkadian language spread at the expense of Sumerian. The New Sumerian period ended about 2000 BC, when Semitic peoples from the desert destroyed the 3rd dynasty of Ur and established the Semitic dynasties of Isin, Larsa, and Babylon. The period of these dynasties is called the Old Babylonian period.

After 2000 BC the Sumerians lost their political identity and spoken Sumerian was gradually replaced by Akkadian. As a written language, however, Sumerian remained in use almost as long as the Akkadian language. This final stage of the Sumerian language is called Post-Sumerian. In the early part of the Post-Sumerian period the use of written Sumerian is extensively attested in legal and administrative texts, as well as in royal inscriptions, which are often bilingual, in Sumerian and Babylonian.

The Sumerian language has a rich literature, which includes myths, epics, hymns, lamentations, rituals, incantations, proverbs, and the so-called wisdom compositions. Many of these texts were recorded in writing for the first time in the Old Babylonian period. For many centuries after Sumerian ceased to be spoken, it was studied in the Babylonian schools. In Hellenistic times there were some cuneiform tablets that show Sumerian words transcribed in Greek letters. About the early 1st century AD all knowledge of the Sumerian language disappeared along with that of cuneiform writing. It was not rediscovered until after the decipherment of cuneiform writing in the early 19th century.

Sumerian is an agglutinative language that uses prefixes, infixes, and suffixes. The same roots are often used for both nouns and verbs, which are distinguished by the syntax and by different affixes. Sumerian has a relatively simple sound system, with 4 vowels and 16 consonants. In Classical Sumerian consonants are not distinguished by voicing but by aspiration. Nouns are inflected for number and case. The plural number is indicated either by suffixes or by reduplication. Verbal inflection in the Sumerian language is very complicated, involving prefixes, infixes, and suffixes, all following a rigid order.

Several Sumerian dialects are known, including *eme-gir,* the official dialect of Sumerian, and *eme-SAL,* the dialect often used in hymns and incantations. In 1976 scholars at the University of Pennsylvania (Philadelphia) undertook the compilation of the first standard Sumerian dictionary.

**Sumerian writing,** type of writing used by the ancient Sumerian civilization of southern Mesopotamia. It is the earliest form of cuneiform writing (*q.v.*).

**Sumgait** (city, Azerbaijan): *see* Sumqayıt.

**sumi-e** (Japanese painting): *see* suiboku-ga.

**Sumitomo** GROUP, loose consortium of independent Japanese companies. These companies were created out of the giant, family-owned Sumitomo business combine, or *zaibatsu* (*q.v.*), that was broken up after World War II. The *zaibatsu,* in turn, grew out of the House of Sumitomo (Sumitomo-ke), one of the major Japanese merchant houses of the Tokugawa period (1603–1867).

The Sumitomo enterprise originated in a medicine and book shop set up in Kyōto in 1630 by Sumitomo Masatomo. His brother-in-law, Soga Riemon, had set up a small copper refinery that used a European-derived procedure for extracting the gold and silver content of copper ores. Soga's oldest son, Tomomochi, who became Sumitomo's son-in-law, established a copper refinery in Ōsaka that absorbed both families' business operations and became the centre of the Japanese copper industry. In 1690–91 the company discovered and began working a huge copper find on the island of Shikoku; this mine became the basis of much of Sumitomo's future enterprises. The House of Sumitomo established a close relationship with the Tokugawa shogunate and was able to export large quantities of copper despite the general ban on overseas trade.

The link to the shogunate was at first detrimental to Sumitomo in the early Meiji period (1868–1912), but the company was quickly able to win the support of the new government. The company began to diversify into such interests as copper products and steel-making and later into chemicals and machinery. A family-controlled holding company, Sumitomo, Ltd. (Sumitomo Gōshi Kaisha), was organized in 1921 to direct the emerging combine. In the 1930s Sumitomo became one of the largest *zaibatsu* in Japan, and by the end of World War II it controlled some 135 companies. With the postwar dissolution of the holding company by the U.S. occupation authorities, the former subsidiaries became independent companies.

In the 1950s these companies began to reassociate. The new grouping that emerged was significantly different from the old *zaibatsu* in that there was no central, family-controlled holding company. It was characterized instead by informal policy coordination between the various company presidents and by a degree of financial interdependency among the companies. The Sumitomo group is composed of several dozen firms. All of the major firms are large multinational corporations based in Tokyo or Ōsaka.

Sumitomo Bank, Ltd. (Sumitomo Ginkō), was established in 1895 and functioned as the main financial instrument of the Sumitomo *zaibatsu.* After World War II the bank became the central coordinating body of the companies in the Sumitomo group. By the late 20th century the Sumitomo Bank was one of the chief commercial banks in Japan and one of the largest banks in the world.

Sumitomo Chemical Company, Ltd. (Sumitomo Kagaku Kōgyō KK), was established in 1925 and acquired its present name in 1934. Originally an operation to recover sulfur and to produce fertilizer from the by-products of copper mining, the company now manufactures a wide range of petrochemicals and other chemical products.

Sumitomo Electric Industries, Ltd. (Sumitomo Denki Kōgyō KK), and Sumitomo Heavy Industries, Ltd. (Sumitomo Jūkikai Kōgyō KK), are descended from subsidiaries of Sumitomo's copper interests. Sumitomo Electric, established in 1897, is a major producer of electric wire and cable. Sumitomo Heavy Industries, established as a separate company in 1934, is a major producer of steelmaking systems, mass-production machinery, other heavy machinery and equipment, and ships.

Three large corporations—Sumitomo Metal Mining Company, Ltd. (Sumitomo Kinzoku Kōzan KK), Sumitomo Metal Industries, Ltd.

(Sumitomo Kinzoku Kōgyō KK), and Sumitomo Light Metal Industries, Ltd. (Sumitomo Keikinzoku Kōgyō KK)—have emerged from the first mining and smelting operation established in the late 16th century. Sumitomo Metal Mining, the descendent of the original company, took its present form in 1950. In addition to its primary interests in the mining, smelting, and processing of nonferrous metals (excluding aluminum), its activities include the manufacture of electronics materials, chemicals, and construction materials. Sumitomo Metal Industries, established in 1935, was called Fusō Metal Industries during the postwar occupation. The company manufactures steel and a variety of steel products. Sumitomo Light Metal Industries, formerly a division of Sumitomo Metal Industries, was set up as an independent company in 1959. The company is engaged primarily in the manufacture of rolled aluminum. It also has an aluminum-smelting subsidiary and interests in bauxite mines.

**Sumiyoshi Gukei,** original name SUMIYOSHI HIROZUMI (b. 1631, Kyōto, Japan—d. April 25, 1705, Edo [now Tokyo]), Japanese painter of the early Tokugawa period (1603–1867) who became the first official painter of the ruling Tokugawa shogunate.

Gukei came from the Yamato-e (painting based on Japanese subjects and techniques) background, as against the Kara-e (painting strongly influenced by Chinese art) background. His father, Jokei (1599–1670), of the Tosa family of Yamato-e painters, had assumed the name Sumiyoshi in 1662, but it was Gukei who established the Sumiyoshi school of painting and contributed to the spread of Yamato-e in Edo (now Tokyo), as the Tosa school painters had done in Kyōto. His scroll "Scenes of Kyōto and Its Environs" (Tokyo National Museum) is remarkable for its vividness of style and the way the daily life of courtiers and townsmen, as well as of country folks, is depicted with a powerful sense of reality and humour. These qualities were exceptional among the Yamato-e painters of the time.

*To make the best use of the Britannica, consult the* INDEX *first*

**summary jurisdiction,** in Anglo-American law, jurisdiction of a magistrate or judge to conduct proceedings resulting in a conviction or order without trial by jury. Since in the later common law the only recognized mode of trial, except in cases of contempt, was jury trial, summary jurisdiction is almost entirely a creation of statute. In the United States, despite federal and state constitutional provisions guaranteeing trial by jury, it is generally held that certain petty offenses, such as disturbing the peace, may be tried summarily. The trial of such cases is usually more informal and expeditious than those for more serious offenses. Civil suits in which the amounts are small may also be tried without a jury.

In England crimes are classified as either summary offenses, which are tried by magistrates' courts, or indictable offenses, for which there is a right to a jury trial. There are also offenses that may in some cases be treated in either way. Since the mid-20th century, most petty offenses punishable by imprisonment for more than three months may be tried on indictment. The English law also includes some civil proceedings within the summary jurisdiction of magistrates.

**summation,** in neurophysiology, the additive effect of several electrical impulses on a neuromuscular junction, the junction between a nerve cell and a muscle cell. Individually the stimuli cannot evoke a response, but collectively they can. Successive stimuli on one nerve are called temporal summation; the addition of simultaneous stimuli from several conducting fibres is called spatial summation.

**summer,** warmest season of the year, between spring and autumn. In the Northern Hemisphere, it is usually defined as the period between the summer solstice (year's longest day), June 21 or 22, and the autumnal equinox (day and night equal in length), September 22 or 23; and in the Southern Hemisphere, as the period between December 22 or 23 and March 20 or 21. The temperature contrast between summer and the other seasons exists only in middle and high latitudes; temperatures in the equatorial regions generally vary little from month to month. For physical causes of the seasons, *see* season.

The concept of summer in European languages is associated with growth and maturity, especially that of cultivated plants, and indeed summer is the season of greatest plant growth in regions with sufficient summer rainfall. Festivals and rites have been used in many cultures to celebrate summer in recognition of its importance in food production.

A period of exceptionally hot weather, often with high humidity, during the summer is called a heat wave. Such an occurrence in the temperate regions of the Northern Hemisphere in the latter part of summer is sometimes called the dog days.

**summer camp,** any combined recreational and educational facility designed to acquaint urban children with outdoor life. The earliest camps were started in the United States about 1885 when reaction to increased urbanization led to various back-to-nature movements. These attempts at rediscovering the outdoors, plus long summer vacations, led to the development of summer camps, which were at first exclusively for boys. Camps for girls date from about 1900, and since that time coeducational camps have developed as well.

The periods of summer camps vary from one or two weeks to about eight weeks, and the children in attendance range in age from about 6 to 18 years. Since the earliest camps that stressed masculine fraternity and the simple life, many different types have developed with a wide variety of emphases, from so-called wilderness camps, where children live in tents and cook their own food, to camps with heated cabins, hot showers, swimming pools, and an elaborate cuisine. Some camps offer only the land and water sports peculiar to their locale plus some arts-and-crafts activities; others may be directed toward furthering a natural talent or a special interest. There are, for example, art and music camps and others devoted to baseball, horseback riding, tennis, and sailing. There are also remedial camps for children having difficulty in school and others dedicated to such goals as weight reduction.

**Summer Offensive** (World War I): *see* June Offensive.

**summer squash,** a type of squash (*q.v.*).

**summer theatre,** also called SUMMER STOCK, or STRAWHAT THEATRE, in American theatre, productions staged during the summer months (the off-season for professional theatre) by professional touring companies at theatres generally located near resort areas. Usually featuring a well-known star, the plays are often Broadway hits of previous seasons or new plays being tested for the Broadway stage. The original concept of summer theatre, dating from the late 19th century, was to combine Broadway talent with young unknown actors, giving them experience in the professional theatre.

There are more than 300 summer theatres in the United States, including tents, permanent theatres, and showboats housing musical revues. Some of the better-known summer theatres are the Elitch's Gardens in Denver, Colo. (established in 1891); the Bucks County Playhouse in New Hope, Pa.; the Westport Country Playhouse in Westport, Conn.; and the American Shakespeare Festival Theatre in Stratford, Conn.

**Summerhill School,** experimental primary and secondary coeducational boarding school in Leiston, Suffolk, Eng. Founded in 1921, it is famous for the revolutionary educational theories of its headmaster, A.S. Neill. The teaching methods and curriculum are flexible, and the accent is on contemporary needs rather than the traditional classical course of studies, although those also are offered. The school is self-governing (students and staff each have a voice in policy matters), and class attendance is optional; the children are free to do as they please except in concerns of safety, health, or interference with the rights of others. There are six forms (classes) organized more according to ability than to age. The curriculum is pre-university, with a heavy emphasis on arts and crafts. Although some have criticized its modern methods, its goals are traditional: to encourage personal achievement and integrity and to prepare students for advanced education and professional careers.

**Summerside,** town, seat (1876) of Prince county, on the southern coast of Prince Edward Island, Canada. The town lies along Bedeque Bay and Northumberland Strait, 38 miles (61 km) west of Charlottetown. Settled in 1780 as Green's Shore by Daniel Green (a Quaker Loyalist from Pennsylvania, U.S.), it was renamed for an inn, Summerside House, established there in 1840 by Joseph Green, the youngest son of the founder. Now a fishing port and summer resort, the town is the centre of a silver fox- and mink-farming region and of the Malpeque Bay oyster industry. The town's Acadian Museum has early 19th-century farm implements. Nearby is an airport. Inc. 1877. Pop. (1991) town, 7,474; metropolitan area, 15,237.

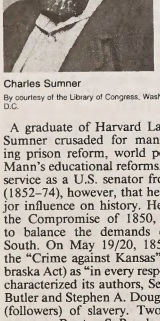
**Summersville,** city, seat of Nicholas county, central West Virginia, U.S. It lies near the Gauley River, 45 miles (72 km) east of Charleston. Founded on Peters Creek in 1824 and named for Judge Lewis Summers, it was incorporated in 1897. In July 1861, Nancy Hart, the noted Confederate spy, led an attack upon the town, capturing a Union force and burning most of the buildings. She was later captured but escaped to Confederate lines, returning to settle in the locality after the war. Carnifex Ferry Battlefield State Park (156 acres [63 hectares]), 10 miles (16 km) southwest on the banks of the Gauley River, is the site of an American Civil War engagement (Sept. 10, 1861) where Union troops, led by General William S. Rosecrans, defeated a Confederate force under Brigadier General John B. Floyd. Summersville Lake was dammed (1966) on the Gauley River for flood control and recreation. Part of the Monongahela National Forest is east of the city. Lumbering, sawmilling, and agriculture (milk, potatoes, and corn [maize]) are the main economic activities. Pop. (1990) 2,906.

**Summit,** village, Cook county, northeastern Illinois, U.S., just west of Chicago, straddling the watershed between the Great Lakes and the Mississippi River. Named for the ridge separating the watershed, it was the site of a portage (route used for carrying boats overland) used (1673) by the explorers Jacques Marquette and Louis Jolliet. The spot, designated as a national historic site, marks the west end of the portage that connected the waters of the Great Lakes (and the St. Lawrence River) with those of the Mississippi River (and the Gulf of Mexico). An artery of travel used by Indians in their migrations and by fur traders, it was an early factor (preceding

the Illinois and Michigan Canal) in Chicago's commercial growth. Although primarily a residential suburb, Summit has the Argo plant, one of the world's largest corn (maize) products companies. Inc. 1890. Pop. (1990) 9,971.

**summons,** also called CITATION, in law, document issued by a court ordering a specific person to appear at a specific time for some specific purpose. It is issued either directly to the person or to a law officer who must carry out the instructions. Often the purpose of a citation or summons is to require a person to answer charges or a complaint filed against him. It may also be used simply to notify a person that he has an interest in the proceedings at hand, which it would be to his advantage to attend.

**Sumner, Charles** (b. Jan. 6, 1811, Boston—d. March 11, 1874, Washington, D.C.), U.S. statesman of the American Civil War period dedicated to human equality and to the abolition of slavery.



Charles Sumner
By courtesy of the Library of Congress, Washington, D.C.

A graduate of Harvard Law School (1833), Sumner crusaded for many causes, including prison reform, world peace, and Horace Mann's educational reforms. It was in his long service as a U.S. senator from Massachusetts (1852–74), however, that he exercised his major influence on history. He bitterly attacked the Compromise of 1850, which attempted to balance the demands of North against South. On May 19/20, 1856, he denounced the "Crime against Kansas" (the Kansas–Nebraska Act) as "in every respect a swindle" and characterized its authors, Senators Andrew P. Butler and Stephen A. Douglas, as myrmidons (followers) of slavery. Two days later Congressman Preston S. Brooks of South Carolina invaded the Senate, labelled the speech a libel on his state and on his uncle, Senator Butler, and then severely beat Sumner with a cane. It took three years for Sumner to recover from the beating.

Sumner was chairman of the Senate Foreign Relations Committee from March 1861 to March 1871. Close acquaintanceships with prominent Englishmen such as Richard Cobden, John Bright, William Ewart Gladstone, and other European leaders—gained during his several European sojourns (1837–40)—afforded him unusual understanding of and influence in international affairs. He helped preserve peace between Britain and the United States by persuading President Lincoln to give up Confederate commissioners James M. Mason and John Slidell after their capture aboard the "Trent" in November 1861.

Sumner opposed President Lincoln and later Pres. Andrew Johnson on post-war Reconstruction policy. He took the position that the defeated South was a conquered province outside the protection of the Constitution, and that the Confederate states should provide constitutional guarantees of equal voting rights to blacks before those states could be readmitted to the Union.

In 1870 Sumner helped defeat Pres. Ulysses S. Grant's proposal to annex Santo Domingo. As a result, Grant apparently brought about Sumner's removal from the chairmanship of the Foreign Relations Committee, a blow that almost broke Sumner.

In a move for magnanimity toward the defeated South, Sumner introduced a Senate resolution (1872) providing that the names of battles between fellow citizens should not be placed on the regimental colours of the U.S. Army. Reaction in his home state was immediate and bitter. The Massachusetts legislature censured the resolution as "an insult to the loyal soldiery of the nation" and as meeting "the unqualified condemnation of the people of the Commonwealth." Two years later, however, the legislature rescinded its action. Shortly after receiving news that he had been exonerated, Sumner suffered a fatal heart attack.

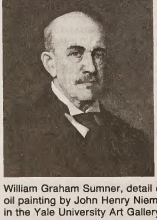
BIBLIOGRAPHY. *Complete Works,* with an introduction by G.F. Hoar (1900); David Donald, *Charles Sumner and the Coming of the Civil War* (1960).

**Sumner, James Batcheller** (b. Nov. 19, 1887, Canton, Mass., U.S.—d. Aug. 12, 1955, Buffalo, N.Y.), U.S. biochemist who was the first to crystallize an enzyme, an achievement that led to knowledge of the protein nature of enzymes and earned him, with John Howard Northrop and Wendell Meredith Stanley, the 1946 Nobel Prize for Chemistry.

After crystallizing the enzyme urease in 1926, Sumner went to Stockholm to study with Hans von Euler-Chelpin and Theodor (The) Svedberg. He crystallized the enzyme catalase in 1937 and also contributed to the purification of several other enzymes. Professor at the Cornell University Medical School, Ithaca, N.Y. (1929–55), in 1947 he became director of the Cornell laboratory of enzyme chemistry, an institution that was established in recognition of his work.

**Sumner, William Graham** (b. Oct. 30, 1840, Paterson, N.J., U.S.—d. April 12, 1910, Englewood, N.J.), U.S. sociologist and economist, prolific publicist of Social Darwinism.

Like the British philosopher Herbert Spencer, Sumner, who taught at Yale from 1872 to 1909, expounded in many essays his firm belief in laissez-faire, individual liberty, and the innate inequalities among men. He viewed competition for property and social status as resulting in a beneficent elimination of the ill adapted and the preservation of racial soundness and cultural vigour. For him the middle-class Protestant ethic of hard work, thrift, and sobriety was conducive to whole-

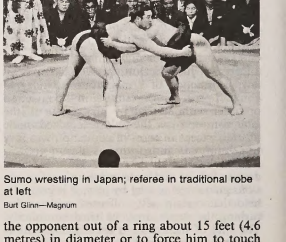


William Graham Sumner, detail of an oil painting by John Henry Niemeyer; in the Yale University Art Gallery
By courtesy of the Yale University Art Gallery, bequest of the artist

some family life and sound public morality. Foreseeing the drift toward the welfare state, but considering poverty the natural result of inherent inferiorities, he opposed all reform proposals that smacked of paternalism because they would impose excessive economic burdens on the middle class, his "forgotten man." In his best known work, *Folkways* (1907), he stated that customs and morals originate in instinctive responses to the stimuli of hunger, sex, vanity, and fear. He emphasized the irrationality of folk customs and their resistance to reform. Sumner's notes became the basis of *The Science of Society,* 4 vol. (1927–28), edited by Albert G. Keller.

**Sumo,** Indian people of the eastern coastal plain of Nicaragua, closely related to the neighbouring Miskito people. There were about 2,000 or more Sumo living in the region in the 1970s. Their language is thought by some authorities to be related to the Chibchan family. The Sumo are agricultural, their staple crop being sweet manioc (yuca). They also grow corn (maize), sweet potatoes, squash, tomatoes, and beans. Cultivation is of the slash-and-burn pattern; planting is done with the digging stick. They live in small villages, formerly in communal dwellings but nowadays in single-family thatched huts. Among their crafts are basketry, weaving, pottery, and the making of bark cloth. Their clothing is semi-traditional; commercial cloth and European styles are becoming common. They believe in spirits associated with nature, and each village usually has a shaman who can placate malevolent spirits and free sick people from their influence. There is a well-developed oral literature, consisting mainly of mythology and history. *See also* Miskito.

**sumo,** style of Japanese wrestling in which weight, size, and strength are of the greatest importance, though speed and suddenness of attack are also useful. The object is to propel



Sumo wrestling in Japan; referee in traditional robe at left
Burt Glinn—Magnum

the opponent out of a ring about 15 feet (4.6 metres) in diameter or to force him to touch the ground with any part of his body other than the soles of his feet. The wrestlers wear only loincloths and grip each other by the belt.

In Japan, sumo wrestling was under Imperial patronage between 710 and 1185 and was a popular spectator sport. During this era it was refined from a brutal submission spectacle into a highly ritualized toppling match in which victory could be gained by forcing the opponent out of a 15-foot circle. Then, under the shoguns, public matches were banned, and martial forms of the sport for the samurai, or military caste, were emphasized instead. Professional sumo wrestling in Japan dates from the revival of public matches after 1600 and is often called the Japanese national sport. Six great championships are held annually, attracting immense crowds, and several hundred athletes make their living at this sport. A complex system of ranking leads to the des-

ignation of *Yokozuna,* or "grand champion." The list of men awarded this title commences with Akashi Shiganosuke, victor in 1632. Specially selected youths are brought up into the profession and fed a special protein diet, which creates immense, bulky bodies. Exceptionally agile men weighing 300 pounds or more are common in this sport. Lengthy rituals and elaborate posturings accompany the bouts, which are, by contrast, quite brief, often lasting only a few seconds.

**sumptuary law,** any law designed to restrict excessive personal expenditures in the interest of preventing extravagance and luxury. The term denotes regulations restricting extravagance in food, drink, dress, and household equipment, usually on religious or moral grounds. Such laws have proved difficult or impossible to enforce over the long term.

Sumptuary laws are of ancient origin, and numerous instances are to be found in ancient Greece. The Spartan inhabitants of Laconia, for example, were forbidden to attend drinking entertainments and were also forbidden to own a house or furniture that was the work of more elaborate implements than the ax and saw. The possession of gold or silver was also forbidden to the Spartans, their legislation permitting only the use of iron money. A system of sumptuary laws was extensively developed in ancient Rome; a series of laws beginning in 215 BC governed the materials of which garments could be made and the number of guests at entertainments and forbade the consumption of certain foods.

Sumptuary laws were enacted in many countries of Europe from the Middle Ages, though with no more effectiveness than in ancient Greece or Rome. In France, Philip IV issued regulations governing the dress and the table expenditures of the several social orders in his kingdom. Under later French kings the use of gold and silver embroidery, silk fabrics, and fine linen was restricted. In England during the reign of Edward II a proclamation was issued against the "outrageous and excessive multitude of meats and dishes which the great men of the Kingdom had used, and still used, in their castles." Besides the standing regulations governing dress, Edward III in 1336 tried to restrict merchants and the servants of gentlemen from eating more than one meal of flesh or fish per day. In 1433 an act of the Scottish parliament prescribed the lifestyle of all social orders in Scotland, even going so far as to limit the use of pies and baked meats to those who held the rank of baron or higher.

In feudal Japan sumptuary laws were passed with a frequency and minuteness of scope that had no parallel in the history of the Western world. In the early 11th century, for instance, an imperial edict regulated the size of houses and imposed restrictions on the materials that could be used in their construction. During the Tokugawa period (1603–1867) sumptuary laws were passed in bewildering profusion, regulating the most minute details of personal life.

In the 20th century, democratization, industrial mass production, and the rise of consumer-oriented societies all combined to render sumptuary laws obsolete in most countries.

**Sumqayıt,** formerly SUMGAIT, city, eastern Azerbaijan. Sumqayıt lies at the mouth of the Sumqayıt River as it enters the Caspian Sea, on the northern side of the Abşeron Peninsula. Founded in 1944 as a suburb of Baku and achieving city status in 1949, Sumqayıt grew rapidly as a major chemical and metallurgical centre, largely on the basis of petroleum from the peninsula. Its vast modern factories produce aluminum, steel pipes for the oil industry, synthetic rubber, fertilizers, detergents, and petrochemicals. In February 1988 riots in the city killed more than 30 people, wounded some 200, and produced thousands of refugees; most of the victims were Armenians, who constituted a large minority of the population. Pop. (1991 est.) 236,200.

**Sumter,** city, seat (1798) of Sumter county, east-central South Carolina, U.S. Settled in 1785, it was named Sumterville (shortened in 1856) in honour of the American Revolutionary War general Thomas Sumter. In an agricultural area and once a typical cotton plantation village, Sumter is now primarily a commercial and trucking centre. Cotton and tobacco are still the chief cash crops. Industrial activities include food processing and the manufacture of furniture, batteries, and clothing. There are also veneer plants, textile-print and wool-dyeing works, cottonseed-oil mills, and fertilizer-mixing plants. Sumter is the site of Morris College (1908; Baptist), Central Carolina Technical College (1962), and a branch of the University of South Carolina (1966). The Swan Lake Iris Gardens in the city are known for their old cypress trees, azaleas, and camellias, as well as irises. Shaw Air Force Base is nearby. Inc. town, 1845; city, 1887. Pop. (1994 est.) 42,773.

**Sumter, Thomas** (b. Aug. 14, 1734, Hanover county, Va. [U.S.]—d. June 1, 1832, South Mount, S.C., U.S.), legislator and officer in the U.S. War of Independence, remembered for his leadership of troops against British forces in North and South Carolina, where he earned the sobriquet of the "Carolina Gamecock."

Sumter served in the French and Indian War and later moved to South Carolina. After the fall of Charleston (1780) he escaped to North Carolina, where he became brigadier general of state troops. After successes over the British at Catawba and at Hanging Rock (Lancaster county), he was defeated the same year at Fishing Creek (Chester county). He defeated Mayor Wemyss at Fishdam Ford and repulsed Colonel Banastre Tarleton at Blackstock (both in Union county) in November 1780. After the war Sumter served in the U.S. House of Representatives (1789–93; 1797–1801) and in the U.S. Senate (1801–10). He was the last surviving general officer of the War of Independence. Fort Sumter in Charleston Harbor was named for him.

**Sumy,** *oblast* (province), northeastern Ukraine. It lies on the southwestern margins of the Central Russian Upland. In the north in the Desna Basin is mixed forest, with extensive areas of marsh. South of the Seym River is forest steppe on soils of such high fertility that most of the natural vegetation of oak wood and steppe grasses has been cleared and put under the plow. Agriculture dominates the economy, chiefly cultivation of grains, sugar beets, tobacco, hemp, and potatoes; many cattle are kept. The reliance on agriculture has led to a steady decline of overall population since 1939, despite an increasing urban population. The *oblast*'s cities, including Sumy, an administrative and chemical centre, are small or midsized and engaged principally in processing farm produce, especially sugar refining. Some petroleum is obtained in the south of the *oblast.* Area 9,200 square miles (23,800 square km). Pop. (1994 est.) 1,424,700.

**Sumy,** city and administrative centre of Sumy *oblast* (province), northeastern Ukraine, on the Psel River. Although a settlement existed there in the 8th and 9th centuries, Sumy was founded as a fortress in 1652 and as a town in 1780. Among survivals of its past are the Cathedral of the Transfiguration and the Church of the Resurrection, both 18th century. Modern Sumy's industries produce machinery for the chemical industry, electron microscopes, pumps, and fertilizers and other chemicals. Light industries include sugar refining and other food processing and the production of clothing and footwear. Teacher-training and cultural institutes also are located there. Pop. (1993 est.) 307,000.

**Sun,** star around which the Earth and the other components of the solar system revolve. It is the dominant body of the system, constituting more than 99 percent of its entire mass. The Sun is a source of an enormous amount of energy, a portion of which provides the Earth with the light and heat necessary to support life.

A brief treatment of the Sun follows. For full treatment, *see* MACROPAEDIA: Solar System.

The Sun is a sphere of luminous gas 1,392,000 km (864,950 miles) in diameter. Its mass is $1.99 \times 10^{33}$ grams, or about 330,000 times the mass of the Earth. The Sun generates energy by nuclear fusion reactions in its core at a rate of $3.86 \times 10^{33}$ ergs per second. Although its core temperature is close to 15,000,000 K, the temperature of the surface of the Sun (the photosphere) is only about 6,000 K. This is average in terms of stellar temperatures, and the Sun is an average star in every respect. Just one of 100 billion stars in the Milky Way Galaxy, it is classified as a yellow dwarf of spectral class G2 and falls in the middle of the main sequence on the Hertzsprung-Russell diagram. The Sun's apparent magnitude is −26.5, but its absolute magnitude—the brightness it would appear to have at a standard distance of 10 parsecs (32.6 light-years)—is a mere +4.6, which is near the limit of naked-eye visibility. The Sun appears extremely bright to the terrestrial observer only because it is the star nearest the Earth, lying at an average distance of 149,600,000 km (92,957,000 miles).

The Sun is so massive that its constituent matter is strongly compressed by gravity. At the Sun's core, the compressed gas is at such a high temperature that nuclear-fusion reactions are triggered. The dominant energy-producing reaction at the core is the proton-proton chain. Under intense heat and pressure, protons (hydrogen nuclei) collide and combine one after the other to form stable helium nuclei. The helium nuclei are slightly less massive than the protons that combined to produce them, and this residual mass is released as energy. The Sun converts five million tons of matter into energy every second; this is a negligible proportion of its total mass. Energy is first released as gamma rays, but this form of electromagnetic radiation undergoes a considerable number of interactions with overlying material on its way to the photosphere. Several hundreds of thousands of years later, the degraded radiation emerges mainly as visible light and infrared radiation (heat). A by-product of the proton-proton reaction is neutrinos. Because these particles have neither mass nor electrical charge, they escape from the Sun at the speed of light. Recent experiments designed to detect solar neutrinos reaching the Earth, however, have found fewer than expected. This discrepancy may suggest that the Sun's core temperature is slightly cooler than 15 million K, that the exact mix of elements at the core is different from that inferred from the composition of its surface layers, or that the neutrinos interact with the solar mass and are converted into a different, undetectable form of neutrino.

Solar radiation emerges at the photosphere. Detailed spectral studies reveal that the composition of this region is about 90 percent hydrogen, 9.9 percent helium, and a small admixture of heavy elements (*e.g.,* iron, calcium, and sodium). This reflects the chemical makeup of the material from which the Sun was formed, though fusion reactions will have altered the mix in the interior.

Observations of the photosphere show that the Sun rotates slowly. Because it is a gaseous body, however, the Sun spins at different rates at different latitudes, with the equatorial regions spinning fastest. One rotation takes 36

days at the poles, but only 25 days at the equator. On more detailed examination, the photosphere is found to be in constant motion, literally bubbling up and down as energy emerges in a network of 1,000-kilometre wide granulation cells. It has been recently established that the whole solar surface oscillates back and forth about 4 km every 2 hours 40 minutes—nearly twice the predicted resonant period of vibration for the Sun.

The appearance of the photosphere is continually changing, with an increase or decrease in the number of sunspots. These areas of the solar surface, which may measure as much as 50,000 km across, are places where strong local magnetic fields inhibit the normal convective motions of the photosphere. The gas inside a sunspot is about 1,500 K cooler than its surroundings, and so the spot appears dark against the Sun's disk.

Magnetic activity extends into the Sun's atmosphere. Upward-moving jets of gas, called spicules, emerge from the chromosphere, the inner atmosphere that extends out to about 7,000 km above the solar surface. The spicules apparently follow the same loops of magnetic field that break through the photosphere to cause sunspots. In the corona, the outer atmosphere that constitutes the luminous envelope of the Sun, sudden changes in the local magnetic fields appear to result in the formation of prominences, especially eruptive ones—flame-like protuberances of coronal matter in which constituent atoms and ions emit light upon capturing electrons. Another type of feature, called a loop prominence, is produced by matter ejected into the corona by solar flares, violent eruptions associated with rapidly evolving magnetic fields in photospheric sunspot regions. Such eruptions initially release streams of high-speed electrons and atomic nuclei, followed by a secondary emission of large amounts of ultraviolet, gamma, and X radiation. The flares increase the intensity of the solar wind (*q.v.*), a continuous outflow of charged particles from the corona. The solar wind moves through interplanetary space at speeds of 350 to 700 km per second, and it extends at least to the orbit of Neptune.

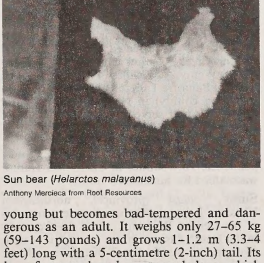
The solar activity cycle, during which the number of sunspots, prominences, and flares increase from minimum to maximum before decreasing again, extends for a period of 11 years. Although this cycle has recurred regularly for many thousands of years, the Sun appears to have remained virtually unchanged. The Sun is not expected to undergo any dramatic changes for another 5 billion years, when it will expand into a red giant star as it approaches the later stages of its life (*see* star).

**Sun, The,** morning newspaper published in Baltimore, long one of the most influential dailies in the United States. It was founded in Baltimore in 1837 by A.S. Abell as a four-page tabloid. Abell dedicated *The Sun* to printing the news without regard to its editors' prejudices, and within a year its circulation exceeded 12,000. It began as a penny paper aimed at a mass audience, but as it developed, *The Sun* came to be directed especially to a serious, intellectual, and issue-oriented readership. Its growth was slow but solid, as Abell rejected the prevailing wisdom that a newspaper should be a mouthpiece for a political party and held instead to an independent political line.

Through much of its history, *The Sun* has excelled at coverage of national and international news, at the same time placing less emphasis on local news. *The Sun* compiled an outstanding record in covering the Mexican War of 1846–48, in one famous instance reporting the fall of Vera Cruz (1847) before official tidings of the event reached the U.S. government. Its editors' discretion kept *The Sun* from being shut down by Union censors during the American Civil War.

Abell's death in 1888 gave control of the paper to his three sons, and they carried on in the founder's tradition. *The Sunday Sun* was first published in 1901 and was turned over to the editorship of the astute and acerbic H.L. Mencken in 1906. *The Evening Sun* was created out of the *Baltimore World,* bought in 1910. *The Sun* papers have always provided outstanding war coverage, particularly in World War II. The original morning *Sun* has rarely led the press of Baltimore in circulation but has done so regularly in prestige and in influence. *The Sun* newspapers, together with their corporate owner, the A.S. Abell Company, were bought by the Times Mirror Company in 1986.

**sun bear,** also called BRUANG, HONEY BEAR, or MALAYAN SUN BEAR (species *Helarctos,* or *Ursus, malayanus*), smallest member of the family Ursidae, found in Southeast Asian forests. The bear is often tamed as a pet when



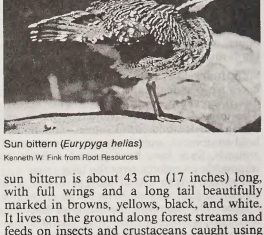
Sun bear (*Helarctos malayanus*)
Anthony Mercieca from Root Resources

young but becomes bad-tempered and dangerous as an adult. It weighs only 27–65 kg (59–143 pounds) and grows 1–1.2 m (3.3–4 feet) long with a 5-centimetre (2-inch) tail. Its large forepaws bear long, curved claws, which it uses for tearing or digging in its search for insect nests and colonies, particularly those of bees and termites. Other items of its omnivorous diet include fruit, honey, and small vertebrates.

Generally nocturnal, the tree-climbing sun bear is shy and retiring but quite intelligent. It has an orange-yellow-coloured chest crescent that according to legend represents the rising sun. Other light features (often including its muzzle and feet) contrast with its black coat of short, coarse fur.

**Sun Belt,** region comprising 15 southern states in the United States and extending from Virginia and Florida in the southeast through Nevada in the southwest, and also including southern California. Between 1970 and 1990, the South grew in population by 36 percent and the West by 51 percent, both well above the national average. Large in-migration, along with a high birth rate and a decline in out-migration, all contributed to rapid growth of both the Sun Belt's population and manufacturing activities. Improvements in transportation and communications, abundant air conditioning in summer, and a favourable winter climate are attractive forces for retirees as well as workers.

**sun bittern** (species *Eurypyga helias*), slender bird of tropical America, the sole member of the family Eurypygidae (order Gruiformes). It has strikingly patterned wings, which the male spreads in courtship and threat displays. The



Sun bittern (*Eurypyga helias*)
Kenneth W. Fink from Root Resources

sun bittern is about 43 cm (17 inches) long, with full wings and a long tail beautifully marked in browns, yellows, black, and white. It lives on the ground along forest streams and feeds on insects and crustaceans caught using its bill. It builds a bulky nest in trees and lays two or three rusty to brownish eggs that are incubated by both sexes.

**Sun Company, Inc.,** American holding company with a primary interest in petroleum. Headquarters are in Radnor, Pa.

The company was incorporated in 1971 as the successor to a New Jersey oil and gas business incorporated in 1901. The earlier company had been formed as the Sun Oil Company of Ohio in 1886. In 1975 the Sun Company was restructured into 14 separate business units to provide flexibility in expanding into areas not related to its petroleum business. Among its subsidiaries are the Sun Oil Company of Pennsylvania, which is responsible for U.S. manufacturing and marketing, and the Sun Oil Company (Delaware) and several Canadian units, which are responsible for the exploration and production of crude oil and natural gas in North America.

While the company continues to be active in the exploration and refining of petroleum and in the marketing of refined-oil and gas products, it has shown increasing interest in coal, geothermal-energy sources, and nonenergy activities—including real estate, industrial-products distribution, and motor-freight transportation. Its gasoline and other refined motor-oil products are sold through independent dealers, primarily in the eastern two-thirds of the United States and eastern Canada, under the trade names of Sunoco and DX. In addition, the company produces lubricating oils, petrochemicals, greases, and specialty oils sold in North America and overseas. The company also engages in shipbuilding and repair and the manufacture of heavy-industrial equipment.

**sun compass:** *see* solar compass.

**sun dance,** most spectacular and important religious ceremony of the Plains Indians of 19th-century North America. Ordinarily held by each tribe once a year in early summer, it was an occasion when all could gather with guests from other tribes and reaffirm their basic beliefs about the universe and the supernatural through words, ceremonies, and symbolic objects.

The ceremony was most highly developed among the Arapaho, Cheyenne, and Oglala Sioux (and may have originated with these tribes). By the end of the 19th century, it had spread with local variations to include most of the tribes from the Plains Ojibwa in Saskatchewan south to the Kiowa in Texas. The sun dance is an example of the many individual quests for "power" (spiritual energy and insight) or aid from the supernatural that became elaborated as tribal ceremonies. In many instances it was a private experience involving just one votary or a small group

of them. The development of total tribal participation, widespread cooperative effort, direction by tribal and religious leaders, and elaboration beyond the immediate sun dance indicate the meaning of this ceremony in terms of tribal aspirations (secular and religious) and in the reinforcement of social control.

In the most elaborate versions a great camp circle was formed, preliminary instruction was given to the pledger and his associates, necessary supplies were gathered, and a dance structure was erected with a central pole to symbolize a source of spiritual and mystical power (*e.g.,* the sun). Preliminary dances by others and the erection of an altar were followed by the sun dance itself. This continued intermittently for several days and nights; during this time those dancers who were fulfilling a vow or seeking power neither ate nor drank, their sacrifice ending in frenzy and exhaustion. Among some tribes self-torture and mutilation ended the rite.

The United States government outlawed the sun dance in 1904. Nevertheless, among a number of tribes, benign forms of the ceremony continued, usually as part of Fourth of July celebrations. There were a few tribes, however, that have attempted to revive the sun dance in its original form and meaning.

**sun-grebe** (bird): *see* finfoot.

**Sun I-Hsien:** *see* Sun Yat-sen.

**Sun-Joffe Manifesto** (Jan. 26, 1923), joint statement issued at Shanghai by the Chinese Nationalist revolutionary leader Sun Yat-sen and Adolf Joffe, representative of the Soviet Foreign Ministry, which provided the basis for cooperation between the Soviet Union and Sun's Kuomintang, or Nationalist Party.

In preliminary negotiations, Sun agreed to the formation of a United Front between the small Chinese Communist Party and the Kuomintang. The Communists were to retain their Communist Party membership but would join the Kuomintang as individuals, thus constituting a "bloc within" the party. In return, the Soviet Union pledged military and political aid to the Kuomintang.

The Soviets were convinced that a bourgeois democratic revolution must occur in China before the country could be ready for socialism and that the occurrence of a bourgeois revolution in China would lead to the destruction of Western imperialism and thus would severely weaken the capitalist system. In the manifesto, therefore, Joffe agreed that the Soviets would support Sun's program to reunify China and would renegotiate the unequal treaties forced on China by imperial Russia. Sun, however, agreed to a continued Russian presence in Outer Mongolia and to a recognition of Soviet rights to the Chinese Eastern Railway, which ran across Manchuria (Northeast Provinces) and connected Siberia with the Soviet warm-water port of Vladivostok.

Sun appointed his assistant Liao Chung-k'ai to accompany Joffe to Japan and to learn more about the Soviet system from him. Another assistant, Chiang Kai-shek, was sent to Moscow to study with Leon Trotsky and learn Soviet methods of military organization.

**Sun King, The:** *see* Louis XIV *under* Louis (France).

**Sun Microsystems, Inc.,** American manufacturer of computers and software with headquarters in Palo Alto, Calif.

Andreas Bechtolsheim, William Joy, Vinod Khosla, and Scott McNealy founded Sun in 1982 for the purpose of selling low-cost, high-performance desktop computers running the UNIX operating system. These computer workstations found immediate acceptance among engineers, software developers, and scientists who benefited from having their own dedicated machines.

By using the UNIX operating system, which had long been a part of the computer-science curriculum in universities worldwide, Sun was able to claim that its workstations incorporated international standards and were therefore "open," whereas its competitors' products were "closed" because they used proprietary operating systems. Moreover, UNIX computers were used during the development of ARPANET—the predecessor to the Internet. This combination of UNIX and universities helped place Sun's computers among the most common Internet servers.

McNealy was famous for his assertion that "the network is the computer," which epitomized Sun's approach to networking interoperability. In 1995 Sun introduced the Java programming language to overcome problems associated with networking different manufacturers' machines, often running different operating systems. According to its supporters, Java was a "Write once, run anywhere" computer language, meaning that software written in Java would not have to be rewritten for each computer operating system. Such versatility made Java a popular language for writing applications for the Internet.

**sun orchid,** any of about 45 plant species of the genus *Thelymitra,* family Orchidaceae, distributed throughout Australasia. The flowers of all species have a hooded column with tufted, comblike, or earlike appendages.

Sun orchids remain closed except in strong sunlight. Some self-pollinating species never open their flowers. The lemon orchid (*T. antennifera*), the twisted sun orchid (*T. flexuosa*), the custard orchid (*T. violosa*), and the scented sun orchid (*T. avistata*) are common Australian species.

**sun rose,** also called ROCK ROSE, any of about 100 species of low-growing flowering plants making up the genus *Helianthemum* in the rock rose family (Cistaceae), the flowers of which resemble single roses. They include several sunny garden plants, varieties of which are useful in rock gardens and wild gardens.

*Helianthemum apenninum, H. cinereum, H. glaucum,* and *H. hirsutum* are dwarf shrubby wildlings native to Europe. *H. nummularium,* also European, has many cultivated varieties with flowers ranging from white to yellow and pink. In North America *H. canadense,* also called frostweed, *H. corymbosum,* and *H. rosmarinifolium* are low eastern wildlings. *H. scoparium,* called rock, or sun, rose, is a rushlike shrub that grows to 30 cm (1 foot) in height and is native to California.

Also known as rock rose (*q.v.*) are related plants of the genus *Cistus* (family Cistaceae).

**Sun Tzu,** also spelled SUN-TZU (fl. early 4th century BC), reputed author of the Chinese classic *Ping-fa* (*The Art of War*), the earliest known treatise on war and military science.

The book is traditionally attributed to Sun Tzu (personal name Sun Wu), a military strategist and general who served the state of Wu near the end of the Spring and Autumn Period (770–476 BC). It is more likely, however, that it was written early in the Warring States period (475–221 BC), at a time when China was divided into six or seven states that often resorted to war with each other in their struggles for supremacy.

*The Art of War* is a systematic guide to strategy and tactics for rulers and commanders. The book discusses various maneuvers and the effect of terrain on the outcome of battles. It stresses the importance of accurate information about the enemy's forces, dispositions and deployments, and movements. This is summarized in the axiom "Know the enemy and know yourself, and you can fight a hundred battles with no danger of defeat." It also emphasizes the unpredictability of battle and the use of flexible strategies and tactics. The book's insistence on the close relationship between political considerations and military policy greatly influenced some modern strategists. Mao Zedong and the Chinese Communists took from *The Art of War* many of the tactics they utilized in fighting the Japanese and, later, the Chinese Nationalists.

**Sun Valley,** city in Blaine county, Idaho, U.S. Sun Valley is a famous year-round recreation area and winter sports resort along the Big Wood River in Sawtooth National Forest, just east of Ketchum. Because of its fine snowpack and calm weather, it was developed by the Union Pacific Railroad, which built Sun Valley Lodge (1936). The skiing slopes of Dollar and Baldy mountains are protected from north winds by the Sawtooth Range. Elevation ranges from 6,000 feet (1,830 m) at the valley floor to 9,200 feet (2,800 m) atop Mount Baldy. Pop. (2000 est.) 1,427.



Skiers on Mount Baldy, Sun Valley, Idaho
H. Gritscher—Peter Arnold, Inc.

**sun worship,** veneration of the sun or a representation of the sun as a deity, as in Atonism in Egypt in the 14th century BC.

Although sun worship has been used frequently as a term for "pagan" religion, it is, in fact, relatively rare. Though almost every culture uses solar motifs, only a relatively few cultures (Egyptian, Indo-European, and Meso-American) developed solar religions. All of these groups had in common a well-developed urban civilization with a strong ideology of sacred kingship. In all of them the imagery of the sun as the ruler of both the upper and the lower worlds that he majestically visits on his daily round is prominent.

The sun is the bestower of light and life to the totality of the cosmos; with his unblinking, all-seeing eye, he is the stern guarantor of justice; with the almost universal connection of light with enlightenment or illumination, the sun is the source of wisdom.

These qualities—sovereignty, beneficence, justice, and wisdom—are central to any elite religious group, and it is within these contexts that a highly developed solar ideology is found. Kings ruled by the power of the sun and claimed descent from the sun. Solar deities, gods personifying the sun, are sovereign and all-seeing. The sun is often a prime attribute of or is identified with the Supreme Deity.

In ancient Egypt the sun god Re was the dominant figure among the high gods and retained this position from early in that civilization's history. In the myth relating the voyage of the sun god over the heavenly ocean, the sun sets out as the young god Kheper; appears at noon in the zenith as the full-grown sun, Re; and arrives in the evening at the western region in the shape of the old sun god, Atum. When the pharaoh Ikhnaton reformed Egyptian religion, he took up the cult of the ancient deity Re-Horakhte under the name of Aton,

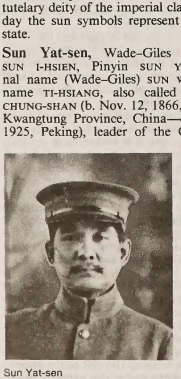
an older designation of the Sun's disk. Under Akhenaton, the sun's qualities as creator and nourisher of the Earth and its inhabitants are glorified.

The sun-god occupied a central position in both Sumerian and Akkadian religion, but neither the Sumerian Utu nor the Semitic Shamash was included among the three highest gods of the pantheon. The sun was one of the most popular deities, however, among the Indo-European peoples and was a symbol of divine power to them. Sūrya is glorified in the Vedic hymns of ancient India as an all-seeing god who observes both good and evil actions. He expels not only darkness but also evil dreams and diseases. Sun heroes and sun kings also occupy a central position in Indian mythology, where Vivasvant, the father of Yama, corresponds to the Iranian Vivahvant, the father of Yima. There is a dynasty of sun kings, characteristically peaceful, that is quite distinct from the warlike moon kings. In medieval Iran, sun festivals were celebrated as a heritage from pre-Islāmic times. The Indo-European character of sun worship is also seen in the conception of the solar deity, drawn in his carriage, generally by four white horses, common to many Indo-European peoples, and recurring in Indo-Iranian, Greco-Roman, and Scandinavian mythology.

During the later periods of Roman history, sun worship gained in importance and ultimately led to what has been called a "solar monotheism." Nearly all the gods of the period were possessed of solar qualities, and both Christ and Mithra acquired the traits of solar deities. The feast of Sol Invictus (Unconquered Sun) on December 25 was celebrated with great joy, and eventually this date was taken over by the Christians as Christmas, the birthday of Christ.

The most famous type of solar cult is the Sun Dance (*q.v.*) of the Plains Indians of North America. In the Pre-Columbian civilizations of Mexico and Peru, sun worship was a prominent feature. In Aztec religion extensive human sacrifice was demanded by the sun gods Huitzilopochtli and Tezcatlipoca. In both Mexican and Peruvian ancient religion, the Sun occupied an important place in myth and ritual. The ruler in Peru was an incarnation of the sun god, Inti. In Japan the sun goddess, Amaterasu, who played an important role in ancient mythology and was considered to be the supreme ruler of the world, was the tutelary deity of the imperial clan, and to this day the sun symbols represent the Japanese state.

**Sun Yat-sen,** Wade–Giles romanization SUN I-HSIEN, Pinyin SUN YIXIAN, original name (Wade–Giles) SUN WEN, courtesy name TI-HSIANG, also called JIH-HSIN, or CHUNG-SHAN (b. Nov. 12, 1866, Hsiang-shan, Kwangtung Province, China—d. March 12, 1925, Peking), leader of the Chinese Kuomintang (Nationalist Party), known as the father of modern China. Influential in overthrowing the Manchu dynasty (1911), he served as the first provisional president of the Republic of China (1911–12) and later as de facto ruler (1923–25).



Sun Yat-sen
Brown Brothers

*Early life and influences.* Sun was born to a family of poor farmers in Hsiang-shan, in the South Chinese province of Kwangtung. In 1879 his brother Sun Mei, who had earlier emigrated to Hawaii as a labourer, brought him to Honolulu, where, as a student at a British missionary school for three years and at an American school, Oahu College, for another year, he first came into contact with Western influences. Because his brother objected to his penchant for Christianity, Sun returned to his native village in 1883 and went to study at the Diocesan Home in Hong Kong in the fall of the next year.

In 1885 he transferred to the Government Central School (later known as Queen's College) and married Lu Mu-chen (1867–1952), the girl chosen for him by his parents. Out of this marriage a son and two daughters were born. In either 1884 or 1885 Sun was baptized by an American missionary. After another trip to Hawaii, he enrolled in the Canton Hospital Medical School in 1886. He transferred later to the College of Medicine for Chinese in Hong Kong and was graduated in 1892.

Although not trained for a political career in the traditional style, Sun was nevertheless ambitious and was troubled by the way China, which had clung to its traditional ways under the conservative Ch'ing dynasty, suffered humiliation at the hands of more technologically advanced nations. Forsaking his medical practice in Canton, he went north in 1894 to seek political fortunes. In a long letter to Li Hung-chang, governor general of Chihli, he set forth his ideas of how China could gain strength, but all he received from Li was a perfunctory endorsement of his scheme for an agricultural–sericultural association. With this scant reference, Sun went to Hawaii in October 1894 and founded an organization called the Revive China Society (Hsing-Chung hui), which became the forerunner of the secret revolutionary groups Sun later headed. As far as it can be determined, the membership was drawn entirely from natives of Kwangtung and from lower social classes, such as clerks, peasants, and artisans.

*Years in exile.* Taking advantage of China's defeat in the Sino-Japanese War (1894–95) and the ensuing crisis, Sun went to Hong Kong in 1895 and plotted for an uprising in Canton, the capital of his native province. When the scheme failed, he began a 16-year exile abroad.

In 1896, under circumstances not entirely clear, Sun was caught and detained for 13 days by the Chinese legation in London. It appears likely that Sun ran into a fellow Cantonese who worked for the legation and was found out and seized while visiting him under an alias. The legation planned to ship Sun back to China, but, before this could be done, Sun had converted a British employee at the legation to his side and got word through to James Cantlie, former dean of Hong Kong College of Medicine. The British Foreign Office intervened, and Sun was released from his captivity. The incident engendered great publicity and gave Sun's career a powerful boost.

After spending much of the ensuing eight months reading in the British Museum, Sun travelled to Japan by way of Canada. Arriving in July 1897, he was met by Miyazaki Torazō, an adventurer who had heard of the London incident and who was willing to help Sun in his political activities. Miyazaki introduced Sun to many influential Japanese, including Ōkuma Shigenobu, Soejima Taneomi, and Inukai Tsuyoshi, from some of whom Sun was to receive both political and financial assistance.

During the turmoil of 1900, Sun participated in secret manoeuvres involving Sir Henry Blake, the British governor of Hong Kong, and Ho Kai, an influential Chinese in that colony. Their aim was to persuade Li Hung-chang to declare independence from the Ch'ing. Responding to an invitation by Li's staff, Sun journeyed to Hong Kong, but, fearing a trap, he did not go ashore. Instead, he was represented by Miyazaki and two other Japanese at the meeting, which proved fruitless.

Previously, Sun had made contact with bandits and secret societies in Kwangtung. These forces began a revolt in Hui-chou in October 1900. The campaign, the second of 10 claimed by Sun between 1895 and 1911, lasted 12 days.

*Founding of the Alliance Society.* The year 1903 marked a significant turning point in Sun's career; from then on, his following came increasingly from the educated class, the most prestigious and influential group in China. For this decisive change Sun owed much to two factors: the steady decline of the Ch'ing dynasty and the powerful propaganda of Liang Ch'i-ch'ao, a reformist who fled to Japan in 1898, founded a Chinese press, and turned it into an instant success. Liang did not actually oppose the Ch'ing regime, but his attacks on the Dowager Empress, who effectively ruled the country, served to undermine the regime and make revolution the only logical choice. As a consequence, Sun's stock rose steadily among the Chinese students abroad. In 1904 he was able to establish several revolutionary cells in Europe, and in 1905 he became head of a revolutionary coalition, the Alliance Society (T'ung-meng hui), in Tokyo. For the next three years the society propagandized effectively through its mouthpiece, "People's Journal" (*Min pao*).

The rise in Sun's fortune increased many of his difficulties. The Alliance Society was very loosely organized, and Sun had no control over the individual members. Worse still, all the revolts Sūn and the others organized ended in failure. The members fell into despair, and outside financial contributions declined. Furthermore, as a result of pressures exercised by the Ch'ing, foreign governments increasingly shunned Sun. In 1907 the Japanese government gave him a sum of money and asked him to leave the country. A year later French Indochina, where Sun had hatched several plots, banned him completely. Hong Kong and several other territories were similarly out of his reach.

In the circumstances, Sun spent a year in 1909–10 touring Europe and the United States. Returning to Asia in June 1910, he left for the West again in December after a meeting with other revolutionaries, in which they decided to make a massive effort to capture Canton. This time Sun raised more money in Canada and the United States, but the uprising of April 27 in Canton (known as the March 29 Revolution, because of its date in the Chinese calendar) fared no better than the earlier plots. The possibility of revolutionary success seemed more remote than ever.

But help was to come from the Ch'ing. If only for self-preservation, the court had sponsored reform since 1901. In the next few years it reorganized the army, instituted a school system, abolished the civil-service examinations based on traditional Chinese scholarship, reconstructed many government organs, and convened provincial and national assemblies. The educated class nevertheless remained unsatisfied with the tempo of change, and the regime was rapidly losing its grip over the situation.

*The revolution of 1911.* In 1911 the Ch'ing decided to nationalize all the trunk railways, thus incurring the wrath of local vested interests. Armed rebellion broke out in the province of Szechwan, and the court exposed itself to further attacks by failing to suppress it. In October of the same year a local revo-

lutionary group in Wu-han, one of many in China by this time, began another rebellion, which, in spite of its lack of coordination, unexpectedly managed to overthrow the provincial government. Its success inspired other provincial secessions.

Sun Yat-sen learned of the Wu-han revolution from the newspapers while he was in Denver, Colo. He returned to Shanghai in December and was elected provisional president by delegates meeting in Nanking. Knowing that his regime was weak, Sun made a deal with Yüan Shih-k'ai, an Imperial minister who had been entrusted with full power by the court. On Feb. 12, 1912, the emperor abdicated; the next day Sun resigned, and on the 14th Yüan was elected his successor.

*Later struggles.* In September, Yüan appointed Sun director general of railway development. Their entente might have lasted if Sung Chiao-jen, who had reorganized the Alliance Society into the Kuomintang and was serving as its head, had not been assassinated in March 1913, reportedly at Yüan's instigation. This precipitated a second revolution, in which Sun opposed Yüan. When the campaign failed, Sun fled once again to Japan. While there, he unavailingly sought Japanese aid by promising vast concessions in China, and he also alienated many revolutionaries by requiring them to take an oath of personal allegiance to him. He was also criticized for marrying his secretary, Soong Ch'ing-ling (November 1914), without divorcing his first wife.

A combination of internal opposition and external pressures defeated Yüan in 1916. The next year Sun went from Shanghai to Kwangtung to launch a movement against the premier, Tuan Ch'i-jui. Elected generalissimo of a separatist regime in July, Sun had to resign and leave for Shanghai toward the middle of 1918, when he lost the support of Lu Jung-t'ing, the military overlord of Kwangtung.

Earlier, Lu had agreed to Sun's gaining control over 20 battalions of armed guards if the forces would remain outside Kwangtung. Accepting this condition, Sun appointed Ch'en Chiung-ming as the commander and dispatched his men to Fukien. By persuading Ch'en to fight Lu, Sun found his way back to office for another 16 months, at the end of which Ch'en turned against him, and Sun had to leave for Shanghai again. From that sanctuary, he wooed the troops from Kwangsi and Yunnan, and with their help he again returned to Canton. In February 1923 he installed himself as generalissimo of a new regime.

Meanwhile, a new factor had risen in Sun's political life. Unsuccessful at obtaining aid from the West and Japan, he looked increasingly to the Soviet government, which had come to power in Russia in 1917. A Soviet diplomat, Adolf Joffe, visited Sun in Shanghai in both 1922 and 1923. On the latter occasion the two issued a joint manifesto declaring that the Communist system was not suitable for China, that Russia intended to give up its privileges there, and that Russia had no intention of extending its influence over Outer Mongolia. At Soviet prodding, the Chinese Communist Party resolved to cooperate with the Kuomintang.

In October 1923, Mikhail Borodin, a representative of the Comintern (Communist International), arrived at Canton and soon gained Sun's confidence. Early in 1924 Sun reorganized the Kuomintang as a tightly disciplined body with authority descending from the top to the lower levels on the model of the Soviet Communist Party. Under his directive a party congress elected three Communists to its central executive committee and approved the establishment of a military academy (of which Sun appointed Chiang Kai-shek president). Part of his party-building efforts were a series of lectures Sun delivered on his own doctrine, the Three Principles of the People.

Although these actions strengthened the Kuomintang, there was still considerable opposition to Sun's authority when he died of cancer in Peking in March 1925. His coffin remained uninterred in a temple in Hsi-Shan until 1929, when it was moved to a mausoleum in Nanking.

*Assessment.* Sun's political doctrines are summarized in his Three Principles of the People (nationalism, democracy, and people's livelihood—the last involving the regulation of private capital and "equalizing land rights") and his Plan for National Reconstruction, which explained basic parliamentary procedures, attacked the traditional Chinese saying that to know is easier than to do, and set forth a grandiose plan for China's industrialization, concocted by Sun without much help from engineers or economists.

Although sanctified by his followers, Sun's doctrine was not his major strength. All contemporary sources attribute to him a magnetic personality, a great capacity for tolerating others' weaknesses, a singular dedication to the pursuit of power, and a knowledge of the West unequaled by that of any of his political rivals. Perhaps the last factor is the most important, for it is this that set Sun apart and made him the symbol of Chinese modernization. Quite fittingly, the Chinese Communists call him "a pioneer of the revolution." (Y.C.W.)

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**sunbeam snake** (*Xenopeltis unicolor*), primitive, little-known burrowing serpent found in cultivated and other open regions of India and southeast Asia. It is sometimes classified as the sole member of the family Xenopeltidae. Its colour is dark brown or black, but it is highly iridescent (hence the common name). The sunbeam snake reaches a length of 1 m (about 3 feet). It feeds on lizards, other snakes, frogs, and small rodents. A characteristic movement of the alarmed sunbeam snake is the excited twitching of the tail, which resembles the action of the rattlesnake. The sunbeam, however, is harmless to humans.

A genus of Central American snake, *Loxocemus,* is often included in the Xenopeltidae because of its structural similarities. Otherwise, because of its vestigial hindlimbs and primitive skull, it is placed with the pythons and boas in the family Boidae.

**sunbird,** any of about 95 species of the songbird family Nectariniidae (order Passeriformes) that have brilliant plumage in breeding males. They are 9 to 15 cm (3½ to 6 inches) long and live chiefly on nectar. Unlike



Sunbird (*Cinnyris*)
G.J. Broekhuysen—Ardea, London

hummingbirds, sunbirds rarely hover while feeding but instead perch on the flower stalk. Sunbirds are most numerous in Africa but occur eastward to Pacific islands. A widely distributed African species is the splendid sunbird (*Cinnyris coccinigaster*), with purple head, green back, and black wings and tail. A related group, the spider hunters (*Arachnothera*), are plain species with longer bills and shorter tails; they are found in Southeast Asia.

**sunburn,** acute cutaneous inflammation caused by overexposure to ultraviolet (UV) radiation of the so-called UVB wavelength band (290–320 nanometre; a nanometre is $10^{-9}$ metre), which originates from sunlight or artificial sources. Reactions to overexposure range in severity from mild redness and tenderness to intense pain, edema (swelling), and blistering; systemic symptoms include shock, chills, fever, and nausea. The visible manifestations of sunburn usually begin within 6–12 hours after the first ultraviolet exposure and peak within 24–28 hours, followed by a gradual easing of symptoms and light tanning or "peeling" (the sloughing off of the skin), depending on the severity of the burn.

Sunburn begins within 15 minutes after exposure to UV rays, triggering inflammation (the erythema, or redness). To limit epidermal damage, the pigment melanin (which is produced by epidermal cells called melanocytes) darkens through oxidation. Melanocytes increase in both size and number within two to three days, producing more melanin. Within days, a protective tan (in mild cases of sunburn) is formed.

Cold compresses applied to the affected skin and analgesic medicines can relieve some of the pain of sunburn. Severe sunburn can be prevented by limiting exposure to ultraviolet rays until a sufficient protective tan has developed or by applying a sunscreen that contains either para-aminobenzoic acid (PABA) or benzophenones. A long-term effect of prolonged and repeated exposure to sunlight can cause a number of skin disorders, including basal-cell carcinomas (small, smooth nodules) that usually appear on the face.

**Sunbury,** town, south-central Victoria, Australia, on the road and rail route between Bendigo and the state capital, Melbourne, 24 miles (39 km) to the southeast. The Aboriginal name for the area was Koora Kooracup, but, when a gold rush to Bendigo began in 1851, a hotel (built on Jacksons Creek to house travelers to the goldfield) was named Sunbury, after Sunbury, Middlesex, England; the town took its name from the hotel. Surveyed in 1851 and proclaimed a municipality in 1866, Sunbury is now the service centre for a prosperous district supporting dairying, sheep grazing, and the growing of wheat, oats and barley. Many of its fine 19th-century buildings have been classified by Australia's National Trust. Pop. (1981) 11,085.

**Sunbury,** city, seat (1772) of Northumberland County, east-central Pennsylvania, U.S., on the Susquehanna River, 50 miles (80 km) north of Harrisburg. Located on the site of Shamokin, a Susquehanna Indian village, it was laid out in 1772 by John Lukens, surveyor general of Pennsylvania, and named after Sunbury, Middlesex, Eng. Fort Augusta, a settlers' bulwark against Indian attacks, was built in 1756. In July 1883, Thomas Edison began operating in Sunbury the world's first three-wire central electric-lighting station. The city is an industrial and agricultural marketing centre, manufacturing textiles, metal products, and construction materials. Shamokin Dam (Fabridam), an inflated fabric-tube dam barrage impounding the Susquehanna River, has created the 3,000-acre (1,214-hectare) Augusta

Lake for recreation. Inc. borough, 1797; city, 1922. Pop. (1990) 11,591.

**Sunch'ŏn,** city, Chŏlla-nam *do* (province), southern South Korea. Located on the Yŏsu Peninsula, 87 miles (140 km) southeast of Kwangju, the provincial capital, it is an administrative and economic centre of the eastern part of the province. It is connected by rail with Seoul through Kwangju and Taejŏn and, since 1968, has been connected with Pusan through Chinju and Masan. A transportation junction, it is also a service centre for the surrounding area. Songgwang Temple, one of the three largest Buddhist temples in South Korea and the country's centre of Sŏn Buddhism (the Korean form of Zen), is located northwest of the city. Pop. (1985 prelim.) 121,938.

**Sunda Double Trench** (Indian Ocean): *see* Java Trench.

**Sunda Islands,** group of islands extending from the Malay Peninsula to the Moluccas southeast of the Asiatic mainland toward New Guinea. They include the Greater Sundas (Sumatra, Java, Borneo, Celebes, and adjacent smaller islands) and the Lesser Sundas (Bali, Lombok, Sumbawa, Sumba, and Flores, Timor, Alor, and adjacent smaller islands). With the exception of Borneo, eastern Sumatra, and nearby areas, they belong to the zone of island arcs and submarine ridges, lying between Asia and Australia, which are geologically unstable and volcanically active. Bounded by the Indian Ocean on the south and west and by the Strait of Malacca, the South China Sea, and the Celebes Sea on the north and east, the islands surround the Java, Flores, and Savu seas. The islands include most of the land area of Indonesia, with only northern and northwestern Borneo not under Indonesian political control. Malaysian cultures and languages predominate in the area.

**Sunda Shelf,** stable continental shelf, or platform, a southward extension of mainland Southeast Asia. Most of the platform is covered by shallow seas, including the southern South China Sea, the Gulf of Thailand, and the Java Sea, averaging less than 330 feet (100 m) in depth. Borneo and parts of Java, Sumatra, and associated islands are eroded metamorphic sections of the shelf left above sea level. The entire shelf, which has an area of 690,000 square miles (1,800,000 square km), was above sea level at one time, as is illustrated by the remaining traces of a stream network, the channels of which cross north over the shelf into the South China Sea Basin, and a second network going east into the Sunda Depression and the Flores Trough. The Sunda is separated from the Sahul Shelf (south) by the volcanic (and volcanically active) Lesser Sunda Islands and associated deeps. The existence of the shelf was first (1845) reported by G.W. Earl.

**Sunda Strait,** Indonesian SELAT SUNDA, channel, 16–70 miles (26–110 km) wide, between the islands of Java (east) and Sumatra, that links the Java Sea (Pacific) with the Indian Ocean (south). There are several volcanic islands within the strait, the most famous of which is Krakatoa, which erupted in 1883, destroying 300 towns and villages and killing about 36,000 people. The strait was the scene of an encounter between U.S. and Japanese forces in March 1942. The Sunda Strait is an important passage connecting the Indian Ocean with eastern Asia.

**Sundance Kid,** byname of HARRY LONGABAUGH, or LONGBAUGH (b. 1870, Phoenixville, Pa., U.S.—d. 1909?, Concordia Tin Mines, near San Vicente, Bolivia?), American outlaw, reputed to be the best shot and fastest gunslinger of the Wild Bunch, a group of robbers and rustlers who ranged through the Rocky Mountains and plateau desert regions of the West in the 1880s and '90s.

Harry Longabaugh left home when he was 15 and took his nickname from the town of Sundance, where he was imprisoned (for his first and only time) from August 1887 to February 1889 for stealing a horse. After release he headed for the hideout of Hole in the Wall in central Wyoming and began his outlaw career.

At the turn of the century, the Sundance Kid joined with Butch Cassidy and a girlfriend, Etta Place, and in 1901 drifted to New York City and then South America, where they set up ranching in Chubut province, Argentina. In 1906 he and Cassidy returned to outlawry, robbing banks, trains, and mining interests in Argentina, Bolivia, Chile, and Peru. (Sundance escorted the ailing Etta Place back to the United States in 1907 but then returned to South America.) In 1909, according to Pinkerton accounts, the two outlaws were cornered by a Bolivian cavalry unit; Sundance was mortally wounded, and Cassidy took his own life. Another story puts their death at a bank robbery in Mercedes, Uruguay, in 1911; still other stories have Sundance surviving and returning to the United States and dying in obscurity under a new name (Harry Long) somewhere in the West (perhaps Casper, Wyo.) in the 1930s or as late as 1957.

**Sundanese,** one of the three principal ethnic groups of the island of Java, Indonesia. The Sundanese, estimated to number about 25,850,000 in the late 20th century, are a highland people of western Java, distinguished from the Javanese mainly by their language and their strict adherence to the Muslim faith.

Historically they were first recorded under the Indo-Javanese Brahmanical states (8th century AD) and subsequently accepted the Mahāyāna Buddhism adopted by the Shailendra kingdom. Muslim trade influenced them to accept Islām in the 16th century, the people of Bantam being especially fervent; however, animistic and Hindu influences survive.

The Sundanese village is ruled by a headman and a council of elders. The single-family houses are made of wood or bamboo, raised on piling. Rice culture and ironworking, as well as marriage, birth, and death ceremonies, conform closely to the Javanese pattern, though often mixed with elements of Hindu origin. The Sundanese language, like Javanese, has status styles: *kasar* (informal), *halus* (deferential), and *panengah* (a middle style).

The opening of roads into the highlands, development of the plantation economy, and the establishment of village schools have tended to erase differences between the Sundanese and other peoples of Java. They have spread into central Java and into the Lampung area of southern Sumatra.

**Sundarbans,** formerly SUNDERBUNDS, vast tract of forest and saltwater swamp forming the lower part of the Ganges Delta, extending about 160 miles (260 km) along the Bay of Bengal from the Hooghly River Estuary (India) to the Meghna River Estuary in Bangladesh. The whole tract reaches inland for 60–80 miles (100–130 km). A network of estuaries, tidal rivers, and creeks intersected by numerous channels, it encloses flat, marshy islands covered with dense forests.

The name *Sundarbans* is perhaps derived from the term meaning "forest of *sundari*," a reference to the large mangrove tree that provides valuable fuel. Along the coast the forest passes into a mangrove swamp; the southern region, with numerous wild animals and crocodile-infested estuaries, is virtually uninhabited. It is one of the last preserves of the Bengal tiger and the site of a tiger preservation project. The cultivated northern area yields rice, sugarcane, timber, and betel nuts.

**Sunday,** first day of the week; in Christianity, the Lord's Day, the weekly memorial of Jesus Christ's Resurrection from the dead. The practice of Christians gathering together for worship on Sunday dates back to apostolic times, but details of the actual development of the custom are not clear. Before the end of the 1st century AD, the author of Revelation gave the first day its name of the "Lord's Day" (Rev. 1:10). Saint Justin Martyr (*c.* 100–*c.* 165), philosopher and defender of the Christian faith, in his writings described the Christians gathered together for worship on the Lord's Day: the gospels or the Old Testament was read, the presiding minister preached a sermon, and the group prayed together and celebrated the Lord's Supper.

The emperor Constantine (d. 337), a convert to Christianity, introduced the first civil legislation concerning Sunday in 321, when he decreed that all work should cease on Sunday, except that farmers could work if necessary. This law, aimed at providing time for worship, was followed later in the same century and in subsequent centuries by further restrictions on Sunday activities. *See also* Sabbatarianism; week.

**Sunday, Billy,** byname of WILLIAM ASHLEY SUNDAY (b. Nov. 19, 1862/63, Ames, Iowa, U.S.—d. Nov. 6, 1935, Chicago), American evangelist whose revivals and sermons reflected the emotional upheavals caused by transition from rural to industrial society in the United States.

Sunday grew up as an orphan and worked as an undertaker's assistant before entering professional baseball in 1883. In 1891 he gave up baseball to become a YMCA worker but turned in 1896 to conducting religious revivals in major American cities. Ordained a Presbyterian minister in 1903, Sunday was theologically a Fundamentalist. Following the lead of the American evangelist Dwight L. Moody, and with the aid of a choir director named Homer A. Rodeheaver and a score of revival "specialists," he conducted more than 300 revivals with an estimated attendance of 100,000,000.

Also prominent in the movement to prohibit liquor sales in the United States, Sunday reached the peak of his fame in his New York City revival of 1917, two years before prohibition became national policy by constitutional amendment. He claimed that 1,000,000 "hit the sawdust trail" to come forward and profess their conversion to Christ as a result of his preaching. Considered by some critics a sensationalist, he nevertheless gained the enthusiastic support of evangelical churches and influential laymen.

**Sunday school,** also called CHURCH SCHOOL, or CHRISTIAN EDUCATION, school for religious education, usually for children and young people and usually a part of a church or parish. The movement has been important primarily in Protestantism.

Although religious education of various types had been known earlier within Christianity, the beginning of the modern Sunday school can be traced to the work of Robert Raikes (1736–1811), a newspaper publisher in Gloucester, Eng., who was interested in prison reform. He decided that young children, many of whom were employed in factories every day except Sunday, could be deterred from a life of crime if they were given basic and religious education on Sundays. The first school was opened in 1780 with the cooperation of the Anglican parish minister, although lay people were in charge. Classes were held in the teachers' homes. After three years, Raikes's writing about the Sunday schools in Gloucester in his newspaper aroused interest, and the system was copied throughout the British Isles. Some church officials opposed the schools because they thought that teaching interfered with the proper observance of Sunday, and others did

not believe in educating the poor because it might lead to revolution. Eventually, however, the Sunday schools became closely associated with the churches. When Raikes died, 31 years after the first school was opened, it was reported that about 500,000 children in the British Isles were attending Sunday schools.

The movement spread to the European continent and to North America. In Europe, however, because religious instruction was usually given in the regular schools, the Sunday schools were not so important as they were in the United States, where the separation of church and state prohibited religious instruction in the public schools.

In the United States each denomination generally established its own Christian education policy, although interdenominational cooperation was frequently an important factor. The Philadelphia Sunday School Union, the first interdenominational Sunday school association in the United States, was organized in 1791. The International Council of Religious Education, which was organized in 1922, became part of the National Council of Churches in 1950.

Various systems of teaching have been used in the Sunday schools. The Bible and the denomination's catechism were usually the materials used for instruction until special church-school materials were developed and curricula were constructed to reflect the doctrinal (and social) positions of the various denominations. Teachers are usually lay volunteers, often specially trained.

The Eastern Orthodox churches also conduct church schools, but the movement has never been as important as in Protestantism. Roman Catholics generally have not adopted the Sunday school system but, instead, have provided religious instruction with general education within their own church-affiliated schools.

**Sunday Times, The,** influential Sunday newspaper published in London, Eng. It is known around the world for the quality of its reporting and editing and for its coverage of British politics and the arts. It corresponds in quality to its daily counterpart, *The Times*.

Founded in 1822 as a nationally circulated paper with an independent editorial policy, *The Sunday Times* reflects the dignified, carefully written, and well-edited character of *The Times*. For years, reports of *Sunday Times* correspondents have been syndicated to other major world newspapers. The paper's publication was disrupted and suspended for a year in 1978–79, when unionized employees refused to permit the introduction of modern editing and printing methods; but a settlement was reached, and *The Sunday Times* maintained its reputation and recovered its high circulation.

**Sundbyberg,** town, Stockholm *län* (county), east-central Sweden. Sundbyberg lies on the northwestern outskirts of Stockholm. When founded in 1877, it was one of Stockholm's first residential suburbs. It was chartered in 1927 and has become an important industrial centre. The church (1909–11) is noted for its stained glass. Other imposing buildings are the large Marabou chocolate factory and the multistory apartments around Storskogen Park. The town's products include electrical and chemical equipment, building materials, and outboard motors. Immediately to the southwest is Bromma Airport for internal services. Pop. (2001 est.) 33,967.

**Sunderbunds** (India and Bangladesh): *see* Sundarbans.

**Sunderland,** port city and metropolitan district, metropolitan area of Tyne and Wear, England. It lies at the mouth of the River Wear, along the North Sea. In 674 a monastery was founded in an area on the north bank of the river known later as Monkwearmouth. The Venerable Bede, the noted chronicler of Anglo-Saxon affairs, was born in the area about 673 and studied there. On the south side of the river, slightly to the west, Bishopwearmouth was granted to the bishops of Durham in 930. Sunderland itself (the name derives from the part of Monkwearmouth "sundered" from the monastery by the river) was granted a charter in the late 12th century and incorporated as a borough in 1634. In the early medieval period, the community at Wearmouth was the only port of the Durham bishopric and traded in salt and fish.

Development of the coal trade in the 17th century, based on an expansion of mining in the River Wear valley, resulted in rapid growth of the town. By the 1680s, 180,000 tons of coal were exported annually from Sunderland. By the mid-18th century the town was probably the premier shipbuilding centre in Britain. Its other manufactures included glassware and pottery. The heavy dependence of the local economy on shipbuilding and ship-repairing industries resulted in severe unemployment during the Great Depression of the 1930s. The need for economic diversification resulted in the subsequent establishment of industrial estates at Southwick and Hendon in an attempt to attract new forms of manufacturing.

Sunderland has a technical college specializing in electrical engineering, a college of education, and a college of art. There is a museum and art gallery. Within the borough are the seaside resorts of Roker and Seaburn. Area 53 square miles (138 square km). Pop. (1999 est.) 289,040.

**Sunderland,** EARLS OF, titled English nobility in the family Spencer, grouped below chronologically and indicated by the symbol •.

**• Sunderland, Henry Spencer, 1st Earl of,** BARON SPENCER OF WORMLEIGHTON (baptized Nov. 23, 1620—d. Sept. 20, 1643, Newberry, Somerset, Eng.), English Cavalier during the English Civil Wars.

Born to great wealth, he was educated at Magdalen College, Oxford (M.A., 1636), and succeeded his father as Baron Spencer in 1636. A firm Royalist, he served as Charles I's negotiator in the early years of the conflict with Parliament—a conflict that evolved into the Civil Wars. On June 8, 1643, he was created Earl of Sunderland. Three months later he was killed at the Battle of Newberry.

**• Sunderland, Robert Spencer, 2nd Earl of,** BARON SPENCER OF WORMLEIGHTON (b. Sept. 5, 1641, Paris, France—d. Sept. 28, 1702, Althorp, Northamptonshire, Eng.), English statesman who was one of the most influential advisers during the reigns of Charles II, James II, and William III. His ability to shift allegiances was both the secret of his success and the cause of his unpopularity.

Spencer was the only son and heir of the 1st Earl of Sunderland, and in 1679 he became secretary of state. In January 1681 he was dismissed from office for voting to exclude Charles II's Roman Catholic brother James, Duke of York (later King James II), from the succession. Nevertheless, he was reinstated as secretary of state in January 1683 and became the architect of Charles's pro-French foreign policy. Although he served as chief minister under King James II, Sunderland could maintain his position only by acquiescing to the king's pro-Catholic policies. To win the queen's support, he converted to Roman Catholicism in June 1688, but in October he was dismissed in a desperate effort by James to regain popular support.

When William of Orange (later King William III) seized power in the Revolution of 1688, Sunderland fled to the European continent. Having renounced Roman Catholicism, he returned to England in May 1690. Within two years he had established himself as one of William III's most valued political counselors and the principal intermediary between the king and Parliament. William made him lord chamberlain in April 1697, but parliamentary opposition (led by the Whig Junto) soon drove him out of office (December 1697).

**• Sunderland, Charles Spencer, 3rd Earl of,** BARON SPENCER OF WORMLEIGHTON (b. 1674—d. April 9, 1722, London, Eng.), British statesman, one of the Whig ministers who directed the government of King George I from 1714 to 1721. His scheme of having the South Sea Company take over the national



Charles Spencer, 3rd Earl of Sunderland, detail of an engraving by G. Houbraken, 1746

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

debt led to a speculation mania known as the South Sea Bubble, which ended in financial disaster (1720).

The son of the 2nd Earl of Sunderland and the son-in-law of the Duke of Marlborough, he succeeded to the earldom in 1702. He joined the Junto, a group of leading Whigs, and served under Queen Anne as secretary of state from 1706 to 1710, when he and his Whig colleagues were expelled from office.

After George I's accession in 1714, Sunderland was made lord lieutenant of Ireland and then (1715) lord privy seal in a ministry that included James Stanhope, Robert Walpole, and Viscount Charles Townshend. In 1717 Sunderland and Stanhope ousted Townshend and Walpole in a dispute over Stanhope's foreign policy. Sunderland then took control of domestic affairs, becoming lord president of the Privy Council and first lord of the Treasury (1718). In 1719 Sunderland's Peerage Bill, designed to assure a permanent Whig majority in the House of Lords, was soundly defeated, and after the South Sea scandal (in which he had been bribed) he yielded his office to Walpole in 1721.

**sundew,** any plant of the family Droseraceae (order Nepenthales), which contains four genera (*Aldrovanda, Dionaea, Drosera,* and *Drosophyllum*) and about 100 annual and perennial species of flowering plants notable for their ability to trap insects. They are widely distributed in tropical and temperate regions. One of the best-known sundews is the Venus's-flytrap (*q.v.*). The name sundew is most commonly applied to members of the genus *Drosera,* which is distributed worldwide but most abundant in Australia, but the term sundew also applies to all Droseraceae. (*See also* Nepenthales.)

*Drosera* species, which occur for the most part in wet, boggy places with a sandy acid soil, are predominantly perennials. The small, nodding, five-petaled white or pinkish flowers are borne on one side of a curving stem, 10 to 25 cm (4 to 10 inches) tall, which rises from a rosette

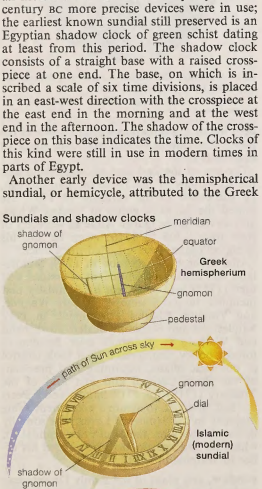
of basal leaves. The roundish, often red-dish-stalked basal leaves, less than 2.5 cm in diameter, are covered with gland-tipped hairs that exude a sticky substance attractive to insects. Insects are captured by flexible tentacles (in reality stalked glands) on the upper surface of the leaf, and eventually become engulfed by a web of sticky tentacles. After the trapped prey has been digested by enzymes secreted by the tentacles, the leaf reopens, resetting the trap.

The most common North American sundew, *D. rotundifolia,* has small white or pinkish flowers 1.25 cm across or less. The round, flat leaf with purplish hairs narrows abruptly to a long fuzzy stalk. The fruit is spindle shaped.

**sundial,** the earliest type of timekeeping device, which indicates the time of day by the position of the shadow of some object exposed to the Sun's rays. As the day progresses, the Sun moves across the sky, causing the shadow of the object to move and indicating the passage of time.

The first device for indicating the time of day was probably the gnomon, dating from about 3500 BC. It consisted of a vertical stick or pillar; the length of the shadow that it cast gave an indication of the time of day. By the 8th century BC more precise devices were in use; the earliest known sundial still preserved is an Egyptian shadow clock of green schist dating at least from this period. The shadow clock consists of a straight base with a raised cross-piece at one end. The base, on which is inscribed a scale of six time divisions, is placed in an east-west direction with the crosspiece at the east end in the morning and at the west end in the afternoon. The shadow of the cross-piece on this base indicates the time. Clocks of this kind were still in use in modern times in parts of Egypt.

Another early device was the hemispherical sundial, or hemicycle, attributed to the Greek




Three types of sundials
Encyclopædia Britannica, Inc.

astronomer Aristarchus of Samos about 280 BC. Made of stone or wood, the instrument consisted of a cubical block into which a hemispherical opening was cut; to this block a pointer or style was fixed with one end at the centre of the hemispherical space. The path traveled by the tip of the pointer's shadow during the day was, approximately, a circular arc. The length and position of the arc varied according to the seasons, so an appropriate number of arcs was inscribed on the internal surface of the hemisphere. Each arc was divided into 12 equal divisions, and each day, reckoned from sunrise to sunset, therefore had 12 equal intervals, or "hours." Because the length of the day varied according to the season, these hours likewise varied in length from season to season and even from day to day and were consequently known as seasonal hours. Aristarchus's sundial was widely used for many centuries and, according to the Arab astronomer al-Battānī (*c.* AD 858–929), was still in use in Muslim countries during the 10th century. The Babylonian astronomer Berosus (*fl. c.* 290 BC) invented a variant of this sundial by cutting away the part of the spherical surface south of the circular arc traced by the shadow tip on the longest day of the year.

The Greeks, with their geometrical prowess, developed and constructed sundials of considerable complexity. For instance, the Tower of the Winds (*q.v.*) in Athens, octagonal in shape and dating from about 100 BC, contains eight planar sundials facing various cardinal points of the compass. Moreover, numerous ancient Greek sundials feature conical surfaces cut into stone blocks in which the axis of the cone (which contains the tip of the gnomon) is parallel to the polar axis of the Earth. In general, it appears that the Greeks constructed instruments with either vertical, horizontal, or inclined dials, indicating time in seasonal hours.

As with the Greeks, Roman sundials employed seasonal hours. In 290 BC the first sundial, which had been captured from the Samnites, was set up in Rome; the first sundial actually designed for the city was not built until almost 164 BC. In his great work *De architectura,* the Roman architect and engineer Vitruvius (*fl.* 1st century BC) named many types of sundials, some of which were portable.

The medieval Muslims were especially interested in sundials, for these provided means for determining the proper times for prayer. Indeed, most Muslim dials contain lines indicating these times, and on a few they are the only lines at all. Although the Muslims learned the basic principles of designing sundials from the Greeks, they increased the variety of designs available through the use of trigonometry. For example, they invented the now-ubiquitous sundial with the gnomon parallel to the polar axis of the Earth. At the beginning of the 13th century AD, Abū al-Ḥasan al-Marrakushi wrote on the construction of hour lines on cylindrical, conical, and other types of sundials and is credited with introducing equal hours, at least for astronomical purposes.

With the advent of mechanical clocks in the early 14th century, sundials with equal hours gradually came into general use in Europe, and until the 19th century sundials were still used to reset mechanical clocks.

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**Sundiata,** also spelled SUNDJATA, also called MĀRĪ DIĀṬA, or MARI JATA (d. 1255), West African monarch who founded the western Sudanese empire of Mali (*see* Mali, Ancient). During his reign he established the territorial base of the empire and laid the foundations for its future prosperity and political unity.

Sundiata was a Mandingo from the small kingdom of Kangaba, near the present Mali–Guinea border. Little is known about his early life. Mandingo oral traditions indicate that he was one of 12 royal brothers who were heirs to the throne of Kangaba. When Sumanguru, ruler of the neighbouring state of Kaniaga, overran Kangaba at the beginning of the 13th century, he murdered all of Sundiata's brothers. According to tradition, Sundiata was spared because he was a sickly boy who already appeared to be near death.

It is believed that Sundiata was once a *dugu-tigi,* or headman, of one of the villages of Kangaba. He organized a private army and consolidated his position among his own people before challenging the power of Sumanguru and the neighbouring Susu people. He defeated Sumanguru decisively in the Battle of Kirina (near modern Koulikoro, Republic of Mali) *c.* 1235 and succeeded in forcing the former tributary states of Kaniaga to recognize his suzerainty. In 1240 Sundiata seized and razed Kumbi, the former capital of the Sudanese empire of Ghana, and by this act succeeded in obliterating the last symbol of Ghana's past imperial glory.

After 1240 Sundiata apparently led no furher conquests but consolidated his hold on the states already under his control. His generals, however, continued to extend the boundaries of his empire to include areas as far north as the southern fringes of the Sahara (including the important trade centre of Walata), east to the Great Bend of the Niger River, south to the goldfields of Wangara (the exact location is still unknown to scholars), and west to the Sénégal River.

Soon after 1240 Sundiata moved the seat of his empire from Jeriba to Niani (also called Mali), near the confluence of the Niger and Sankarani rivers. The lure of profits from the gold trade, made possible by Mali's acquisition of Wangara, and the tranquillity that prevailed under Sundiata's leadership attracted merchants and traders; Niani soon became a key commercial centre in the Sudan.

Although Sundiata was nominally a Muslim and therefore acceptable to the predominantly Muslim merchant class, he managed to retain his support among the non-Muslim population. He did so by fulfilling many of the traditional religious functions expected of rulers in the West African societies whose political leaders were viewed as religious figures with quasi-divine powers. Little is known about the actual administration of Mali during Sundiata's time. The imperial system he established, however, survived the years of internecine conflicts over the succession after his death.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

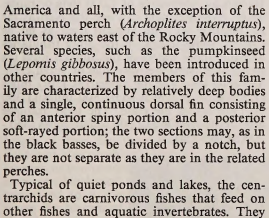
**Sundman, Per Olof** (b. Sept. 4, 1922, Vaxholm, Swed.), Swedish novelist who wrote in the tradition of Social Realism during the 1960s. He also served as a member of the Swedish Parliament (1969–79).

Per Olof Sundman spent much of his life in the northern province of Jämtland and used that isolated area as a locale for his first book, *Jägarna* (1957; "The Hunters"), a collection of short stories. It is not incidents or human relationships that are the focus of Sundman's interest so much as the documents the novelist chooses to present to the reader without any accompanying evaluation

or commentary. Sundman's radical psychological behaviourism is underscored by a simple, bare style. The purpose of his analytic method is to make the reader aware of the complex and at times incomprehensible nature of truth. In *Undersökningen* (1958; "The Investigation") the technique is applied in an investigation of the head of a power station in a poverty-stricken and depopulated area in the northern part of Sweden. His most successful novel and the one that brought him the Nordic Council Literary Prize in 1967, *Ingenjör Andrées luftfärd* (1967; *The Flight of the Eagle*), is pieced together from the remaining documents of an ill-fated attempt to reach the North Pole by balloon. The analysis of the three main characters in the tragic drama proceeds from the documents themselves with a minimum of artistic ordering. *Berättelsen om Såm* (1977; "The Story of Sam") examines the ancient Icelandic saga of Hrafnkel.

**Sundsvall,** town and seaport in Västernorrland *län* (county), northern Sweden. It lies at the mouth of the Selånger River on the Gulf of Bothnia. It was chartered in 1624 by Gustavus II Adolphus. In 1721 it was burned by the Russians and in 1803 and 1888 it suffered further disastrous fires. The town centre, therefore, dates largely from the 1890s, when it was entirely rebuilt in brick and stone. Lying between Ljungan and Indalsälven, two streams once used for timber floating, Sundsvall is the centre of one of the most important pulp- and paper-producing regions in northern Europe. It also has aluminum and engineering plants. Pop. (1995 est.) mun., 94,815.

**sunfish,** any of numerous species of North American freshwater fishes placed with the crappies and black basses in the family Centrarchidae (order Perciformes). The family contains about 30 species, all native to North



Pumpkinseed sunfish (*Lepomis gibbosus*)
Jacques Six

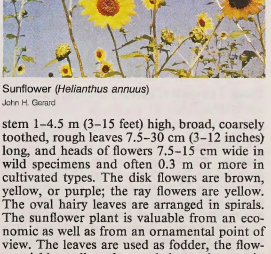
America and all, with the exception of the Sacramento perch (*Archoplites interruptus*), native to waters east of the Rocky Mountains. Several species, such as the pumpkinseed (*Lepomis gibbosus*), have been introduced in other countries. The members of this family are characterized by relatively deep bodies and a single, continuous dorsal fin consisting of an anterior spiny portion and a posterior soft-rayed portion; the two sections may, as in the black basses, be divided by a notch, but they are not separate as they are in the related perches.

Typical of quiet ponds and lakes, the centrarchids are carnivorous fishes that feed on other fishes and aquatic invertebrates. They range in size from tiny sunfishes (*Elassoma*) that mature at a length of 2.5 cm (1 inch) to the largemouth black bass, attaining a maximum of about 80 cm and 10 kg (22 pounds).

The sunfishes, though small (usually less than 20 cm long), are considered fine food and game fishes. Some possess a distinctive flap, or "ear lobe," at the upper hind edge of the gill cover. Sunfishes, deeper-bodied than the black basses, are also more brightly coloured, as their name implies. The males are especially colourful during the spring breeding season, when they, like other centrarchids, hollow out nests with their tails and, after inducing the female to lay, guard the eggs and sometimes the young.

Better known species of sunfishes include the black-banded sunfish (*Enneacanthus chaetodon*) of the eastern United States; the bluegill (*Lepomis macrochirus*), a well-known food and sport fish coloured greenish, with an orange belly and blue on the lower edge of the head and gill covers; the longear sunfish (*L. megalotis*), marked with orange spots and wavy, bright-blue streaks; the pumpkinseed, or common, sunfish (*L.*, or *Eupomotis, gibbosus*), a green or bluish fish with an orange belly and a red spot on its ear; and the rock bass (*Ambloplites rupestris*), a food and sport fish coloured greenish with irregular dark markings.

**sunflower,** plant of the genus *Helianthus* of the family Asteraceae, native primarily to North and South America. The common sunflower is an annual herb with a rough hairy



Sunflower (*Helianthus annuus*)
John H. Gerard

stem 1–4.5 m (3–15 feet) high, broad, coarsely toothed, rough leaves 7.5–30 cm (3–12 inches) long, and heads of flowers 7.5–15 cm wide in wild specimens and often 0.3 m or more in cultivated types. The disk flowers are brown, yellow, or purple; the ray flowers are yellow. The oval hairy leaves are arranged in spirals. The sunflower plant is valuable from an economic as well as from an ornamental point of view. The leaves are used as fodder, the flowers yield a yellow dye, and the seeds contain oil and are used for food. The yellow, sweet oil obtained by compression of the seeds is considered equal to olive or almond oil for table use. Sunflower oilcake is used for stock and poultry feeding. The oil is also used in soap and paints and as a lubricant. The seeds may be eaten dried or roasted. Argentina, Russia, Ukraine, France, the United States, and China are the leading producers of sunflower seed.

Of the approximately 60 species of *Helianthus*, only a few are cultivated, some for their spectacular size. They are tall, hardy annual or perennial herbs, several of which can be grown in gardens with moderately good soil. The Jerusalem artichoke (*H. tuberosus*) is cultivated for its edible underground tubers.

**Sung ——:** for rulers of the Sung dynasty, *see under* individual names.

**Sung** DYNASTY, Pinyin SONG (960–1279), Chinese dynasty that ruled the country (only in the south after 1127) during one of its most brilliant cultural epochs.

The Sung dynasty was founded when Chao K'uang-yin, the military inspector general of the Chou dynasty, last of the Five Dynasties, usurped control of the empire in a coup. Thereafter, he used his mastery of diplomatic maneuvering to persuade powerful potential rivals to exchange their power for honours and sinecures, and he proceeded to become an admirable emperor. He set the nation on a course of sound administration by instituting a competent and pragmatic civil service; he followed Confucian principles, lived modestly, and took the country's finest military units under his personal command. Before his death he had begun an expansion into the southern Ten Kingdoms.

Chao's successors maintained an uneasy peace with the menacing Liao kingdom of the Khitan to the north. Over time, the quality of the bureaucracy deteriorated, and when the Juchen (Mongolian tribes from the North who overthrew the Liao) burst into the northern Sung state, it was easy prey. The Juchen took over the North and established a dynasty with a Chinese name, the Chin. But they were unable to take those regions of the Sung territory south of the Yangtze River.

In the South, the climate and the beautiful surroundings were the setting for the Southern Sung dynasty established (1127) by Kao-tsung. He chose a capital he called Lin-an (present Hang-chou) and set about maintaining defenses against the hostile North and restoring imperial authority in the hinterland. Kao-tsung was a conscious admirer and emulator of the highly successful approach of the Han dynasty to the management of civil service, and the empire's bureaucrats long functioned well. In due course, however, the dynasty began to decline. But the eventual fall of the Sung dynasty was neither sudden nor a collapse upon itself such as had ended several of its predecessors. The Mongols, under Genghis Khan, began their move on China with an assault on the Chin state in the North in 1211. After their eventual success in the North and several decades of uneasy coexistence with the Sung, the Mongols—under Genghis Khan's grandsons—advanced on the Sung forces in 1250. The Sung forces fought on until 1276, when their capital fell. The dynasty finally ended in 1279 with the destruction of the Sung fleet near Canton.

During the Sung dynasty, commerce developed to an unprecedented extent; trade guilds were organized, paper currency came into increasing use, and several cities with populations of more than 1,000,000 flourished along the principal waterways and the southeast coast. Widespread printing of the Confucian Classics and the use of movable type, beginning in the 11th century, brought literature and learning to the people. Flourishing private academies and state schools graduated increasing numbers of competitors for the civil service examinations. The administration developed a comprehensive welfare policy that made this one of the most humane periods in Chinese history. In the works of the 12th-century philosophers Chu Hsi and Lu Chiu-yüan, Neo-Confucianism was systematized into a coherent doctrine.

The Sung dynasty is particularly noted for the great artistic achievements that it encouraged and, in part, subsidized. The Northern Sung dynasty at Pien-ching had begun a renewal of Buddhism and of literature and the arts. The greatest poets and painters in the empire were in attendance at court. The last of the Northern Sung emperors was himself perhaps the most noteworthy art collector in the country. His capital at Pien-ching was a city of beauty, abounding in palaces, temples, and tall pagodas when, in 1126, the Juchen burned it. The architecture of the Sung era was noted for its tall structures; the highest pagoda at Pien-ching was 360 feet (110 m). Sung architects curved the eave line of roofs upward at the corners. Pagodas, six- or eight-sided and built of brick or wood, still survive from the period.

The sculpture of the Sung period continued to emphasize representations of the Buddha, and in that genre there were no substantive improvements over the work of Sung sculptors in succeeding dynasties. Landscape painting was one of the outstanding arts of the Northern Sung, and its most noted figures were Fan K'uan and Li Ch'eng. In the Southern

Sung many great painters served at the Hanlin Academy, becoming noted for brush effects, miniatures, and, under Zen influence, paintings of Buddhist deities, animals, and birds.

In the decorative arts the Sung dynasty marked a high point in Chinese pottery. Sung wares are noted for their simplicity of shape and the purity of colour and tone of their glazes. From the Northern dynasty came Ting, Ju, Chun, Tz'u-chou, northern celadon, and brown and black glazed wares; from the Southern came Ching-te-chen whiteware, Chichou wares, celadons, and the black pottery of Fukien. *Kuan* produced near the Southern capital was the finest of an enormous number of celadons of the dynasty.

The tendency of Sung jade carvers to adopt old lines and techniques makes difficult the accurate dating of jades that may be from the Sung, and it has been similarly difficult to place Sung lacquerware.

In music the Northern Sung adopted a two-stringed fiddle from the Mongols, and the court revived musical events and entertainments. Music attracted considerable attention in the dynasty's enormous works of literature: the official history of the dynasty devoted 17 of its 496 chapters to musical events, and an encyclopaedia of 1267 has 10 of 200 chapters on the subject of music. Music drama flourished throughout the Sung, and distinctly different styles evolved in the North and the South. The literature of the Sung dynasty emphasized a return to old-time simplicity of expression in prose, and short tales called *ku-wen* were written in great volume. A school of oral storytelling in the vernacular arose, and conventional poetry enjoyed wide cultivation. Sung poets achieved their greatest distinction, however, in the new genre of the *tz'u*, sung poems of joy and despair. These poems became the literary hallmark of the dynasty. For the diversity and richness of its cultural achievements, the Sung dynasty is remembered as one of China's greatest.

**Sung-chiang,** Pinyin SONGJIANG, town in Shanghai *shih* (municipality), China. Until 1958 it was a part of Kiangsu province. It takes its name from the Sung Chiang (river), which flows from the T'ai Lake to the sea, through Shanghai.

It first became an independent county in 751 under the name of Hua-t'ing, and in 1278 its name was changed to Sung-chiang. It was a superior prefecture under the Ming (1368–1644) and Ch'ing (1644–1911) dynasties and grew into a large town. Sung-chiang was originally the centre of a prosperous rice-growing area and—together with Süchow—was a major source of grain revenues. After cotton was introduced under the Mongols in the 14th century, the area produced cotton, and cotton spinning, and weaving became a major domestic industry. By the 18th century the quality of the region's cotton textiles had gained an international reputation. In the 19th century the town was a strategic centre for the defense of Shanghai during the Taiping Rebellion (1850–64) and was badly damaged in the fighting.

The phenomenal 19th-century growth of Shanghai, however, also took away the town's role as a commercial centre, and in the 20th century it became completely dominated by its metropolitan neighbour. Sung-chiang has excellent waterway communications with the plain around T'ai Lake and is also on the railway from Shanghai to Hang-chou. Pop. (mid-1980s est.) 50,000–100,000.

**Sung Chiao-jen,** Pinyin SONG JIAOREN (b. April 5, 1882, T'ao-yüan, Hunan province, China—d. March 22, 1913, Shanghai), founder of the Nationalist (Kuomintang) Party, whose assassination blighted hopes for democratic government in China in the early 20th century.

Expelled from middle school in China for revolutionary activities, in 1904, Sung began studies in Japan. In Tokyo the following year, he became one of the leading members of the T'ung-meng hui ("United League"), the newly organized revolutionary party of the Chinese nationalist leader Sun Yat-sen.

After the Chinese Revolution of 1911 the former military commander Yüan Shih-k'ai became president of the new Chinese republic, and Sung was one of the four T'ung-meng hui members invited to join the new cabinet. Sung objected to Yüan's autocratic methods, however, and he soon resigned his post.

Hoping to create a political party that could capture a workable majority of the seats in the new National Assembly, Sung merged the old T'ung-meng hui with several smaller political parties and formed the Nationalist Party. After an intensive campaign, the election early in 1913 gave the Nationalists 269 of the 596 seats in the National Assembly. Most observers expected Sung to become premier of a new cabinet and a strong rival of Yüan for power. On March 20, 1913, Sung was shot as he was boarding a train for the capital. He died two days later, not yet 31. His death helped spark the second revolution of 1913, in which Sun Yat-sen and other progressive forces unsuccessfully attempted to unseat Yüan. A decade later Sun Yat-sen reorganized the Nationalists as a revolutionary party.

**Sung Mei-ling,** also called MADAME CHIANG KAI-SHEK: *see* Soong Mei-ling.

**Sung Tzu-wen** (Chinese Nationalist official): *see* Soong, T.V.

**Sung Yang** (Chinese Communist leader): *see* Qu Qiubai.

**Śuṅga** DYNASTY, Indian ruling house founded by Puṣyamitra about 185 BC, which replaced the Mauryan dynasty. Puṣyamitra assassinated Bṛhadratha, the last Mauryan ruler, at a military parade and assumed royal power. Puṣyamitra was a Brahmin, and, though he is said to have persecuted Buddhists, Buddhism still flourished in many areas under his control.

Most of the traditional accounts of Puṣyamitra's reign are late in date. According to these, his rule extended over the cities of Pāṭaliputra, Ayodhyā, and Vidiśā and perhaps over Jālandhara and Śākala as well. The Mauryan system of administering the provinces through princes of royal blood continued, and royal power tended to decentralize in the form of the establishment of nuclear kingdoms within the empire. Puṣyamitra conducted several campaigns against the Yavanas, or the Indo-Greeks, who were trying in this period to expand from Bactria into northwestern India.

Śuṅga history after Puṣyamitra, who ruled for roughly 36 years, is largely uncertain. Nothing substantial is known about his successor, Agnimitra, the hero of Kālidāsa's play *Mālavikāgnimitra*. According to the *Purāṇas*, Agnimitra's successors, in genealogical order, were: Sujyeṣṭha (or Vasujyeṣṭha), Vasumitra, Andhraka (or Bhadraka), Puliṇdaka, Ghoṣa, Vajramitra, Bhāgavata, and Devabhūmi (Devabhūti). If the Purānic account is to be believed, the total tenure of Śuṅga rule was 112 years, coming to an end about 73 BC.

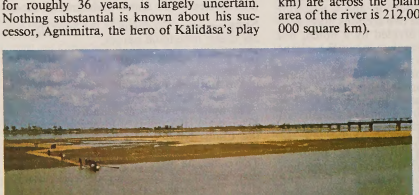
**Śuṅga script,** Brāhmī script of north India, possibly connected with the late Maurya scripts and the early Kalinga character, and associated with the Śuṅga dynasty (c. 185 BC–*c.* 73 BC). The script was one of three prototypes of the North Indian subdivision of Brāhmī script, out of which the Gupta scripts rose.

**Sungari River,** Wade-Giles SUNG-HUA CHIANG, Pinyin SONGHUA JIANG, river in Heilungkiang and Kirin provinces, Northeast China. The Sungari is the largest of the tributaries of the Amur River, which it joins below the Chinese town of T'ung-chiang, some distance above Khabarovsk in far eastern Russia.

The Sungari rises in the Ch'ang-pai Mountains in the border area between Kirin and North Korea. Its upper course runs north through rugged country, after which it empties into the Manchurian Plain above the city of Chi-lin (Kirin). There the river has been dammed at Feng-man as part of a huge hydroelectric project, forming a large retention lake extending more than 100 miles (62 km) upstream. From Chi-lin the river flows northwest until, in the vicinity of Ta-an, it is joined by its chief tributary, the Nen (Nonni) River, which drains the northern Manchurian Plain. It then flows eastward through the city of Harbin (Ha-erh-pin), where it is joined by another northern tributary, the Hu-lan River, before passing between the southern end of the Lesser Khingan Range and the northern end of the eastern Manchurian mountain system at Chia-mu-ssu to emerge into the flat and marshy terrain of the Amur River valley.

The Sungari, at least below Chi-lin, flows somewhat placidly. Frozen annually from late November until March, its flow varies greatly, being at its maximum in the summer, when the May floods from thawing snows in the mountains are followed by summer rains that last until August. Since the river gradient in the plain is very low, flooding is frequent. In some years, 1932 for example, floods caused great devastation.

The Sungari, like the Nen, is an important waterway. It is navigable upstream as far as Harbin by steamships of 1,000 tons or more. Small river steamers can use the Nen as far as Tsitsihar and the Sungari itself as far as Chi-lin, while several of the other tributaries and the upper waters of the Sungari itself (as well as the Nen) are navigable by small craft. The total length of the Sungari is 1,197 miles (1,927 km), of which some 800 miles (1,300 km) are across the plain. The total drainage area of the river is 212,000 square miles (550,000 square km).



Sungari River at Harbin, Northeast China
Emil Schulthess—Black Star

**sunlamp,** electric discharge lamp (*q.v.*) that emits radiation of wavelengths present in sunlight, particularly the short wavelengths of the ultraviolet region.

**sunlight,** also called SUNSHINE, solar radiation that is visible at the Earth's surface. The amount of sunlight is dependent on the extent of the daytime cloud cover. Some places on the Earth receive more than 4,000 hours per year of sunlight (more than 90 percent of the maximum possible), as in the Sahara; others receive less than 2,000 hours, as in regions of frequent storminess, such as Scotland and Iceland. Over much of the middle-latitude region of the world, the amount of sunlight varies regularly as the day progresses, owing to greater cloud cover in the early morning and during the late afternoon.

Ordinarily, sunlight is broken down into three major components: (1) visible light, with wavelengths between 0.4 and 0.8 micrometre, (2) ultraviolet light, with wavelengths shorter than 0.4 micrometre, and (3) infrared radiation, with wavelengths longer than 0.8 micrometre. The visible portion constitutes nearly half of the total radiation received at the surface of the Earth. Although ultraviolet light constitutes only a very small proportion of the total radiation, this component is extremely important. It produces vitamin D through the activation of ergosterol. Unfortunately, the polluted atmosphere over large cities robs solar radiation of a significant portion of its ultraviolet light. Infrared radiation has its chief merit in its heat-producing quality. Close to half of total solar radiation received at the surface of the Earth is infrared.

On its path through the atmosphere the solar radiation is absorbed and weakened by various constituents of the atmosphere. It is also scattered by air molecules and dust particles. Short wavelengths of light, such as blue, scatter more easily than do the longer red wavelengths. This phenomenon is responsible for the varying colour of the sky at different times of day. When the sun is high overhead, its rays pass through the intervening atmosphere almost vertically. The light thus encounters less dust and fewer air molecules than it would if the sun were low on the horizon and its rays had a longer passage through the atmosphere. During this long passage the dominant blue wavelengths of light are scattered and blocked, leaving the longer, unobstructed red wavelengths to reach the Earth and lend their tints to the sky at dawn and dusk.

An effective absorber of solar radiation is ozone, which forms by a photochemical process at heights of 10–50 km (6–30 miles) and filters out most of the radiation below 0.3 micrometre. Equally important as an absorber in the longer wavelengths is water vapour. A secondary absorber in the infrared range is carbon dioxide. These two filter out much of the solar energy with wavelengths longer than 1 micrometre.

The Eppley pyrheliometer measures the length of time that the surface receives sunlight and the sunshine's intensity as well. It consists of two concentric silver rings of equal area, one blackened and the other whitened, connected to a thermopile. The sun's rays warm the blackened ring more than they do the whitened one, and this temperature difference produces an electromotive force that is nearly proportional to the sunlight's intensity. The electromotive force is automatically measured and recorded and yields a continuous record of the duration and intensity of the periods of sunlight.

**sunn,** also called SANN HEMP, or INDIAN HEMP (*Crotalaria juncea*), plant of the pea family (Fabaceae, or Leguminosae) or its fibre, one of the bast fibre group. The plant is also cultivated in many tropical countries as a green manure crop that is plowed under to fertilize soil. The sunn plant is not a true hemp. It is probably native to the Indian subcontinent, where it has been cultivated since prehistoric times. It was introduced to the Western Hemisphere early in the 19th century.

Sunn is an annual cultivated from seed and grows best in loamy, well-drained soil, but it is adaptable to poor soils and fairly arid climates and is often grown in rotation with such crops as rice, corn (maize), and cotton. Plants reach a height of about 2.5 to 3 m (8 to 10 feet). The dense sowing of fibre crops limits leaf growth to plant tops. Leaves are bright green in colour, pointed in form, and 5 to 7.5 cm (2 to 3 inches) in length; the small yellow flowers grow in spikelike clusters from the angle between the leafstalk and the plant stem (leaf axil). Fibre crops are either cut or pulled out when seedpods begin to form; green manure crops are plowed under when the plants begin to flower. Fibres are obtained by a retting operation, followed by stripping, washing, and drying.

Sunn fibre is lustrous, with whitish, gray, or yellow colour. The fibre strands, about 1 to 1.5 m long, are composed of individual fibre cells, cylindrically shaped and with striated surface markings. Sunn fibre is almost as strong as hemp and more durable than jute. It increases in strength when wet and is fairly resistant to mildew and other microorganism attack. The fibre is made into cordage, fishing nets, sacking fabrics, canvas, and rug yarns and is used to manufacture such paper products as cigarette and tissue papers. India is the main producer, and the United Kingdom, Belgium, and the United States are the leading importers.

**sunna,** also spelled SUNNAH (Arabic: "habitual practice"), the body of traditional social and legal custom and practice of the Muslim community. In pre-Islāmic Arabia, sunna referred to precedents established by tribal ancestors, accepted as normative, and practiced by the entire community. The early Muslims did not immediately concur on what constituted their sunna. Some looked to the people of Medina for an example, others followed the behaviour of the Companions of Muḥammad, whereas the provincial legal schools, current in Iraq, Syria, and the Hejaz (in Arabia) in the 8th century AD, attempted to equate sunna with an ideal system—based partly on what was traditional in their respective areas and partly on precedents that they themselves had developed. These varying sources, which created differing community practices, were finally reconciled late in the 8th century by the legal scholar ash-Shāfiʿī (767–820), who accorded the sunna of the Prophet Muḥammad, as preserved in eyewitness records of his words, actions, and approbations, and known as the Ḥadīth, normative and legal status second only to that of the Qurʾān.

The authoritativeness of the sunna was further strengthened when Muslim scholars, in response to the wholesale fabrication of hadiths by supporters of various doctrinal, legal, and political positions, developed *ʿilm al-ḥadīth,* the science of attesting the authenticity of individual traditions. The sunna was then used in *tafsīr,* Qurʾānic exegesis, to supplement the meaning of the text, and in *fiqh,* Islāmic jurisprudence, as the basis of legal decisions not discussed in the Qurʾān. *See also* ʿilm al-ḥadīth; tafsīr.

**Sunni ʿAlī:** *see* Sonni ʿAlī.

**Sunnite,** Arabic SUNNĪ, plural SUNNĪ, member of one of the two major branches of Islām, the branch that consists of the majority of that religion's adherents. Sunnite Muslims regard their sect as the mainstream and traditionalist branch of Islām, as distinguished from the minority sect, the Shīʿites.

The Sunnites recognize the first four caliphs as Muḥammad's rightful successors, whereas the Shīʿites believe that Muslim leadership belonged to Muḥammad's son-in-law, ʿAlī, and his descendants alone. In contrast to the Shīʿites, the Sunnites have long conceived of the theocratic state built by Muḥammad as an earthly, temporal dominion and have thus regarded the leadership of Islām as being determined not by divine order or inspiration but by the prevailing political realities of the Muslim world. This led historically to Sunnite acceptance of the leadership of the foremost families of Mecca and to the acceptance of unexceptional and even foreign caliphs, so long as their rule afforded the proper exercise of religion and the maintenance of order. The Sunnites accordingly held that the caliph must be a member of Muḥammad's tribe, the Quraysh, but devised a theory of election that was flexible enough to permit that allegiance be given to the de facto caliph, whatever his origins. The distinctions between the Sunnites and other sects regarding the holding of spiritual and political authority remained firm even after the end of the Caliphate itself in the 13th century.

The Sunnites' orthodoxy is marked by an emphasis on the views and customs of the majority of the community, as distinguished from the views of peripheral groups. The institution of consensus evolved by the Sunnites allowed them to incorporate various customs and usages that arose through ordinary historical development but that nevertheless had no roots in the Qurʾān.

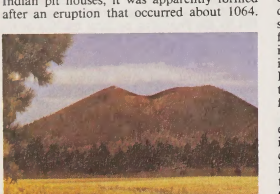
The Sunnites recognize the six "authentic" books of the Ḥadīth, which contain the spoken tradition attributed to Muḥammad. The Sunnites also accept as orthodox one of the four schools of Muslim law. In the 20th century the Sunnites constituted the majority of Muslims in all nations except Iran, Iraq, and perhaps Yemen. They numbered about 900 million in the late 20th century and constituted nine-tenths of all the adherents of Islām.

**Sunnyvale,** city, Santa Clara county, California, U.S. It lies at the southern end of San Francisco Bay, near San Jose. Settled in 1850, it was known as Murphy's Station (later as Encinal) but was renamed Sunnyvale at its incorporation in 1912 and developed as a fruit-processing centre. The city's economic base shifted, however, when the U.S. Navy dirigible base, built nearby in the 1930s, and the expansion of the Joshua Hendy Iron Works (later Westinghouse Electric) in 1942 contributed to a developing industrial pattern, which now includes electronics and the manufacture of guided missiles. Pop. (1992 est.) 121,588.

**sunscald,** common disorder of exposed, thin-barked trees, shrubs, and other plants. Dead patches form on the sun-exposed trunk and limbs of young trees, often those recently transplanted to open areas from nurseries where they were shaded by nearby trees. Evergreens and shrubs show scorched foliage and shoot dieback in dry, sunny, and windy spots, especially in very early spring. Control includes wrapping young tree trunks, applying whitewash, white latex paint, or an antidesiccant (to retard loss of plant moisture), and growing susceptible plants in more protected locations. Evergreens, especially in winter and very early spring, should be protected from too much sun and from cold, drying winds. Much sunscald injury can be avoided by watering plants thoroughly in dry autumns before the soil freezes and applying a mulch to keep the soil frozen until spring, when full-scale plant activity resumes and roots can provide the moisture the top growth requires. *See also* scorch.

**Sunset Crater Volcano National Monument,** national monument in north-central Arizona, U.S. It lies 15 miles (24 km) north-

east of Flagstaff. The monument is centred on a truncated cinder cone, the remnant of an extinct volcano, that rises to an elevation of 1,000 feet (300 m). The cone was dated by means of tree rings found in remains of buried Indian pit houses; it was apparently formed after an eruption that occurred about 1064.

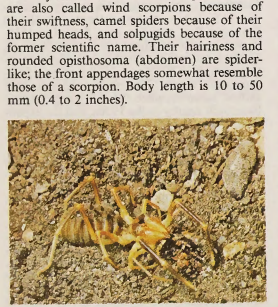


Sunset Crater Volcano National Monument, Arizona
© David Muench 1982

The summit crater, 400 feet (120 m) deep and about 1,280 feet (390 m) in diameter, is brilliantly hued, as though illuminated by the setting sun. Established in 1930, the preserve occupies an area of 5 square miles (13 square km). The monument contains numerous lava flows, fumaroles, and lava beds with ice caves.

**sunshine:** *see* sunlight.

**sunspider,** also called SUN SCORPION, or WIND SCORPION, any of the 800 species of the order Solifugae (formerly Solpugida) of the arthropod class Arachnida. The name sunspider refers to the species' habitation of hot, dry regions as well as to the golden colour and daytime liveliness of most species. They are also called wind scorpions because of their swiftness, camel spiders because of their humped heads, and solpugids because of the former scientific name. Their hairiness and rounded opisthosoma (abdomen) are spiderlike; the front appendages somewhat resemble those of a scorpion. Body length is 10 to 50 mm (0.4 to 2 inches).



Sunspider (*Galeodes*)
J.A.L. Cooke

Sunspiders are extremely voracious, and the largest forms can kill small vertebrates. The chelicerae (first pair of appendages) are large, toothed, jawlike pincers, and the leglike pedipalps (second pair of appendages) have suctorial tips for seizing prey. Unique racket-shaped organs (malleoli) on the hindmost legs may be sensory.

Sunspiders are common in Africa and southeastward to India; in Indonesia, especially the Celebes; and in parts of the New World.

**sunspot,** vortex of gas on the surface of the Sun associated with strong local magnetic activity. Spots look dark only by contrast with the surrounding photosphere, which is several thousand degrees hotter. The dark centre of a spot is called the umbra; the outer, lighter ring, the penumbra. Spots may be several times larger than the Earth or so small that telescopic observation is difficult. They may last for months. Single spots do appear, but most are in pairs or groups, with the members of a pair (leader and follower in respect to the direction of the Sun's rotation) having opposite magnetic polarity. This polarity reverses from one solar cycle to the next; *i.e.*, if leaders in one cycle are north magnetic poles, leaders in the succeeding cycle will be south poles. Leaders and followers in one hemisphere of the Sun are almost always opposite in polarity from their counterparts across the equator.

Some large spots are visible to the unaided eye when the Sun is seen through clouds or in a camera-obscura image. But general acceptance of the reality of these apparent flaws in the Sun came only about 1611, when systematic study was begun independently by Galileo, Thomas Harriot, Johannes Fabricius, and Christoph Scheiner. S.H. Schwabe in 1843 announced discovery of the solar cycle, in which the number of spots reaches a maximum about every 11 years on the average, as do the effects of solar disturbances (*e.g.*, auroras) on the Earth.

By observing spots, R.C. Carrington found (*c.* 1860) that the Sun rotates not as a solid body but differentially, fastest at the equator. Sunspots are never seen exactly at the equator or near the poles. Vilhelm Bjerknes theorized in 1926 that spots are the erupting ends of magnetic vortices broken by the Sun's differential rotation. Various elaborations on this idea have been proposed, but the cause of sunspots is still uncertain. George Ellery Hale in 1908 discovered their magnetic fields; John Evershed in 1909 detected the radial motion of gas away from sunspot centres. Annie Russel Maunder in 1922 charted the latitude drift of spots during each solar cycle. Her chart is sometimes called the butterfly diagram because of the winglike shapes assumed by the graph. Each solar cycle begins with small spots appearing in middle latitudes of the Sun. Succeeding spots appear progressively closer to the Sun's equator as the cycle reaches its maximum level of activity and declines.

**Sunyani,** town, west-central Ghana. It is surrounded by the forested Southern Ashanti Uplands. The site was a camping place for elephant hunters in the late 19th century. The British set up a district headquarters there in 1924; and with the construction of the road to Kumasi, Sunyani became commercially important as a clearinghouse for cocoa, kola nuts, and staple foods (plantains, yams, and corn [maize]). There is a sports arena in Coronation Park, and the town also has an airport. Pop. (1984) 38,834.

**suona** (musical instrument): *see* so-na.

**Super Bowl,** in U.S. professional football, the championship game of the National Football League, played by the winners of the league's American Football Conference and National Football Conference each January.

The game resulted from the 1966 merger of the American Football League (AFL) and the older, established National Football League (NFL). It was originally called the AFL–NFL World Championship Game. The present name was suggested by Lamar Hunt, owner of the AFL's Kansas City Chiefs. The first game was played on Jan. 15, 1967, in the Los Angeles Coliseum, the NFL's Green Bay Packers defeating the AFL's Kansas City Chiefs by a score of 35–10. When the AFL–NFL merger became final in 1970, the NFL absorbed the AFL teams, split into two conferences, and continued the Super Bowl under its own banner. *See* Sporting Record: *Football.*

**superb warbler** (bird): *see* fairy wren.

**supercharger,** in piston-type internal-combustion engines, air compressor or blower used to increase the amount of air drawn into the cylinders by the pumping action of the pistons during each intake stroke. With the additional air, more fuel is burned, and the power of the engine is thus increased.

In aircraft piston engines, supercharging compensates for the reduced atmospheric pressure at high altitudes. Development of the gas turbine, which requires constant flow of air and fuel, brought the introduction of the turbosupercharger, a centrifugal blower driven by a small gas turbine powered by the exhaust gases from the engine cylinders.

**supercomputer,** any of a class of extremely powerful computers. The term is commonly applied to the fastest high-performance systems available at any given time. Such computers are used primarily for scientific and engineering work requiring exceedingly high-speed computations.

Supercomputers have certain distinguishing features. Unlike conventional computers, they usually have more than one central processing unit (CPU), though some machines do have a single-processor design. (The CPU contains the circuits for interpreting program instructions and executing arithmetic and logic operations in proper sequence.) The use of several central processors to achieve high computational rates is necessitated by the physical limits of circuit technology. Electronic signals cannot travel faster than the speed of light, which thus constitutes a fundamental speed limit for signal transmission and circuit switching. This limit has almost been reached owing to the miniaturization of circuit components, dramatic reduction in the length of wires connecting circuit boards, and innovative cooling techniques (*e.g.*, in various supercomputer systems, processor and memory circuits are immersed in a cryogenic fluid to achieve the low temperatures at which they operate fastest).

To bypass this physical barrier, supercomputer manufacturers developed systems with as many as eight processors, whereby it becomes possible to divide up a task into smaller components that can be handled by each separate processor simultaneously. Machines of this kind include the Cray Y-MP, capable of more than 3,000,000,000 calculations per second, and the ETA-10, with a peak speed of about 10,000,000,000 calculations per second.

Rapid retrieval of stored data and instructions are required to support such extremely high computational speeds. Therefore, most supercomputers have a very large storage capacity (*i.e.*, in excess of 2,000,000,000 bytes of shared memory), as well as a very fast input/output capability.

Still another distinguishing characteristic of supercomputers is their use of vector arithmetic—*i.e.*, they are able to operate on pairs of lists of numbers rather than on mere pairs of numbers. For example, a typical supercomputer can multiply a list of hourly wage rates for a group of factory workers by a list of hours worked by members of that group to produce a list of dollars earned by each worker in roughly the same time that it takes a regular computer to calculate the amount earned by just one worker.

Supercomputers were originally used in applications related to national security, including nuclear-weapons design and cryptography. Today, they are routinely employed by the aerospace, petroleum, and automotive industries. They also have found wide application in other areas involving engineering or scientific research, as, for example, in studies of the structure of subatomic particles and of the origin and nature of the universe. Supercomputers have become an indispensable tool in weather forecasting: predictions are now based on numerical models.

Higher-performance supercomputers are expected to be developed through increased use of parallel processing. Computer experts have already built systems that harness together thousands of individual processors to share the workload. These processors, however, are still considerably slower than the ones employed in current supercomputers, so that the latter remain unsurpassed in performance except in certain special circumstances. *See also* Cray, Seymour R. (S.Ka.)

**superconductivity,** complete disappearance of electrical resistance in various solids when they are cooled below a characteristic temperature. This temperature, called the transition temperature, varies for different materials but generally is below 20 K (−253° C).

A brief treatment of superconductivity follows. For full treatment, *see* MACROPAEDIA: Matter.

Superconductivity was first discovered in mercury by the Dutch physicist Heike Kamerlingh Onnes in 1911. Similar behaviour has been found in approximately 25 other chemical elements, including lead and tin, and in thousands of alloys and chemical compounds. All other materials that have been investigated to within fractions of a degree of absolute zero show normal resistance to the flow of electric currents.

The use of superconductors in magnets is limited by the fact that strong magnetic fields above a certain critical value, depending upon the material, cause a superconductor to revert to its normal, or nonsuperconducting, state, even though the material is kept well below the transition temperature.

Another basic property of superconductors, besides their lack of resistance, is their ability to prevent external magnetic fields from penetrating their interior: they are perfect diamagnets. All external magnetic fields less than the critical value are totally screened from the interior of type I superconductors, but strong fields are only partially screened from the interior of type II. Some type II superconductors have been found to retain their superconductivity in all but the strongest magnetic fields.

In 1986 and 1987 a few type II superconductors were discovered to retain their superconductivity at temperatures as high as 98 K. Compounds retaining their superconductivity at temperatures as high as 134 or 127 K were soon found. These high-temperature superconductors all contain copper and oxygen atoms that form planes or chains of atoms in the crystal. Their properties are anisotropic—*i.e.,* dependent on the direction of current flow and of magnetic field with respect to the planes and chains of atoms. These new materials are ceramics, and their properties are sensitive to the amount of oxygen in them. Because they are superconducting at temperatures that can be inexpensively obtained with liquid nitrogen, these ceramic oxides hold great promise for practical applications. Problems of brittleness, instabilities in some chemical environments (such as moist air), and a tendency for impurities to segregate at surfaces of the crystals (where they interfere with the flow of high currents in the superconducting state) have yet to be overcome, however.

Suggested uses for superconducting materials include medical magnetic-imaging devices, magnetic energy-storage systems, motors, generators, transformers, computer parts, and very sensitive devices for measuring magnetic fields, voltages, or currents. The main advantages of devices made from superconductors are low power dissipation, high-speed operation, and high sensitivity.

**superego,** in the psychoanalytic theory of Sigmund Freud, latest developing of three agencies (with the id and ego; *qq.v.*) of the human personality. The superego is the ethical component of the personality and provides the moral standards by which the ego operates. The superego's criticisms, prohibitions, and inhibitions form a person's conscience, and its positive aspirations and ideals represent one's idealized self-image, or "ego ideal."

The superego develops during the first five years of life in response to parental punishment and approval. This development occurs as a result of the child's internalization of his parents' moral standards, a process greatly aided by a tendency to identify with the parents. The developing superego absorbs the traditions of the family and the surrounding society and serves to control aggressive or other socially unacceptable impulses. Violation of the superego's standards results in feelings of guilt or anxiety and a need to atone for one's actions. The superego continues to develop into young adulthood as a person encounters other admired role models and copes with the rules and regulations of the larger society. *See also* Oedipus complex.

**superfluidity,** the unusual properties of liquid helium when it is cooled below 2.18 K (−270.97° C), called the lambda ($\lambda$) point. The term was coined in 1938 by the Soviet physicist Pyotr Kapitsa following an extensive series of experiments showing that in this state of helium, called helium II (He II), there is an apparent enormous rise in heat conductivity, rapid flow through capillaries or over the rim of its containment vessel as a thin film, and that a number of other unusual properties also appear.

In order to account for such behaviour, the "two fluid" model, as proposed by Laszlo Tisza, described He II as a mixture of normal helium and superfluid helium. The normal component is attributed to helium atoms in excited energy states, whereas the superfluid component is attributed to atoms all in the ground state (having lowest or zero-point energy). As the temperature continues to be lower below the lambda point, more of the He II becomes superfluid. It is assumed that this superfluid component is able to move through its container without friction, thereby explaining most of the unusual behaviour of helium II.

**superfluous man,** Russian LISHNY CHELOVEK, a character type whose frequent recurrence in 19th-century Russian literature is sufficiently striking to make him a national archetype. He is usually an aristocrat, intelligent, well-educated, and informed by idealism and goodwill but incapable, for reasons as complex as Hamlet's, of engaging in effective action. Although he is aware of the stupidity and injustice surrounding him, he remains a bystander. The term gained wide currency with the publication of Ivan Turgenev's story "The Diary of a Superfluous Man" (1850). Although most of Turgenev's heroes fall into this category, he was not the first to create the type. Aleksandr Pushkin introduced the type in *Eugene Onegin* (1833), the story of a Byronic youth who wastes his life, allows the girl who loves him to marry another, and lets himself be drawn into a duel in which he kills his best friend. The most extreme example of this character is the hero of Ivan Goncharov's *Oblomov* (1859). An idle, daydreaming noble who lives on the income of an estate he never visits, Oblomov spends all his time lying in bed thinking about what he will do when (and if) he gets up.

The radical critic Nikolay A. Dobrolyubov analyzed the superfluous man as an affliction peculiar to Russia and the by-product of serfdom. Throughout the 19th and early 20th centuries, superfluous men continued to dominate Russian novels and plays. They include some of the most attractive and sympathetic characters in literature: Pierre Bezukhov (in Leo Tolstoy's *War and Peace,* 1865–69), Prince Myshkin (in Fyodor Dostoyevsky's *The Idiot,* 1868–69), and in numerous examples by Anton Chekhov.

**Superfortress** (aircraft): *see* B-29.

**supergiant star,** any star of very great intrinsic luminosity and relatively enormous size, typically several magnitudes brighter than a giant star and several times greater in diameter. The distinctions between giants (*see also* giant star), supergiants, and other classes are made in practice by examining certain lines in the stars' spectra. A star classed as a supergiant may have a diameter several hundred times that of the Sun and a luminosity nearly 1,000,000 times as great. Supergiants are tenuous stars, and their lifetimes are probably only a few million years, extremely short on the scale of stellar evolution.

**supergravity,** a type of quantum theory of elementary particles and their interactions that is based on the particle symmetry known as supersymmetry and that naturally includes gravity along with the other fundamental forces (the electromagnetic force, the weak nuclear force, and the strong nuclear force).

The electromagnetic and the weak forces are now understood to be different facets of a single underlying force that is described by the electroweak theory. Further unification of all four fundamental forces in a single quantum theory is a major goal of theoretical physics. Gravity, however, has proved difficult to treat with any quantum theory that describes the other forces in terms of messenger particles that are exchanged between interacting particles of matter. General relativity, which relates the gravitational force to the curvature of space-time, provides a respectable theory of gravity on a larger scale. To be consistent with general relativity, gravity at the quantum level must be carried by a particle, called the graviton, with an intrinsic angular momentum (spin) of 2 units, unlike the other fundamental forces, whose carriers (*e.g.,* the photon and the gluon) have a spin of 1.

A particle with the properties of the graviton appears naturally in certain theories based on supersymmetry—a symmetry that relates fermions (particles with half-integral values of spin) and bosons (particles with integral values of spin). In these theories supersymmetry is treated as a "local" symmetry; in other words, its transformations vary over space-time, unlike a "global" symmetry, which transforms uniformly over space-time. Treating supersymmetry in this way relates it to general relativity, and so gravity is automatically included. Moreover, these supergravity theories seem to be free from various infinite quantities that usually arise in quantum theories of gravity. This is due to the effects of the additional particles that supersymmetry predicts (every particle must have a supersymmetric partner with the other type of spin). In the simplest form of supergravity, the only particles that exist are the graviton with spin 2 and its fermionic partner, the gravitino, with spin 3/2. (Neither has yet been observed.) More complicated variants also include particles with spin 1, spin 1/2, and spin 0, all of which are needed to account for the known particles. These variants, however, also predict many more particles than are known at present, and it is difficult to know how to relate the particles in the theory to those that do exist.

(Ch.Su.)

**superheterodyne reception,** the commonest technique for recovering the information (sound or picture) from carrier waves of a range of frequencies, transmitted by different broadcasting stations. The circuitry, devised by Edwin H. Armstrong during World War I, combines the high-frequency current produced by the incoming wave with a low-frequency current produced in the receiver, giving a beat (or heterodyne) frequency that

is the difference between the original combining frequencies. This different frequency, called the intermediate frequency (IF), is beyond the audible range (hence the original term, supersonic heterodyne reception); it can be amplified with higher gain and selectivity than can the initial higher frequency. The IF signal, retaining modulation to the same degree as the original carrier, enters a detector from which the desired audio or other output signal is obtained.

The receiver is tuned to different broadcast frequencies by adjusting the frequency of the current used to combine with the carrier waves. This arrangement is employed in most radio, television, and radar receivers.

**superhighway:** *see* expressway.

**Superior,** city, seat (1854) of Douglas county, northwestern Wisconsin, U.S. It lies at the western tip of Lake Superior, opposite Duluth, Minn., from which it is separated by the St. Louis River estuary. A port of entry, it shares an extensive natural harbour with Duluth, forming the western terminus of the St. Lawrence Seaway.

In 1655 the Jesuit Claude-Jean Allouez built a mission in the area. Later, fur-trading posts were established. Permanent settlement, started in 1853, produced three communities that were consolidated by incorporation (1889) as a city. Superior's growth was stimulated by the discovery of iron ore (1883) in the Gogebic Range. Grain, iron ore, copper, taconite, limestone, and coal are shipped. Crude oil for refining arrives from western Canada via a 1,127-mile (1,814-kilometre) pipeline. The port has extensive railway connections. Superior's industries include shipbuilding, heavy equipment manufacturing, wood conversion, and flour milling. Tourism is significant, and Manitou Falls, largest in the state, is 12 miles (19 km) south. The University of Wisconsin at Superior originated as a state teachers college in 1893. Pop. (1992 est.) 27,772.

**Superior, Lake,** most northwesterly and largest of the five Great Lakes of North America and one of the world's largest bodies of freshwater. Bounded on the east and north by Ontario (Can.), on the west by Minnesota (U.S.), and on the south by Wisconsin and Michigan (U.S.), it discharges into Lake Huron at its eastern end via the St. Marys River. The lake is 383 miles (616 km) long (east to west), and its greatest width is 160 miles (258 km) from north to south. It has a mean surface elevation of 600 feet (180 m) above sea level and a maximum depth of 1,330 feet (405 m). The lake's drainage basin is 49,300 square miles (127,700 square km), exclusive of its surface area of 31,700 square miles (82,100 square km).

Lake Superior receives approximately 200 rivers, of which the largest are the Nipigon (from the north) and the St. Louis (from the west). Other principal rivers entering the north shore are the Pigeon, Kaministikwia, Pic, White, and Michipicoten. No large rivers reach the lake from the south. The principal islands in the lake are Isle Royale, a U.S. national park; the Apostle Islands, near the Wisconsin shore; Michipicoten, on the east side; and St. Ignace, near the mouth of the Nipigon River (Can.).

The coastline of Lake Superior is picturesque, particularly the north shore, which is indented by deep bays backed by high cliffs. Much of the coastal area is sparsely settled. Extensive forests are held in federal, state, provincial, and private timberlands. Seasonal hunting, sport fishing, and tourism form the basis for an important regional recreation industry. Valuable mineral deposits surround the lake. Iron ore was mined and smelted locally from 1848, and the opening (1855) of the ship canal along the St. Marys River allowed regular shipment to the lower lakes. Subsequently, iron was extracted from many parts of the Lake Superior district, including the Mesabi Range in Minnesota. Recently, more use has been made of the abundant taconite and other low-grade ores. Other minerals extracted include silver (near Thunder Bay, Ont.), nickel (north of the lake), and copper (south of the lake).

Lake Superior has many natural harbours, and improvements have created additional ports. The navigation season is generally about eight months long. At Thunder Bay, grain from the Canadian prairies is transferred from rail to ship. Iron ore is exported from Taconite Harbor and Two Harbors (Minn.). The harbour shared by Duluth (Minn.) and Superior (Wis.) is a shipping point for iron ore, grain, and flour. The principal ports along the lake's south shore are Ashland (Wis.), Hancock and Houghton (both on a 25-mile-long canal across the Keweenaw Peninsula, Mich.), and Marquette (Mich.).

The first European to see Lake Superior was probably the French explorer Étienne Brûlé in 1622. Pierre Espirit Radisson and Médard Chouart des Groseilliers gathered a valuable cargo of furs during their extensive travels on the lake (1659–60). The French Jesuit missionary Claude-Jean Allouez circumnavigated and charted the lake in 1667. Daniel Greysolon, Sieur Dulhut (or DuLuth), opened the lake to active trading in 1679. French fur trading then flourished at intervals, but the entire region came under British control between 1763 and 1783. Trade remained in the hands of the British until 1817, when John Jacob Astor's American Fur Company took over south of the Canadian border. The lake's name is from the French Lac Supérieur ("Upper Lake").

**Superior Bay,** also called ALLOUEZ BAY, narrow inlet of western Lake Superior, indenting the coast of Minnesota (northwest) and Wisconsin (southeast), U.S. The bay is 7 miles (11 km) long and 0.5 to 1 mile wide and is sheltered from the lake by a low sand and gravel formation called Minnesota Point. Receiving the St. Louis River, the bay forms part of one of the most important harbours on the Great Lakes. The twin ports of Duluth, Minn., and Superior, Wis., along the bay are the westernmost points for the St. Lawrence Seaway. The name Allouez is for Father Claude-Jean Allouez, a French missionary who traveled through the region in the 1660s.

**Superior Upland,** geographic region in northern Wisconsin, Minnesota, and Michigan, U.S., lying south and west of Lake Superior. A southern extension of the Canadian Shield of ancient mountain ranges, it is composed of crystalline rock with little overlying soil. Pleistocene glaciation (the southward movement of ice that began approximately 2,500,000 years ago) scraped most of the land bare. Agriculture is thus limited, but the region has yielded much iron ore and is ruggedly scenic.

**superman,** German ÜBERMENSCH, in philosophy, the superior man, who justifies the existence of the human race. "Superman" is a term significantly used by Friedrich Nietzsche, particularly in *Also sprach Zarathustra* (1883–85), although it had been employed by J.W. von Goethe and others. This superior man would not be a product of long evolution; rather, he would emerge when any man with superior potential completely masters himself and strikes off conventional Christian "herd morality" to create his own values, which are completely rooted in life on this earth. Nietzsche was not forecasting the brutal superman of the German Nazis, for his goal was a "Caesar with Christ's soul." George Bernard Shaw popularized the term "superman" in his play *Man and Superman* (1903).

**Superman,** 20th-century American comic-strip superhero who first appeared in *Action Comics* in June 1938 and in a newspaper strip in January of the following year; both were written by Jerry Siegel and drawn by Joseph Shuster. Superman, the "man of steel," later became the protagonist of a radio show, animated-film cartoons, a novel, a Broadway musical, a television series, and motion pictures.

Superman, as the story goes, was sent as a baby to Earth by his parents from their home on the doomed planet Krypton. He was found and reared in mid-America by Martha and Jonathan Kent, who named him Clark. As a boy he discovered the latent native powers that would later evolve into flight, X-ray vision, and unlimited strength—the hallmarks of Clark Kent's alter ego, Superman. This dual identity provided the central tension of the saga. As the mild-mannered Kent, he worked as a reporter on the *Daily Planet* in Metropolis, where he developed a romantic interest in fellow reporter Lois Lane. She, however, dazzled by the courageous crime-fighting exploits of Superman and unaware of his secret identity, continually rejected Kent's overtures. Superman, invulnerable to all dangers except for the mysterious substance Kryptonite, in turn remained resolutely aloof and independent in his fight for "truth, justice, and the American way."

**supermarket,** large retail store operated on a self-service basis, selling groceries, fresh produce, meat, bakery and dairy products, and sometimes an assortment of nonfood goods. Supermarkets gained acceptance in the United States during the 1930s. The early stores were usually located in reconverted industrial buildings in outlying areas; they had no elaborate display facilities, and their primary advantage was their low prices. During the 1940s and '50s they became the major food marketing channel in the United States and in the 1950s spread through much of Europe. The extent to which they have succeeded in various countries has depended on the ability or willingness of producers and wholesalers to adapt their operations to large-scale retailing. The spread of supermarkets is part of a trend in the developed countries toward reducing costs and simplifying the pattern of marketing.

During the 1960s, supermarkets appeared in developing countries in the Middle East, East Asia, and Latin America, where they appealed largely to upper middle income groups who had the necessary buying power and food-storage facilities.

**supernova,** plural SUPERNOVAS, or SUPERNOVAE, any of a class of violently exploding stars whose luminosity after eruption suddenly increases millions or even billions of times its normal level.

The term supernova is derived from nova (Latin: "new"), the name for another type of exploding star. Supernovas resemble novas in several respects. Both are characterized by a tremendous, rapid brightening lasting for a few weeks, followed by a slow dimming. Spectroscopically, they show blue-shifted emission lines, which imply that hot gases are blown outward. But a supernova explosion, unlike a nova outburst, is a cataclysmic event for a star, one that essentially ends its active (*i.e.*, energy-generating) lifetime. When a star "goes supernova," considerable amounts of its matter, equaling the material of several Suns, may be blasted into space with such a burst of energy as to enable the exploding star to outshine its entire home galaxy.

Historically, only seven supernovas are known to have been recorded before the early 17th century, with the most famous occurring in AD 1054. It was seen in one of the horns of the constellation Taurus. The remnants of this explosion are visible today as the Crab Nebula, which is composed of glowing ejecta

of gases flying outward in an irregular fashion and a rapidly spinning, pulsating neutron star, called a pulsar, in the centre. The supernova of 1054 was recorded by Chinese and Korean observers; it also may have been seen by southwestern American Indians, as suggested by certain rock paintings discovered in Arizona and New Mexico. It was bright enough to be seen during the day, and its great luminosity lasted for weeks. Other prominent supernovas are known to have been observed from Earth in AD 185, 393, 1006, 1181, 1572, and 1604.

The closest and most easily observed of the hundreds of supernovas that have been recorded since 1604 was first sighted on the night of Feb. 24, 1987, by the Canadian astronomer Ian K. Shelton while working at the Las Campanas Observatory in Chile. Designated SN 1987A, this formerly extremely faint object attained a magnitude of 4.5 within just a few hours, thus becoming visible to the unaided eye. The newly appearing supernova was located in the Large Magellanic Cloud at a distance of about 50,000 parsecs. It immediately became the subject of intense observation by astronomers throughout the Southern Hemisphere. SN 1987A's brightness peaked in May with a magnitude of about 3 and slowly declined in the following months.

Supernovas may be divided into two broad classes, Type I and Type II, according to the way in which they detonate. Type I supernovas may be up to three times brighter than Type II; they also differ from Type II supernovas in that their spectra contain no hydrogen lines and they expand about twice as rapidly.

The so-called classic explosion, associated with Type II supernovas, has as progenitor a very massive star (a Population I star) of at least eight solar masses that is at the end of its active lifetime. (These are seen only in spiral galaxies, most often near the arms.) Until this stage of its evolution, the star has shone by means of the nuclear energy released at and near its core in the process of squeezing and heating lighter elements such as hydrogen or helium into successively heavier elements—*i.e.*, in the process of nuclear fusion. Forming elements heavier than iron absorbs rather than produces energy, however, and, since energy is no longer available, an iron core is built up at the centre of the aging, heavyweight star. When the iron core becomes too massive, its ability to support itself by means of the outward explosive thrust of internal fusion reactions fails to counteract the tremendous pull of its own gravity. Consequently, the core collapses until it reaches a point at which its constituent nuclei and free electrons are crushed together into a hard, rapidly spinning core. This core consists almost entirely of neutrons, which are compressed in a volume only 20 km (12 miles) across but whose combined weight equals that of several Suns. A teaspoonful of this extraordinarily dense material would weigh 50 billion tons on Earth.

The supernova detonation occurs when material falls in from the outer layers of the star and then rebounds off the core, which has stopped collapsing and suddenly presents a hard surface to the infalling gases. The shock wave generated by this collision propagates outward and blows off the star's outer gaseous layers. The amount of material blasted outward depends on the star's original mass.

In some cases, the core collapse may be too great to produce a supernova and the imploding star is compressed into an even smaller and denser body than a neutron star—namely, a black hole. Infalling material disappears into the black hole, the gravitational field of which is so intense that not even light can escape. The entire star is not taken in by the black hole, since much of the falling envelope of the star either rebounds from the temporary formation of a spinning neutron core or misses passing through the very centre of the core and is spun off instead.

Type I supernovas have only recently become explicable, though not without some uncertainty, on the basis of observational data. It appears that the immediate process resulting in the Type I explosion—the collapsing core suddenly becoming rigid and causing the infalling material to rebound—is similar to what occurs with Type II supernovas. The progenitor of the Type I variety, however, is a lighter-weight star (a Population II star) of only four to eight solar masses. Type I supernovas occur in all kinds of galaxies and may result when the extremely massive white dwarf component in a binary star system draws so much matter from its companion that it collapses to a neutron core.

There is less infalling material in the case of Type I supernovas. As a consequence, radioactive elements, most notably nickel-56, that are formed during the rebound near the core's surface may be blasted out through the material above. Moreover, when nickel-56 decays to cobalt-56 and the latter to iron-56, significant amounts of energy are released. This energy is the source of much of the light emitted during the weeks following the explosion.

Supernova explosions release not only tremendous amounts of radio radiation and X-radiation but also cosmic rays and many of the heavier elements that make up the components of the solar system, including the Earth, into the interstellar medium. Spectral analyses show that abundances of the heavier elements are greater than normal, indicating that these elements do indeed form during the course of the explosion. The shell of remnants continues to expand until, at a very advanced stage, it dissolves into the interstellar medium. *Compare* nova. *See also* black hole.

**superposed order,** in Classical architecture, an order, or style, of column placed above another order in the vertical plane, as in a multilevel arcade, colonnade, or facade. In ancient Greece, where the orders originated, they were rarely superposed unless it was structurally required; and when Greek builders did superpose orders, as in some examples of the stoa, or covered walk, they were always of the same order as the columns below. In the Parthenon at Athens (5th century BC), the great eastern chamber, known as the Hecatompedon, has a two-tiered colonnade with superposed Doric orders on three sides.

Roman architects used superposed orders freely as decorative elements. The Colosseum, built at Rome in the 1st century AD, has four stories: on the ground level the order is Doric; on the next level it is Ionic; on the third, Corinthian; and the top story has pilasters (attached rectangular columns), also of the Corinthian order. Renaissance builders frequently used superposed orders, usually in the same ascending series as on the Colosseum, though they sometimes added a Composite order. They also developed the Colossal, or giant, order, a single column reaching upward through two or more stories, which could substitute for the superposed orders.

**supersonic flight,** passage through the air at speed greater than the local velocity of sound. The speed of sound (Mach 1) varies with atmospheric pressure and temperature: in air at a temperature of 15° C (59° F) and sea-level pressure, sound travels at about 1,225 km (760 miles) per hour. At speeds beyond about five times the velocity of sound (Mach 5), the term hypersonic flight is employed.

The first aircraft to fly at supersonic speeds was a Bell XS-1 rocket-powered research plane on Oct. 14, 1947; it attained a top speed of 1,126 km (700 miles) per hour, or Mach 1.06. Thereafter many military aircraft capable of supersonic flight were built, though their speed was generally limited to Mach 2.5 because of problems caused by frictional heating of the skin of the plane. The first supersonic passenger-carrying, commercial airplane (or supersonic transport, SST), the Concorde, was built jointly by aircraft manufacturers in Great Britain and France and entered regular service in 1976; British Airways and Air France stopped flying the Concorde in 2003. The Concorde had a maximum cruising speed of 2,179 km (1,354 miles) per hour, or Mach 2.04. On Oct. 13, 1997, the ThrustSSC, a British-made car powered by two jet engines, became the first land-traveling vehicle to break the sound barrier.

**superstition,** belief, half-belief, or practice for which there appears to be no rational substance. Those who use the term imply that they have certain knowledge or superior evidence for their own scientific, philosophical, or religious convictions. An ambiguous word, it probably cannot be used except subjectively. With this qualification in mind, superstitions may be classified roughly as religious, cultural, and personal.

Every religious system tends to accumulate superstitions as peripheral beliefs—a Christian, for example, may believe that in time of trouble he will be guided by the Bible if he opens it at random and reads the text that first strikes his eye. Often one person's religion is another one's superstition: Constantine called paganism superstition; Tacitus called Christianity a pernicious superstition; Roman Catholic veneration of relics, images, and the saints is dismissed as superstitious by many Protestants; Christians regard many Hindu practices as superstitious. Finally, all religious beliefs and practices may seem superstitious to the person without religion.

Superstitions that belong to the cultural tradition are enormous in their variety. Many persons have held, seriously or half-seriously, irrational beliefs concerning methods of warding off ill or bringing good, foretelling the future, and healing or preventing sickness or accident. A few specific folk traditions, such as belief in the evil eye or in the efficacy of amulets, have been found in most periods of history and in most parts of the world. Others may be limited to one country, region, or village, to one family, or to one social or vocational group.

Finally, people develop personal superstitions: a schoolboy writes a good examination paper with a certain pen, and from then on that pen is lucky.

Superstition has been deeply influential in history. Even in so-called modern times, in a day when objective evidence is highly valued, there are few people who would not, if pressed, admit to cherishing secretly one or two irrational beliefs or superstitions.

**superstring theory,** a type of theory of particle physics that treats elementary particles as extended one-dimensional "string-like" objects rather than as the dimensionless points in space-time used in other theories. Superstring theories became popular during the 1980s when Michael Green and John Schwarz showed that certain types of such theories might provide a fully self-consistent quantum theory that describes gravity as well as the weak, strong, and electromagnetic forces. The development of such a unified quantum theory is a major goal in theoretical particle physics, but usually the inclusion of gravity has led to intractable problems with infinite quantities in the calculations.

The basic entities in superstring theory are one-dimensional massless strings only $10^{-33}$ cm long. (This distance is the so-called Planck length, at which quantum effects in gravity can no longer be ignored.) The strings vibrate, and each different mode of vibration corresponds to a different particle. The strings can also interact in ways that correspond to the observed interactions of particles.

String theories of elementary particles were first introduced in the early 1970s in attempts to describe the strong force. Although quantum chromodynamics was soon accepted as the correct theory of the strong force, string theory was given new life with the incorporation of supersymmetry, the symmetry between fermions (particles with half-integral values of spin) and bosons (particles with integral values of spin). Not only did the resulting superstring theory successfully encompass all the fundamental forces, but only a limited type of the many possible versions seemed to be properly self-consistent, making it a leading candidate for a fully unified theory of particles and forces.

At first sight this particular type of superstring theory might seem to have an insurmountable drawback in that it deals with a space-time of ten dimensions instead of the three dimensions of space and one of time that are perceived in the everyday world. It seems, however, that six of the ten dimensions may be "compactified," or "curled up"—*i.e.*, so small that they are unnoticeable. Other problems remain, however. The theory is still a long way from explaining the masses of the known particles. It also implies the existence of new particles in a form of "shadow matter," with which normal matter can interact only through gravity. (Ch.Su.)

**supersymmetry,** in particle physics, a symmetry between fermions (subatomic particles with half-integer values of intrinsic angular momentum, or spin) and bosons (particles with integer values of spin).

An entity is said to exhibit symmetry when it appears unchanged after undergoing a transformation operation. A square, for example, has a fourfold symmetry by which it appears the same when rotated about its centre through 90, 180, 270, and 360 degrees; four 90-degree rotations bring the square back to its original position. With supersymmetry, fermions can be transformed into bosons without changing the structure of the underlying theory of the particles and their interactions. When a fermion is transformed into a boson and then back again into a fermion, however, it turns out that the particle has moved in space, an effect that is related to special relativity. Thus, supersymmetry relates transformations in an internal property of particles (spin) to transformations in space-time.

One attraction of supersymmetry is that it provides a connection between the known elementary particles of matter (quarks and leptons, which are all fermions) and the particles that convey the fundamental forces (all bosons). By showing that one type of particle is in effect a different facet of the other type, supersymmetry reduces the number of basic types of particle from two to one.

Supersymmetry also plays an important role in modern theories of particle physics because the new particles that it requires eliminate various infinite quantities that otherwise appear in calculations of particle interactions at high energies, particularly in attempts at unified theories of the fundamental forces. These new particles are the bosons (or fermions) into which the known fermions (or bosons) are transformed by supersymmetry. Thus, supersymmetry implies a doubling of the number of the known particles. For example, fermions such as electrons and quarks should have bosonic supersymmetric partners, which have been given the names of selectrons and squarks. Similarly, known bosons such as the photon and the gluon should have fermionic supersymmetric partners, called the photino and the gluino. There has been no experimental evidence that such "superparticles" exist. If they do indeed exist, their masses could be in the range of 50 to 1,000 times that of the proton. (Ch.Su.)

**supertanker,** large tanker (*q.v.*) or cargo ship, commonly an oil-carrying vessel that might exceed 500,000 tons deadweight.

**Supervielle, Jules** (b. Jan. 16, 1884, Montevideo, Uruguay—d. May 17, 1960, Paris, France), poet, dramatist, and short-story writer of Basque descent who wrote in the French language but in the Spanish tradition.

Supervielle's themes are the love of a lonely but fraternal man for the pampas and for the open spaces of his South American childhood and his nostalgia for a cosmic brotherhood of men. His poems (*Gravitations*, 1925; *Les Amis inconnus*, 1934 ["The Unknown Friends"]; *La Fable du monde*, 1938 ["Fable of the World"]) are sensitive, sometimes humorous, sometimes precious. In his novels *Le Voleur d'enfants* (1926; "The Kidnapper") and *L'Enfant de la haute mer* (1931; "The Child of the High Seas"), he allies fantasy and simplicity. His plays *La Belle au bois* (1932; "The Beauty of the Wood") and *Robinson* (1949) constitute an escape into a land of fantasy.

**Suphan Buri,** also spelled SUPHANBURI, town, west-central Thailand. Suphan Buri is located at the head of navigation of the Nakhon Chai Si River, 55 miles (88 km) northwest of Bangkok. An ancient walled city, it became part of the Angkor-based Khmer empire in the 11th century, the Sukhothai state in the 13th, and the Ayutthaya kingdom in the 14th. The modern town is a commercial centre for an agricultural region that produces rice, corn (maize), and oil seeds. Pop. (1991 est.) 25,814.

**Supilo, Frano** (b. Nov. 30, 1870, Cavtat, Dalmatia, Austria-Hungary [now in Croatia]—d. Sept. 23, 1917, London, Eng.), Croatian nationalist who opposed Austro-Hungarian domination before World War I and played a significant role in the controversies preceding the formation of an independent Yugoslav state.

As editor of *Novi List*, a Croatian journal he founded in 1900 at Rijeka, Supilo worked to promote Croatian-Serbian interests in opposition to Habsburg supremacy. In 1905 he drew up the Rijeka Resolution designed to create a Croat-Serb coalition, which he hoped would bring about an alliance with anti-Habsburg Hungarians. In an effort to discredit the coalition, Austro-Hungarian authorities provided the publicist Heinrich Friedjung with documents alleging that Supilo and his associates were working on behalf of Serbia. The latter sued Friedjung, and at the trial (1909) it was demonstrated that the documents were forgeries. Nevertheless, Supilo resigned as president of the coalition.

After the outbreak of World War I, Supilo supported the Allied cause and, together with the Croatian nationalist Ante Trumbić and Ivan Meštrović, a noted sculptor, founded the Yugoslav Committee in London (1915) with the purpose of liberating the South Slavs. A period of difficult negotiations followed involving the British and French promise to Italy of territories along the eastern Adriatic in the secret Treaty of London (1915), while the South Slavs debated between themselves over the nature of the future Yugoslav state. When Supilo insisted that a constitution precede unification, he was outvoted. Although he resigned from the committee over that issue, he later endorsed the Declaration of Corfu (July 20, 1917), whereby the South Slavic peoples would form a single kingdom (later called Yugoslavia).

**Suppé, Franz von,** Suppé also spelled SUPPÈ, original name FRANCESCO EZECHIELE ERMENEGILDO CAVALIERE SUPPÉ DEMELLI (b. April 18, 1819, Spalato, Dalmatia, Austrian Empire [now Split, Croatia]—d. May 21, 1895, Vienna, Austria), Austrian composer of light operas. He greatly influenced the development of Austrian and German light music up to the middle of the 20th century.

Suppé conducted at the Theater an der Wien, the Josephstadt, and other theatres in Vienna. His most successful comic operas were produced in Vienna and include *Leichte Kavallerie* (1866), *Fatinitza* (1876), and *Boccaccio* (1879). He also wrote choral works, a symphony, and string quartets.

**Suppiluliumas I,** also spelled SHUPPILULIUMASH, or SUBBILULIUMA (fl. 14th century BC), Hittite king (reigned *c.* 1380–*c.* 1346 BC), who dominated the history of the ancient Middle East for the greater part of four decades and raised the Hittite kingdom to Imperial power. The son and successor of Tudhaliyas III, Suppiluliumas began his reign by rebuilding the old capital, Hattusas (Boğazköy in modern Turkey), and consolidating the Hittite heartland.

Suppiluliumas' military career was almost exclusively devoted to struggles with the kingdom of Mitanni in the east and the reestablishment of a firm Hittite foothold in Syria. After an unsuccessful exploratory raid, he schemed to circumvent the Mitanni defenses in northern Syria by crossing the Euphrates River farther north and approaching its capital, Wassukkani, from the rear. Suppiluliumas' new tactics were successful, and he was able to capture and sack Wassukkani. He then turned south across the Euphrates and secured the allegiance of the Syrian princelings.

Suppiluliumas left his son Telipinus in charge of Syrian affairs and returned to Hattusas to resume religious duties. In the meantime, however, the debilitated Mitanni kingdom underwent a series of upheavals abetted by the renascent Assyrian kingdom, which had long been a tributary of the Mitanni. In the end, Assyria gained its independence, infiltrated Mitanni, and emerged as a new power in the region.

Suppiluliumas immediately returned to Syria, besieging the city of Carchemish. Hittite power was thus consolidated in all of northern Syria, where Suppiluliumas installed his sons Telipinus and Piyassilis as kings of Aleppo and Carchemish. In addition, Suppiluliumas concluded with Mattiwaza, son of the murdered Mitannian king Tushratta, a treaty of mutual assistance. A Mitannian buffer state was set up to shield the Hittite dominions in Syria from the growing Assyrian menace.

Suppiluliumas' preeminent international reputation is shown by an event that occurred during his siege of Carchemish. Ankhesenamen, daughter of the Egyptian king Akhenaton and childless widow of his successor Tutankhamen, wrote to the Hittite king and asked for one of his sons in marriage. Under Egypt's matrilinear succession laws, the new husband was to be the pharaoh. Suppiluliumas agreed and sent one of his sons, who on his way to Egypt was murdered by adversaries of the Queen's plans. This outrage was probably never completely avenged, for Suppiluliumas soon died in a plague brought into central Anatolia by Egyptian prisoners of war.

**supplejack,** any of various woody climbing plants with pliant, tough stems, particularly *Berchemia scandens,* of the buckthorn family (Rhamnaceae), also known as rattan vine. *B. scandens* occurs in the central and southern United States. It climbs to the tops of trees and has alternate, elliptical (oblong oval) leaves 3–7.5 cm (1.25–3 inches) long. The small, greenish white flowers are borne in a terminal cluster; the bluish black fruit is about 1 cm in diameter.

**supplicatio,** in Roman religion, a rite or series of rites celebrated either as a thanksgiving to the gods for a great victory or as an act of humility after a national calamity. During those times the public was given general ac-

cess to some or all of the gods; the statues or sacred emblems of the gods often were placed on platforms or couches. The people would then kneel or prostrate themselves in Greek fashion (thus the name *supplicatio*). On some occasions an expiatory *supplicatio* was celebrated in association with a *lectisternium*, in which images of pairs of gods were exhibited on couches before tables spread with food. Originally a *supplicatio* lasted from one to five days, but in later times it was extended to 10, 20, or even 50 days.

**supply and demand,** in economics, relationship between the quantity that producers wish to sell at various prices and the quantity of a commodity that consumers wish to buy.

The quantity of a commodity demanded can be seen to depend on the price of that commodity, the prices of all other commodities, the incomes of consumers, and their tastes. In economic analysis, the last three factors are often held constant; the analysis then involves examining the relationship between various prices and the maximum quantity that would potentially be purchased at each of these prices. These price–quantity combinations may be plotted on a curve, known as a demand curve.

The quantity of a commodity that is available in the market depends not only on the price obtainable for the commodity but also on the prices of substitutable products, the techniques of production, and the availability and costs of labour and other factors of production. In analyzing supply in the short run, one usually assumes that all but the price are constant in order to observe the relationship between various prices and the quantity potentially offered by suppliers at each price.

It is the function of a market to equate demand and supply through the price mechanism. If buyers wish to purchase more of a commodity than is available at the prevailing price, they will tend to bid the price up. If they wish to purchase less than is available at the prevailing price, suppliers will bid prices down. Thus, there is a tendency toward an equilibrium price, at which the quantity demanded is just equal to the quantity supplied.

As the price rises, the quantity offered usually increases, and the willingness of consumers to buy an article normally declines, but these changes are not necessarily proportional. The measure of the responsiveness of supply and demand to changes in price is their elasticity. Elasticity is calculated as the ratio of the percentage change in the quantity demanded or supplied to the percentage change in price. Thus, if the price of a commodity decreases by 10 percent, and the sales of it consequently increase by 20 percent, the elasticity of demand for that commodity is said to be 2.

The demand for products that have good, readily available substitutes is likely to be elastic, because consumers can easily replace one good with another if its price rises. The demand for a product may be inelastic if there are no close substitutes and if expenditures on the product comprise only a small part of the consumer's income. Firms faced with relatively inelastic demands for their products may increase their total revenue by raising prices; those with elastic demands cannot.

Although the concept of elasticity is most often associated with consumers' demand for a product, it can be applied to other variables. It may be used to measure the responsiveness of the quantity demanded by consumers to changes in their income. Another type of elasticity, known as the cross-elasticity of demand, measures the response in consumers' demand for one product to changes in the price of another. The cross-elasticity is likely to be positive if the products are substitutes for one another, because an increase in the price of one will result in an increase in demand for the other.

Supply-and-demand analysis may be applied to markets for final goods and services or to markets for labour, capital, and other factors of production as well. It can be applied at the level of the firm, the industry, or the entire economy. At the last level, though, the analysis is of quite a different nature. The total demand for all goods and services by all sectors of the economy, for example, determines the aggregate income in the economy; income thus depends on production, and a circular relationship exists between production, income, and final demand. The same may be said of the relationship between the supply of factors of production and the compensation offered, as in the case of unemployed workers who (theoretically) would willingly accept work at the going wage if it were available.

**supply curve,** in economics, graphic representation of the relationship between product price and quantity of product that a seller is willing and able to supply. Product price is measured on the vertical axis of the graph and quantity of product supplied on the horizontal axis.

In most cases, the supply curve is drawn as a slope rising upward from left to right, since product price and quantity supplied are directly related (*i.e.*, as the price of a commodity increases in the market, the amount supplied increases). This relationship is dependent on certain *ceteris paribus* (other things equal) conditions remaining constant. Such conditions include the number of sellers in the market, state of technology, production costs, seller price expectations, and prices of related products. A change in any of these conditions will cause a shift in the supply curve. A shifting of the curve to the left corresponds to a decrease in the quantity of product supplied, whereas a shift to the right reflects an increase. *Compare* demand curve.

**supraorbital ridge** (anatomy): *see* browridge.

**suprarenal gland:** *see* adrenal gland.

**suprasegmental,** also called PROSODIC FEATURE, in phonetics, a speech feature such as stress, tone, or word juncture that accompanies or is added over consonants and vowels; these features are not limited to single sounds but often extend over syllables, words, or phrases. In Spanish the stress accent is often used to distinguish between otherwise identical words: *término* means "term," *terminó* means "I terminate," and *terminó* means "he terminated." In Mandarin Chinese, tone is a distinctive suprasegmental: *shih* pronounced on a high, level note means "to lose"; on a slight rising note means "ten"; on a falling note means "city, market"; and on a falling–rising note means "history." English "beer dripped" and "beard ripped" are distinguished by word juncture.

The above examples demonstrate functional suprasegmentals. Nonfunctional suprasegmentals that do not change the meaning of words or phrases also exist; stress in French is an example. Suprasegmentals are so called in contrast to consonants and vowels, which are treated as serially ordered segments of the spoken utterance.

**Suprematism,** Russian SUPREMATISM, first movement of pure geometrical abstraction in painting, originated by Kazimir S. Malevich in Russia in about 1913. In his first Suprematist work, a pencil drawing of a black square on a white field, all the elements of objective representation that had characterized his earlier, Cubist-Futurist style, had been eliminated. Malevich explained that "the appropriate means of representation is always the one which gives fullest possible expression to feeling as such and which ignores the familiar appearance of objects." Referring to his first Suprematist work, he identified the black square with feeling and the white background with expressing "the void beyond this feeling."

Although his early Suprematist compositions most likely date from 1913, they were not exhibited until 1915, the year he edited the Suprematist manifesto, with the assistance of several writers, most notably the poet Vladimir Mayakovsky. In these first Suprematist works—consisting of simple geometrical forms such as squares, circles, and crosses—he limited his palette to black, white, red, green, and blue. By 1916–17 he was presenting more complex shapes (fragments of circles, tiny triangles); extending his colour range to include brown, pink, and mauve; increasing the complexity of spatial relationships; and introducing the illusion of the three-dimensional into his painting. His experiments culminated in the "White on White" paintings of 1917–18, in which colour was eliminated, and the faintly outlined square barely emerged from its background. Finally, at a one-man exhibition of his work in 1919, Malevich announced the end of the Suprematist movement.

Suprematism had a few adherents among lesser known artists, such as Ivan Kliun, Ivan Puni, and Olga Rosanova. While not affiliated with the movement, the distinguished Russian painter Wassily Kandinsky showed the influence of Suprematism in the geometrization of his forms after 1920. This geometrical style, together with other abstract trends in Russian art, was transmitted by way of Kandinsky and the Russian artist El Lissitzky to Germany, particularly to the Bauhaus (*q.v.*), in the early 1920s.

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**Supreme Court of Japan,** Japanese SAIKŌ SAIBANSHO, the highest court in Japan, a court of last resort with powers of judicial review and the responsibility for judicial administration and legal training. The court was created in 1947 during the U.S. occupation and is modelled to some extent after the U.S. Supreme Court. As was the Federal Constitutional Court of West Germany, the Supreme Court of Japan was endowed with the prerogative of judicial review, largely as a result of U.S. influence.

The Supreme Court of Japan is the successor to the Daishin-in, which was established in 1875 and reorganized in 1890 under the Meiji Constitution (1889) as a supreme court of final appeal in criminal and civil cases. Under the control of the Ministry of Justice, that court had little independence and could not deal with questions of constitutionality. The 1947 court, therefore, was intended to have the freedom to work independently of the government and to decide the constitutionality of statutes and administrative decisions.

The Supreme Court of Japan is made up of 14 justices and a chief justice, who sit as the Grand Bench to hear constitutional cases and cases that a petty bench (made up of five of the justices) has been unable to decide. There are three petty benches: civil, criminal, and administrative. A petty bench may consider a constitutional issue only if the Grand Bench has set precedent in the specific area covered.

Distribution of cases among the petty benches and assignments of individual Supreme Court judges are determined by the entire court sitting as the Judicial Assembly. The assembly is responsible for determining regulations for the national courts, the public prosecutors, and the legal profession and for disciplining violators of these regulations. As Japan has a unified national court system, all courts are under the control of the Supreme Court. The court even prepares a list of nominees for

positions in the inferior courts. The Judicial Assembly, through the Legal Training and Research Institute, also oversees graduate legal training for those who wish to pursue careers as judges, prosecutors, and lawyers.

The justices are appointed by the Cabinet (the chief justice by the emperor upon designation by the Cabinet). At least two-thirds must have considerable experience as lawyers, prosecutors, law professors, or members of high courts. Justices serve for life but may be retired for advanced age or ill health; they may also be impeached by the Diet. The only restriction on the justices is that they are forbidden to take part in politics. Theoretically, the public has some control over the appointments to the court. In the first general election following the appointment of a justice, the electorate is allowed to voice its approval or disapproval; the electorate reviews the status of a justice after a tenure of 10 years.

Cases come to the Supreme Court on appeal from one of the high courts, which are themselves appeals courts. The Supreme Court has no original jurisdiction, and it can deal only with a legal issue arising from a specific case. Even constitutional issues cannot be considered abstractly outside specific legal problems. The court can void any decision in which it finds there has been an incorrect interpretation or application of the law. The court may also overturn a ruling if it finds error in the facts of the case or if it considers the punishment unjust. It may remand a case back to a lower court if it finds justification for the reopening of proceedings.

**Supreme Court of Judicature,** in England and Wales, a court that, since 1971, has consisted of the Court of Appeal, the High Court of Justice, and the Crown Court.

Until the Judicature Act of 1873 (*q.v.*) the English court system was cluttered with courts, most of them dating back into medieval periods, with overlapping judicial powers. In 1873 several of these courts were abolished and replaced by a Supreme Court of Judicature consisting of the the Court of Appeal and the High Court of Justice, the latter having five divisions—Chancery; Queen's (or King's) Bench; Common Pleas; Exchequer; and Probate, Divorce, and Admiralty. In 1881 refinement of the court system continued with the Queen's Bench Division absorbing Common Pleas and Exchequer. Under the Courts Act of 1971, the court system of England and Wales was further refined, with other specialized courts being abolished and replaced by the Crown Court in 1972. The Crown Court is an intermediary court that is above the magistrates' courts but below the High Court of Justice and the Court of Appeal.

The modern Supreme Court of Judicature has the following judicial responsibilities: The Court of Appeal (*q.v.*) is divided into a Civil Division and a Criminal Division. The High Court of Justice is made up of three divisions which have both original and appellate jurisdiction: (1) the Chancery Division, presided over by the lord chancellor, or vice chancellor, and dealing with land sales, estates, etc., (2) the Queen's Bench Division, presided over by the lord chief justice and dealing mainly with contract and tort (the Admiralty Court and the Commercial Court being both part of the Queen's Bench Division), and (3) the Family Division, headed by a president, which deals with adoption, matrimonial proceedings, and other familial matters. The Crown Court (*q.v.*) is concerned mostly with criminal cases.

The Supreme Court of Judicature, as a comprehensive body, sits below the House of Lords, which is the final court of appeal.

**Supreme Court of the United States,** final court of appeal and final expositor of the U.S. Constitution. Within the framework of litigation, the Supreme Court marks the boundaries of authority between state and nation, state and state, and government and citizen.

The court was instituted by the Constitution of 1787 as the head of a federal court system with the authority to act in cases arising under the Constitution, laws, or treaties of the United States; in controversies to which the United States is a party; in controversies between states or between citizens of different states; in cases of admiralty and maritime jurisdiction; and in cases affecting ambassadors, other public ministers, and consuls.

The size of the court is set by Congress; it varied during the 19th century from 6 to 10 members before stabilizing in 1869 at 9. Appointments to the Supreme Court and to the lower federal courts are made by the president with the advice and consent of the Senate. Tenure is during good behaviour, subject to expulsion by conviction on impeachment. Only one justice has been impeached, Samuel Chase, who was acquitted in 1805. In 1969 one, Abe Fortas, was forced to resign, however, because of his outside financial dealings.

In maintaining the constitutional order, the Supreme Court from an early date has exercised the power of declaring acts of Congress or of the state legislatures unconstitutional. Such power of judicial review, however, is not expressly conferred by the Constitution (*see* judicial review). Executive, administrative, and judicial actions are also subject to review by the Supreme Court. Relatively few cases are brought in the original jurisdiction of the court. The great bulk of the court's business comes to it in its appellate jurisdiction. Depending on the nature of the decision in the state or lower federal court, the route to the Supreme Court is by appeal or certiorari. The difference between the two is that an appeal obliges the court to review the case, whereas a review under certiorari is discretionary.

The development of this bifurcated jurisdiction reflects a response by Congress to a long struggle by the court to cope with the volume of cases annually docketed. In 1891 a measure of relief was afforded by the Circuit Court of Appeals Act, which set up intermediate courts with final authority over appeals from federal district courts, save in cases of exceptional public importance. The Judge's Act (Feb. 13, 1925), sponsored by the court itself, carried the reforms further and greatly limited the obligatory jurisdiction, giving the court a large measure of control over its business by placing most classes of cases under certiorari.

Any assessment of the unifying forces in U.S. society must ascribe an important role to the Supreme Court. The chief technical instrument employed by the court has been the commerce clause of the Constitution, applied to nullify state laws of taxation or regulation that discriminate against or unduly burden interstate commerce; the clause has also been used to uphold the power of Congress to regulate vast sectors of the economy.

While the commerce clause has been the chief doctrinal source of power over the economy, the due process and equal protection clauses have been the principal sources of protection of persons and corporations against arbitrary or repressive acts of government. These clauses were used at first to protect property rights, but by the 20th century they began to be applied to the area of civil liberties, particularly in the extension of Bill of Rights guarantees to state actions. By the mid-20th century the equal protection clause of the Fourteenth Amendment, which had been designed for the benefit of emancipated blacks, began to serve its historic purpose as a barrier to racially discriminatory laws.

The opinions of the court have often been the epitome of reasoned elaboration. In conjunction with its long tradition of dissent, it serves to clarify, refine, and test the philosophic ideals written into the Constitution and translate them into working principles for a federal union under law. Beyond its specific contributions, this symbolic and pragmatic function may be regarded as the most significant role of the court in the life of the nation.

**Sup'ung Dam,** Korean SUP'UNG-DAM, Chinese (Wade-Giles) SHUI-FENG SHUI-PA, or (Pinyin) SHUIFENG SHUIBA, hydroelectric project on the Yalu River at the Korean border with Liaoning *sheng* (province), China, upstream from Tan-tung. It was originally designed as a joint project of the Japanese-controlled Manchukuo government, which administered Manchuria from 1931 to 1945, and the Japanese administration in Korea to supply power for the industrial developments in Manchuria and northern Korea. Construction was begun in 1937 by the Noguchi interests, which played a large part in Korean industry. When completed in 1941, the dam was 525 feet (160 m) high and 2,790 feet (850 m) long and formed a vast reservoir (Chinese Shui-fêng Shui-k'u; Korean Sup'ung-ho) 70 miles (30 km) long. By mid-1944 operating capacity was 450,000 kilowatt-hours. After Japan's defeat in 1945, the Soviet armies occupied Manchuria and removed the Sup'ung generating plant to the Soviet Union. The equipment was, however, restored during the first years of Chinese Communist rule, and additional capacity was added, largely with aid from the Soviet Union and eastern European countries.

The Sup'ung generating plant is linked with the central Northeast (Manchurian) grid system, serving the cities of Shen-yang (Mukden), Chi-lin (Kirin), and Ha-erh-pin (Harbin), and also with the grid system in the Liaotung Peninsula, supplying Lü-ta and Lü-shun. In addition to its hydroelectric generating capacity, the Sup'ung Dam helps regulate the flow of the Yalu and is used also in irrigation.

**Sūq al-Arab 'a'** (Tunisia): *see* Jundūbah.

**Suquṭrā** (Yemen): *see* Socotra.

**Ṣūr** (Lebanon): *see* Tyre.

**Sūr** DYNASTY, Afghān family that ruled in northern India from 1540 to 1556. Its founder, Shēr Shāh Sūr, was descended from an Afghān adventurer recruited by Sultan Bahlūl Lodī of Delhi during his long contest with the Sharqī sultans of Jaunpur. The Shāh's personal name was Farid, the title of Shēr ("Tiger") being conferred when he killed a tiger as a young man. After Bābur, founder of the Mughal dynasty, defeated the Lodīs, Shēr Shāh Sūr obtained control of the Afghān kingdoms of Bihār and Bengal and defeated the Mughal emperor Humāyūn at Chausa (1539) and Kanauj (1540). Shēr Shāh ruled the whole of North India for five years, annexing Mālwa and defeating the Rājputs. He reorganized the administration, laying foundations on which the Mughal emperor Akbar later built. He was killed by a cannon ball while besieging the fortress of Kālinjar in central India.

Shēr Shāh's son, Islām or Salīm Shāh, was a man of ability and maintained Afghān rule despite dissensions. On his death (1553), the Sūr dynasty broke up among rival claimants. Sikandar Sūr was defeated in June 1555 by Humāyūn, who occupied Delhi in July. When Muḥammad 'Ādil Shāh's Hindu general Hemū threw off his allegiance only to be defeated by the Mughals at Pānipat (1556), the Sūr dynasty ended. The Sūrs' reign was a brief interlude in Mughal rule, brightened only by the brilliance of Shēr Shāh. They were the last Afghān rulers of northern India.

**Sura River,** river in west-central Russia, being a tributary of the Volga River. It rises in eastern Penza *oblast* (province) and flows north for 537 miles (864 km) to join the Volga River at Vasilsursk, near Nizhny Novgorod. The area of its drainage basin is 26,000 square miles (67,500 square km).

The river is navigable to Penza city. It receives the Inza, Alatyr, and Pyana rivers.

**Surabaya,** also spelled SURABAJA, Dutch SOERABAJA, *kotamadya* (municipality) and capital of Jawa Timur *provinsi* (province), Indonesia. It is situated on the northeastern coast of Java and lies along the Surabaya Strait opposite Madura Island. The canalized Mas River, which is a branch of the Brantas River, flows through the centre of the city.

Surabaya has been the chief trading centre of eastern Java since the 14th century. Occupied by Japan during World War II, the city was heavily bombed by the Allies and was damaged again during Indonesia's war for independence (1945–49). In November 1945 a fierce battle was fought in Surabaya between Indonesian nationalists and British troops who were attempting to assert Allied control, which was interpreted by the nationalists to mean a prelude to the return of the Dutch.

Surabaya's port, Tanjungperak, lies just north of the city and next to Ujung, Indonesia's main naval station. Of Indonesian cities, Surabaya is surpassed in size only by Jakarta and has remained the chief commercial centre of eastern Java. From its port is shipped the bulk of Java's chief agricultural product, sugar, as well as coffee, tobacco, teak, cassava, rubber, spices, vegetable oils, and petroleum products. The city also has a large fishing fleet. The city's industries include shipbuilding and ship-repair yards, locomotive workshops, and the manufacture of textiles, glass, chemicals, beer, cigarettes, and shoes. A suburb has a petroleum refinery. The surrounding area is a flat, rich agricultural region. Surabaya is linked with the rail and road system that connects the eastern and western coasts of Java and is thus in communication with the other chief cities of the island. It also has major shipping communications with the chief ports of the Indo-Pacific region, because it lies along the main sea route from Singapore and Jakarta to the Pacific and eastern Asia. There is an airport at Tanjungperak.

Notable sites in the city of Surabaya include a large mosque (1868); Airlangga University (1954), with faculties of law, medicine, and dental surgery; the Tenth of November Institute of Technology (1960); a naval college; and the old Dutch colonial Fort Prins Hendrik. Pop. (1990) 2,421,016.

**surah,** also spelled SURA, Arabic SŪRAH, a chapter in the sacred scripture of Islām, the Qur'ān. Each of the 114 surahs, which vary in length from several pages to several words, encompasses one or more revelations received by Muḥammad from Allāh (God). In the traditional Muslim classification, the word Madanīyah ("of Medina") or Makkīyah ("of Mecca") appears at the beginning of each surah, indicating to some Muslim scholars that the surah was revealed to Muḥammad in the period of his life when he was preaching in one or the other of these cities. In some cases an intermixture of verses is similarly designated; modern critical scholarship, however, does not accept the validity of these divisions. Except for the first surah, the fatiha (Arabic *fātiḥah,* "the opening"), which is a brief seven verses, the surahs are arranged in descending order of length and are num-

**Justices of the Supreme Court of the United States**
chief justices in italic

| name | term of service* | appointed by president |
|---|---|---|
| *John Jay* | 1789–95 | Washington |
| James Wilson | 1789–98 | Washington |
| John Rutledge | 1790–91 | Washington |
| William Cushing | 1790–1810 | Washington |
| John Blair | 1790–96 | Washington |
| James Iredell | 1790–99 | Washington |
| Thomas Johnson | 1792–93 | Washington |
| William Paterson | 1793–1806 | Washington |
| *John Rutledge*† | 1795 | Washington |
| Samuel Chase | 1796–1811 | Washington |
| *Oliver Ellsworth* | 1796–1800 | Washington |
| Bushrod Washington | 1798–1829 | J. Adams |
| Alfred Moore | 1800–04 | J. Adams |
| *John Marshall* | 1801–35 | J. Adams |
| William Johnson | 1804–34 | Jefferson |
| Brockholst Livingston | 1807–23 | Jefferson |
| Thomas Todd | 1807–26 | Jefferson |
| Gabriel Duvall | 1811–35 | Madison |
| Joseph Story | 1812–45 | Madison |
| Smith Thompson | 1823–43 | Monroe |
| Robert Trimble | 1826–28 | J.Q. Adams |
| John McLean | 1830–61 | Jackson |
| Henry Baldwin | 1830–44 | Jackson |
| James M. Wayne | 1835–67 | Jackson |
| *Roger Brooke Taney* | 1836–64 | Jackson |
| Philip P. Barbour | 1836–41 | Jackson |
| John Catron | 1837–65 | Van Buren |
| John McKinley | 1838–52 | Van Buren |
| Peter V. Daniel | 1842–60 | Van Buren |
| Samuel Nelson | 1845–72 | Tyler |
| Levi Woodbury | 1845–51 | Polk |
| Robert C. Grier | 1846–70 | Polk |
| Benjamin R. Curtis | 1851–57 | Fillmore |
| John Archibald Campbell | 1853–61 | Pierce |
| Nathan Clifford | 1858–81 | Buchanan |
| Noah H. Swayne | 1862–81 | Lincoln |
| Samuel Freeman Miller | 1862–90 | Lincoln |
| David Davis | 1862–77 | Lincoln |
| Stephen Johnson Field | 1863–97 | Lincoln |
| *Salmon P. Chase* | 1864–73 | Lincoln |
| William Strong | 1870–80 | Grant |
| Joseph P. Bradley | 1870–92 | Grant |
| Ward Hunt | 1873–82 | Grant |
| *Morrison Remick Waite* | 1874–88 | Grant |
| John Marshall Harlan | 1877–1911 | Hayes |
| William B. Woods | 1881–87 | Hayes |
| Stanley Matthews | 1881–89 | Garfield |
| Horace Gray | 1882–1902 | Arthur |
| Samuel Blatchford | 1882–93 | Arthur |
| Lucius Q.C. Lamar | 1888–93 | Cleveland |
| *Melville Weston Fuller* | 1888–1910 | Cleveland |
| David J. Brewer | 1890–1910 | B. Harrison |
| Henry B. Brown | 1891–1906 | B. Harrison |
| George Shiras, Jr. | 1892–1903 | B. Harrison |
| Howell E. Jackson | 1893–95 | B. Harrison |
| Edward Douglass White | 1894–1910 | Cleveland |
| Rufus Wheeler Peckham | 1896–1909 | Cleveland |
| Joseph McKenna | 1898–1925 | McKinley |
| Oliver Wendell Holmes | 1902–32 | T. Roosevelt |
| William R. Day | 1903–22 | T. Roosevelt |
| William H. Moody | 1906–10 | T. Roosevelt |
| Horace H. Lurton | 1910–14 | Taft |
| Charles Evans Hughes | 1910–16 | Taft |
| Willis Van Devanter | 1911–37 | Taft |
| Joseph R. Lamar | 1911–16 | Taft |
| *Edward Douglass White* | 1910–21 | Taft |
| Mahlon Pitney | 1912–22 | Taft |
| James C. McReynolds | 1914–41 | Wilson |
| Louis Brandeis | 1916–39 | Wilson |
| John H. Clarke | 1916–22 | Wilson |
| *William Howard Taft* | 1921–30 | Harding |
| George Sutherland | 1922–38 | Harding |
| Pierce Butler | 1923–39 | Harding |
| Edward T. Sanford | 1923–30 | Harding |
| Harlan Fiske Stone | 1925–41 | Coolidge |
| *Charles Evans Hughes* | 1930–41 | Hoover |
| Owen Roberts | 1930–45 | Hoover |
| Benjamin Nathan Cardozo | 1932–38 | Hoover |
| Hugo L. Black | 1937–71 | F. Roosevelt |
| Stanley F. Reed | 1938–57 | F. Roosevelt |
| Felix Frankfurter | 1939–62 | F. Roosevelt |
| William O. Douglas | 1939–75 | F. Roosevelt |
| Frank Murphy | 1940–49 | F. Roosevelt |
| *Harlan Fiske Stone* | 1941–46 | F. Roosevelt |
| James F. Byrnes | 1941–42 | F. Roosevelt |
| Robert H. Jackson | 1941–54 | F. Roosevelt |
| Wiley B. Rutledge | 1943–49 | F. Roosevelt |
| Harold H. Burton | 1945–58 | Truman |
| *Fred M. Vinson* | 1946–53 | Truman |
| Tom C. Clark | 1949–67 | Truman |
| Sherman Minton | 1949–56 | Truman |
| *Earl Warren* | 1953–69 | Eisenhower |
| John Marshall Harlan | 1955–71 | Eisenhower |
| William J. Brennan, Jr. | 1956–90 | Eisenhower |
| Charles E. Whittaker | 1957–62 | Eisenhower |
| Potter Stewart | 1958–81 | Eisenhower |
| Byron R. White | 1962–93 | Kennedy |
| Arthur J. Goldberg | 1962–65 | Kennedy |
| Abe Fortas | 1965–69 | L. Johnson |
| Thurgood Marshall | 1967–91 | L. Johnson |
| *Warren E. Burger* | 1969–86 | Nixon |
| Harry A. Blackmun | 1970–94 | Nixon |
| Lewis F. Powell, Jr. | 1972–87 | Nixon |
| William H. Rehnquist | 1972–86 | Nixon |
| John Paul Stevens | 1975– | Ford |
| Sandra Day O'Connor | 1981– | Reagan |
| *William H. Rehnquist* | 1986– | Reagan |
| Antonin Scalia | 1986– | Reagan |
| Anthony M. Kennedy | 1988– | Reagan |
| David H. Souter | 1990– | Bush |
| Clarence Thomas | 1991– | Bush |
| Ruth Bader Ginsburg | 1993– | Clinton |
| Stephen G. Breyer | 1994– | Clinton |

*The date the justice took the judicial oath is here used as the beginning date of service, for until that oath is taken the justice is not vested with the prerogatives of the office. Justices, however, receive their commissions ("letters patent") before taking their oaths—in some instances, in the preceding year. †John Rutledge was acting chief justice; the U.S. Senate refused to confirm him.

bered serially. They are further identified by a name, usually derived from an unusual image appearing in the text but not necessarily indicative of the general content. About one-fourth of the surahs are also preceded by the *fawātiḥ*; these are detached letters, the function and meaning of which have not yet been satisfactorily determined.

Every surah but the ninth, which presents a unique textual problem, opens with the *basmalah* formula ("in the name of God, the Compassionate, the Merciful") and is followed by numbered verses (*āyahs*). Written in prose, much of which is of a highly intense quality and is often rhymed, the individual *āyahs*, rather than the entire surah, are commonly regarded as proofs of God's authority and existence and a validation of Muḥammad's mission. Indeed, all the surahs—except the fatiha, which is a short devotional prayer, and the last two surahs—are in the form of an address from God, either speaking himself in the first person or speaking through the imperative form *qūl*, "say!," and ordering that the words that follow be proclaimed. The subject matter of the revelations is varied, ranging from stories of previous prophets (Abraham, Moses, Jesus) to an extremely vivid eschatology. The general tone is deeply moralistic and theocentric, reverberating with a demand for obedience to a transcendent but compassionate God.

In pious circles the Qur'ān is often divided into 30 equal sections known as *juz'* (Persian and Urdu *sipāra*, or *pāra*). These break up the surahs arbitrarily, without regard to content, into 30 parts in order to facilitate the systematic reading of the entire Qur'ān in 30 days, or one lunar month.

**Surakarta,** Dutch SOERAKARTA, also called SOLO, *kotamadya* (city), Jawa Tengah *propinsi* (Central Java province), Java, Indonesia. It lies along the Solo River. Once the capital of Surakarta principality under the Dutch, it was occupied by Japan during World War II and was later incorporated into the republic.

The city has broad, treelined streets with many modern buildings. Notable historic buildings include a palace (1745; of the susuhunan, one of the traditional princes of central Java), a prince's court (1788; that of the mangkunegaran, another traditional ruler), and a Dutch fort (1779; now a garrison headquarters). Famous as an educational and cultural centre, Surakarta contains the University of Sebelas Maret, which was created in 1976 in the consolidation of nine existing institutions. The city also has a museum and a library.

The city is a market for the surrounding densely populated agricultural area, which produces tobacco, sugar, rice, coconuts, fruits and vegetables, and cassava. The making of batik cloth is a main industry, as are the manufacture of cigarettes, furniture, and textiles; there is also jewelry making and a metal foundry. Local handicrafts are pottery making, wood and bone carving, and the making of musical instruments. The city is an important cultural centre for central Javanese dance, music, and literature and is linked by road, rail, and air to the rest of Java. Pop. (1999 est.) 522,400.

**suramin sodium,** synthetic drug used in medicine, especially in the treatment of African sleeping sickness (African trypanosomiasis), a disease caused by an infestation of the protozoan *Trypanosoma* spread by the tsetse fly. Suramin sodium is administered by intravenous injection. It is most effective when given in the early stages of the disease because it attacks the *Trypanosoma* organisms as they circulate in the bloodstream and concentrate in the lymph nodes. (At a later stage they invade the spinal fluid.)

**Surat,** city, southeastern Gujarāt state, west-central India. It lies near the mouth of the Tāpti River and the Gulf of Cambay. It is believed to have been founded by a Brahman named Gopi, who built the Gopi Tank (water reservoir) in 1516 and named the area Surajpur, or Suryapur; Surat became the name of the city in 1520. It was plundered by Muslims in the 12th and 15th centuries; in 1514 the Portuguese traveler Duarte Barbosa described Surat as a leading port. It was burned by the Portuguese (1512 and 1530) and conquered by the Mughals (1573) and was twice sacked by the Marāṭhā king Śivājī (17th century). Surat thereafter became the emporium of India, exporting cloth and gold. Its major industries were textile manufacture and shipbuilding. The British established their first Indian factory (trading post) at Surat (1612).

The city gradually declined throughout the 18th century. The British and Dutch both claimed control, but in 1800 its administration passed to the British. By the mid-19th century Surat was a stagnant city of 80,000 inhabitants. It prospered again with the opening of India's railways. The ancient art of manufacturing fine muslin was revived, and Surat's cottons, silks, brocades, and objects of gold and silver have become famous. The city houses other industries and has several educational institutions. It is served by highways and the Western Railway.

The surrounding area is intensively cultivated; chief crops include cotton, millet, pulses, and rice. Textile manufacturing is concentrated in Surat city. Pop. (2001 prelim.) city, 2,433,787; metropolitan area, 2,811,466.

**Surat Thani,** town, southern Thailand, on the Malay Peninsula. Locally the town is called Ban Don. It is a port at the head of the Ta Pi delta and a station on the Bangkok–Singapore railway. The surrounding area is important for its production of tin, fish, rice, and coconuts. Pop. (1999 est.) town, 112,504.

**Surchandarja** (Uzbekistan): *see* Surkhandarya.

**Surco** (Peru): *see* Santiago de Surco.

**surcoat,** also spelled SURCOTE, sleeved or sleeveless outer garment worn by European



Marie de Luxembourg (right) wearing a surcoat at her marriage (1322) in Paris to Charles IV le Bel; detail of a miniature in the *Grandes Chroniques de France*, manuscript illuminated by Jean Fouquet, *c.* 1460; in the Bibliothèque Nationale, Paris (Ms. fr. 6465).

By courtesy of the Bibliotheque Nationale, Paris; photograph, J.P. Ziolo

men and women during the 13th and 14th centuries. The surcoat for men was usually a tunic, or simple piece of material with a hole for the head, often worn over armour. For women, the surcoat was a more significant and characteristic garment, which originated in the 13th century as a voluminous outer cloak.

At the beginning of the 14th century, the armhole became a long vertical slit open to the hips, and the neck was cut low to create a narrow strip over the shoulders. The neck and armholes were frequently edged with fur or embroidery, sometimes elaborately. The skirt fell in loose folds from the hips. The sideless surcoat, popular for more than 90 years and often decorated with a row of buttons or jewels, offered an attractive contrast to the garment showing underneath.

**Surduc Pass,** also called JIU DEFILE, or JIU PASS, Romanian PASUL SURDUC, pass, southwestern Romania. The Jiu River flows through the pass between the Vîlcan (west) and the Paring (east) mountains, in the Transylvanian Alps (Southern Carpathians). The pass connects the Petroşani Depression (upper Jiu Valley) with the Plain of Oltenia. A road and the Bumbeşti–Livezeni railway line, opened in 1947, follow the pass by means of 30 tunnels and several viaducts.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Sûre River,** German SAUER FLUSS, river rising in the Belgian province of Luxembourg and flowing 107 miles (172 km) east and southeast into the Mosel (Moselle) River, 7 miles (11 km) southwest of Trier in Rhineland-Palatinate, Germany. The Sûre, which is navigable past Dekirche for about 40 miles (64 km), forms the Luxembourg–Germany border below the confluence of the Our River. It was the scene of severe fighting in the Battle of the Bulge during World War II.

**Surendranagar,** also called WADHWĀN, city, central Gujarāt state, west-central India. It is situated at the centre of the base of the Kāthiāwār Peninsula. The city is a part of the Wadhwān urban agglomeration. The former capital of the princely state of Wadhwān, it is now a trade and processing centre for agricultural products. Industries include the manufacture of textiles, soap, and glass. It is also a rail and road junction. Pop. (2001 prelim.) city, 156,417; metropolitan area, 219,828.

**Suresnes,** town, Hauts-de-Seine *département*, Paris region, north-central France. It is a western suburb of Paris and lies along the Seine River. The town's manufactures include aircraft, automotive parts, radios, electrical equipment, and perfume. Immediately west is Mont Valérien, an important defense post during the Franco-German War (1870–71), where an eternal flame burns in memory of 4,500 Frenchmen killed by the Gestapo during World War II. Pop. (1999) 39,706.

**suretyship** (law): *see* guaranty and suretyship.

**surface-active agent,** also called SURFACTANT, substance such as a detergent that, when added to a liquid, reduces its surface tension, thereby increasing its spreading and wetting properties. In the dyeing of textiles, surface-active agents help the dye penetrate the fabric evenly. They are used to disperse aqueous suspensions of insoluble dyes and perfumes.

The surface-active molecule must be partly hydrophilic (water-soluble) and partly lipophilic (soluble in lipids, or oils). It concentrates at the interfaces between bodies or droplets of water and those of oil, or lipids, to act as an emulsifying agent, or foaming agent.

Other surface-active agents that are more

lipophilic and less hydrophilic may be used as defoaming agents, or as demulsifiers. Certain surface-active agents are germicides, fungicides, and insecticides.

Surface-active agents are used in corrosion inhibition, in ore flotation, to promote oil flow in porous rocks, and to produce aerosols. *See also* detergent.

**surface-feeding duck:** *see* dabbling duck.

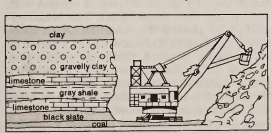
**surface hardening,** treatment of steel by heat or mechanical means to increase the hardness of the outer surface while the core remains relatively soft. The combination of a hard surface and a soft interior is greatly valued in modern engineering because it can withstand very high stress and fatigue, a property that is required in such items as gears and anti-friction bearings. Surface-hardened steel is also valued for its low cost and superior flexibility in manufacturing.

The oldest surface-hardening method is carburizing, in which steel is placed at a high temperature for several hours in a carbonaceous environment. The carbon diffuses into the surface of the steel, rendering it harder. Various techniques of carburizing have been developed to increase efficiency and reduce cost. The pack method involves packing into a steel box the parts to be hardened along with a compound of charcoal or coke to which carbonates have been added. The pack is then heated to a very high temperature, usually 1,700°–1,750° F (925°–955° C). The depth of the carbon penetration depends on the exposure time and temperature. In gas carburizing the parts are heated in contact with such carbon-bearing gases as carbon monoxide, carbon dioxide, methane, or propane. This process is usually done in a large furnace into which the parts are fed at one end and from which they emerge at the other end in the hardened state. The same process is used in carbonitriding except that ammonia is added to the furnace atmosphere and it takes place at lower temperatures that produce less distortion in the steel. Gears, ball and roller bearings, and piston pins are among the products made by carburizing.

Another method of surface hardening, called nitriding, utilizes nitrogen and heat. Cam shafts, fuel injection pumps, and valve stems are typically hardened by this process. Flame hardening and induction hardening, in which high heat is applied for a short time (by gas flame or high-frequency electric current, respectively) and then the steel is immediately quenched, are used generally for larger implements.

Mechanical means of hardening the surface of steel parts include peening, which is the hammering of the heated surface, as by iron pellets shot onto the surface or by air blasting, and cold-working, which consists of rolling, hammering, or drawing at temperatures that do not affect the composition of the steel.

**surface mining,** removal of the soil and rock (overburden) above a seam of coal or other mineral and extraction of the exposed mineral. When applied to the winning of coal, the technique is conventionally called strip-




Strip mine
By courtesy of the National Coal Association

mining, which began when the supply of coal exposed at the surface of the Earth—in ledges or outcroppings—was exhausted, and it became necessary to remove earth to lay bare the coal seams. The method is used to best advantage where the coal is not deeply buried, although many modern strip mines employ equipment capable of removing overburden nearly 200 feet (60 metres) in thickness. In Europe the technique is widely used for brown-coal deposits, while in the United States a large proportion of both anthracite and bituminous coal is so mined; surface mining also is used to obtain iron, copper, and phosphate ores (in these instances, the operation is called open-pit or opencast mining).

Surface mining is most economical where flat terrain and horizontal seams permit a large area to be stripped. Where deposits occur in rolling or mountainous terrain, a contour method is used that creates a shelf with a slope on one side and an almost vertical wall on the other.

Surface mining has been criticized, especially in the United States, because, unless steps are taken to restore the lands, the area is damaged or destroyed. Several U.S. states and the federal government have legislated such restoration, and many producers now voluntarily practice it. *See also* placer mining.

**surface tension,** property of a liquid surface displayed by its acting as if it were a stretched elastic membrane. This phenomenon can be observed in the nearly spherical shape of small drops of liquids and of soap bubbles. Because of this property, certain insects can stand on the surface of water. A razor blade also can be supported by the surface tension of water. The razor blade is not floating: if pushed through the surface, it sinks through the water.

Surface tension depends mainly upon the forces of attraction between the particles within the given liquid and also upon the gas, solid, or liquid in contact with it. The molecules in a drop of water, for example, attract each other weakly. Water molecules well inside the drop may be thought of as being attracted equally in all directions by the surrounding molecules. However, if surface molecules could be displaced slightly outward from the surface, they would be attracted back by the nearby molecules. The energy responsible for the phenomenon of surface tension may be thought of as approximately equivalent to the work or energy required to remove the surface layer of molecules in a unit area. Surface tension may be expressed, therefore, in units of energy (joules) per unit area (square metres). Water has a surface tension of 0.07275 joule per square metre at 20° C (68° F). In comparison, organic liquids, such as benzene and alcohols, have lower surface tensions, whereas mercury has a higher surface tension. An increase in temperature lowers the net force of attraction among molecules and hence decreases surface tension.

Surface tension is also viewed as the result of forces acting in the plane of the surface and tending to minimize its area. On this basis, surface tension is often expressed as an amount of force exerted in the surface perpendicular to a line of unit length. The unit then is newtons per metre, which is equivalent to joules per square metre.

**surfactant** (chemistry): *see* surface-active agent.

**surfbird** (*Aphriza virgata*), American shorebird that has a black triangle on its otherwise white tail. Surfbirds are about 25 centimetres (10 inches) long. With the knots, they constitute the subfamily Calidritinae (family Scolopacidae).

Surfbirds breed in rock fields at high elevations in the mountains of south central Alaska. The male assumes parental duties once the hen has laid the four eggs in a nest on the ground. He may suddenly explode from the nest, an action believed to be a defense against trampling. Surfbirds winter on rocky beaches



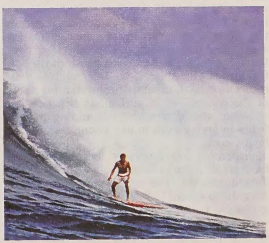
Surfbird (*Aphriza virgata*)
Herbert Clarke

with much seaweed and heavy surf, chiefly from Alaska to California; some go as far south as southern Chile.

**surfing,** sport of riding breaking waves toward the shore, especially by means of a surfboard. The sport, which originated prehistorically in the South Seas, is now enjoyed throughout the world on open-ocean coastlines with surf.

A brief treatment of surfing follows. For full treatment, *see* MACROPAEDIA: Sports, Major Team and Individual.

Polynesian sailors were perforce required to manoeuvre through surf to land. Whether their skill at this preceded surfing, or vice versa, is not known. This early surfing was done both with a board and with the body. In 1777 and 1778 the explorer Capt. James Cook and his party first reported seeing longboard and canoe surfers in Tahiti and on Oahu, observing that the sport seemed recreational rather than competitive. In 1821, surfing was banned by European missionaries who thought it immoral. The sport was revived in the early 20th century by two Hawaiian surfers. In 1907 surfer George Freeth was brought to Redondo Beach, Calif., for a promotional event and introduced surfing in California. In 1914 and 1915, surfer and



Surfing at Waimea Bay, Oahu, Hawaii
Don James

Olympic swimmer Duke Kahanamoku gave surfing exhibitions in Sydney and the sport soon became popular in Australia. By the 1960s the sport had achieved worldwide popularity and international competitions were being held.

The best conditions for surfing occur when large, smooth ocean swells in deep water peak up into steep sets of waves, or breakers, as they encounter a shelflike reef or sandbar. Surfers also look for another type of wave, more difficult to ride, the taller, plunging "dumper," which occurs with a steep rise of bottom to the beach. The lee side of a point of land or a jetty often has the proper contour for good rolling breaker waves. Under ideal conditions, as at

Makaha, Hawaii, with 4-m waves, riders can surf half a mile or more.

The surfer first swims with the board out beyond the crests of breaking waves to the point where the larger rollers peak up. As the wave approaches, he paddles toward shore to attain sufficient speed to coast down the face of the wave. Once the surfer has caught the wave with the board, he can rise first to a kneeling and then to a standing position and ride the wave until it dies out near the beach. Longboard riders hold their arms over their heads and shift their limbs, and thus their body weight, to control their speed and direction. To increase speed and distance, experts ride diagonally toward shore.

Although the long, narrow board, or Malibu, from 1.83 to 2.25 m (about 7 to 7.5 feet) long, is most often associated with surfing, surfers can also surf using shorter belly boards or lightweight canoes or can bodysurf without a board by holding their bodies rigid with arms above the head. Belly-board surfers clasp the board to their chests and steer with their legs. Bodysurfers and belly-board surfers wear swim fins on their feet to make their paddling out to join the wave easier. These surfers generally enjoy their sport closer to shore and with smaller waves.

The International Surfing Association (ISA) is the world governing authority for the sport; there are some 38 member nations in the ISA. The organization was formed in 1976 after the demise of the older International Surfing Federation (ISF). Surfing world championships have been held since the early 1960s. Surfing events have been held on both coasts of North America and in Peru, Hawaii, South Africa, and Australia. In international competitions, groups of competing surfers perform in the same area, each making perhaps 10 wave runs during a meet. A panel of judges awards points based on takeoff, turns, length of ride, and difficulty of wave selected. Selection of wave and when to end the ride are at the discretion of each surfer.

**surfperch,** also called SEAPERCH, any of 23 species of fishes of the family Embiotocidae (order Perciformes). Surfperches are found in the North Pacific Ocean; two species are native to Japanese waters, but all others are confined to the North American coast, mostly off California. One species, the tule perch (*Hysterocarpus traski*), inhabits freshwater, but most of the others live in surf along beaches. All saltwater species are unusual among marine fishes in giving birth to live young rather than laying eggs.

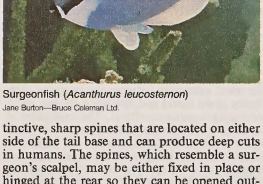
Surfperches are relatively deep-bodied and have small mouths, large scales, and a single, long dorsal fin. The species range in length from 13 to 45 cm (5 to 18 inches). The barred surfperch (*Amphistichus argenteus*), marked with yellow stripes, is one of several species favoured by anglers. Along with several other surfperches, it is also of some commercial importance.

**surge,** in meteorology, an atmospheric process that operates on oceans and inland waters whereby a change in atmospheric pressure or a high-velocity wind works in conjunction with normal gravitational tides to produce dramatic changes in oceanic circulation, and, oftentimes, flooding in coastal areas. Though surges usually occur over vast areas, they can also be generated by local storms over inland seas and lakes.

Changes in atmospheric pressure are commonly noted in regions close to the large, semipermanent pressure centres of the Earth, such as the high-pressure area associated with the southern North Atlantic Ocean. Passage of a high-pressure centre causes a fall in the water level, and passage of a low-pressure centre causes a rise. In areas where such occurrences have often been noted, a rise or fall of 2 millibars in 24 hours over an area of about 8,000,000 square km (about 3,090,000 square miles) is common.

The sudden increase in the speed of a large wind stream, especially in the tropics, can also cause surges. The progress of this type of surge can be followed on weather maps as it expands. During a "surge of the trades" in the trade-wind belts, wind speed often increases by about 40 km/h (25 mile/h) throughout the region between the surface and the 4,500-metre (15,000-foot) level. A surge in the monsoon currents is called a burst, or surge, of the monsoon.

**surgeonfish,** also called TANG, any of about 75 species of thin, deep-bodied, tropical marine fishes of the family Acanthuridae (order Perciformes). Surgeonfishes are small-scaled, with a single dorsal fin and one or more distinctive, sharp spines that are located on either side of the tail base and can produce deep cuts in humans. The spines, which resemble a surgeon's scalpel, may be either fixed in place or hinged at the rear so they can be opened outward and directed forward.



Surgeonfish (*Acanthurus leucosternon*)
Jane Burton—Bruce Coleman Ltd.

Surgeonfishes are mostly algae eaters. They develop from a transparent larva (acronurus) and, with growth, may change considerably in form or colour. Their maximum length usually does not exceed 50 cm (20 inches). Species include the yellow surgeon, or yellow tang (*Zebrasoma flavescens*), an Indo-Pacific species about 20 cm (8 inches) long and coloured either bright yellow or deep brown, and the blue tang (*Acanthurus coeruleus*), an Atlantic and Caribbean fish, yellow when young but more or less blue when adult.

**surgery,** branch of medicine that is concerned with the treatment of injuries, diseases, and other disorders by manual and instrumental means. Surgery basically involves the management of acute injuries and illnesses as differentiated from chronic, slowly progressing diseases, except when patients with the latter type of disease must be operated upon.

A general treatment of surgery follows. For further treatments, *see* MACROPAEDIA: Diagnosis and Therapeutics; Medicine.

*History.* Surgery is as old as humanity, for anyone who has ever stanched a wound has acted as a surgeon. In some ancient civilizations surgery reached a rather high level of development, as in India, China, Egypt, and Hellenistic Greece. In Europe during the Middle Ages, the practice of surgery was not taught in most universities, and ignorant barbers instead wielded the knife, either on their own responsibility or upon being called into cases by physicians. The organization of the United Company of Barber Surgeons of London in 1540 marked the beginning of some control of the qualifications of those who performed operations. This guild was the precursor of the Royal College of Surgeons of England.

In the 18th century, with increasing knowledge of anatomy, such operative procedures as amputations of the extremities, excision of tumours on the surface of the body, and removal of stones from the urinary bladder had helped to firmly establish surgery in the medical curriculum. Accurate anatomical knowledge enabled surgeons to operate more rapidly; patients were sedated with opium or made drunk with alcohol, tied down, and a leg amputation, for example, could then be done in three to five minutes. The pain involved in such procedures, however, continued to limit expansion of the field until the introduction of ether anesthesia in 1846. The number of operations thereafter increased markedly, but only to accentuate the frequency and severity of "surgical infections." In the mid-19th century the French microbiologist Louis Pasteur developed an understanding of the relationship of bacteria to infectious diseases, and the application of this theory to wound sepsis by the British surgeon Joseph Lister from 1867 resulted in the technique of antisepsis, which brought about a remarkable reduction in the mortality rate from wound infections after operations. The twin emergence of anesthesia and antisepsis marked the beginning of modern surgery.

Wilhelm Conrad Röntgen's discovery of X rays at the turn of the century added an important diagnostic tool to surgery, and the discovery of blood types in 1901 by the Austrian biologist Karl Landsteiner made transfusions safe. New techniques of anesthesia involving not only new agents for inhalation but also regional anesthesia accomplished by nerve blocking (spinal and local anesthesia) were also introduced. The use of positive pressure and controlled respiration techniques (to prevent the lung from collapsing when the pleural cavity was opened) made chest surgery safe for the first time. The intravenous administration (injection into the veins) of anesthetic agents was also adopted. In the period from the 1930s to the 1960s, the replenishment of body fluids by intravenous infusion, the introduction of chemicals and antibiotics to fight infection and to treat the metabolically disturbed body, and the development of heart-lung machines helped bring surgery to a state in which every body cavity, system, organ, and area could safely be operated on.

*Present-day surgery.* Contemporary surgical therapy is greatly helped by monitoring devices that are used during surgery and during the postoperative period. Blood pressure and pulse rate are monitored during an operation because a fall in the former and a rise in the latter give evidence of a critical loss of blood. Other items monitored are the heart contractions as indicated by electrocardiograms; tracings of brain waves recorded by electroencephalograms, which reflect changes in brain function; the oxygen level in arteries and veins; carbon dioxide partial pressure in the circulating blood; and respiratory volume and exchange. Intensive monitoring of the patient often continues into the critical postoperative stage.

Asepsis, the freedom from contamination by pathogenic organisms, requires that all instruments and dry goods coming in contact with the surgical field be sterilized. This is accomplished by placing the materials in an autoclave, which subjects its contents to a period of steam under pressure. Chemical sterilization of some instruments is also used. The patient's skin is sterilized by chemicals, and members of the surgical team scrub their hands and arms and bathe them in alcohol. Sterilized gowns, caps, and masks that filter the team's exhaled air and sterilized gloves of disposable plastic complete the picture. Thereafter, attention to avoiding contact with nonsterilized objects is the basis of maintaining asepsis.

During an operation, hemostasis (the arresting of bleeding) is achieved by use of the hemostat, a clamp with ratchets that grasps

blood vessels or tissue; after application of hemostats, suture materials are tied around the bleeding vessels. Absorbent napkins called sponges are used for drying the field. The most commonly used instruments in surgery are still the scalpel (knife), hemostatic forceps, flexible tissue-holding forceps, wound retractors for exposure, crushing and noncrushing clamps for intestinal and vascular surgery, and the curved needle for working in depth.

The most common method of closing wounds is by sutures. There are two basic types of suture materials; absorbable ones such as catgut (which comes from sheep intestine) or synthetic substitutes; and nonabsorbable materials, such as nylon sutures, steel staples, or adhesive tissue tape. Catgut is still used extensively to tie off small blood vessels that are bleeding, and since the body absorbs it over time, no foreign materials are left in the wound to become a focus for disease organisms. Nylon stitches and steel staples are removed when sufficient healing has taken place.

There are three general techniques of wound treatment; primary intention, in which all tissues, including the skin, are closed with suture material after completion of the operation; secondary intention, in which the wound is left open and closes naturally; and third intention, in which the wound is left open for a number of days and then closed if it is found to be clean. The third technique is used in badly contaminated wounds to allow drainage and thus avoid the entrapment of microorganisms. Military surgeons use this technique on wounds contaminated by shell fragments, pieces of clothing, and dirt.

The 20th century witnessed several new surgical technologies to supplement the techniques of manual incision. Lasers are now widely used to destroy tumours and other pigmented lesions, some of which are inaccessible by conventional surgery. They are also used to surgically weld detached retinas back in place and to coagulate blood vessels to stop them from bleeding. Stereotaxic surgery uses a three-dimensional system of coordinates obtained by X-ray photography to accurately focus high-intensity radiation, cold, heat, or chemicals on tumours located deep in the brain that could not otherwise be reached. Cryosurgery uses extreme cold to destroy warts and precancerous and cancerous skin lesions and to remove cataracts. In the late 20th century, some traditional techniques of open surgery were being replaced by the use of a thin, flexible fibre-optic tube equipped with a light and a video connection; the tube, or endoscope, is inserted into various bodily passages and provides views of the interior of hollow organs or vessels. Accessories added to the endoscope allow small surgical procedures to be executed inside the body without making a major incision.

Preoperative and postoperative care both have the same object: to restore patients to as near their normal physiologic state as possible. Blood transfusions, intravenous administration of fluids, and the use of measures to prevent common complications such as lung infection and blood clotting in the legs are the principal features of postoperative care.

There are four major categories of surgery: (1) wound treatment, (2) extirpative surgery, (3) reconstructive surgery, and (4) transplantation surgery. The technical aspects of wound surgery, already partly discussed, centre on procuring good healing and the avoidance of infection. Extirpative surgery involves the removal of diseased tissue or organs. Cancer surgery usually falls into this category, with mastectomy (removal of the breast), cholecystectomy (removal of the gallbladder), and hysterectomy (removal of the uterus) among the most frequent procedures. Reconstructive surgery deals with the replacement of lost tissues, whether from fractures, burns, or degenerative-disease processes, and is especially prominent in the practice of plastic surgery and orthopedic surgery. Grafts from the patient or from others are frequently used to replace lost tissues. Reconstructive surgery also uses artifical devices (prostheses) to replace damaged or diseased organs or tissues. Common examples are the use of metal in reconstructing hip joints and the use of plastic valves to replace heart valves. Transplantation surgery involves the use of organs transplanted from other bodies to replace diseased organs in patients. Kidneys are the most commonly transplanted organs.

The major medical specialties involving surgery are general surgery, plastic surgery, orthopedic surgery, obstetrics and gynecology, neurosurgery, thoracic surgery, colon and rectal surgery, otolaryngology, ophthalmology, and urology. General surgery is the parent specialty and now centres on operations involving the stomach, intestines, breast, blood vessels in the extremities, endocrine glands, tumours of soft tissues, and amputations. Plastic surgery is concerned with the bodily surface and with reconstructive work of the face and exposed parts. Orthopedic surgery deals with the bones, tendons, ligaments, and muscles; fractures of the extremities and congenital skeletal defects are common targets of treatment. Obstetricians perform cesarean sections, while gynecologists operate to remove tumours from the uterus and ovaries. Neurosurgeons operate to remove brain tumours, treat injuries to the brain resulting from skull fractures, and treat ruptured intravertebral disks that affect the spinal cord. Thoracic surgeons treat disorders of the lungs; the subspecialty of cardiovascular surgery is concerned with the heart and its major blood vessels and has become a major field of surgical endeavour. Colon and rectal surgery deals with disorders of the large intestine. Otolaryngologic surgery is performed in the area of the ear, nose, and throat (*e.g.*, tonsillectomy), while ophthalmologic surgery deals with disorders of the eyes. Urologic surgery treats diseases of the urinary tract and, in males, of the genital apparatus.

**Surguja** (India): *see* Ambikāpur.

**Surgut,** city and port, Khanty-Mansi autonomous *okrug* (district), Tyumen *oblast* (province), Russia, on the Ob River. Incorporated in 1965, Surgut is one of the main administrative and supply centres of the Western Siberian oil fields. Surgut has an enormous thermal-power station. The city is linked by railroad with Nizhnevartovsk to the east and Tobolsk and Tyumen to the southwest. A railroad from Surgut to the Urengoy natural-gas fields to the north was completed in the early 1980s to supply the huge Arctic natural-gas fields. Pop. (1992 est.) 260,000.

**Sūri** (India): *see* Siuri.

**suricate,** also called MEERKAT, or SLENDER-TAILED MEERKAT, also spelled MIERKAT (*Suricata suricatta*), slender-bodied, burrowing carnivore of the civet family (Viverridae). Found in dry regions of southern Africa, the suricate is distinguished from the closely related mongooses in having four (rather than five) toes on each foot. It grows to a head-and-body length of 25–35 cm (10–14 inches) with a tail 18–25 cm long. It has a tapering muzzle and low-set ears. Its long fur is grizzled yellowish brown or pale gray, marked by dark bars across the back. The face is whitish with black ears and eye patches, and the tail is tipped with black.

The suricate usually lives in communities, or colonies, and at times can be found in company with the yellow mongoose, or thick-tailed meerkat (*Cynictis penicillata*). The suricate is omnivorous and active during the day. Its litters consist of two to four young. Easily tamed as a pet, the suricate is sometimes kept as a household rodent killer. The animal's importation into some countries is regulated because of its potential destructiveness to native wildlife.



Suricate (*Suricata suricatta*)
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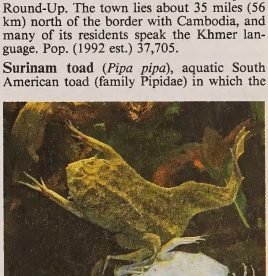
**Surigao,** city, northeastern tip of Mindanao Island, Philippines. Surigao was one of the earliest places of Spanish settlement in the Philippines; the Royal House was the residence of the Spanish governor.

Surigao, a port and trading centre, lies just southeast of Bilaa Point on the Surigao Strait. South of the city, fishing, lumbering, and farming (coconuts, abaca [Manila hemp], and rice) are economically important. Most of these activities are carried out by the Cebuano people, a subgroup of the Visayan (Bisayan) peoples, who compose the largest population segment of northern Mindanao.

The city has ferry service to southern Leyte Island and is the northern terminus of a highway running south to Davao. Nonoc Island, about 10 miles (16 km) northeast, contains one of the world's largest nickel deposits and has been mined since 1974. Lake Mainit lies about 17 miles (28 km) south of the city. Inc. city, 1970. Pop. (1990) 100,000.

**Surin,** town, east-central Thailand. The town is located on the railway between Nakhon Ratchasima and Ubon Ratchathani and is a trade and production centre for rice, lacquerware, and silk. It has an agricultural college and attracts tourists with its annual Elephant Round-Up. The town lies about 35 miles (56 km) north of the border with Cambodia, and many of its residents speak the Khmer language. Pop. (1992 est.) 37,705.

**Surinam toad** (*Pipa pipa*), aquatic South American toad (family Pipidae) in which the



Surinam toads (*Pipa pipa*), showing (top) the dorsal and (bottom) the ventral surfaces
© Jane Burton—Bruce Coleman Ltd.

eggs are incubated on the back of the female. The Surinam toad is about 20 cm (8 inches) long. It has a flat, squarish body, small eyes, and a flat head with loose flaps of skin on the snout and jaws. The digits end in small, star-shaped appendages that aid food finding.

The Surinam toad mates in water. As each egg is released, it is fertilized and pressed by the male to the back of the female. In the next several hours, the skin grows around the eggs to enclose them in a cyst with a horny lid. After about 80 days' development, the young emerge as miniatures of the adult.

**Suriname,** officially REPUBLIC OF SURINAME, Dutch REPUBLIEK SURINAME, republic located on the north-central coast of South America. It is bounded on the north by the Atlantic Ocean, east by French Guiana, south by Brazil, and west by Guyana. The capital is Paramaribo. Area 63,251 square miles (163,820 square km), excluding 6,809 square miles (17,635 square km) disputed with Guyana. Pop. (1993 est.) 405,000.

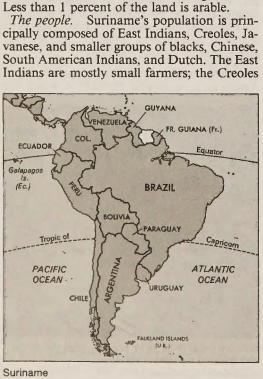
A brief treatment of Suriname follows. For full treatment, *see* MACROPAEDIA: Suriname.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*The land.* Suriname has a narrow coastal plain near or below sea level, much of it swampy and requiring drainage systems and dikes. A hilly, mainly forested region behind the coastal plain culminates to the south in low, forested mountain ranges, which project from a central massif along the Brazilian border and cover four-fifths of the country. There is also a relatively small plateau-savanna region in the southwest.

Seven major rivers cross Suriname from south to north, emptying into the Atlantic. Among these is the Maroni River, which forms most of the border with French Guiana. The rivers have rapids and falls in their upland southerly stretches, limiting navigation on them. Suriname has a year-round humid tropical climate that is tempered along the coast by the northeast trade winds. Rainfall ranges from more than 118 inches (3,000 mm) annually in the mountains of the interior to an average of 76 inches (1,900 mm) along the northwestern coast. Temperatures show little variation from the annual mean of 81° F (27° C). Only the coastal region, part of the hilly uplands, and some of the river valleys have been cleared of forest for agriculture. Less than 1 percent of the land is arable.

*The people.* Suriname's population is principally composed of East Indians, Creoles, Javanese, and smaller groups of blacks, Chinese, South American Indians, and Dutch. The East Indians are mostly small farmers; the Creoles




Suriname

are concentrated in the political, retail, and professional occupations in Paramaribo; and the Javanese work mostly on Dutch-owned plantations. The Surinamese blacks, called Bush Negroes (Bosch Negers) by the Dutch, have reconstituted western African tribal rule, religion, and a traditional western African slash-and-burn agriculture coupled with fishing and hunting.

The official language is Dutch; English, Sranan (a creole), Hindi, and other Asian, African, and American Indian languages are also spoken. The principal religion is Christianity, followed by Hinduism and Islām. The population is concentrated principally in Paramaribo and along the coast. Demographic rates are generally typical of a developing country, although the birth and death rates are lower than average for Latin America as a whole. The estimated annual rate of natural population increase is also low by Latin-American standards. Emigration to The Netherlands in the 1970s diminished Suriname's population by as much as one-third.

*The economy.* Suriname has a developing mixed economy in which both the public and private sectors participate. Bauxite mining, alumina and aluminum production, services, and agriculture are the largest sectors of the economy. The gross national product (GNP), which was growing more rapidly than the population, suffered a sharp decline in the mid-1980s because of political instability before beginning to grow slowly in the late 1980s. The GNP per capita is nonetheless one of the highest in South America.

Agriculture, concentrated on the coastal plain, accounts for about one-eighth of the gross domestic product (GDP) and employs nearly one-sixth of the workforce. Rice production ordinarily meets domestic demand, and there is a surplus for export. The principal cash crops include bananas, sugarcane, plantains, coconuts, and oranges.

Most of the wood cut is used for industrial purposes, and some is exported. The government controls the largest forestry company. The shrimps and prawns that Suriname catches are an important source of foreign exchange.

Mineral industries are the major source of foreign exchange and are dominated by the production and export of bauxite, alumina, and aluminum, controlled by Dutch and North American companies. Although limited petroleum production began in the early 1980s, Suriname must also import petroleum, primarily to generate electricity.

Manufacturing accounts for about one-tenth of the GDP, employs almost one-tenth of the labour force, and centres on the processing of food and timber and the smelting of aluminum and alumina. The country's electricity is generated primarily by hydroelectric plants along the Suriname and other rivers.

Suriname's transportation infrastructure is poorly developed. Only about one-fourth of the country's road system is paved, and there are only about 186 miles (300 km) of railway. Navigable rivers and canals are important for freight and passenger travel, and Paramaribo is the principal port. There is an international airport at Zanderij.

Semimanufactured goods, machinery and transport equipment, and petroleum and other fuels dominate imports; major exports are alumina, aluminum, shrimp, rice, and bananas. Trading partners include the United States (which usually supplies one-third or more of Suriname's imports), The Netherlands, Norway, and Trinidad and Tobago. Suriname has received substantial foreign aid from The Netherlands, which forgave all outstanding debts in 1975.

*Government and social conditions.* Suriname's constitution was suspended by a military council in 1980, but a new constitution, under which the country returned to civilian rule, was overwhelmingly approved by the voters in 1987. Under the new constitution, the chief of state is the president, who is elected by the National Assembly to a five-year term. The military maintains a continuing role in government by means of an executive Council of State, which can annul laws passed by the National Assembly. The main political party is the New Front (formerly Front for Democracy and Development), a four-party coalition made up of the Javanese, Creole, and East Indian minorities in the country.

Health conditions are generally acceptable, although many of the country's doctors have emigrated to The Netherlands. Suriname's infant mortality rate is one of the lowest in Latin America, and life expectancy is high by Latin-American standards.

Education is compulsory for all children between the ages of 6 and 12. Nearly half of the students leaving primary school continue their education. Higher education is provided by the government at the Anton de Kom University (1968). There are several daily newspapers published in Dutch; there are also Chinese periodicals. Suriname has two television stations, controlled by the government, and several radio stations.

*Cultural life.* A striking feature of Suriname society is the diversity of its ethnic composition and cultures. The American Indians carry on their traditional life-style almost entirely untouched by outside influence, while the Bush Negroes continue their way of life much as their ancestors did in Africa. The Creoles, East Indians, and Javanese also maintain their own identities to a large extent.

*History.* Suriname's earliest-known inhabitants, the Surinen (whence the country's name), were driven out prior to the 16th century by other American Indians. Spanish explorers claimed Suriname in 1593, but the Dutch began to settle there in 1602. English settlers sent by Barbados' governor Francis Willoughby followed in 1651. In exchange for Nieuw Amsterdam (New York), the Dutch received Suriname in 1667 by the Treaty of Breda. In 1682 the Dutch West India Company introduced coffee and sugarcane plantations and African slaves to cultivate them. Brutality drove many slaves into the interior, where they successfully resisted recapture, and eventually the Dutch granted them recognition and lands. Later they reconstituted their western African culture and government through chiefs and came to be called Bush Negroes by the Dutch. Except for brief interludes (1799–1802 and 1804–15) of British rule, Suriname remained a Dutch colony.

Slavery was abolished in 1863, whereupon indentured servants were brought from China, Java, and India to work the plantations. By World War II, plantation agriculture had stagnated, and bauxite, first discovered in 1915, had supplanted its produce as the major export. Suriname was one of only two Dutch territories to avoid capture by the Axis powers during World War II. Constitutional reforms (1948–51) led to autonomy and eventual self-government in 1954.

Independence was granted to Suriname in 1975, with Henck Arron as the first prime minister in a constitutional parliamentary state. The resignation of Javanese ministers from the government in 1979 led to a military coup d'état in early 1980. Another coup brought Dési Bouterse into power from 1982 to 1988. In 1987 the electorate overwhelmingly approved a new constitution, but the military (still under Bouterse) continued tight control, directly or indirectly. A guerrilla insurgency by blacks furthered disruption in the country, and the instability in the region caused some foreign governments to withhold economic aid.

**Suriname River,** river, central and eastern Suriname, rising in the highlands at the junc-

tion of the Wilhelmina and Eilerts de Haan ranges. It flows northeastward about 300 miles (480 km) to empty into the Atlantic Ocean just north of Paramaribo, the national capital. The river is obstructed by rapids in its upper course, where it is called the Gran River, and is dammed at Sintia, Adadien, and Awa. It is joined by the Pikien River at Djoemoe Asidonhopo, below which it is called the Suriname. The river was dammed at Afobaka to create the Professor Doctor Ingenieur W.J. van Blommestein Lake, Suriname's largest lake. Below Afobaka, the river flows through heavily populated and cultivated alluvial floodplains passing the cities of Brokopondo, Paramaribo, and Nieuw Amsterdam to empty into the Atlantic at its estuary, where it receives its only major tributary, the Commewijne.

**Suriyawong, Somdet Chao Phraya Si:** *see* Si Suriyawong, Somdet Chao Phraya.

**Surji-Arjungaon, Treaty of** (Dec. 30, 1803), settlement between the Marāṭhā chief Daulat Rāo Sindhia and the British, the result of Lord Lake's campaign in upper India in the first phase of the second Marāṭhā war (1803–05).

Lake captured Aligarh and defeated Sindhia's French-trained army at Delhi and Laswari (September-November 1803). By this treaty the Mughal emperor Shāh 'Ālam II passed under British protection; the Yamuna-Ganges doab (territory between the rivers), Āgra, and Sindhia's territories in Gohad and Gujarāt were entrusted to the British East India Company; and Sindhia's control over Rājasthān was relaxed. In addition, Sindhia received a British resident and signed a defensive treaty.

In November 1805 this treaty was revised by the acting governor-general, Sir George Barlow, in accordance with the London policy of withdrawal. Gwalior and Gohad were restored to Sindhia, the defensive treaty abrogated, and the East India Company's protectorate over Rājasthān withdrawn. On Nov. 5, 1817, the treaty was again revised under pressure from the British on the eve of the third Marāṭhā war. Sindhia promised to help the British against the Pindari marauders and surrendered his rights in Rājasthān. Shortly afterward, British treaties of protection were concluded with 19 Rajput states.

**Surkhandarya,** also spelled SURKHANDARIA, or SURCHANDARJA, most southerly *oblast* (province) of Uzbekistan. It embraces the basins of the Sherabad and Surkhan rivers, right-bank tributaries of the Amu River, which forms the frontier with Afghanistan in the south. In the east are the Babatag Mountains, and in the north and west are the lofty Gissar Range and its spurs, the Baysuntau and Kugitangtau, which act as a barrier against cold air masses from the north and make the *oblast* the warmest part of Uzbekistan, with relatively mild winters and hot, dry summers.

Cotton, chiefly fine staple, is grown on irrigated land in the Surkhan and Sherabad river valleys, and wheat and barley on unirrigated land; other crops include rice, sugarcane, and fruits. Karakul and Gissar sheep and goats are raised on the desert pasture. About four-fifths of the population is rural, and there are two major cities, Termez, the capital, and Denau. Uzbeks constitute about seven-tenths of the inhabitants; other groups include Tajiks, Russians, and Tatars. Area 8,050 square miles (20,800 square km). Pop. (1990 est.) 1,293,000.

**Surma River,** also called BARĀK, river in northeastern India and eastern Bangladesh, 560 miles (900 km) in length. It rises in the Manipur Hills in northern Manipur state, India, where it is called the Barāk, and flows west and then southwest into Mizorām state. There it veers north into Assam state and flows west past the town of Silchar.

The river next splits into two branches, the Surma (north) and the Kusiyāra (south), which enter Bangladesh and turn southwest. The Surma flows past Sylhet in a rich teagrowing valley, while the Kusiyāra subdivides into two more branches, both of which rejoin the Surma. At Bhairab Bāzār, in east-central Bangladesh, the river enters an old channel of the Brahmaputra and becomes the Meghna River, which flows south past Dhākā (formerly Dacca) and enters the Ganges. Steamers can navigate the river as far upstream as Silchar in the rainy season.

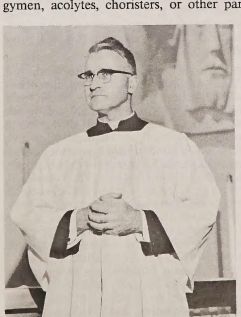
**surmullet** (fish): *see* goatfish.

**surname,** also called FAMILY NAME, or LAST NAME, name added to a "given" name, in many cases inherited and held in common by members of a family. Originally, many surnames identified a person by his connection with another person, usually his father (Johnson, MacDonald); others gave his residence (Orleans, York, Atwood [*i.e.,* living at the woods]) or occupation (Weaver, Hooper, Taylor). A surname could also be descriptive of a person's appearance (Little, Red) or his exploits (Armstrong).

Surnames appeared at vastly different times in different cultures: in 2852 BC, a Chinese emperor decreed the adoption of hereditary family names. In England it was a gradual process, beginning about 1000 AD—when it was stimulated by a paucity of first names—and lasting about six centuries. In some cultures the generalized use of surnames did not occur until the 20th century: in 1935 a Turkish law went into effect making surnames mandatory. Jews were late in adopting surnames and often were compelled to do so. Because they were frequently barred from adopting names used by Christians, some simply chose compounds that sounded good, *e.g.,* Rosenthal ("rose valley"). Others were assigned names expressive of the dominant culture's contempt (*e.g.,* Eselskopf, "donkey's head").

Surname formation often reflects the history and biases of culture. In Spain, partisanship and family pride entered into the process: the first family names originated from the war cries of Christians during the Moorish invasion. Swedish surnames reflect the Swedes' love of nature, incorporating words such as *berg* ("mountain") and *blom* ("flower"). In Russia, after the Revolution, many families shed the surnames derived from degrading peasant nicknames (*e.g.,* Krasnoshtanov, "red pants") and adopted names such as Orlov ("eagle").

**surplice,** white outer vestment worn by clergymen, acolytes, choristers, or other participants in Roman Catholic and in Anglican, Lutheran, and other Protestant religious services. It is a loose garment, usually with full sleeves. Originally the surplice was full length, but gradually it was shortened to the knees or above. In the 20th century some surplices were again made full length.



Contemporary surplice
Algimantas Kezys

A modified alb, the surplice probably originated in the 11th century in France or England, where the girdled alb was given up in the cold climate and the surplice was worn for uniform appearance over fur-lined garments. It was adopted in Rome in the 13th century. After the Protestant Reformation (16th century), the surplice was retained by the Church of England, and it is the most common vestment worn by Anglican and many Lutheran clergymen. It has no counterpart in the Eastern churches.

**surplus value,** Marxian economic concept that professed to explain the instability of the capitalist system. Adhering to David Ricardo's labour theory of value, Karl Marx held that human labour was the source of economic value. The capitalist pays his workers less than the value their labour has added to the goods, usually only enough to maintain the worker at a subsistence level. Of the total worth of the worker's labour, however, this compensation, in Marxian theory, accounts for only a mere portion, equivalent to the worker's means of subsistence. The remainder is "surplus labour," and the value it produces is "surplus value." To make a profit, Marx argued, the capitalist appropriates this surplus value, thereby exploiting the labourer.

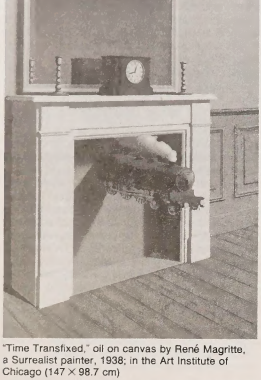
*Consult the* INDEX *first*

**Surquillo,** city and *distrito* ("district"), southern Lima-Callao metropolitan area, Peru. Surquillo is primarily a lower- and middle-income residential area, but there are also scattered retail and service establishments. It is situated about 6 miles (10 km) from central Lima and just north and east of Miraflores. Pop. (1990 est.) district, 156,773.

**Surratt, Mary,** in full MARY EUGENIA SURRATT, *née* JENKINS (b. May 1820, near Waterloo, Md., U.S.—d. July 7, 1865, Washington, D.C.), American boardinghouse operator who with three others was convicted of conspiracy to assassinate President Abraham Lincoln.

Mary Jenkins married young, and, though in 1840 her husband purchased some 1,200 acres of land, by 1857 his means were much reduced, and the outbreak of the American Civil War completed his ruin; he died in 1862. With the aid of John, the younger of their two sons, Mary Surratt moved into Washington, where she opened a boardinghouse. Among her son's pro-Southern friends who met at her boardinghouse was John Wilkes Booth, a well-known actor who conspired with John Surratt and others to kidnap Lincoln. When the Confederacy fell, Booth instead assassinated Lincoln and died resisting capture. Mary Surratt was arrested with Lewis Payne (who had wounded William Seward, the secretary of state), George Atzerodt (who had failed to murder Vice President Andrew Johnson), and three other alleged conspirators. She stood trial on May 12, 1865, before a nine-man military commission. On July 5 all were found guilty, though only four—Mary Surratt included—were sentenced to hang. At then-president Johnson's insistence, they were hanged within 48 hours. Most later historians believe Surratt to have been unconnected with the conspiracy and innocent of any crime.

**Surrealism,** movement in visual art and literature, flourishing in Europe between World Wars I and II. Surrealism grew principally out of the earlier Dada movement, which before World War I produced works of anti-art that



"Time Transfixed," oil on canvas by René Magritte, a Surrealist painter, 1938; in the Art Institute of Chicago (147 × 98.7 cm)

Joseph Winterbotham Collection, 1970.426; photograph © 1991, The Art Institute of Chicago, all rights reserved

deliberately defied reason; but Surrealism's emphasis was not on negation but on positive expression. The movement represented a reaction against what its members saw as the destruction wrought by the "rationalism" that had guided European culture and politics in the past and that had culminated in the horrors of World War I. According to the major spokesman of the movement, the poet and critic André Breton, who published "The Surrealist Manifesto" in 1924, Surrealism was a means of reuniting conscious and unconscious realms of experience so completely that the world of dream and fantasy would be joined to the everyday rational world in "an absolute reality, a surreality." Drawing heavily on theories adapted from Sigmund Freud, Breton saw the unconscious as the wellspring of the imagination. He defined genius in terms of accessibility to this normally untapped realm, which, he believed, could be attained by poets and painters alike.

In the poetry of Breton, Paul Éluard, Pierre Reverdy, and others, Surrealism manifested itself in a juxtaposition of words that was startling because it was determined not by logical but by psychological—that is, unconscious—thought processes. Its major achievements, however, were in the field of painting. Surrealist painting was influenced not only by Dadaism but also by the fantastic and grotesque images of such earlier painters as Hieronymus Bosch and Francisco Goya and of closer contemporaries such as Odilon Redon, Giorgio de Chirico, and Marc Chagall. The practice of Surrealist art strongly emphasized methodological research and experimentation, stressing the work of art as a means for prompting personal psychic investigation and revelation. Breton, however, demanded firm doctrinal allegiance. Thus, although the Surrealists held a group show in Paris in 1925, the history of the movement is full of expulsions, defections, and personal attacks.

The major Surrealist painters were Jean Arp, Max Ernst, André Masson, René Magritte, Yves Tanguy, Salvador Dalí, Pierre Roy, Paul Delvaux, and Joan Miró. The work of these artists is too diverse to be summarized categorically as the Surrealist approach in the visual arts. Each artist sought his own means of self-exploration. Some single-mindedly pursued a spontaneous revelation of the unconscious, freed from the controls of the conscious mind; others, notably Miró, used Surrealism as a liberating starting point for an exploration of personal fantasies, conscious or unconscious, often through formal means of great beauty. A range of possibilities falling between the two extremes can be distinguished. At one pole, exemplified at its purest by the works of Arp, the viewer is confronted with images, usually biomorphic, that are suggestive but indefinite. As the viewer's mind works with the provocative image, unconscious associations are liberated, and the creative imagination asserts itself in a totally open-ended investigative process. To a greater or lesser extent, Ernst, Masson, and Miró also followed this approach, variously called organic, emblematic, or absolute Surrealism. At the other pole the viewer is confronted by a world that is completely defined and minutely depicted but that makes no rational sense: fully recognizable, realistically painted images are removed from their normal contexts and reassembled within an ambiguous, paradoxical, or shocking framework. The work aims to provoke a sympathetic response in the viewer, forcing him to acknowledge the inherent "sense" of the irrational and logically inexplicable. The most direct form of this approach was taken by Magritte in simple but powerful paintings such as that portraying a normal table setting that includes a plate holding a slice of ham, from the centre of which stares a human eye. Dalí, Roy, and Delvaux rendered similar but more complex alien worlds that resemble compelling dreamlike scenes.

A number of specific techniques were devised by the Surrealists to evoke psychic responses. Among these were frottage (rubbing with graphite over wood or other grained substances) and grattage (scraping the canvas)—both developed by Ernst to produce partial images, which were to be completed in the mind of the viewer; automatic drawing, a spontaneous, uncensored recording of chaotic images that "erupt" into the consciousness of the artist; and found objects.

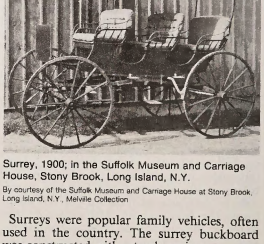
With its emphasis on content and free form, Surrealism provided a major alternative to the contemporary, highly formalistic Cubist movement and was largely responsible for perpetuating in modern painting the traditional emphasis on content.

**Surrey,** county of southern England, just southwest of London, adjoining the River Thames. The area of 648 square miles (1,679 square km) consists of lowland crossed by two east-west ridges—the chalk hills of the North Downs just south of the Thames valley and, farther south, a band of lower greensand rocks, which includes the highest point in the county, Leith Hill (965 feet [294 m]). The two ridges, with their intervening vale and the gaps cut in them by such rivers as the Mole and the Wey, give the county a variety of landscapes, and in 1958 some 160 square miles (415 square km) of southern Surrey were officially designated as an Area of Outstanding Natural Beauty.

In the European Middle Ages sheep raising was an important activity, and by the 16th century a cloth trade was also growing at Guildford, Godalming, and Farnham. Market gardens, too, became significant in the west and along the River Thames. The forested hills, sparsely populated until the 19th century, served two main purposes: as hunting preserves (Henry VIII, for example, built a flamboyant hunting lodge at Nonsuch Park) and as a source of timber for charcoal (used in iron smelting and gunpowder production), construction, and shipbuilding. Transport of these products, originally dependent on rivers, was facilitated after 1800 by the construction of railways. The Surrey Iron Railway from Wandsworth to Merstham, worked by horses, was the first public railway sanctioned by the British Parliament (1801). During the 19th century, there developed in Surrey the densest network of suburban railways anywhere in the world, originating at seven terminal stations in London and covering northern Surrey. Suburban growth along the lines spread virtually unchecked until World War II. Since the war, growth has continued but under planning restraints, including strict controls in London's Greenbelt and the designated area of natural beauty. Striking growth has occurred in independent centres such as Guildford and Woking.

Surrey is divided into Mole Valley, Tandridge, and Waverley districts and eight boroughs: Elmbridge, Epsom and Ewell, Guildford, Reigate and Banstead, Runnymede, Spelthorne, Surrey Heath, and Woking. Pop. (1989 est.) 1,000,000.

**surrey,** popular American doorless, four-wheeled carriage of the late 19th and early 20th centuries. Usually two-seated (for four passengers), surreys had a variety of tops, ranging from the rigid, fringed canopy-top, popularized in the Richard Rodgers and Oscar Hammerstein song "The Surrey with the Fringe on Top," to parasol and extension tops.



Surrey, 1900; in the Suffolk Museum and Carriage House, Stony Brook, Long Island, N.Y.

By courtesy of the Suffolk Museum and Carriage House at Stony Brook, Long Island, N.Y., Melville Collection

Surreys were popular family vehicles, often used in the country. The surrey buckboard was constructed without axle springs.

**Surrey, EARLS AND DUKE OF,** titled English nobility of several creations, grouped below chronologically and indicated by the symbol •.

**• Surrey, John de Warenne, 7th Earl of,** byname EARL WARENNE, also called (incorrectly) EARL OF SUSSEX (b. *c.* 1231—d. Sept. 27, 1304, Kennington, Surrey, Eng.), eminent English lord during the reigns of Henry III and Edward I of England.

John de Warenne was son and heir of the 6th Earl, William de Warenne, and succeeded upon his father's death in 1240. (He and his family claimed the earldom of Sussex but never held it de jure.) He married Alice de Lusignan, half sister of Henry III; and, except for a brief period in 1262–63, he strongly supported his friend the young lord Edward (afterward Edward I) during the Barons' Wars. In 1264 he defended Rochester Castle against Simon de Montfort until relieved by Edward. They then repaired to Warenne's town of Lewes, where the royal army was defeated (May 1264), and Warenne escaped to France. In 1265 he landed in Pembroke with Henry III's half brother William de Valence and took part in the campaign that ended at the

Battle of Evesham (Aug. 4, 1265) with Montfort's death.

The successful claim of Warenne's son-in-law John de Balliol to the throne of Scotland gave Surrey a strong interest and a leading part in Scottish affairs. However, after the treaty between Scotland and France in 1295, Edward I invaded Scotland in 1296, and Warenne won the Battle of Dunbar. Edward I then appointed him keeper of the realm of Scotland, but in 1297 he was defeated by William Wallace at Stirling Bridge. He fought in Edward's later campaigns in Scotland and took part in the victory at Falkirk (1298).

**•Surrey, John de Warenne, 8th Earl of,** EARL OF STRATHEARN, byname EARL WARENNE, also called (incorrectly) EARL OF SUSSEX (b. June 24, 1286—d. June 30, 1347, Conisborough, Yorkshire, Eng.), prominent supporter of Edward II of England, grandson of the 7th Earl of Surrey.

Warenne opposed Edward II's favourite, Piers Gaveston, but nevertheless supported the king against the Lords Ordainer, a baronial committee seeking to restrict the king's powers of appointment and other prerogatives. He was one of the last earls to remain faithful to Edward II in 1326.

Warenne joined in Edward III's Scottish wars, and his cousin Edward Balliol, as king of Scotland, created him Earl of Strathearn in 1332. His abduction in 1317 of Alice, Countess of Lancaster, involved him in a private war (1317–18) with Thomas, 2nd Earl of Lancaster, that cost him many of his estates. At his death he left no issue, and his remaining estates passed to the crown.

**•Surrey, Richard Fitzalan, 10th Earl of:** *see* Arundel, Richard Fitzalan, 4th Earl of.

**•Surrey, Thomas Fitzalan, 11th Earl of:** *see* Arundel, Thomas Fitzalan, 5th Earl of.

**•Surrey, Thomas Holland, Duke of,** 3RD EARL OF KENT, also called THOMAS DE HOLAND, (b. 1374—d. Jan. 7/8, 1400, Cirencester, Gloucestershire, Eng.), prominent English noble in the reign of Richard II.

Son of Thomas Holland, 2nd Earl of Kent (1350–97), he aided in the arrest and destruction of Richard II's enemies and was awarded with the dukedom of Surrey in 1397. In 1398 he was created marshal of England and given large estates, and, later in the same year, he was made the king's lieutenant in Ireland.

After Henry IV seized power in September 1399, Surrey, along with other advisers of the former king, was temporarily arrested. On November 6 he was deprived of his dukedom. He then joined in a conspiracy against Henry but was betrayed and, while in flight, was seized by a mob and beheaded.

**•Surrey, Thomas Howard, Earl of:** *see* Norfolk, Thomas Howard, 2nd Duke of.

**•Surrey, Henry Howard, Earl of** (b. 1517, Hunsdon, Hertfordshire, Eng.?—d. Jan. 13, 1547, London, Eng.), poet who, with Sir Thomas Wyat (1503–42), introduced into England the styles and metres of the Italian humanist poets and so laid the foundation of a great age of English poetry.

The eldest son of Lord Thomas Howard, Henry took the courtesy title of Earl of Surrey in 1524 when his father succeeded as 3rd Duke of Norfolk. It was Surrey's fate, because of his birth and connections, to be involved (though usually peripherally) in the jockeying for place that accompanied Henry VIII's policies. From 1530 until 1532 he lived at Windsor with his father's ward, Henry Fitzroy (1519–36), who was bastard son of Henry VIII by Elizabeth Blount and who had been created Duke of Richmond in 1525. In 1532, after talk of marriage with the princess Mary (daughter of Henry VIII and Catherine of Aragon), he married Lady Frances de Vere, the 14-year-old daughter of the Earl of Oxford, but they




Henry Howard, Earl of Surrey, drawing by Hans Holbein the Younger; in Windsor Castle, Berkshire

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did not live together until 1535. Despite this marriage, an alliance between him and the princess Mary was still discussed. In 1533 Richmond married Surrey's sister Mary, but the two did not live together because Mary preferred to stay in the country. Richmond died three years later, under suspicious circumstances.

Surrey was confined at Windsor (1537–39) after being charged by the Seymours (high in favour since the king's marriage to Jane Seymour in 1536) with having secretly favoured the Roman Catholics in the rebellion of 1536. He had in fact joined his father against the insurgents. In 1540 he was a champion in court jousts, and his prospects were further improved by the marriage of his cousin Catherine Howard to the king. He served in the campaign in Scotland in 1542 and in France and Flanders from 1543 to 1546. He acted as field marshal in 1544 and won royal approval.

Returning to England in 1546, he found the king dying and his old enemies the Seymours incensed by his interference in the projected alliance between his sister Mary and Sir Thomas Seymour, Jane's brother; he made matters worse by his assertion that the Howards were the obvious regents for Prince Edward, Henry VIII's son by Jane Seymour. The Seymours, alarmed, accused Surrey and his father of treason and called his sister, the Duchess of Richmond, to witness against him. She made the disastrous admission that he was still a close adherent to the Roman Catholic faith. Because Surrey's father, the Duke of Norfolk, had been considered heir apparent if Henry VIII had had no issue, the Seymours urged that the Howards were planning to set Prince Edward aside and assume the throne. Surrey defended himself unavailingly and at the age of 30 was executed on Tower Hill. His father was saved only because the king died before he could be executed.

Most of Surrey's poetry was probably written during his confinement at Windsor; it was nearly all first published in 1557, 10 years after his death. He acknowledged Wyat as a master and followed him in adapting Italian forms to English verse. He translated a number of Petrarch's sonnets already translated by Wyat. Surrey achieved a greater smoothness and firmness, qualities that were to be important in the evolution of the English sonnet. Surrey was the first to develop the sonnet form used by William Shakespeare.

In his other short poems he wrote not only on the usual early Tudor themes of love and death but also of life in London, of friendship, and of youth. The love poems have little force except when, in two "Complaint[s] of the absence of her lover being upon the sea," he wrote, unusual for his period, from the woman's point of view.

The short poems were printed by Richard Tottel in his *Songes and Sonettes, Written by the Ryght Honorable Lorde Henry Haward Late Earle of Surrey and Other* (1557; usually known as *Tottel's Miscellany*). "Other" included Wyat, and critics from George Puttenham onward have coupled their names.

*Certain Bokes of Virgiles Aenaeis,* published in 1557, in Surrey's translation of Books II and IV of the *Aeneid* marked the first use in English of blank verse, a style adopted from Italian verse.

**•Surrey, Philip Howard, Earl of:** *see* Arundel, Philip Howard, 1st (or 13th) Earl of.

**•Surrey, Thomas Howard, Earl of:** *see* Arundel, Thomas Howard, 2nd (or 14th) Earl of.

**Surrey Heath,** district (borough) in the northwestern part of the county of Surrey, England. The district, with 37 square miles (97 square km), owes its name to its natural vegetation. The sands and gravels that underlie the area yield an acid and infertile soil supporting rough heathland, scrub, and pine forest. Much of the district is still common land, used for recreation, while other parts were taken over by the military in the 19th century for maneuvers and firing ranges. Although the district is largely rural, Camberley and Frimley have undergone development and have some light industry. Pop. (1989 est.) 83,600.

**surrogate motherhood,** practice in which a woman (the surrogate mother) bears a child for a couple unable to produce children in the usual way, usually because the wife is infertile or otherwise unable to undergo pregnancy. In so-called traditional surrogacy, the surrogate mother is impregnated through artificial insemination with the sperm of the husband. In gestational surrogacy, the wife's ova and the husband's sperm are subjected to in vitro fertilization, and the resulting embryo is implanted in the surrogate mother. Normally, in either procedure, the surrogate gives up all parental rights, but this has been subject to legal challenge.

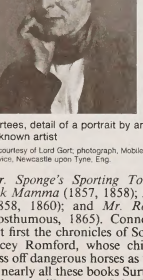
The practice of surrogate motherhood, though not unknown in previous times, came to international attention in the mid-1970s when a reduction in the number of children available for adoption and the increasing specialization of techniques in human embryology made such methods a viable alternative to lengthy and uncertain adoption procedures or childlessness. Surrogate motherhood has raised a number of issues—such as the matter of payment for services (which, taken to the extreme, has implications of making children a commodity) and the rights of all of the individuals involved should any aspect of the procedure go awry.

**Surt, Khalīj** (Mediterranean Sea): *see* Sidra, Gulf of.

**Surtees, Robert Smith** (b. May 17, 1803, The Riding, Northumberland, Eng.—d. March 16, 1864, Brighton, Sussex), novelist of the chase and the creator of Mr. Jorrocks, one of the great comic characters of English literature, a Cockney grocer who is as blunt as John Bull and entirely given over to fox hunting.

Riding to hounds was a passion with Surtees from the days when he hunted from the family residence, Hamsterley Hall in Durham; nearly all his writing involved horses and riding. Surtees' earliest works were published in *The Sporting Magazine,* and in 1831, with Rudolph Ackermann as publisher, he launched the *New Sporting Magazine* (*N.S.M.*), editing it until 1836. His novels appeared as serials in

the *N.S.M.* or elsewhere or in monthly parts before final publication in book form, and these first and last dates are given after their titles. *Jorrocks' Jaunts and Jollities* (1831, 1838), a collection of tales (the prototype for Charles Dickens' *Pickwick Papers*), *Handley Cross* (1843, expanded 1854), and *Hillingdon Hall* (1843, 1845) all feature Mr. Jorrocks. There followed *Hawbuck Grange* (1846, 1847);



Surtees, detail of a portrait by an unknown artist

By courtesy of Lord Gort; photograph, Mobile Photo Service, Newcastle upon Tyne, Eng.

*Mr. Sponge's Sporting Tour* (1849, 1853); *Ask Mamma* (1857, 1858); *Plain or Ringlets?* (1858, 1860); and *Mr. Romford's Hounds* (posthumous, 1865). Connoisseurs generally put first the chronicles of Soapey Sponge and Facey Romford, whose chief business is to pass off dangerous horses as tractable animals. In nearly all these books Surtees was fortunate to have as illustrators John Leech and Hablot Knight Browne ("Phiz"), the illustrator of the *Pickwick Papers*.

Surtees was a mordant satirist. The snobbery, envy, greed, and ignorance that consume many of his characters are set down without geniality. His portrayal of provincial England just leaving the coaching for the railway era exposes its boredom, ill manners, discomfort, and coarse food, and its matter-of-factness makes admirable social history. Yet the descriptions of fast runs with hounds over open country leave the most lasting impression.

**Surtsey** (Icelandic: "Surts Island"), volcanic island off the southern coast of Iceland, southwest of the Vestmannaeyjar ("Vestmann Islands"). It emerged from the Atlantic Ocean in a fiery eruption in November 1963. During the next three and one-half years its volcanic core built up an island 1 square mile (2.5 square km) in area, with elevations more than 560 feet (171 m) above sea level and 950 feet (290 m) above the ocean floor. At the height of the eruptions, a column of steam nearly 4 miles (6 km) high rained ash over a large area, including the Vestmannaeyjar. After the island cooled, numerous geologists, biologists, and ecologists visited it, and it is now the site of a long-term biological research program being conducted by Icelandic and U.S. scientists. The island was named in 1965 by the government of Iceland for Sutur, the fire god of Icelandic mythology.

**surveying,** method of making relatively large-scale, accurate measurements of the Earth's surfaces.

A brief treatment of surveying follows. For full treatment, *see* MACROPAEDIA: Mapping and Surveying.

*History of surveying.* Evidence that property boundaries were surveyed as early as 1400 BC has been found in the fertile valleys and plains of Egypt. Before the 3rd century BC the Chinese knew about the magnetic properties of the lodestone and possessed some form of magnetic compass. By the 2nd century BC the Greeks used the astrolabe, an instrument for measuring the altitudes of stars above the horizon.

During their occupation of Egypt, the Romans acquired Egyptian surveying instruments, to which they added the water level and the plane table. Plane tables for trigonometric surveying, though not providing high precision, are still in use. By the early 17th century, the English mathematician Edmund Gunter developed a surveying chain, which marked out standard measures of distance. The chain long remained in general use and was superseded by the steel tape only in the beginning of the 20th century.

By the late 18th century modern surveying practices were in use. With the measurement in the 1790s of the meridian passing through Barcelona, Spain, and Dunkirk, Fr., the metre—the basic unit for the metric system of measurement—was established. It became the fundamental standard of length for surveying.

The 20th century ushered in improvements in precision by introducing techniques for mapping from aerial photographs and for measuring distances by electronic devices. Important technological developments benefiting worldwide surveying in the late 20th century included the use of satellites as reference points for geodetic surveys and computers to speed the processing and recording of survey data.

*Fundamentals of surveying.* Surveying is divided into the categories of plane surveying and geodetic surveying. Plane surveying concentrates on mapping relatively small areas (smaller than 12 miles [20 km] across), where the curvature of the Earth is not a significant factor; the calculations of plane trigonometry are sufficient. Geodetic surveying covers large areas of the globe, with all attendant corrections for the curvature of the Earth; such surveying must be very accurate, and geodetic instruments are precise.

Measurements made in the direction of gravity are designated as vertical, and measurements made perpendicular to the direction of gravity are designated as horizontal. Surveying measurements are of four types: (1) horizontal lengths or distances, (2) vertical lengths, or differences in height or elevation, (3) horizontal angles measured in horizontal planes, and (4) vertical angles measured in vertical planes.

Horizontal lengths are generally measured in short, straight sections that together form short arcs along the Earth's surface. With a surveyor's level, the difference in height between two points can be determined. Directions are given in azimuths or bearings.

*Surveying of land areas.* Land-area surveys are made to determine the relative horizontal and vertical position of topographic features and to establish reference marks to guide construction or to indicate land boundaries. Reconnaissance of the area is followed by a preliminary survey; a map and then a plan are prepared based on the preliminary survey; and finally a location survey is made, based on the plan. Surveys to establish property boundaries involve a thorough knowledge of real-estate laws as well as skills in survey techniques.

*Surveying of water areas.* A survey of a water-covered area determines the horizontal coordinates of points on the surface of the body of water (position fixing) and determines the water's depth at those points.

Position fixing requires that measurements be made both on land and on water. The shape of the coastline is determined with aerial photographs. For making large-scale maps of shallow waters, depths are still plumbed by sounding poles. In water deeper than 12 feet (3.7 m), the hydrographer determines depth by echo sounders, which send out pulses of sound or radio waves and detect the time delay of echoes returned from the bottom. At the end of each day's surveying, the soundings are corrected for tide and are plotted on special maps. Depth contours are drawn to be used as guides for determining the spacing of sounding lines and for the special examination of undersea features.

**Surveyor,** any of a series of seven unmanned U.S. space probes sent to the Moon between 1966 and 1968 to photograph and study the lunar surface. Surveyor 1 (launched May 30, 1966), carrying a scanning television camera and special sensors, transmitted 11,150 photographs as well as information about environmental conditions on the Moon. Surveyor 2 crashed on the Moon (Sept. 23, 1966). Surveyor 3 (April 17, 1967) included additional equipment such as a surface-sampling device and two small mirrors to expand the camera vision; it returned 6,315 photographs. Surveyor 4 crashed or soft-landed on the Moon (July 16, 1967). Surveyor 5 (Sept. 8, 1967) measured the proportions of chemical elements in lunar soil and studied other surface properties; it returned 18,000 photographs.

After taking photographs of one area of the Moon's surface, Surveyor 6 (Nov. 7, 1967) was lifted, moved 8 feet (2.4 m), and repositioned to continue photographing another area. This marked the first lift-off from an extraterrestrial body. Altogether, 27,000 photographs were obtained. Surveyor 7 (Jan. 7, 1968) was the only probe in the series that was soft-landed in the highland region of the Moon. Data transmitted by the craft revealed that the chemical composition and landscape of this region was quite different from those of sites at lower elevations. This craft obtained 21,000 photographs. *See also* Moon exploration.

**surveyor's chain,** also called GUNTER'S CHAIN, measuring device and arbitrary measurement unit still widely used for surveying in English-speaking countries. Invented by the English mathematician Edmund Gunter in the early 17th century, Gunter's chain is exactly 22 yards (about 20 m) long and divided into 100 links. In the device, each link is a solid bar. Measurement of the public land systems of the United States and Canada is based on Gunter's chain. An area of 10 square chains is equal to one acre.

**surveyor's level,** instrument used in surveying to measure the height of distant points in relation to some datum (usually, mean sea level). It consists of a telescope fitted with a spirit level and, generally, mounted on a tripod. It is used in conjunction with a graduated rod placed at the point to be measured and sighted through the telescope. The theodolite (q.v.), or transit, is used to measure horizontal and vertical angles; it may be used also for leveling.

**survival,** in cultural anthropology, a cultural phenomenon that originates under one set of conditions and persists in a period when those conditions no longer obtain. The term was first employed by the British anthropologist Edward Burnett Tylor in his *Primitive Culture* (1871). Tylor believed that seemingly irrational customs and beliefs, such as peasant superstitions, were vestiges of earlier rational practices. He distinguished between continuing customs that maintained their function or meaning and those that had lost their utility and were further thought to be poorly integrated with the rest of culture. The latter he termed survivals.

The Scottish evolutionist John Fergusson McLennan used the term to mean symbolic forms of earlier customs (*e.g.,* mock battles in nuptial rituals were said to be survivals of an earlier stage of marriage by capture). Some writers did not view survivals as useless but rather as having a transformed use. They emphasized the change in function and its integration with the rest of culture.

The Polish-British anthropologist Bronisław Malinowski, however, entirely rejected the suggestion that any part of culture could have

no function or could be disconnected from the rest of the cultural system.

The term survival is still used in connection with cultural change or stability and with cultural evolution. Survivals of previous forms are said to result from cultural lag and are used to reconstruct historical sequences.

**survival training,** teaching people to survive in the wilderness, using essentially Stone Age skills. Such techniques include building shelters from available materials, making fire without matches, locating water, identifying edible plants, manufacturing tools, hunting and trapping animals with primitive devices, and making protective clothing and blankets from skins and fibres. Taught in some secondary schools, colleges, youth groups, and special camps, the programs may also incorporate backpacking, mountain walking, high-altitude camping, and rock climbing.

Shelters built in survival training include lean-tos or teepees made of branches thatched with grass, bark, leaves, or mud, rock shelters, and snow caves. Beds are made from boughs and grass or in cold weather may be constructed over stones heated in a campfire. Fires are started with tinder made from dry bark and shredded grass lighted either with a spark struck from flint or with a bow drill. Students are taught how to obtain water from the soil by digging holes, squeezing mud, or building an evaporation still and to collect water from the air and from plants; to harvest and process edible plants and identify insects to provide emergency food; to hunt birds and small game with arrows or throwing sticks or to trap them with snares and nets; to fish with willow poles, natural fibres, and bone; to make tools by flaking, hammering, or scraping stone or by working bone; to make bows and arrows from wood, sinew, and feather; to make ropes and weave clothing and blankets from bark, grass, and tanned skins.

On completion of training, each student undergoes a final test called the "solo," in which he is left in a remote area for several days and nights with a minimum of equipment and must find his own food and shelter, using the skills that he has learned.

**survivorship curve,** graphic representation of the number of individuals in a population that can be expected to survive to any specific age. There are three general types of curves. The first, characteristic of small mammals, fishes, and invertebrates, has a high death rate (or low survivorship rate) immediately following birth. The second type, illustrated by the large mammals, is the opposite. The organism tends to live a long life (low death rate and a high survivorship rate); toward the end of its life expectancy, however, there is a dramatic increase in the death rate. In the third type, found in birds and mice, the mortality or survivorship rate is relatively constant during the organism's entire life.

**Sūrya,** in Hindu mythology and religion, the sun and the sun god. Although in the Vedic period several other deities also possessed solar characteristics, most of these were merged into a single god in later Hinduism. Sūrya once ranked together with Viṣhnu, Śiva, Śakti, and Gaṇeśa, and many temples dedicated to him are found throughout India. In modern Hinduism he is worshiped as the supreme deity by only a small following, the Saura sect, though he is invoked by all Hindus, and the *Gāyatri-mantra,* uttered daily at dawn by orthodox Hindus, is addressed to the sun.

Sūrya is the mythological father of many notable sons, including Manu (progenitor of the human race), Yama (lord of death), the Aśvins (twin physicians to the gods), Karṇa (a great warrior of the *Mahābhārata*), and Sugriva (king of monkeys). The *Purāṇas* record that the weapons of the gods were forged from pieces trimmed from Sūrya, whose full



Sūrya, stone image from Deo-Barunarak, Bihār, India, 9th century AD
Pramod Chandra

emanation was too bright to bear. His power was conceived of as dispelling darkness, curing disease, and heating and illuminating the world. His wife Uṣas—in some accounts, his mother or mistress—is the personification of dawn.

Sculptures of Sūrya often show him in "northern" or Scythian dress—close-fitting coat and high boots—suggesting an influence from Iranian sun cults. He is commonly represented in a chariot drawn by seven horses, or by a single horse with seven heads, holding full-blown lotuses, his head surrounded by a nimbus or by rays. One of the most splendid temples dedicated to Sūrya is the 13th-century Sūrya Deula ("Sun Temple"), once called the Black Pagoda, at Konārak, in Orissa. There, the whole structure is conceived as a chariot on wheels in which the sun god rides across the heavens pulled by prancing horses.

**Suryavarman,** name of Khmer kings of Cambodia, grouped below chronologically and indicated by the symbol •.

• **Suryavarman I** (d. *c.* 1050), great Khmer king of the Angkor period of Cambodian history. He was renowned as a conqueror and builder who greatly expanded his territorial holdings and consolidated the conquered lands into a strong, unified empire.

Suryavarman defeated King Udayadityavarman by 1002 and Jayaviravarman (of Malay origin), his would-be successor, by 1010, securing the Khmer throne for himself. In contrast to his Hindu subjects, Suryavarman was a Mahāyāna Buddhist who, in the opinion of some scholars, considerably enhanced the prestige and influence of his religion among the Khmers and yet was tolerant of the local Vishnu cult of Hinduism.

Inscriptions record Suryavarman's boundless energy in promoting public works, especially irrigation projects; in founding monasteries; and in planning and developing the site of the traditional Cambodian capital, Angkor. Among the many temples completed during his reign are the beautiful Phimeanakas ("Celestial Palace") and the temple mountain, the Ta Keo, both remarkable examples of Khmer architecture.

Suryavarman was a strong and capable ruler who had a knowledge of prayer, ritual, sacrifice, and astronomy. He expanded his territory into the Chao Phraya River valley west of the Tonle Sap in what is now Thailand. He further subjugated vast tracts of land on the fringes of southern Laos. He asserted his suzerainty over these territories so firmly that they remained within the Cambodian empire for several centuries. His reign was marked by domestic peace and prosperity; no revolts against him are mentioned.

Suryavarman received the posthumous title of Nirvāṇapada, "the king who has gone to nirvana," a testimony to the Buddhist element in the politico-religious ethic of his time.

• **Suryavarman II** (d. *c.* 1150), Cambodian king renowned as a religious reformer and temple builder. Under his rule the temple of Angkor Wat, the world's largest religious structure, was constructed.

Suryavarman defeated rival claimants to the throne and established sole rule over Cambodia by 1113, reuniting the country after more than 50 years of unrest. Warlike and ambitious, he expanded the limits of Cambodia to include much of what is now Thailand; his kingdom stretched as far west as the frontiers of the Burmese state of Pagan, south to the coast of the Gulf of Thailand, and east to the kingdom of Champa in the southern part of what is now Vietnam. Khmer holdings also included part of the eastern coast of the Malay Peninsula.

Suryavarman was formally crowned in 1113, with his guru, the powerful priest Divākara-paṇḍita, presiding. The king was a religious reformer who blended the mystical cults of Vishnu and Śiva, supreme Hindu deities, and promulgated Vaiṣṇavism as the official religion, rather than Buddhism, which had briefly flourished under his predecessors.

Angkor Wat, dedicated to Vishnu, was begun in the early years of Suryavarman's reign and was not finished until after his death. Surrounded by a wall and a moat, the building is decorated with sculptures portraying Suryavarman as Vishnu; he is shown reviewing his troops, holding audiences, and performing other functions of a sovereign. Suryavarman also sponsored the construction of several other temples in the style of Angkor Wat.

In 1116 Suryavarman resumed diplomatic relations (in abeyance since the 9th century) with the Chinese, who officially recognized his kingdom as their vassal in 1128. By sending tribute to China, he acquired a powerful ally to discourage attacks from neighbouring Southeast Asian kingdoms and ensured that China would not interfere in Khmer domestic affairs.

From 1123 until 1136 he waged a series of unsuccessful campaigns against Dai Viet, the Vietnamese kingdom that had asserted its independence from China in 939. He attempted a land attack through Laos to Nghe An in 1128 and met with defeat. A few months later, Suryavarman's fleet of 700 junks began a long harassment along the coast in the Gulf of Tonkin. Suryavarman coerced the kingdom of Champa to assist him in these efforts, but in 1136 the Cham king, Jaya Indravarman III, defected and made an alliance with the Vietnamese.

Suryavarman deposed the Cham king in 1144 and annexed Champa in the following year. The Chams, under a new leader, King Jaya Harivarman I, defeated Khmer troops in a decisive battle at Chakling, near Phan Rang, in southern Vietnam. Suryavarman put his brother-in-law, Harideva, on the Cham throne, but Jaya Harivarman I deposed him and reclaimed that throne. In 1150 Suryavarman died in the midst of a new campaign against Champa, leaving his people exhausted by war and victimized by the once-subservient Chams, who eventually ravaged Angkor.

**Susa,** also called SHUSHAN, Greek SUSIANE, modern SHUSH, capital of Elam (Susiana) and administrative capital of the Achaemenian king Darius I and his successors from 522 BC. It was located at the foot of the Zagros Mountains near the bank of the Karkheh Kūr (Choaspes) River in the Khuzistan region of Iran.

The archaeological site, identified in 1850 by W.K. Loftus, consists of four mounds. One held the citadel and was excavated (*c.* 1881) by Marcel Dieulafoy. A third mound to the south contained the royal Elamite city, while the fourth mound consisted of the poorer houses.

The finest pottery was found in the lowest strata and belonged to two different civilizations, both Neolithic. Above the early strata were remains of Elamite and early Babylonian civilizations. In the upper portions of the mounds Achaemenian, Greek, Elamite,



Winged bull, glazed bricks from Susa, Achaemenian period (539–330 BC); in the Louvre, Paris

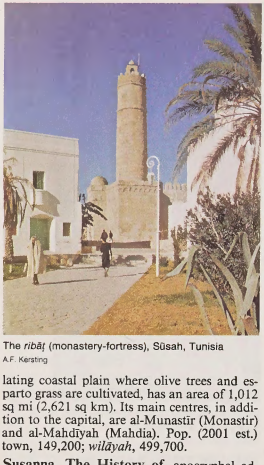
By courtesy of the Musee du Louvre, Paris; photograph, Cliche Musees Nationaux, Paris

Parthian, and Sāsānian remains were found. Until sometime after the 14th century AD the city was a flourishing centre of a district known for silk, sugarcane, and oranges.

**Sūsah** (Tunisia): *see* Hadrumetum.

**Sūsah,** also spelled SOUSSE, or SOUSA, capital of Sūsah *wilāyah* (governorate), central east Tunisia. The town, an important port and commercial centre, originated as the Phoenician settlement of Hadrumetum. It declined under Arab control but was revived by the Aghlabid rulers of al-Qayrawān (Kairouan) in the 9th century, whose port it remained until the invasions of the Bedouin Arabs in the 11th century. Reestablished as a prominent port under the French protectorate (1881–1955), Sūsah is once again an important trade centre, although agricultural activity has fallen off in favour of fishing, and tourism is important. Major economic pursuits include canning of sardines, automotive parts manufacture and assembly, processing of olive oil, and cotton textile milling. The old town, enclosed by ramparts that date from the Byzantine period and from the Aghlabid dynasty, contains the Great Mosque and *ribāṭ* (monastery-fortress, dating from the 9th century), the *sūqs* (marketplaces), and some Muslim quarters. Sūsah is linked by road and rail to Tūnis, Safāqis (Sfax), Qābis (Gabès), and Qafṣah (Gafsa).

Sūsah *wilāyah,* encompassing a lightly undulating coastal plain where olive trees and esparto grass are cultivated, has an area of 1,012 sq mi (2,621 sq km). Its main centres, in addition to the capital, are al-Munastīr (Monastir) and al-Mahdīyah (Mahdia). Pop. (2001 est.) town, 149,200; *wilāyah,* 499,700.



The *ribāṭ* (monastery-fortress), Sūsah, Tunisia

A.F. Kerstring

**Susanna, The History of,** apocryphal addition to the Old Testament Book of Daniel; it appears in both the Septuagint (Greek) and Vulgate (Latin) versions. In the latter it constitutes the last chapter, but in many editions of the former it is the introductory chapter. In the Roman canon it is the penultimate chapter (13). Based on the traditional motif of the triumph of righteousness over sin, the story has two concurrent themes, of an innocent woman falsely accused of adultery, and of a wise judge.

**Susanoo,** in full SUSANOO NO MIKOTO, also spelled SUSANOWO (Japanese: Impetuous Male), in Japanese mythology, the storm god, younger brother of the sun goddess Amaterasu. He was born as his father Izanagi washed his nose. Susanoo, having been granted charge of the sea plain, was driven out of heaven because of his outrageous behaviour at his sister's court (*see* Amaterasu).

Susanoo descended into the land of Izumo in western Japan and killed an eight-headed dragon that had been terrorizing the countryside. From the tail of the dragon he recovered the marvelous sword Kusanagi (*q.v.*) that he presented to his sister and that later came to form part of the Imperial Treasures of Japan. Susanoo married the girl he had rescued from the dragon, and together they produced many generations of gods. The most famous of their offspring was Okuninushi, the "Master of the Great Land" (Izumo).

**Susanville,** city, seat (1864) of Lassen County, northeastern California, U.S., on the Susan River, at the eastern base of the Sierra Nevada, at the head of the Honey Lake Valley, 80 mi (129 km) northwest of Reno, Nev. In 1853 Isaac Roop staked a claim and built a cabin on the site. The following year Peter Lassen and a group of prospectors joined him; they struck gold, and the settlement, later named for Roop's daughter, became a bustling mining town. In 1856 Roop established the short-lived "republic" of Nataqua and made Susanville its capital. The city is now a marketing and shipping centre for an agricultural area (dairy products and grain) and has lumber and flour mills. It is the seat of Lassen College (1925) and is a gateway to Lassen Volcanic National Park and Lassen National Forest (headquartered at Susanville). The Roop's Fort and William Pratt Memorial Museum (1854) was the "capitol" building of the Nataqua republic, which in 1863 resisted California's jurisdiction (the Sagebrush War). Eagle Lake and the California Conservation Center are nearby. Inc. town, 1900; city, 1940. Pop. (2000) 13,541.

**susceptibility, electric:** *see* electric susceptibility.

**susceptibility, magnetic:** *see* magnetic susceptibility.

**sushi,** a staple rice dish of Japanese cuisine, consisting of cooked rice flavoured with vinegar and a variety of vegetable, egg, or raw seafood garnishes and served cold. Restaurants specializing in sushi abound in Japan, where subtleties of preparation find a discriminating clientele.

*Nigiri-zushi* is a hand-formed oblong of rice topped with sliced raw fish and a dab of *wasabi,* green horseradish paste; the ingredients of *oshi-zushi* are pressed to shape in a mold. For *maki-zushi,* a sheet of *nori* (laver, a seaweed) is spread with rice, then with seafood or vegetables and garnishes. The whole is rolled into a cylinder and sliced. In *chirashi-zushi,* a homestyle version, the ingredients are not formed, rather the vinegared rice is strewn with toppings and garnishes. Vinegar-pickled ginger root (*sūshoga*) is a traditional palate-clearing accompaniment to sushi.

**Susiana** (ancient country, Iran): *see* Elam.

**Susiane** (ancient city, Iran): *see* Susa.

**suslik,** any of certain ground squirrels of the genus *Spermophilus. See* ground squirrel.

**Suslov, Mikhail Andreyevich** (b. Nov. 21 [Nov. 8, old style], 1902, Shakhovskoye, Russia—d. Jan. 25, 1982, Moscow), leading Soviet Communist ideologue and power broker from the 1950s until his death.

The son of a peasant, Suslov joined the Young Communist League during the upheavals of the Russian Revolution and the subsequent Civil War and joined the Communist Party in 1921 at the age of 19. He was sent to Moscow for secondary education and later studied economics at the Plekhanov Institute of the National Economy (1924–29) and the Economics Institute of the Red Professors. He taught at Moscow State University and at the Industrial Academy. He first received a political role in 1931, when he became a member of control commissions that supervised Stalinist purges in the Urals and the Ukraine. During the Great Purges that began in 1937, he rose in the party hierarchy, becoming a leading official first in Rostov and then in the Caucasus and a member of the Central Committee in 1939. During World War II he supervised the deportations of ethnic minorities from the Caucasus and, after the war, was in Lithuania, rounding up dissidents for deportation to Siberia.

From the late 1940s on, he remained at the centre of power in Moscow, becoming a member of the Presidium (Politburo) in 1952 and, except for a brief time after Stalin's death (1953–55), enjoying a pivotal position in the ruling clique. He was generally viewed as both conservative and flexible, being critical of Titoism, Eurocommunism, and other brands of independence from Moscow but, nevertheless, favouring hard-line political solutions rather than military ones, except as a last resort, as in Czechoslovakia (1968) and Poland (1981–82). In 1957 he helped Nikita Khrushchev to quell a conspiracy by a so-called "anti-party group" in the Politburo. But in October 1964, Suslov was the chief organizer of the bloodless coup that ousted Khrushchev and substituted Leonid Brezhnev—apparently in a successful effort to restore the power of the

consensus-oriented Politburo. He thereafter concentrated on interparty relations, between the Soviet party and other Communist parties around the world.

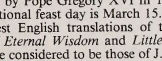
**Suso, Heinrich,** Suso also spelled SEUSE, also called HENRY SUSO, original name HEINRICH VON BERG (b. March 21, 1295?, probably Constance, Swabia—d. Jan. 25, 1366, Ulm), one of the chief German mystics and leaders of the Friends of God (Gottesfreunde), a circle of devout ascetic Rhinelanders who opposed contemporary evils and aimed for a close association with God.

Of noble birth, Suso joined the Dominicans in Constance, where five years later he experienced a profound religious awakening. Between *c.* 1322 and *c.* 1325 he was in Cologne for theological studies under Meister Eckehart, considered to be one of the greatest German speculative mystics. Suso returned *c.* 1326 to teach at Constance, where he wrote *c.* 1327 his first work, *Little Book of Truth,* in defense of Eckehart, who for his controversial works had been tried (1327). Suso's masterpiece is considered to be his *Little Book of Eternal Wisdom* (*c.* 1328), which subsequently became possibly the most popular religious treatise until Thomas à Kempis' (died 1471) influential *Imitatio Christi.* Although containing some mystical topics and theological reflections, *Eternal Wisdom* is essentially a practical work written in simple language.

In 1327/30 Suso was removed from his professorship for his doctrine and for his defense of Eckehart, who was condemned by the Pope in 1329. Some scholars hold that he wrote *c.* 1334/48 *Horologium sapientiæ* ("Clock of Wisdom"), a Latin adaptation of *Eternal Wisdom,* with hopes of securing Eckehart's approval. Others believe that the *Horologium* preceded *Eternal Wisdom.* He later became a well-known preacher, particularly in Switzerland and the upper Rhine. He was prior of the Friends of God in Constance (1343–44), then exiled to Diessenhofen, Switz., by the German king Louis IV the Bavarian. Before moving to Ulm *c.* 1347, Suso was broken by hardships, persecutions, and slander. He was beatified by Pope Gregory XVI in 1831, and his traditional feast day is March 15.

The best English translations of the *Little Book of Eternal Wisdom* and *Little Book of Truth* are considered to be those of J.M. Clark (1953). C. Gröber's *Der Mystiker Heinrich Seuse* ("The Mystic Heinrich Seuse") appeared in 1941, followed by Sister M. Catherine's *Henry Suso: Saint and Poet, a Study,* in 1947.

**suspension,** in musical composition, means of creating tension through prolongation of a consonant note while the underlying harmony changes, normally on a strong beat.



The resulting temporary dissonance persists until the suspended note resolves into a new consonant harmony. In the example, the top note is suspended, then resolved.

**suspension bridge,** bridge with overhead cables supporting its roadway. One of the oldest of engineering forms, suspension bridges were constructed by primitive peoples using vines for cables and mounting the roadway directly on the cables. A much stronger type was introduced in India in about the 4th century AD using cables of plaited bamboo and later of iron chain, with the roadway suspended.

In modern times, the suspension bridge provided an economical solution to the problem of long spans over navigable streams or at other sites where it is difficult to found piers in the stream. British, French, U.S., and other engineers of the late 18th and early 19th centuries encountered serious problems of stability and strength against wind forces and heavy loads; failures resulted from storms, heavy snows, and droves of cattle. Credit for solving the problem belongs principally to John Augustus Roebling, a German-born U.S. engineer who added a web truss to either side of his roadways and produced a structure so rigid that he successfully bridged the Niagara Gorge at Niagara Falls, N.Y., the Ohio River at Cincinnati, and, finally, in his masterpiece, the East River between Brooklyn and Manhattan at New York City.

The technique of cable spinning for suspension bridges was invented by the French engineer Louis Vicat, a contemporary of Roebling. Vicat's method employed a travelling wheel to carry the continuous cable strand from the anchorage on one side up over the tower, down on a predetermined sag (catenary) to the midpoint of the bridge, up and over the tower on the farther side to the farther anchorage, where a crew received the wheel, anchored the strand, and returned the wheel, laying a fresh strand. From these successive parallel strands a cable was built up.

Another major development in the modern suspension bridge was the pneumatic caisson, which permitted pier foundation at great depths. It was used initially by French, British, and U.S. engineers, including Washington Roebling, who completed his father's Brooklyn Bridge.

For a time in the 1930s, American engineers experimented with a narrow solid girder in place of the web truss to stiffen the roadway, but the failure of the Tacoma Narrows Bridge (*q.v.*) in 1940 under aerodynamic forces instigated a return to the web truss. Later, aerodynamically stable box girders replaced the web truss.

As of the late 1980s, three suspension bridges (the Golden Gate [*q.v.*], in San Francisco; the Verrazano-Narrows [*q.v.*], in New York City; and the Humber Bridge [*q.v.*], near Hull, Humberside, Eng.) had main-span lengths of more than 4,000 feet (1,200 metres). Modern steel alloys are considered capable of much greater spans. Though suspension bridges can be made strong enough to support freight trains, they have nearly all been designed for automobile traffic.

A cable-braced bridge was developed by German engineers at Cologne, Düsseldorf, and elsewhere in the 1950s and '60s; in this form a single tower at the midpoint supports the roadway by means of a number of cables. Another development of the 1960s, aimed at reducing time of construction, was cable fabricated in the shop.

**Susquehanna,** also called SUSQUEHANNOCK, or CONESTOGA, Iroquoian-speaking American Indians who lived in palisaded towns along the Susquehanna River in what are now New York, Pennsylvania, and Maryland. Little is known of Susquehanna political organization, but they are thought to have been subdivided into several subtribes and clans; the name may have referred originally to a confederacy of tribes. Like other Iroquoian tribes, they were semi-sedentary agriculturalists.

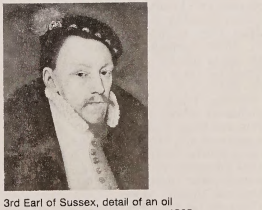
The Susquehanna were first described by Capt. John Smith, who explored the upper Chesapeake Bay area in 1608. Throughout the historical period they were at war with the Iroquois, who conquered them in 1676 and forced them to settle near the Oneida in New York. They were later allowed to return to their former territory along the Susquehanna River. Epidemics steadily reduced their number (estimated to have been about 5,000 in 1600), and in 1763 the 20 remaining Susquehanna were massacred by whites inflamed by accounts of an Indian war on the Pennsylvania frontier, several hundred miles away.

**Susquehanna River,** one of the longest rivers of the Eastern Seaboard of the United States. It rises in Otsego Lake, central New York state, and winds through the Appalachian Mountains in New York, Pennsylvania, and Maryland before flowing into the head of Chesapeake Bay at Havre de Grace, Md. About 444 mi (715 km) long, the river and its tributaries (which include the Chemung, Lackawanna, West Branch of the Susquehanna, and Juniata rivers) drain an area of 27,570 sq mi (71,410 sq km). Though the river itself never served as an important waterway, because of rapids and other obstructions, its valley was significant as a land route to the Ohio River system and later as a focus of coal mining. The Susquehanna is the potential source of waterpower in the eastern United States; hydroelectric power plants have been built at Holtwood, York Haven, and Safe Harbor, Pa., and Conowingo, Md. Main riverine cities include Binghamton, N.Y., and Wilkes-Barre, Scranton (on the Lackawanna), Williamsport (on the West Branch), and Harrisburg, Pa.

**Sussex** (from Old English Suð Seaxe, South Saxons), one of the kingdoms of Anglo-Saxon England. It ultimately coincided in area with the modern counties of East Sussex and West Sussex, although Hastings in East Sussex appears to have been sometimes separate. According to tradition, a certain Aelle landed in AD 477 at a place now covered by the sea, south of Selsey Bill, and defeated the Britons. The Venerable Bede, writing in the 8th century, says that Aelle held supremacy over all the peoples south of the Humber, the only king of Sussex to hold that eminence. In the 680s St. Wilfrid, expelled from Northumbria, spent several years converting the South Saxons to Christianity. At that time their king was Aethelwalh, but after his death Sussex was divided among several kings. There were still kings early in the reign (757–796) of Offa of Mercia, but later they are named as ealdormen. In the 9th century Sussex fell to the kings of Wessex.

**Sussex** (England): *see* East Sussex; West Sussex.

**Sussex, Thomas Radcliffe, 3rd earl of,** Radcliffe also spelled RATCLYFFE, also called (1542–53) VISCOUNT FITZWALTER, or (1553–57) BARON FITZWALTER (b. *c.* 1525—d. June 9, 1583, London), English lord lieutenant of



3rd Earl of Sussex, detail of an oil painting by an unknown artist, *c.* 1565; in a private collection

By courtesy of Baron Fitz Walter; photograph, *Kentish Gazette,* Canterbury, Eng.

Ireland who suppressed a rebellion of the Roman Catholics in the far north of England in 1569. He was the first governor of Ireland to attempt, to any considerable extent, enforcement of English authority beyond the Pale (comprising parts of the modern counties of Dublin, Louth, Meath, and Kildare).

The eldest son of Henry, 2nd earl of Sussex, Radcliffe took the courtesy title Viscount Fitzwalter in 1542. He served on diplomatic missions for both Edward VI and Mary I. In

1553 Mary made him Baron and in 1556 appointed him lord deputy of Ireland. Fitzwalter attempted, with little success, to subdue the powerful chieftain Shane O'Neill and his allies in Ulster. He defeated the opponents of Conor O'Brien, 3rd Earl of Thomond, who was loyal to the English, and restored him to his lands around Limerick. In February 1557 Fitzwalter succeeded to the earldom of Sussex, and after Elizabeth I ascended the throne she gave him the title lord lieutenant of Ireland (1560). In accordance with her instructions, he established English settlements in Offaly and Leix in the province of Leinster, thereby introducing English influence into the area.

After resigning his Irish post in 1566, Sussex became one of the key members of the governmental faction opposed to Elizabeth's favourite, Robert Dudley, Earl of Leicester. In 1568 he was one of the English commissioners in the York Conference convened to discuss the possibility of returning Mary Stuart to Scotland. Sussex was appointed lord lieutenant of the north in 1569; in this capacity he put down the rebellion of the Earls of Northumberland and Westmorland (1569–70).

**Sussex Incident** (March 24, 1916), torpedoing of a French cross-channel passenger steamer, the *Sussex*, by a German submarine, leaving 80 casualties, including two Americans wounded. The attack prompted a U.S. threat to sever diplomatic relations. The German government responded with the so-called Sussex pledge (May 4, 1916), agreeing to give adequate warning before sinking merchant and passenger ships and to provide for the safety of passengers and crew. The pledge was upheld until February 1917, when unrestricted submarine warfare was resumed.

**sussexite,** white to straw-yellow borate mineral, basic manganese borate [$MnBO_2(OH)$]. Magnesium replaces manganese in the crystal structure to form the similar mineral szaibelyite. Sussexite occurs as hydrothermal fibrous veinlets in the United States at Franklin, N.J., and Iron county, Mich. Szaibelyite occurs abundantly near Inder Lake, Kazakhstan; Rézbánya, Hung.; Suan, N. Korea; Norberg, Swed.; and in California, Nevada, and Michigan. For detailed physical properties, *see* borate mineral (table).

**Süssmayr, Franz Xaver,** Süssmayr also spelled SÜSSMAYER (b. 1766, Schwanenstadt, Oberösterreich [now in Austria]—d. Sept. 17, 1803, Vienna), Austrian composer best known in the 20th century for having completed Wolfgang Amadeus Mozart's *Requiem* (K. 626).

Süssmayr was educated at Kremsmünster, a monastery school. In 1788 he settled in Vienna and became a music teacher. He became acquainted with Mozart in 1790/91 and sometimes collaborated with him. From 1792 to 1794 Süssmayr was harpsichordist and acting Kapellmeister (musical director) of Vienna's National Theatre; he was Kapellmeister from 1794 until his death. His most notable compositions were *Der Spiegel von Arkadien* (1794) and music for the ballet *Il noce de Beneventо* (1802).

Süssmayr's handwriting in the manuscript of Mozart's *Requiem* makes clear that he completed a number of passages after Mozart's death, but the degree to which Süssmayr followed detailed sketches and drafts by Mozart remains a point of dispute.

**Susu,** also spelled SOUSSOU, or SOSO, people living in the southern coastal regions of Guinea and the northwestern parts of Sierra Leone. They speak a dialect of Susu-Yalunka, a language belonging to the Mande branch of the Niger-Congo languages.

In Sierra Leone, villages are grouped under a paramount chief into small chiefdoms of about 3,000 to 6,000 persons each. Every Susu belongs to a patrilineal clan identified by name and totem animal. Marriage between cross-cousins is favoured, and polygynous unions are common. Shoemakers, jewelers, musicians, smiths, and carpenters formerly constituted separate castes and were said to be descended from slaves. The Susu are now largely Muslim.

**Sutaean,** member of an ancient Semitic group of tribes that roamed the Syrian desert. By the first half of the 2nd millennium BC they appeared in the region of Mari as bandits and raiders, attacking caravans, towns, and even entire districts. They seem to have become most active during the 10th and 9th centuries, plundering many sites in Babylonia and Assyria and even ruining the great temple in Sippar of the Babylonian sun god Shamash.

**Sutardjo Petition,** request presented in July 1936 in the Volksraad (People's Council) of the Dutch East Indies by a moderate Indonesian nationalist. Sutardjo; it urged the Dutch government to discuss self-government for Indonesia within the existing Dutch constitutional framework. The petition was regarded as too soft by the radical Indonesian nationalists and too radical by Dutch rightists. The Volksraad adopted the petition, and it was discussed by the Dutch parliament, but on Nov. 16, 1938, a royal decree declared that the country was not yet ready for such a conference. This rejection marked the emergence of a more radical nationalist element.

**Suter, Johann August:** *see* Sutter, John.

**Sutherland,** former county and historic region, northern Scotland. Since the reorganization of 1975 it is largely contained in Sutherland district, of Highland region.

Chambered cairns, standing stones and stone rows, hill forts, settlements, and brochs (round towers) are among the prehistoric remains of Sutherland. In the first half of the 11th century, Sutherland and Caithness (a neighbouring county) were held by Thorfinn (d. *c.* 1065), the Norse jarl of Orkney, whose mother was a daughter of the Scottish king Malcolm II. The Norse named the area Sudrland (southern land) in relation to their settlements in Orkney and Shetland. After conquering the region, William I of Scotland (reigned 1165–1214) seems to have granted land in Sutherland to a Hugh Freskin, whose son William was probably created earl in 1235.

George Granville Leveson-Gower (1758–1833), who had married (1785) Elizabeth (Countess of Sutherland in her own right), succeeded his father as Marquess of Stafford (1803) and was created Duke of Sutherland (1833). He was responsible for the notorious "Highland Clearances" (*c.* 1810–20), though also for road building. Advised that the interior of Sutherland was best suited for sheep raising and little fit for human habitation, he evicted thousands of families, burning their cottages and establishing large sheep farms. The evicted tenants were resettled in small coastal crofts, where they were forced to depend on fishing and the collection and burning of kelp (a source of potash and iodine).

**Sutherland,** district, Highland region, northern Scotland; created by the reorganization of 1975, it is part of the former counties of Sutherland and of Ross and Cromarty. The district, with an area of 2,265 square miles (5,866 square km), faces the North Sea on the east and the Atlantic Ocean on the north and northwest, with Cape Wrath and its magnificent cliffs as mainland Britain's northwestern extremity.

The district consists mainly of bleak undulating moorland dissected by ice-molded glens draining southeastward to the North Sea and northward and northwestward to the Atlantic. Above this main plateau surface rise isolated hills of harder schists and granite. The narrow coastal belt consists of fertile raised beaches and softer sedimentary rocks. The western coast is deeply indented with spectacular fjords and sandy bays. The eastern coast, in contrast, is lower and smoother.

The "Highland Clearances" (*c.* 1810–20), during which thousands of crofters were evicted and large estates were converted into extensive sheep farms, were the beginning of rural depopulation, a trend that continues in the region.

Less than 2 percent of the land is arable, the lowest proportion in Scotland. The best land lies around the Dornoch Firth in the southeast. Over the remainder of Sutherland crofting predominates. Sheep farming is the main industry. Sea and salmon fisheries and forestry are also important.

Whiskey is distilled, and woolen tweeds and yarns are manufactured. The extensive deer forests, grouse moors, lakes, and rivers attract many sportsmen. Golspie is the seat of the district authority. Pop. (1991 prelim.) 13,743.

*Where the same name may denote a person, place, or thing, the articles will be found in that order*

**Sutherland, Earl W(ilbur), Jr.** (b. Nov. 19, 1915, Burlingame, Kan., U.S.—d. March 9, 1974, Miami, Fla.), American pharmacologist and physiologist who was awarded the Nobel Prize for Physiology or Medicine in 1971 for isolation of cyclic adenosine monophosphate (cyclic AMP) and demonstration of its involvement in numerous metabolic processes that occur in animals.

Sutherland graduated from Washburn College (Topeka, Kan.) in 1937 and received the M.D. degree from Washington University Medical School (St. Louis, Mo.) in 1942. After serving in the U.S. Army during World War II, he joined the faculty of Washington University. In 1953 he became director of the department of medicine at Western Reserve University in Cleveland, Ohio, where in 1956 he discovered cyclic AMP. In 1963 he became professor of physiology at Vanderbilt University (Nashville, Tenn.), and from 1973 until his death he was a member of the faculty of the University of Miami Medical School.

**Sutherland, Efua** (b. June 27, 1924, Cape Coast, Gold Coast [now in Ghana]), Ghanaian playwright, poet, teacher, and children's author, who founded the Drama Studio in Accra (now the Writers' Workshop in the Institute of African Studies, University of Ghana, Legon).

After completing her studies at the Teacher Training College in Ghana, Sutherland went to England to do further work at Homerton College, Cambridge, and at the University of London's School of Oriental and African Studies. Upon her return to Accra, she helped to establish the literary magazine *Okyeame;* founded the Experimental Theatre, which became the Ghana Drama Studio; and directed the University of Ghana's traveling theatre group. The Drama Studio produced a number of her plays in 1962, including the well-known *Edufa* (1967), based on *Alcestis* by Euripides, and *Foriwa* (1967), a play which stresses the alliance of new ways and old traditions. *The Marriage of Anansewa: A Storytelling Drama* appeared in 1975.

Sutherland established the Drama Studio as a workshop for writers who wrote for children. The studio soon became a training ground for Ghanaian playwrights. Sutherland herself wrote several works for children, including two animated rhythm plays, *Vulture! Vulture!* and *Tahinta* (1968), and two pictorial essays, *The Roadmakers* (1961) and *Playtime in Africa* (1960).

Many of Sutherland's works were broadcast in Ghana on a popular radio program, "The Singing Net," and most of her unpublished plays were performed in Ghana. Many of her short stories can be described as rhythmic prose poems; a later play, *Nyamekye*, a version of *Alice in Wonderland,* shows the influence of the folk-opera tradition.

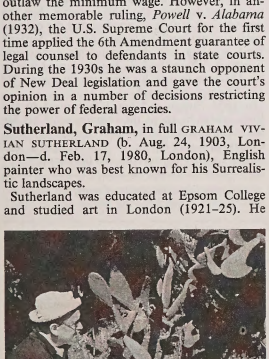
**Sutherland, George,** original name ALEXANDER GEORGE SUTHERLAND (b. March 25, 1862, Stony Stratford, Buckinghamshire, Eng.—d. July 18, 1942, Stockbridge, Mass., U.S.), associate justice of the United States Supreme Court (1922–38).

Sutherland's family immigrated to the United States—to Utah—when he was an infant. He was later educated at Brigham Young Academy and the University of Michigan. Sutherland was admitted to the bar in 1883 and opened a practice in Provo, Utah, where he quickly became involved in politics and ran unsuccessfully for mayor and for territorial delegate to Congress. By this time he had become a Republican, and after Utah's admission as a state he served in the state Senate, the U.S. House of Representatives (1901–03), and the U.S. Senate (1905–17). Although a conservative, he supported many of Pres. Theodore Roosevelt's reform programs.

After an unsuccessful reelection bid in 1916 he became an adviser to Pres. Warren G. Harding, who appointed him to the U.S. Supreme Court in 1922. Sutherland's opinions in the 1920s reflected a commitment to the balance of power between state and federal authority and a firm belief in the limitation of political authority. In *Adkins* v. *Children's Hospital* (1923) he relied on the virtually discarded precedent of *Lochner* v. *New York* to outlaw the minimum wage. However, in another memorable ruling, *Powell* v. *Alabama* (1932), the U.S. Supreme Court for the first time applied the 6th Amendment guarantee of legal counsel to defendants in state courts. During the 1930s he was a staunch opponent of New Deal legislation and gave the court's opinion in a number of decisions restricting the power of federal agencies.

**Sutherland, Graham,** in full GRAHAM VIVIAN SUTHERLAND (b. Aug. 24, 1903, London—d. Feb. 17, 1980, London), English painter who was best known for his Surrealistic landscapes.

Sutherland was educated at Epsom College and studied art in London (1921–25). He



Graham Sutherland, photo by Gisele Freund

© Gisele Freund

particularly emphasized printmaking, which he taught from 1926 to 1940 at the Chelsea School of Art. As an etcher and engraver, he owes much to the Romantic painter Samuel Palmer but was influenced at different times by William Blake, Paul Nash, Henry Moore, and Pablo Picasso. His early work was characterized by an exacting representationalism that evolved into Surrealism. He turned primarily to painting in 1935 and was represented in the 1936 International Surrealist Exhibition in London. From 1940 to 1945 he was an official war artist, and his paintings from that period provide an evocative record of desolation.

Sutherland's "thorn period" began with the "Crucifixion" (1946) for St. Matthew's Church, Northampton, considered to be one of the most important religious paintings of the 20th century. In his late work he incorporated insect and plant forms, particularly thorns, which he transformed into powerful and frightening totemic images. The hard, spiky shapes of fossils provided the theme of his "Origins of the Land" (1951).

Sutherland was known, too, for his expressionistic, penetrating portraits; his painting of the writer Somerset Maugham (1949) was the first of an impressive series. Sutherland also designed an enormous tapestry (1962) for the new Coventry cathedral. In 1960 he was elected to the Order of Merit, and in 1972 he was made a fellow of the American Academy of Arts and Letters.

**Sutherland, Dame Joan** (b. Nov. 7, 1926, Sydney), Australian operatic soprano internationally acclaimed for her coloratura roles.

The daughter of a gifted singer, she studied piano and voice with her mother until 1946,



Joan Sutherland as Lucia di Lammermoor, 1966

© Bettmann/Corbis

when she won a vocal competition and began studying voice with John and Aida Dickens. She made her singing debut as Dido in a concert performance of Henry Purcell's *Dido and Aeneas* in Sydney in 1947 and her operatic debut in the title role of Sir Eugene Goossens' *Judith* in 1951. Cash prizes from several vocal competitions made it possible for her to move to London and begin study with Clive Carey at the Royal College of Music. In 1952 she was accepted into the company of the Royal Opera, Covent Garden, and made her first appearance there as the First Lady in Wolfgang Amadeus Mozart's *Die Zauberflöte.* Her accompanist and vocal coach, Richard Bonynge, who had worked with her in Sydney, was convinced that her future lay in the florid coloratura repertoire even though Covent Garden was training her as a dramatic Wagnerian soprano. In 1954 she married Bonynge, and with his help and encouragement she began to develop her higher range. In 1959 Covent Garden revived Gaetano Donizetti's *Lucia di Lammermoor* for her, and in 1961 she made her New York City debut in the same role at the Metropolitan Opera. Her performance in this difficult title role won international recognition and established her as the leading coloratura of the 20th century.

Sutherland afterwards sang in Venice, Vienna, Dallas (Texas), Paris, Barcelona, Genoa, Milan, San Francisco, Chicago, and her native Sydney. Her greatest later successes were as Vincenzo Bellini's *Norma,* Cleopatra in George Frideric Handel's *Giulio Cesare,* and the three sopranos in Jacques Offenbach's *Les contes d'Hoffman.* She also had an impressive concert career and can be heard on many highly acclaimed recordings. She was made a Dame of the British Empire in 1978.

**Sutherland Falls,** series of three cataracts on the Arthur River, 14 miles (23 km) southeast of Milford Sound in the southwest portion of South Island, New Zealand. The falls rank among the world's highest, with a total drop of 1,904 feet (580 m) in leaps of 815 feet, 751 feet, and 338 feet. Fed by water from snow-fed Lake Quill, the falls are within the Fiordland National Park. They were named for Donald Sutherland, a prospector, who in 1880 became the first European to see them.

**Suthu** (people): *see* Sotho.

**Sutlej River,** Ancient Greek ZARADROS, Sanskrit ŚUTUDRĪ, or ŚATADRU, longest of the five tributaries of the Indus River that give the Punjab (meaning "Five Rivers") its name. It rises on the north slope of the Himalayas in Lake La'nga in southwestern Tibet, at an elevation above 15,000 feet (4,600 m). Flowing northwestward and then west-southwestward through Himalayan gorges, it crosses the Indian state of Himāchal Pradesh and enters the Punjab plain near Nangal, Punjab state. Continuing southwestward in a broad channel, it receives the Beās River and forms 65 miles (105 km) of the India-Pakistan border before entering Pakistan and flowing another 220 miles (350 km) to join the Chenāb River west of Bahāwalpur. The combined rivers then form the Panjnad, the link between the Five Rivers and the Indus.

The hydrology of the Sutlej is controlled by spring and summer snowmelt in the Himalayas and by the South Asian monsoon. The onset of the summer monsoon brings heavy rains that often produce extensive flooding. The maximum recorded flood discharge occurred in 1955, when the river flowed at nearly 600,000 cubic feet (16,900 cubic m) per second. The winter flow is substantially lower, since there is little precipitation or meltwater from the Himalayan glaciers.

The 900-mile- (1,400-km-) long Sutlej is used extensively for irrigation. Its water was a source of dispute between India and Pakistan until the countries concluded the Indus Waters Treaty in 1960, which allocated the water of the Sutlej to India in exchange for exclusive Pakistani rights to the Indus and its western tributaries. Major irrigation works include the Bhakra-Nangal Project, the Sirhind Canal, and the Sutlej Valley Project, the latter in both India and Pakistan.

**Suto** (people): *see* Sotho.

**Sutoku,** in full SUTOKU TENNŌ, personal name AKIHITO (b. July 7, 1119, Kyōto—d. Sept. 14, 1164, Sanuki Province, Japan), 75th emperor of Japan; his attempt to usurp his brother's throne resulted in the bloody Hōgen War, which allowed the powerful warrior Taira clan to gain control of the government.

He ascended the throne in 1123, taking the reign name Sutoku, after the abdication of his father, the emperor Toba; despite his abdication Toba continued to hold power. In 1141 Sutoku also abdicated, and his younger brother came to the throne as the emperor Konoe. When Konoe died in 1155, their father's third and favourite son was selected to ascend the throne as Go-Shirakawa, much to the displeasure of Sutoku, who had expected the succession to pass to his own son. When Toba died the following year, Sutoku, aided by warriors of the Minamoto clan, attempted a coup (the Hōgen Disturbance). The coup

was defeated by the forces of Taira Kiyomori, who then dominated the Emperor. Sutoku was exiled from the capital.

**sūtra** (Sanskrit: "thread"), Pāli SUTTA, in Hinduism, a brief, aphoristic composition; in Buddhism, a more extended exposition, the basic form of the scriptures of both the Theravāda (Way of Elders) and Mahāyāna (Greater Vehicle) traditions. The early Indian philosophers did not work with written texts and later often disdained the use of them; thus, there was a need for explanatory works of the utmost brevity that could be committed to memory. The earliest *sūtras* were expositions of ritual procedures, but their use spread. Pāṇini's grammatical *sūtras* (5th–6th century BC) became in many respects a model for later compositions. All the Indian philosophical systems (except the Sāṃkhya, which had its *kārikās*, or doctrinal verses) had their own *sūtras*, most of which were preserved in writing early in the Christian Era.

Different from its usages in Hindu literature, the Buddhist *sūtra* denotes a doctrinal work, sometimes of considerable length, in which a particular point of doctrine is propounded and deliberated. The most important collection of the Theravāda *sūtras* is to be found in the *Sutta* section of the Pāli canon, which contains the discourses attributed to the Gautama Buddha. In Mahāyāna Buddhism the name *sūtra* is applied to expository texts.

**Sutta Piṭaka** (Pāli: "Basket of Discourse"), Sanskrit SŪTRA PIṬAKA, extensive body of texts constituting the basic "law," or doctrinal, section of the Buddhist canon—properly speaking, the canon of the so-called Hīnayāna (Lesser Vehicle) doctrinal schools, including the Theravāda (Way of the Elders) form of Buddhism predominant in present-day Sri Lanka (Ceylon) and Southeast Asia. The contents of the *Sutta Piṭaka* are attributed, with few exceptions, to the Gautama Buddha himself. The schools whose works were written in Sanskrit divided this body of literature into four collections, called *Āgamas*. Roughly comparable collections, called *Nikāyas*, comprise the Pāli texts of the Theravāda school, but with a fifth group added—the *Khuddaka Nikāya* (*q.v.*; "Short Collection"). The other four *Nikāyas* are as follows:

1. *Dīgha Nikāya* ("Long Collection"; Sanskrit *Dīrghāgama*), 34 long *suttas* including doctrinal expositions, legends, and moral rules. The first, the *Brahmajāla* ("Divine Net") *Sutta*, renowned and much quoted, deals with fundamental Buddhist doctrines and with rival philosophies and tells much about everyday life and religious practices of the period. The *Ambaṭṭha* (a personal name) *Sutta* denounces the principles of caste and the pretensions of Brahmins. The *Mahānidāna* ("Great Origin") *Sutta* gives the fullest canonical treatment of the doctrine of dependent origination, or the chain of causation. The famous *Mahāparinibbāṇa Sutta* ("Discourse on the Great Final Extinction"—*i.e.*, the Buddha's release from the round of rebirths), one of the oldest texts in the canon (though containing later interpolations), narrates the activities and teachings of the Buddha's last year and describes his death. The *Sigālovāda* (a personal name) *Sutta*, the only one of these discourses directly addressed to laymen, is a comprehensive treatment of domestic and social ethics.

2. *Majjhima Nikāya* ("Medium [Length] Collection"; Sanskrit *Madhyamāgama*), 152 *suttas*, some of them attributed to disciples, covering nearly all aspects of Buddhism. Included are texts dealing with monastic life, the excesses of asceticism, the evils of caste, Buddha's debates with the Jains, and meditation, together with basic doctrinal and ethical teachings and many legends and stories.

3. *Saṃyutta Nikāya* ("Cluster Collection"; Sanskrit *Saṃyuktāgama*), a total of 7,762 individual *suttas*, some quite brief, arranged more or less by subject matter into 56 *saṃyuttas*, or "clusters." The best known of these is the *Dhammacakkappavattana-sutta* ("Discourse on the Turning of the Wheel of the Law"), which contains the Buddha's first sermon.

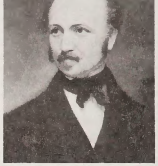
4. *Aṅguttara Nikāya* ("Item-more Collection"; Sanskrit *Ekottarikāgama*), a numerical arrangement, for mnemonic purposes, of 9,557 terse *suttas*. Its first *nipāta* ("group") contains *suttas* dealing with single things, such as the mind or the Buddha; the *suttas* in the second *nipāta* speak of pairs—*e.g.*, 2 kinds of sin; in the third there are triplets; and so on up to 11. Examples are the 3 praiseworthy acts, the 4 places of pilgrimage, the 5 obstacles, the 6-fold duty of a monk, 7 kinds of wealth, 8 causes of earthquake, 9 types of person, 10 objects of contemplation, and 11 kinds of happiness.

**Suttanipāta** (Pāli: "Collection of Discourses"), one of the earliest books of the Pāli canon (where it appears in the late *Khuddaka Nikāya* ["Short Collection"] of the *Sutta Piṭaka*). It is one of the books most quoted in other Buddhist writings, and it serves as important source of information on early Buddhism and its cultural and religious milieu. The work is largely in verse and comprises narratives, dialogues, short lyrics, proverbs, and ballads. It is concerned with the way of life of a hermit, not with an established monastic order. A simple faith is called for, worship and ritual are not mentioned, and philosophical speculation is discouraged. According to the text, what matters is the moral enterprise of the Buddhist way—the realization of the Four Noble Truths and the following of the Eightfold Path—and simple ethical rules are given as guidance.

**suttee,** Sanskrit SATĪ, former Indian custom of a widow burning herself, either on the funeral pyre of her dead husband or soon after his death. Sometimes, the wife was immolated before the husband's expected death in battle, and it was then called *jauhar*. Some authorities feel the etymological connection between the Sanskrit term *satī*, which means "chaste wife" and which is also the name of a Hindu goddess, and the practice of widow self-immolation is erroneous. The custom possibly has links with ancient beliefs that a man needed his companions in the afterlife as well as in this world. During the medieval period the hardships encountered by widows in traditional Hindu society may have contributed to its spread. Numerous suttee stones, memorials to the widows who died in this way, are found all over India, the earliest dated AD 510.

The first reference to the practice in a Sanskrit text is in the *Mahābhārata*, in which some queens undergo suttee; but it is mentioned by the 1st-century-BC Greek author Diodorus Siculus in his account of the Punjab (Pañjāb) in the 4th century BC. In the Muslim period the Rājputs practiced *jauhar* to save women from dishonour by foes, most notably at Chitorgarh. The larger incidence of suttee among the Brahmins of Bengal, particularly during 1680–1830, was due indirectly to the *Dāyabhāga* system of law (*c.* 1100), which prevailed in Bengal and which gave inheritance to widows. At its best, suttee was committed voluntarily, but cases of compulsion, escape, and rescue are known. Steps to prohibit it were taken by the Mughal rulers Humāyūn and his son Akbar, and it was abolished in British India in 1829. Instances of it continued to occur in Indian states for more than 30 years.

**Sutter, John (Augustus),** original name JOHANN AUGUST SUTER (b. Feb. 15, 1803, Kandern, Baden—d. June 18, 1880, Washington, D.C.), German-born pioneer settler and colonizer in California; discovery of gold on his land (1848) precipitated the California Gold Rush.



Sutter, portrait by Samuel Osgood; in the collection of the New-York Historical Society
By courtesy of the New-York Historical Society

Fleeing from bankruptcy and financial failures and leaving his wife and children in Switzerland, he reached California in 1839 and persuaded the Mexican governor to grant him lands on the Sacramento River. There, at its junction with the American River, he established the colony of Nueva Helvetia (New Switzerland), later to become Sacramento. He built "Sutter's Fort" (1841), set up frontier industries, and, in spite of his enormous debts, provided lavish hospitality, and often employment, to traders, trappers, immigrants, and natives who came to his fort.

Discovery of gold on his land brought disaster to Sutter. In the process of building a sawmill, a carpenter named John Marshall found flakes of gold (Jan. 24, 1848). The two men tried to keep the find a secret, but the news leaked out. Workers deserted the colony; gold seekers and squatters overran Sutter's land, stealing and destroying his goods and livestock. When the U.S. courts denied title to his Mexican grants, his ruin was complete. By 1852 he was bankrupt.

In 1851 Sutter and his wife moved to the East, where he spent the remainder of his life in a futile attempt to gain redress through Congress. Sutter Street, in San Francisco, and Sutter County commemorate his name.

*Articles are alphabetized word by word, not letter by letter*

**Suttner, Bertha, Freifrau von** (baroness of), in full BERTHA FÉLICIE SOPHIE, FREIFRAU VON SUTTNER, *née* GRÄFIN (Countess) KINSKY VON WCHINITZ UND TETTAU, pseudonym BERTHA OULOT (b. June 9, 1843, Prague—d. June 21, 1914, Vienna), Austrian novelist and one of the first notable woman pacifists,



Freifrau von Suttner
Ullstein Bilddienst, West Berlin

who is credited with influencing Alfred Nobel in the establishment of the Nobel Prize for Peace, of which she was the recipient in 1905. Her major novel, *Die Waffen nieder!* (1889; *Lay Down Your Arms!*, 1892), has been compared in popularity and influence with Harriet Beecher Stowe's *Uncle Tom's Cabin*.

The daughter of an impoverished Austrian field marshal, she was a governess to the wealthy Suttner family from 1873. She became engaged to Freiherr (Baron) Arthur Gundaccar von Suttner (1850–1902), an engineer and novelist, seven years her junior. The opposition of his family to this match caused her, in 1876, to answer Nobel's advertisement for a secretary–housekeeper at his Paris residence. After only a week she returned to Vienna and secretly married Suttner.

Though she saw Nobel only twice after 1876, she corresponded with him until his death in 1896. Their last meeting (August 1892, Zürich) followed a peace congress in Bern in which she had taken part. It is believed that her increasing identification with the peace movement (in 1891 she founded an Austrian pacifist organization) and her letters on the subject to Nobel caused him to include a peace prize among the awards for which he provided in his will.

From 1892 to 1899, Bertha von Suttner edited the international pacifist journal *Die Waffen nieder!*, named for her most famous novel. Her pacifism had a scientific and free-thinking basis, reflecting the thought of H.T. Buckle, Herbert Spencer, and Charles Darwin. Among books about her is *Florence Nightingale und Baroness von Suttner* (1919), by the noted Swedish radical Ellen K.S. Key.

**Sutton,** outer borough of Greater London, on the southern perimeter at the edge of the Greenbelt, chiefly characterized by private housing. Covering 17 sq mi (43 sq km), it was formerly part of the county of Surrey, and medieval buildings are preserved in such communities as Carshalton and Cheam. Between World Wars I and II, as modern communications brought central London within commuting range, the area developed as a residential suburb, and the old villages grew into modern shopping centres. St. Helens, in the northern part of the borough, was established as a large London County Council housing estate before the creation of Greater London in 1965. The borough has much parkland and open space. There is also some light industry. Pop. (1998 est.) 177,100.

**Sutton, Walter S(tanborough)** (b. 1877, Utica, N.Y., U.S.—d. Nov. 10, 1916, Kansas City, Kan.), U.S. geneticist who provided the first conclusive evidence that chromosomes carry the units of inheritance and occur in distinct pairs.

Sutton worked under Clarence E. McClung, the discoverer of the sex-determining chromosome, at the University of Kansas (M.A., 1901), and later (1907) he completed medical training at Columbia University. In 1909 he began the practice of surgery in Kansas City, Kan., and Kansas City, Mo.; he continued to practice until his death.

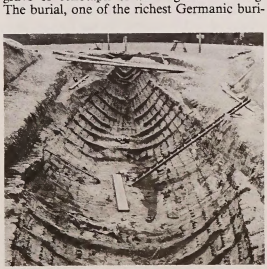
While a student at Columbia, he wrote two papers that greatly affected the history of genetics. Published in 1902 in the *Biological Bulletin*, "On the Morphology of the Chromosome Group in *Brachystola magna*" provided the earliest detailed demonstration that the somatic chromosomes (those in cells other than sex cells) of a grasshopper occur in definite, distinguishable, and different pairs of like (or homologous) chromosomes. The paper ended with the hypothesis that chromosomes carry the units of inheritance and that their behaviour during division of the chromosomes of sex cells (meiosis) is the physical basis of the Mendelian law of heredity. Sutton developed this hypothesis in "The Chromosomes in Heredity" (1903) and concluded that chromosomes contain genes and that their behaviour during meiosis is random. His work formed the basis for the chromosomal theory of heredity.

**Sutton, Willie,** also called WILLIE THE ACTOR, byname of WILLIAM FRANCIS SUTTON, JR. (b. 1901, Brooklyn, N.Y., U.S.—d. Nov. 3, 1980, Spring Hill, Fla.), celebrated American bank robber and prison escapee who earned his nickname "the Actor" because of his talent for disguises, posing as a guard, messenger, policeman, diplomat, or window cleaner to fool authorities.

Raised in a tough Irish-American district in Brooklyn, he was a veteran thief and hoodlum by the time that he was a teenager and, at the age of 21, was arrested and acquitted on a murder charge. After a prison term for safecracking (1926–27), he engaged in bank and store robberies and, in 1930 in Manhattan, robbed his first bank while in disguise, as a Western Union messenger. Two months and other robberies later, he was caught and sentenced to Sing Sing prison. In 1932 he escaped, moved to Philadelphia, was caught again in a robbery, and spent the next 15 years in Pennsylvania prisons. In 1947 he and some confederates made a spectacular escape from Holmesburg County Jail, near Philadelphia, using one real pistol, one dummy wood pistol, and guard uniforms.

Sutton remained free until 1952, when he was recognized and seized by police in Brooklyn. Sent to Attica state prison, New York, he remained there until paroled in 1969. In his book *I, Willie Sutton* (1953, written with Quentin Reynolds), Sutton estimated that in his lifetime he had stolen at least $2,000,000 from banks. The title of *Where the Money Was* (1976, written with Edward Lim), echoes his oft-repeated reason for robbing banks: "Because that's where the money is."

**Sutton Hoo,** estate near Woodbridge, Suffolk, England, that is the site of an early grave or cenotaph of an Anglo-Saxon king. The burial, one of the richest Germanic burials found in Europe, contained a ship fully equipped for the afterlife (but with no body) and threw light on the wealth and contacts of early Anglo-Saxon kings; its discovery, in 1939, was unusual because ship burial was rare in England.



Sutton Hoo ship barrow showing the impression of the ship in the ground after the contents of the burial chamber (marked by the plank and ladder) had been removed

By courtesy of the trustees of the British Museum

The impression of the rotted-away ship's timbers in the trench of sand 25 feet (7.6 metres) deep and the remaining rivets showed the ship to have been a mastless clinker-built rowboat more than 80 feet (24 metres) long. The dating of coins found at the site and the presence of both Christian and pagan features suggest that it may have been the cenotaph of Raedwald (died 624/625), an East Anglian king who had converted to Christianity and subsequently returned to paganism. The identity of the king is still in question, however, and another candidate is Aethelhere who died in 654 fighting for Penda, pagan king of Mercia, at Winwaed. The rite of ship burial and certain items in the grave have parallels in Sweden and suggest a hitherto unsuspected Swedish origin for the East Anglian royal dynasty.

In the burial site there were 41 items of solid gold, now housed in the British Museum, as is a quantity of imported silverware. One great silver dish bears the control stamp of the Byzantine emperor Anastasius I (491–518) and is the only demonstrably Byzantine object known to have been found in England. In addition, silver bowls, cups, and spoons inscribed in Greek and a bronze bowl from the Near East show the range of the kingdom's trading contacts.

*The Sutton Hoo Ship-Burial*, a study by Rupert Bruce-Mitford, was published in 1975.

**Śutudrī River** (Tibet–India–Pakistan): *see* Sutlej River.

**Suva,** capital (since 1882), chief port, and commercial centre of Fiji in the South Pacific Ocean. The city lies on the southeast coast of Viti Levu, Fiji's principal island. Founded in 1849, Suva was made a city in 1952 and is now one of the largest urban centres in the South Pacific islands. It lies on Suva Point between the mouth of the Rewa River (east) and Suva Harbour (west), a regular stop for transpacific shipping. The city has road and air connections with Nadi, 132 mi (212 km) west, site of an international airport. Suva's economic activities include tourism (encouraged by its status as a free port) and light manufacturing such as cigarette making and soapmaking, copra crushing, baking, and brewing.

The city's newspapers and periodicals and broadcasting facilities are in Fijian, Hindi, and English, reflecting its mixed population. Suva is the site of the Fiji School of Medicine and Nursing (1928), the University of the South Pacific (1968), and Fiji College of Agriculture, all of which serve a large area of the South Pacific. The city also has a teachers' training college, an institute of technology, and hospitals. The Fiji Museum houses notable historical and ethnological collections. Pop. (1996) city, 77,366; metropolitan area, 167,421.

**Suvorov, Aleksandr Vasilyevich,** GRAF (Count) RIMNIKSKY, KNYAZ (Prince) ITALIYSKY, REICHSGRAF (Imperial Count) (b. Nov. 24 [Nov. 13, old style], 1729, Moscow—d. May 18 [May 6, O.S.], 1800, St. Petersburg, Russia), Russian military commander notable for his achievements in the Russo-Turkish War of 1787–91 and in the French Revolutionary Wars. In 1789 he was created a Russian count and a count of the



Suvorov, detail of a portrait by J. Schmidt, 1800; in the State Hermitage Museum, Leningrad

By courtesy of the State Hermitage Museum, Leningrad

Holy Roman Empire; in 1799 he was created a Russian prince.

*Early life and career.* Born in Moscow of a noble family, Suvorov was educated at home, joined the Semyonovsky Guards regiment at age 15, and was commissioned a lieutenant of infantry in 1754.

Having gained varied experience during the Seven Years' War (1756–63), in 1763 he became colonel of the Suzdal Regiment, for which he wrote a comprehensive manual notable for its realistic emphasis on battle training at a time when the prevailing fashion was for parade-ground manoeuvres in the Prussian style.

His successes during the Russo-Polish conflict of 1768–72 earned him a reputation as a self-willed subordinate and a boldly unorthodox tactician—a reputation that was confirmed when, in 1773, he joined Count P.A. Rumyantsev's army fighting the Turks on the Danube. His two successful descents on Turtukai, his brilliant defense of Hirsov, and, above all, his successful direction of the Battle of Kozludji (1774) showed him to be an incomparable commander of the field, but after he helped to suppress the Russian peasant revolt led by Yemelyan Pugachov in the same year and subsequent service in the Crimea, his career seemed to founder.

A mission to Astrakhan to prepare an expedition into Persia proved abortive, and, even after he returned to a more active posting in the Caucasus in 1782, the establishment repeatedly passed him over. His marriage to Varvara Prozorovskaya, contracted 10 years before, broke down in 1784, Suvorov refusing to recognize her child, Arkady, as his son, though he remained devoted to his daughter, Natalya.

Returning to St. Petersburg and the court, Suvorov felt consistently ill-at-ease—conscious of his scrawny appearance, rough manners, and inability, as he put it, to "endear myself to my superiors," to which he attributed the slow progress of his career. But in 1787, after almost 15 years, he was at last promoted to the rank of general.

*Victories over the Turks.* In the Russo-Turkish War of 1787–91, he successfully defended Russian territory on the north shore of the Black Sea from Turkish attack. His victory over the Turks at Kinburn (October 1787) restored him to the limelight, and, though his alleged rashness and drunkenness at the siege of Ochakov, in 1788, earned him official displeasure and exclusion from fighting commands, in 1789 he was sent to Moldavia (in present Romania) to conduct joint operations with Russia's Austrian allies. The ensuing victories at Fokshany (now Foçsani, Rom.) and his brilliant and bloody storming of the stronghold of Ismail (1790) confirmed his popularity in the army, but his sense of frustration was revived when he was transferred to Finland in 1791. Hostile rumours circulated against him at court, and, as younger, less deserving men overtook him in rank, his embitterment deepened, and he became noticeably more eccentric.

Then, in 1794 he was recalled to crush the nationalist-revolutionary movement in Poland—which he did with ruthless efficiency. The slaughter involved in his storming of the Warsaw suburb of Praga (which he justified as shortening the war and saving lives) shocked Western opinion, but it earned him a reward of 7,000 serfs and the promotion to field marshal he had long coveted.

Subsequently appointed commander in chief of the southern army, Suvorov set about molding it according to principles he set out in his celebrated military treatise, *Nauka pobezhdat (Science of Victory)*—remarkable for its clipped, colloquial style, its novel emphasis on speed and mobility, and the use of the bayonet and accuracy of fire. But on the accession of the emperor Paul I (reigned 1796–1801), the old Prussian parade-ground emphasis was reimposed, and, refusing to hide his opposition to it, Suvorov was dismissed.

Suspected of treason, he was kept under close surveillance, but a thorough investigation produced no evidence against him, and the Emperor restored him to favour. But Suvorov continued to show his dislike of the way the army was being managed and soon retired again.

*Italian campaign.* Fiercely antirevolutionary, he responded with enthusiasm when he was recalled in February 1799 to command a Russo-Austrian army against the French in northern Italy. A series of rapid victories (April–August 1799) resulted in his capturing Milan and almost completely expelling French forces from Italy.

These successes made him a hero to those opposed to the French Revolution but also aroused Austrian misgivings about Russian ambitions in the west. Suvorov had wished to invade France but was ordered across the Alps to join a Russian force under Aleksandr Rimsky-Korsakov that was being threatened by the French in Switzerland.

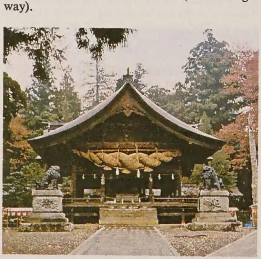
Fighting his way across the mountains, he reached Altdorf, only to hear that Rimsky-Korsakov had already been defeated and that the Austrian divisions in Switzerland, intended to support him, had retired. Surrounded by the enemy, short of ammunition and supplies, and with the first snows of winter falling, Suvorov set out to extract his army from an apparently hopeless position. Though old and sick, he succeeded in arousing his starving and dispirited troops, broke out to reach Glarus, and, repulsing a pursuing French force, succeeded in escaping with three-fourths of his men, achieving one of the most remarkable exploits in the annals of war.

Though disillusioned with the Austrians, Suvorov still envisaged fighting another campaign, but in January 1800, having been promoted to the unprecedented rank of generalissimo, he was recalled. He arrived at St. Petersburg, exhausted and gravely ill, only to find that, on account of a petty misdemeanour, the hero's welcome planned for him had been cancelled and he was excluded from the court. He died a few months later.

(P.L.)

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**Suwa,** city, Nagano Prefecture (*ken*), Honshu, Japan, situated on the eastern shore of Suwa-ko (Lake Suwa). In the Tokugawa era (1603–1867) it was known as Kami-suwa, a castle town on the Kōshū-kaidō (Kōshū Highway).



Lower Shrine of the Shintō Suwa Shrine, Japan

Photos Pack—EB Inc.

Suwa became a regional commercial and administrative centre. Its main industry was silk reeling. With the decline of silk manufacture after World War II, Suwa became a centre for the production of watches, cameras, and music boxes. It is also a tourist centre, known for its shrines, temples, and the beauty of Suwa-ko. Pop. (2001 est.) 53,200.

**Suwałki,** former (1975–98) *województwo* (province), extreme northeastern Poland, now part of Podlaskie and Warmińsko-Mazurskie (*qq.v.*) provinces.

**Suwałki,** city, Podlaskie *województwo* (province), extreme northeastern Poland.

First chronicled as a village having a hermitage of the Camaldolese monks (1682–90), Suwałki received its town rights in 1715. In 1796 it came under Prussian influence and became a Russian garrison in 1897. The city, located on the banks of the Czarna Hańcza River, was heavily damaged by German bombing in 1939. In 1940 it became the site of a Nazi concentration camp and headquarters for the German Gestapo in eastern Poland. After World War II the city was rebuilt, including the restoration of private homes and historical buildings.

Suwałki has a regional museum containing religious articles dating from the 16th and 17th centuries. The city's economy is based on food processing, lumber milling, textile weaving, and the production of building materials. Pop. (2002) 68,923.

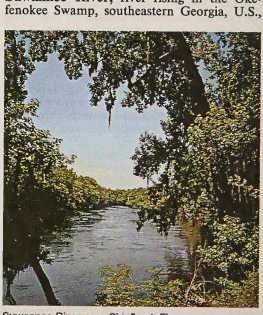
**Suwannee,** county, northeastern Florida, U.S., bordered to the north, southwest, and west by the Suwannee River. The Ichetucknee River and the Santa Fe River form Suwannee county's southeastern border.

Slash pine forests and dozens of small lakes, ponds, and sloughs dot its hilly highlands terrain. Parklands include Ichetucknee Springs State Park and Peacock Springs State Recreational Area.

Suwannee county was created in 1858. Live Oak, the county seat, is the site of Florida's largest tobacco market each summer.

Poultry processing and health care are vital to the economy. Area 688 square miles (1,781 square km). Pop. (2003 est.) 36,695.

**Suwannee River,** river rising in the Okefenokee Swamp, southeastern Georgia, U.S.,



Suwannee River near Chiefland, Fla.

By courtesy of the Florida News Bureau

and meandering generally south-southwestward across northern Florida to enter the Gulf of Mexico at Suwannee Sound, after a course of 250 mi (400 km). All but 35 mi of the river's course are in Florida. The stream is the Swanee River of Stephen Foster's famed song "Old Folks at Home." Named Guasaca Esqui (River of Reeds) by early Native American inhabitants, the river's present name is thought to be a corruption of San Juanee (Little

St. John). The Suwannee receives the waters of numerous springs and the Withlacoochee, Alapaha, and Santa Fe rivers. From its conjunction with the Withlacoochee, its channel is dredged for 135 miles (217 km); the last 25 miles (40 km) are tidal. In the north it flows over shoals and boulders and between cedar-lined limestone banks. Farther south its banks teem with cypresses, oaks, and various species of gardenias, orchids, and ixias. Bass, perch, catfish, bream, and small game are plentiful in and along the Suwannee.

In the 1780s the secluded bays and inlets of Suwannee Sound were rendezvous points for pirates.

**Suwardi Surjaningrat, R.M.** (Indonesian educator): *see* Dewantoro, Ki Hadjar.

**Suwaydā', As-,** also spelled AS-SUWEIDA, town, southern Syria. It is situated at the eastern margin of the Hawrān region in the foothills of Ad-Durūz Mountains. Believed to have been founded by the Nabataeans in the 1st century BC, it came under Roman rule in the 1st century AD. By the 5th century it was the seat of a bishopric. As-Suwaydā' is now a local agricultural market centre. It has ruins of a 3rd-century Roman temple and a 5th-century Byzantine church.

Most of the area surrounding As-Suwaydā' is sparsely populated and of little economic value. Pop. (1985 est.) town, 49,973.

**Suwŏn,** city and provincial capital, Kyŏnggi *do* (province), northwestern South Korea.



Hwahong Gate, part of the medieval Suwŏn castle, built during the reign of King Chŏngjo
Wapinsk—Alpha

Since the late 14th century, it has been a satellite town of Seoul, 26 miles (42 km) to the north, with which it is connected by rail and highway. The provincial government moved from Seoul to Suwŏn in 1967. Formerly a market centre for local agricultural products, Suwŏn has become an agricultural research centre. Seoul National University's College of Agriculture and the government's Office of Agriculture have several research institutes there. Suwŏn has many historic remains, most of them dating from the 18th century. Pop. (1995) 755,550.

**Suyūṭī, As-,** in full ABŪ AL-FAḌL ʿABD AR-RAḤMĀN IBN ABĪ BAKR JALĀL AD-DĪN AS-SUYŪṬĪ (b. 1445, Cairo, Egypt—d. Oct. 17, 1505, Cairo), Egyptian writer and teacher whose works deal with a wide variety of subjects, the Islāmic religious sciences predominating.

The son of a judge, As-Suyūṭī was tutored by a Ṣūfī (Muslim mystic) friend of his father. He was precocious and was already a teacher in 1462. In 1486 he was appointed to a chair in the mosque of Baybars in Cairo. When in 1501 he tried to reduce the stipends of Ṣūfī scholars at the mosque, a revolt broke out, and As-Suyūṭī was nearly killed. After his trial, he was placed under house arrest on the island of Rawḍa (near Cairo). He worked there in seclusion until his death.

As-Suyūṭī's works number at least 300; many are mere booklets, and others are encyclopaedic. He was coauthor of *Tafsīr al-Jalālayn* ("Commentary of the Two Jalāls"), a word-by-word commentary on the Qur'ān, the first part of which was written by Jalāl Ad-Dīn al-Maḥallī. His *Itqān fī'ulūm al-Qur'ān* ("Mastery in the Sciences of the Qur'ān") is a well-known work on Qur'ānic exegesis. *Taʾrikh al-khulafāʾ* (*History of the Caliphs*) is one of the few works of As-Suyūṭī to have been translated into English.

As-Suyūṭī was a compiler of genius rather than an original writer, but it is precisely his ability to select and abridge that makes the books useful. This faculty characterizes his most important philological work, *Al-Muẓhir fī'ulūm al-lughah* ("Guide to the Sciences of Language"), a linguistic encyclopaedia covering such topics as the history of the Arabic language, phonetics, semantics, and morphology. It was largely derived from the works of two predecessors, Ibn Jinnī and Ibn Fāris.

**Suzdal,** in full SUZDAL PRINCIPALITY, Russian in full SUZDALSKOYE KNYAZHESTVO, medieval principality that occupied the area between the Oka River and the Upper Volga in northeastern Russia. During the 12th to 14th centuries, Suzdal was under the rule of a branch of the Rurik dynasty. As one of the successor regions to Kiev, the principality achieved great political and economic importance, first becoming prominent during the reign of Andrey Bogolyubsky (1157–74), who conquered Kiev (1169) and transferred the title of "grand prince" from that ancient capital first to Suzdal, then to Vladimir, his new capital on the Klyazma River. He and his brother and successor, Vsevolod III (1176–1212), organized a strong monarchical political system and, as rulers of the Grand Principality of Vladimir, became the most powerful of the Russian princes. They encouraged their subordinate princes to develop the principality and to build churches, palaces, and new cities.

But the Suzdal princes came to regard their territories as private, hereditary property, and, contrary to Russian custom, they divided it among their heirs. Suzdal–Vladimir thus disintegrated into small principalities (13th and 14th centuries), which nominally recognized the seniority of the grand prince of Vladimir. After the Tatar invasion (1237–40), they became subject to the Golden Horde. Prince Konstantin Vasilyevich (1332–55) attempted to rebuild the area of Suzdal and Nizhny Novgorod (modern Gorky), which the Tatar khan Janibeg had made into a new grand duchy (*c.* 1342). His son Dmitry was briefly the grand prince of Vladimir (1359–62). Nevertheless, the title of grand prince soon reverted to the princes of Moscow, and in 1392 Prince Vasily I Dmitriyevich of Moscow annexed the Suzdal–Nizhny Novgorod region.

**Suzhou** (China): *see* Su-chou.

**Suzman, Helen,** *née* GAVRONSKY (b. Nov. 7, 1917, Germiston, S.Af.), white South African legislator (1953–89) who was an outspoken advocate for the nonwhite majority.

The daughter of Lithuanian Jewish immigrants, Suzman graduated (1940) from the University of Witwatersrand in Johannesburg with a degree in commerce. She served as a statistician with the War Supplies Board from 1941 to 1944 and then returned (1945–52) to her alma mater as a lecturer in economic history. In 1948, when the largely Afrikaner, proapartheid National Party won the national elections, Suzman joined the United Party, a moderate coalition of Afrikaners and English-speaking white South Africans. She was elected to Parliament in 1953. Six years later, she and 11 other liberal members of Parliament formed the aggressively antiapartheid Progressive Party; Suzman alone of the 12 was returned to office in the elections of 1961. From 1961 to 1974 she was the sole antiapartheid member of Parliament. Serving as a voice for the disenfranchised, Suzman was in constant conflict with her conservative colleagues—particularly with P.W. Botha—and she often cast the lone vote against an increasing number of apartheid measures. Until her retirement, Suzman remained a consistent and significant voice in the South African Parliament, though after 1974 she was no longer the sole opposition voice.

**Suzuka,** city, Mie *ken* (prefecture), Honshu, Japan, on Ise Bay. Suzuka is well known in Japan for the traditional manufacture of stencil paper, used in the dyeing of kimonos. Rapid industrialization occurred after World War II; products include textiles, machinery, and electrical appliances. Suzuka contains several shrines and temples, as well as one of the largest automobile speedways in the world. Pop. (2000 prelim.) 186,138.

**Suzuki, D(aisetsu) T(eitarō)** (b. Oct. 28, 1870, Kanazawa, Japan—d. July 12, 1966, Kamakura), Japanese Buddhist scholar and thinker who was the chief interpreter of Zen Buddhism to the West.

Suzuki studied at the University of Tokyo. Early in his youth he became a disciple of Sōen, a noted Zen master of the day, and under his guidance attained the experience of satori (sudden enlightenment), which remained of fundamental importance throughout his life. He stayed 13 years (1897–1909) in the United States, collaborating with Paul Carus as a magazine editor and pursuing his Buddhist studies on his own. He attracted interest by a translation, *The Discourse on the Awakening of Faith in the Mahayana* (1900), and the publication of *Outline of Mahayana Buddhism* (1907). The latter half of his life he spent in teaching, writing, and lecturing both in Japan and abroad, mostly in the United States, and contributed substantially to the understanding of Buddhism in Western countries.

According to Suzuki, the basic characteristic of the Eastern mentality may be found in its emphasis on nonduality, while the Western spirit, as embodied in modern sciences, is based upon dualistic distinctions. Although this Western spirit is prerequisite to daily conduct, it fails to grasp the ultimate reality, which, in Suzuki's philosophy, is an object of intuition or experience rather than of logical inquiry and must therefore be approached by religious experience of nonduality, especially as it is expressed in the tradition of Zen Buddhism.

**Suzuki Bunji** (b. Sept. 4, 1885, Miyagi prefecture, Japan—d. March 12, 1946, Sendai, Miyagi prefecture), Japanese Christian who was one of the primary organizers of the labour movement in Japan. An early convert to Christianity, Suzuki, like many of his coreligionists, soon became active in the struggle for democracy and socialism in his country.

After working briefly as a newspaper reporter, he began a movement in 1911 to combine the many small labour unions that had sprung up with Japan's burgeoning industrialization. At first Suzuki's efforts were limited to the development of a labour school attached to the Unitarian Church of Tokyo. By 1919, however, he had formed the Japanese Federation of Labour (Nippon Rōdō Sōdōmei); management then attempted to create a counter-organization, the Harmonization Society (Kyōchōkai). But in 1921 Suzuki's group scored its first big success: 30,000 dock workers at Kōbe went on strike for several months. As a result, the whole labour movement expanded greatly and became a recognized power within Japan.

Another victory for Suzuki was the manhood suffrage act, which was passed in 1925. He then helped organize the new Social Demo-

cratic Party and was elected to the Diet several times as its representative. But Marxist influence began to grow among workers and intellectuals, and the Japanese labour movement soon moved far to the left of Suzuki's moderate position.

**Suzuki Harunobu,** original name HOZUMI HARUNOBU, pseudonym (*gō*) CHŌEIKEN, or SHIKOJIN, popular name (*tsūshō*) JIROBEI, or JIHEI (b. 1725?, Edo [now Tokyo], Japan—d. July 8, 1770, Edo), Japanese artist of the Ukiyo-e movement (paintings and woodblock prints of the "floating world"), who established the art of *nishiki-e,* or polychrome prints. He created a fashion for pictures of lyrical scenes with figures of exquisite grace.

It is believed that Harunobu studied painting in Kyōto with Nishikawa Sukenobu and went to Edo about 1760. Harunobu's works were of little distinction until he started designing *nishiki-e* in 1765 for haiku (17-syllable verse) poems. It had become fashionable to exchange such prints with poetry at the beginning of the new year. He designed numerous prints, with delicate colouring and graceful lines. Contrasting with the *shun-ga,* or prints depicting erotic scenes, his prints depicting idyllic love were especially appreciated by his contemporaries. He excelled in drawing background scenes that added a subtle mood to his images.

**Suzuki Kantarō,** BARON (Danshaku) (b. Jan. 18, 1868, Ōsaka, Japan—d. April 17, 1948, Chiyō), the last premier (April–August 1945) of Japan during World War II, who was forced to surrender to the Allies.

A veteran of the Sino-Japanese (1894–95) and Russo-Japanese (1904–05) wars, Suzuki was promoted to the rank of admiral in 1923 and became chief of the Naval General Staff two years later. He was appointed grand chamberlain (*jijūchō*) in 1929, but he resigned this post after narrowly surviving the young officers' revolt in 1936.

Suzuki became prime minister upon the resignation of Koiso Kuniaki on April 5, 1945, four days after U.S. forces had landed on Okinawa. Though adamant and unyielding in public, Suzuki secretly asked the Soviets to help negotiate peace between the United States and Japan and was rebuffed by them. In early August the United States dropped atomic bombs on Hiroshima and Nagasaki and the Soviet Union declared war on Japan. On August 14 Suzuki's cabinet decided to accept the Allies' call for unconditional surrender. He resigned shortly after the surrender.

**Suzuki Shōsan** (b. Feb. 5, 1579, Mikawa province, Japan—d. July 28, 1655, Edo [now Tokyo]), Japanese Zen priest.

Suzuki was born of a samurai (warrior) family that had traditionally served the Matsudaira (later Tokugawa) family. He fought with distinction under Tokugawa Ieyasu (1542–1616), who as a shogun (military dictator) won control of Japan. At the age of 42 Suzuki left his family to enter the Zen priesthood. He did not completely dissociate himself from politics, however, for he later appeared, at the age of 59, in Shimabara, Kyushu, where a famous Christian rebellion took place. Together with his younger brother, who was appointed magistrate for the region, he remained there to build 32 Buddhist temples and to do his best to remove Christian influence, until he returned to Edo in 1648.

**Suzuki Zenkō** (b. Jan. 11, 1911, Yamada, Iwate prefecture, Japan—d. July 19, 2004, Tokyo), prime minister of Japan (1980–82) who worked closely with the United States and other Western countries.

The son of a fisherman, Suzuki attended the former Imperial Fisheries Institute and joined the Japan Fisheries Association. At the second postwar general election, in 1947, Suzuki won a seat in the lower house of the Diet (parliament) as a Socialist. Two years later, he switched to the conservative Liberal Party, forerunner of the Liberal-Democratic Party (LDP), and won reelection 12 times, during which period he held several cabinet posts. His abilities as a mediator brought him the chairmanship of the LDP's executive council a record 10 times, but he was virtually unknown abroad when elected prime minister on July 17, 1980. When his predecessor, Ōhira Masayoshi, unexpectedly died 10 days before an election, a three-week battle for succession resulted within the LDP. Suzuki, a loyal and longtime party worker, was the dark-horse winner of the LDP presidency, which assured him the prime ministership.

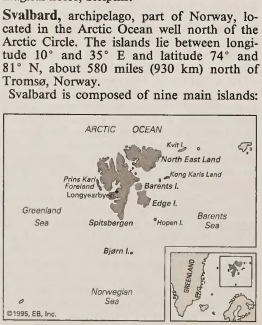
In office Suzuki upheld his political slogan, "politics of harmony," while stressing moderate internationalism. In 1981 he attended a summit with U.S. Pres. Ronald Reagan in which the two countries' relationship was defined as an "alliance." The following year, however, Suzuki drew criticism for Japan's struggling economy and for his handling of the controversy that ensued after Japanese textbooks were revised to downplay the country's aggression against China during World War II. In 1982 Suzuki decided not to seek reelection as leader of the LDP, thereby relinquishing the post of prime minister. He retained his seat in the Diet, however, and continued to lead a sizable faction of the LDP.

**svabite,** arsenate mineral, calcium fluoride arsenate [$Ca_5(AsO_4)_3F$], in the apatite group of phosphates. Typical specimens are transparent, colourless prisms and masses, as at Fajsberg, Swed., and Franklin, N.J., U.S. The svabite series, also containing hedyphane (calcium and lead chloride arsenate), is usually considered to be intermediate between the apatite series and the pyromorphite series. For detailed physical properties, *see* arsenate mineral (table).

**Svadilfari,** in Norse mythology, an unusually swift and intelligent horse belonging to a giant who offered to build a wall around Asgard (the kingdom of the gods) to keep invaders away. The gods stipulated that, if the builder completed the wall in one winter, his reward would be the goddess Freyja and possession of the Sun and the Moon. Svadilfari gave his owner such assistance that the wall was almost completed a few days before the end of winter. The gods, however, were able to prevent the giant from winning his payment by the aid of the trickster god Loki, who changed himself into a mare and attracted Svadilfari away from his work. From their union Loki bore Odin's magical horse, Sleipnir.

**Svalbard,** archipelago, part of Norway, located in the Arctic Ocean well north of the Arctic Circle. The islands lie between longitude 10° and 35° E and latitude 74° and 81° N, about 580 miles (930 km) north of Tromsø, Norway.

Svalbard is composed of nine main islands: Spitsbergen (formerly West Spitsbergen), North East Land, Edge Island, Barents Island, Prins Karls Foreland, Kvit Island (Gilles Land), Kong Karls Land (Wiche Islands), Bjørn (Bear) Island, and Hopen. The total area of Svalbard is 24,209 square miles (62,700 square km). Spitsbergen, the largest island, is 15,075 square miles (39,044 square km).



Svalbard

Svalbard, which means "cold coast," was discovered, according to the *Islandske Annaler* ("Icelandic Annals"), in 1194 but remained unknown to the modern world until rediscovered by the Dutch explorers Willem Barents and Jacob van Heemskerck in June 1596. Dutch and English whalers arrived as early as 1611, followed by French, Hanseatic, Danish, and Norwegian whalers whose quarrels over whaling rights resulted in the division of the coast. The Russians arrived about 1715.

With the decline of whaling by 1800, the islands' importance centred on the presence of coal. Not until the beginning of the 20th century were the deposits surveyed and mineral rights claimed by American, British, Norwegian, Swedish, Dutch, and Russian companies and individuals. The claims were settled after the question of the islands' sovereignty was resolved Feb. 9, 1920, by a treaty granting possession to Norway and mineral rights on an equal basis to various countries. Only Russia and Norway continue to extract and export coal. Apart from mining, the only other economic activity is trapping.

Folding and faulting have given the islands a mountainous topography, with glaciers and snowfields covering nearly 60 percent of the area. The western and northern coastlines of Spitsbergen and Nordaust Land are heavily indented by fjords; the east coast of Nordaust Land is formed by a front of inland ice. Many of the glaciers reach the sea, but in Spitsbergen there are large ice-free valleys. Elsewhere, there are extensive coastal plains, formed by the sea when its level was higher. The highest measured point, Newton Peak on Spitsbergen, reaches 5,633 feet (1,717 m).

The sea around Spitsbergen is shallow, and the pack ice prevents access to most shores except for a few months (May or June to October or November). A branch of the warm North Atlantic Drift, however, moderates the climate and leaves an open passage that permits vessels to approach the western coasts during most months. The climate is Arctic, with temperatures ranging from 59° F (15° C) in the summer to −40° F (−40° C) in the winter. Vegetation consists mostly of lichens and mosses; the only trees are the tiny polar willow and the dwarf birch. Animal life includes polar bears, reindeer, and Arctic foxes. The musk-ox was imported from Greenland in 1929. Seals, walruses, whales, and land game are now protected by law.

Many polar expeditions have made Svalbard their base. The first polar exploration was conducted by British Captain C.J. Phipps in 1773, followed by Norwegian, Swedish, and German groups in the 19th century. Mapping, polar flights, and geologic surveys continued through the first half of the 20th century. The Norwegian Polar Institute, headquartered in Oslo, furthers the work begun by earlier expeditions. The population (there are no indigenous inhabitants) changes seasonally but generally numbers about 3,000. Longyearbyen is the administrative centre. During the summer tourists arrive by boat at Hotellneset, on Advent Fjord. An airport opened in 1975.

Proclamation by Norway of a 200-nautical-mile economic zone in 1977 led to a dispute with the Soviet Union over maritime boundaries around Svalbard.

**Svan language,** Svan LUŠNU NIN, Georgian SVANURI ENA, unwritten language spoken in the high valleys south of Mount Elbrus in the Caucasus. Svan and the Georgian, Mingrelian (Megrelian), and Laz (Chan) languages con-

stitute the Kartvelian, or South Caucasian, language family. Svan has four dialects and differs from the other Kartvelian languages especially in vocabulary. It preserves a number of archaisms not present in the other three Kartvelian tongues, although it also has a number of independent linguistic changes. *See also* Georgian language; Kartvelian languages.

**Svante Sture:** *see* Sture, Svante.

**Svealand,** region, central Sweden, encompassing the *landskaper* (provinces) of Uppland, Södermanland, Västmanland, Närke, Värmland, and Dalarna (*qq.v.*). Svealand is the smallest of Sweden's three regions and lies between the regions of Götaland on the south and Norrland on the north. From the Baltic Sea and the Gulf of Bothnia on the east, it stretches across the breadth of Sweden to the Norwegian frontier. Svealand is a region of fertile plains and wooded heights, great forests, and many lakes. Archaeological remains indicate that some areas were settled as early as the Stone Age. The region was the original home of the Svear (Latin: Suiones), a people who gave Sweden its name (Sverige or Svea Rike, in Swedish, meaning "kingdom of Svea"), and it was the nucleus from which Sweden developed politically and culturally and later secured its independence. Its diversified economy ranges from agriculture and manufacturing to forestry and mining. Area 31,212 square miles (80,844 square km). Pop. (1994 est.) 3,340,238.

**Svedberg, The,** byname of THEODOR SVEDBERG (b. Aug. 30, 1884, Fleräng, near Gävle, Sweden—d. Feb. 25, 1971, Örebro), Swedish chemist who won the Nobel Prize for Chemistry in 1926 for his studies in the chemistry of colloids and for his invention of the ultracentrifuge, an invaluable aid in those and subsequent studies.

After receiving his doctorate from the University of Uppsala in 1907, Svedberg joined the faculty there. When he retired in 1949 he was named director of the new Gustaf Werners Institute for Nuclear Chemistry, a post he held until 1967. His first ultracentrifuge, completed in 1924, was capable of generating a centrifugal force up to 5,000 times the force of gravity. Later versions generated hundreds of thousands of times the force of gravity. Using ultracentrifuge, Svedberg was able to determine precisely the molecular weights of highly complex proteins such as hemoglobin. In later years he made studies in nuclear chemistry, contributed to the improvement of the cyclotron, and helped his student Arne Tiselius in the development of electrophoresis.

**Svein** (Norwegian personal name): *see under* Sweyn.

**Svend** (Danish personal name): *see under* Sweyn.

**Svendborg,** city, Fyns *amtskommune* (county commune), southern Funen Island, Denmark, on Svendborg Sound. Chartered in 1253, it was often plundered in the Middle Ages because of its easily accessible coastal location, and it suffered in the religious wars of the 16th and 17th centuries. The 13th-century Romanesque-style Church of Sankt Nikolaj survives, and the local museum is in a 16th-century timbered house. An important shipping centre and resort, Svendborg has shipbuilding yards, breweries, tobacco factories, and flour mills. There is a folk high school for seamen (1906) to the northeast. A 4,003-foot (1,220-metre) bridge built in 1966 connects Svendborg with the island of Tåsinge to the south. Pop. (1992 est.) city, 26,525; (1993 est.) mun., 42,147.

**Svensk Filmindustri** (Swedish: "Swedish Film Industry"), oldest and one of the most important Swedish motion-picture studios, as well as a major film distributor and exhibitor. Formed in 1919 by the merger of Svenska Biografteatern and Filmindustribolaget Skandia, Svensk Filmindustri initially produced pictures for international distribution. But competition from the growing American and German industries and the advent of sound forced it to concentrate on the home market and domestic educational films.

The Swedish film industry was revitalized after World War II. Films such as *Hets* (1944; *Torment,* or *Frenzy*), directed by Alf Sjöberg and written by Ingmar Bergman (who had joined Svensk in 1942), focused worldwide attention on Swedish films. In the 1940s and '50s Svensk continued to encourage such experimental filmmakers as Gösta Werner and Arne Sucksdorff, who were producers of short subjects, and backed such films of Bergman's as *Seventh Seal* (1956), *Wild Strawberries* (1957), *The Silence* (1963), and *Persona* (1966). Later productions that achieved international success include Jan Troell's *The Emigrants* (1971) and Lasse Hallström's *My Life as a Dog* (1985). In 1984 Svensk absorbed Europa Film, a rival studio founded in the 1930s.

**Svenska Dagbladet** (Swedish: "Swedish Daily Paper"), morning daily newspaper published in Stockholm, one of the most influential papers in Sweden and one that is editorially aligned with the Conservative Party.

Founded in 1884, *Svenska Dagbladet* was operated from 1940 to 1973 under the ownership of a foundation supported by a number of Swedish business firms and other segments of the society, including the church and the armed forces. This was reorganized in 1973 to provide more support from industry and to make it possible for papers with a small circulation to continue to operate. The Swedish government partly subsidizes *Svenska Dagbladet,* but the paper is considered independent and remains the strongest voice of conservatism in a liberal political environment.

**Sverdlov, Yakov Mikhaylovich** (b. May 22 [June 3, New Style], 1885, Nizhny Novgorod, Russia—d. March 16, 1919, Moscow), Soviet Communist Party leader and government official. His organizational skills and mastery of personnel made him a key figure in the Bolshevik Party in 1917–18.

The son of a Jewish engraver, Sverdlov became involved in politics while a teenager and joined the Russian Social-Democratic Workers' Party in 1902. When that party split in 1903, he joined the Bolshevik faction and became a party organizer and agitator, working primarily in the Urals, where he headed the Bolshevik underground. He was arrested a number of times and consequently served prison terms and periods of internal exile.

After the Russian monarchy was overthrown in early 1917, Sverdlov was appointed to head the Bolshevik Party Secretariat. The remarkable talents he displayed in that post made him in effect the party's chief organizer and its director of personnel. Sverdlov figured importantly in the planning and execution of the Revolution of October 1917, which brought the Bolsheviks to power.

Sverdlov was subsequently elected chairman of the Central Executive Committee (CEC) of the All-Russian Congress of Soviets, thereby becoming titular head of the Bolshevik state (Nov. 8, 1917). He used his power to bring the CEC and other organs of the new Soviet government firmly under Bolshevik Party control. Like Vladimir Lenin, Sverdlov believed in a highly centralized party hierarchy, and he worked to place all decision-making power in the party's Central Committee. His working relations with Lenin were extremely close, with the two men dominating decision making in the Central Committee by late 1918. It was Sverdlov who in July 1918 authorized the Urals Soviet to execute the Romanov imperial family in Yekaterinburg that month.

Sverdlov died of an infectious illness in 1919 and was buried on Moscow's Red Square. In 1924 the city of Yekaterinburg in the Urals, where he had performed much of his early party work, was renamed Sverdlovsk in his honour. (The city reverted to its original name in 1991.) Sverdlov's untimely death created a void in the Communist Party's organizational machinery that was never satisfactorily filled; Joseph Stalin took over the party's Secretariat in 1922.

**Sverdlovsk,** *oblast* (province), west-central Russia. The *oblast* occupies an area along the eastern slopes of the Ural Mountains, stretching from the crestline, which reaches 5,148 feet (1,569 m) in Mount Konzhakovsky Kamen, to the West Siberian Plain. Almost the entire *oblast* is in swampy forest, or taiga, of pine, birch, and larch, with only the highest summits above the treeline; in the extreme south is forest-steppe with birch groves. Soils are poor, and agriculture is largely confined to the southeast.

About 90 percent of the population is urban, a reflection of the role of the *oblast* in the Urals industrial area. It is remarkably rich in minerals, including iron ore from Kachkana, Nizhny Tagil, Kushva, and elsewhere; manganese at Ivdel; cobalt, nickel, tungsten, and vanadium near Yekaterinburg; bauxite at Severouralsk; and beryllium near Asbest. One of the largest asbestos deposits in Russia occurs at Asbest, and copper, platinum, and gold are widely distributed. Coal and lignite are scarce, and the *oblast* lacks fuel, importing coal from the Kuznetsk Basin and natural gas from Tyumen *oblast.*

On the basis of the local mineral deposits, ironworking and copper working have been important in the region since the early 18th century, but today there is a varied and technologically modern metallurgical industry. Iron and steel are made at a number of centres, including one of the largest in Russia, at Nizhny Tagil; aluminum is made at Krasnoturinsk and Kamensk-Uralsky; and nickel is processed at Rezh and copper at several centres. Yekaterinburg and Nizhny Tagil are the chief centres of heavy engineering. The chemical and timber-working industries also are highly developed. Area 75,200 square miles (194,800 square km). Pop. (1993 est.) 4,697,900.

**Sverdlovsk** (city, Russia): *see* Yekaterinburg.

**Sverdlovsk,** city, Luhansk *oblast* (province), Ukraine, in the Donets Basin. Sverdlovsk, named for the Bolshevik leader Yakov M. Sverdlov, is a coal-mining centre especially important for the production of anthracite. It also has panel-manufacturing and food industries. To the east lies the Provalsky Steppe, a reserve of natural steppe vegetation. The city was incorporated in 1938. Pop. (1991 est.) 84,000.

**Sverdrup, Johan** (b. July 30, 1816, Jarlsberg, Norway—d. Feb. 17, 1892, Kristiania [now Oslo]), Norwegian statesman, prime minister (1884–89) of Norway in the first ministry of the Venstre (Left, or Liberal) Party. His appointment to that post followed his victory in obtaining ministerial representation in the Storting (legislative assembly).

Sverdrup was educated as a lawyer and entered the Storting in 1851. He became leader of an opposition group of city liberals in that body. He was president of the Odelsting (lower division of the assembly) from 1862 to 1869 and was president of the Storting from 1871 to 1884. In alliance with Søren Jaabæk, leader of the Peasant Party, Sverdrup in 1869 created a unified liberal and national opposition called the Venstre. In 1884 he became prime minister in Norway's first Venstre ministry.

Under his ministry, numerous reforms for which he had worked since 1851 were authorized, notably an extension of the franchise (1884) and introduction of trial by jury and universal conscription (1887).

Soon after 1887 Sverdrup found himself at odds with the radical majority of his party on questions of religious toleration, on church reform, and on the handling of problems of Swedish-Norwegian union. A church-reform bill was defeated, and, in the ensuing 1888 elections, Sverdrup lost his absolute majority. The following year, when a motion of no confidence in his government was proposed in the Storting, he resigned.

**Sverige:** *see* Sweden.

**Sverrir** SIGURDSSON, Norwegian SVERRE SIGURDSSON (b. *c.* 1149, Faroe Islands—d. March 9, 1202, Bergen, Nor.), king of Norway (1177–1202) and one of the best-known figures in medieval Norwegian history. By expanding the power of the monarchy and limiting the privileges of the church, he provoked civil uprisings that were not quelled until 1217.

The son of Gunnhild, a Norwegian woman married to a Faroe Islands man, Sverrir was ordained priest at an unusually early age. After his mother told him that he was actually the son of the former Norwegian king Sigurd II, however, he left for Norway (1174) to claim the throne. By 1177 he had become leader of the Birchlegs, rivals of the incumbent ruler Magnus V. A skillful military leader, Sverrir was proclaimed king in the Trondheim region and soundly defeated the forces of Magnus in 1179. He became sole king of Norway in 1184 after his troops defeated and killed Magnus.

Sverrir made peace with the exiled archbishop Eystein Erlendsson, a supporter of Magnus V, after Eystein's return to Norway in 1183. Sverrir's assertion of royal power to elect bishops and his demand for a reduction in the archbishop's personal armed forces, however, alienated Eystein's successor, Erik Ivarsson, who refused to crown Sverrir and fled to Denmark with many of the nation's bishops in 1190. The remaining bishops crowned Sverrir in 1194 but were later excommunicated along with the king by Pope Innocent III. To the denunciations of the pope and the interdict under which he had been placed Sverrir responded with his "Speech Against the Bishop," the clearest argument of the time in favour of secular paramountcy over the church.

In 1196 the dissident bishop of Oslo, Nicholas Arnesson, joined forces with the exiled archbishop Erik Ivarsson and returned to Norway with a fleet, precipitating the Crosier War, a rebellion of the Crosiers, a group headed by religious and secular leaders opposed to Sverrir's ecclesiastical and administrative reforms. Nicholas gained control of much of eastern Norway, won the support of the labouring classes, and threatened to advance on the inland territory held by Sverrir before suffering serious reverses in 1199. By 1202 Sverrir had defeated the Crosier opposition, but civil war continued after his death. He was succeeded by his son Haakon III, who made peace with the church but died in 1204, only two years after assuming office.

An account of Sverrir's life is given in the Icelandic narrative *Sverris saga*.

**Śvētāmbara** (Sanskrit: "White-robed," or "White-clad"), one of the two principal sects of Jainism, a religion of India. The monks and nuns of the Śvētāmbara sect wear simple white garments. This is in contrast to the practice followed by the parallel sect, the Digambara (*q.v.*), which does not admit women into the ascetic order and whose monks are always nude.

The Śvētāmbara are concentrated chiefly in Gujarāt and western Rājasthān states, but they may also be found throughout northern and central India.

Though the date of the schism is given by the Śvētāmbara as AD 83, differences apparently arose slowly. Inscriptions on unclothed Kushān images of the Tīrthaṅkara (Jaina saviours) suggest that the Śvētāmbara continued to worship nude images for some time. The earliest image of a Tīrthaṅkara wearing a lower garment, from Akota, Gujarāt state, has been ascribed to the late 5th or 6th century. As this is also the time of the last council at Valabhī, some scholars suggest that the council marked the final separation of the two sects. The council also is credited with the final setting down in writing of the Śvētāmbara canon, which is centred on 11 Aṅgas, or texts, the 12th having by that time been lost.

**Svevo, Italo,** pseudonym of ETTORE SCHMITZ (b. Dec. 19, 1861, Trieste, Austrian Empire [now in Italy]—d. Sept. 13, 1928, Motta di Livenza, Italy), Italian novelist and short-story writer, a pioneer of the psychological novel in Italy.

Svevo (whose pseudonym means "Italian Swabian") was the son of a German-Jewish glassware merchant and an Italian mother. At 12 he was sent to a boarding school near Würzburg, Ger. He later returned to a commercial school in Trieste, but his father's business difficulties forced him to leave school and become a bank clerk. He continued to read on his own and began to write.

Svevo's first novel, *Una vita* (1892; *A Life*), was revolutionary in its analytic, introspective treatment of the agonies of an ineffectual hero (a pattern Svevo repeated in subsequent works). A powerful but rambling work, the book was ignored upon its publication. So was its successor, *Senilità* (1898; *As a Man Grows Older*), featuring another bewildered hero. Svevo had been teaching at a commercial school, and, with *Senilità*'s failure, he formally gave up writing and became engrossed in his father-in-law's business.

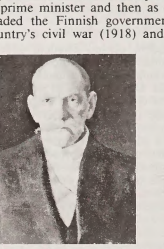
Ironically, business frequently required Svevo to visit England in the years that followed, and a decisive step in his life was to engage a young man, James Joyce, in 1907 as his English tutor in Trieste. They became close friends, and Joyce let the middle-aged businessman read portions of his unpublished *Dubliners*, after which Svevo timidly produced his own two novels. Joyce's tremendous admiration for them, along with other factors, encouraged Svevo to return to writing. He wrote what became his most famous novel, *La coscienza di Zeno* (1923; *Confessions of Zeno*), a brilliant work in the form of a patient's statement for his psychiatrist. Published at Svevo's own expense, as were his other works, this novel was also a failure, until a few years later, when Joyce gave Svevo's work to two French critics, Valéry Larbaud and Benjamin Cremieux, who publicized him and made him famous. In Italy his reputation grew more slowly, though the poet Eugenio Montale wrote a laudatory essay on him in a 1925 issue of *L'Esame*.

While working on a sequel to *Zeno*, Svevo was killed in an automobile accident. Among posthumously published works are two short-story collections, *La novella del buon vecchio e della bella fanciulla, e altre prose inedite e postume* (1930; *The Nice Old Man and the Pretty Girl*), with a preface by Montale, and *Corto viaggio sentimentale e altri racconti inedite* (1949; *Short Sentimental Journey and Other Stories*); as well as *Saggi e pagine sparse* (1954; "Essays and Scattered Pages"); *Commedie* (1960), a collection of dramatic work; and *Further Confessions of Zeno* (1969), an English translation of his incomplete novel. Svevo's correspondence with Montale was published as *Lettere* (1966). Svevo ultimately has been recognized as one of the most important figures in modern Italian literary history.

**Svyatopolk-Mirskii, Pyotr Danilovich:** *see* Svyatopolk-Mirsky, Pyotr Danilovich.

**Svyatoslav I** (Kievan prince): *see* Svyatoslav I.

**Svinhufvud, Pehr Evind** (b. Dec. 15, 1861, Sääksmäki, Fin.—d. Feb. 29, 1944, Luumäki), first chief of state of independent Finland, as prime minister and then as president. He headed the Finnish government during his country's civil war (1918) and in the early



Svinhufvud, detail from an oil painting by Antti Favén, 1923; in the Art Gallery of Ateneum, Helsinki

By courtesy of the Office of the Prime Minister, Helsinki

1930s. He was instrumental in suppressing Finland's Communist Party and maintaining a rightist regime.

Svinhufvud entered the Finnish Parliament in 1894, while Finland was still part of the Russian Empire. His anti-Russian position earned him exile in Siberia from 1914 to 1917. Having returned at the outbreak of the Russian Revolution of March 1917, he became prime minister of Finland, on November 27. He led the victorious "White" government during the Finnish Civil War of 1918 and secured (with German aid) Finland's independence from Soviet Russia. Being pro-German, he resigned after Germany's defeat in World War I and entered the conservative National Coalition Party. As prime minister from July 5, 1930, to Feb. 16, 1931, and president from March 2, 1931, to Feb. 28, 1937, he aided the rightist Lapua Movement in the suppression of the Communist Party but resisted efforts to turn Finland into an authoritarian, antidemocratic state.

**Svishtov,** also spelled SVIŠTOV, town, northern Bulgaria, on the terraced bank of the Danube River. Svishtov is one of the largest Bulgarian Danube ports and is a cultural centre. The Romans built on a strategic site near the town in the 1st century AD. There is little historical record of the town during the First and Second Bulgarian empires (11th–14th century), but under the Turks (15th–19th century) it was a major trade and craft centre, then called Sistova. During the Russo-Turkish War (1877–78), it was damaged several times and sacked by the Russians in 1878.

Svishtov is now an agricultural and fishing centre as well as a university town, with a higher institute of finance and economics. Several important Bulgarian artists and writers were born there. Noteworthy churches include those of St. Demetrius (1640) and SS. Peter and Paul. Pop. (1988 est.) 51,682.

**Svoboda, Ludvík** (b. Nov. 25, 1895, Hrozatín, Moravia, Austria-Hungary [now in Czech Republic]—d. Sept. 20, 1979, Prague, Czech.), president of Czechoslovakia (1968–75) who achieved great popularity by resisting the Soviet Union's demands during and after its invasion of August 1968. He was also a national hero of two world wars.

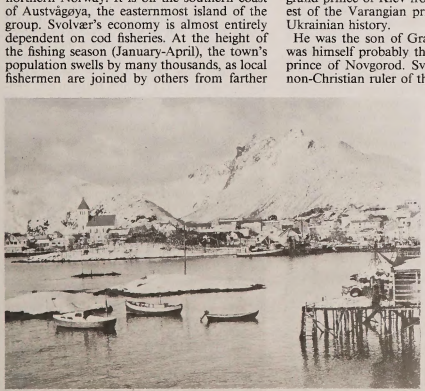
Deserting from the Austro-Hungarian army during World War I, Svoboda fought in the Czechoslovak legion in Russia. After the war he rose in the ranks of the Czechoslovak army. He was in charge of a battalion at

the time of the Munich crisis (1938), which resulted in the occupation by Germany of large parts of Czechoslovakia. After the German seizure in March 1939 of what was left of his country, Svoboda went underground. He organized Czechoslovak refugee units in Poland, and, when that country fell during World War II, he moved to the Soviet Union as head of the Czechoslovak army corps. After Czechoslovakia's liberation in 1945, he was appointed minister of defense by President Edvard Beneš. A Communist sympathizer, Svoboda did nothing to prevent the Communist takeover of Czechoslovakia in 1948.

Although he joined the Communist Party in 1948, he was forced out of the army in 1950, on orders of Joseph Stalin. Imprisoned in 1951 during a Stalinist purge, he lived in obscurity after his release until an inquiry by Nikita S. Khrushchev, then first secretary of the Communist Party of the Soviet Union, led to his return to public life as a military writer and head of the Klement Gottwald Military Academy. He retired in 1959 and was named a hero of both the Soviet Union and the Czechoslovak Socialist Republic in November 1965. After the overthrow of the conservative regime of Antonín Novotný in 1968, Svoboda was elected president of the republic on March 30, 1968, on the recommendation of Alexander Dubček, the new first secretary of the Communist Party of Czechoslovakia. Svoboda firmly resisted Soviet demands and played a major role in securing the release from the Soviet Union of Dubček and his aides, who had been seized during the Soviet invasion of August 1968. He left public life in 1975, largely because of poor health.

**Svobodny,** also spelled SVOBODNYJ, formerly (until 1924) ALEKSEYEVSK, city and centre of Svobodny *rayon* (sector), Amur *oblast* (province), southeastern Russia. It is situated on the right bank of the Zeya River, which is a tributary of the Amur River, and on the Trans-Siberian Railroad. Svobodny was founded in 1912. It is now an important transportation centre, having railway shops and serving as the operating and repair base for the steamship fleet of the Amur River. It also has shipbuilding and metalworking industries. Svobodny is connected by highway with Fevralsk, a station on the BAM (Baikal–Amur Magistral) railroad. Pop. (2000 est.) 71,000.

**Svolvær,** chief town and port of the Lofoten island group, Nordland *fylke* (county), northern Norway. It is on the southern coast of Austvågøya, the easternmost island of the group. Svolvær's economy is almost entirely dependent on cod fisheries. At the height of the fishing season (January-April), the town's population swells by many thousands, as local fishermen are joined by others from farther south. The town's industries, ancillary to fishing, include the processing of cod-liver oil and the production of fertilizer from fish viscera. Local shipyards build and repair fishing boats. The rugged and bleak countryside around Svolvær has attracted both tourists and artists, and the town has become something of an artists' colony. Gunnar Berg (1863–93), a native of the Lofoten group, painted memorable scenes of the everyday life of the local fisherfolk, one of his best-known works hangs in Svolvær's town hall. Pop. (1970) mun., 3,942.



The fishing port of Svolvær, Nor.
Mittet Foto A/S

**Svyatopolk-Mirsky, Pyotr Danilovich,** Svyatopolk-Mirsky also spelled SVIATOPOLK-MIRSKII (b. 1857—d. May 16 [May 29, New Style], 1914, St. Petersburg, Russia), Russian minister of the interior during the years of prerevolutionary unrest.

Svyatopolk-Mirsky, who owned much land and had been governor-general of several important districts, was named minister of the interior in 1904 upon the assassination of his predecessor, the fervently reactionary V.K. Plehve. The new minister was a man of enlightened views who attempted to include moderate liberal opinion in governmental policies. The contrast with the preceding ministry caused his administration to be referred to as the "political spring." He repealed several of the most unpopular censorship measures, released a number of zemstvo (district and provincial assembly) leaders from internal exile, and permitted the zemstvos to resume their normal activities. These gestures, although well-received by the public and the press, could not stem the political disaffection of the period. In November 1904 the National Zemstvo Congress that had met under Svyatopolk-Mirsky's sponsorship sent him a series of recommendations for reform. Svyatopolk-Mirsky responded by proposing to Tsar Nicholas II the inclusion of members of the zemstvos and other bodies in the State Council, but this provision was struck out by the tsar at the last moment and replaced by a denunciation of the government's opponents as enemies of the state. The resulting proclamation served to widen the breach between the government and the agitators for reform. Svyatopolk-Mirsky was dismissed from office on Jan. 15, 1905, in the wake of the government massacre of peaceful demonstrators on January 9 (known as Bloody Sunday).

**Svyatoslav I,** also spelled SVIATOSLAV, Russian in full SVYATOSLAV IGOREVICH (d. 972), grand prince of Kiev from 945 and the greatest of the Varangian princes of early Russo-Ukrainian history.

He was the son of Grand Prince Igor, who was himself probably the grandson of Rurik, prince of Novgorod. Svyatoslav was the last non-Christian ruler of the Kievan state. After coming of age he began a series of bold military expeditions, leaving his mother, Olga, to manage the internal affairs of the Kievan state until her death in 969.

The *Russian Primary Chronicle* (*Povest vremennykh let*) says that Svyatoslav "sent messengers to the other lands announcing his intention to attack them." Between 963 and 965 he defeated the Khazars along the lower Don River and the Ossetes and Circassians in the northern Caucasus; he also attacked the Volga Bulgars. In 967 he defeated the Balkan Bulgars at the behest of the Byzantines, to whom he then refused to cede his conquest. He declared his intention of establishing a Russo-Bulgarian empire with its capital at Pereyaslavets (now Pereyaslav-Khmelnytsky) on the Danube River. In 971, however, his comparatively small army was defeated by a Byzantine force under the emperor John I Tzimisces, and Svyatoslav was compelled to abandon his claim to Balkan territory.

In the spring of 972, while Svyatoslav was returning to Kievan Rus with a small retinue, he was ambushed and killed by the Pechenegs (a Turkic people) near the cataracts of the Dnieper River.

**Svyatoy Vasily Blazhenny** (Moscow): *see* Saint Basil the Blessed.

**Swabia,** German SCHWABEN, historic region of southwestern Germany, including what is now the southern portion of Baden-Württemberg *Land* (state) and the southwestern part of Bavaria *Land* in Germany, as well as eastern Switzerland and Alsace.

Swabia's name is derived from that of the Suebi, a Germanic people who, with the Alemanni, occupied the upper Rhine and upper Danube region in the 3rd century AD and spread south to Lake Constance and east to the Lech River. Known first as Alemannia, the region was called Swabia from the 11th century. The Franks under Clovis mastered the Alemanni about AD 500 and governed them by the Lex Alemannorum, a code based on Alemannic customary law. By the 7th century Irish missionaries began to introduce Christianity. Centres of Christian activity included the abbeys of St. Gall and of Reichenau and the bishoprics of Basel, Constance, and Augsburg; most Swabian sees came into the archepiscopal province of Mainz.

Swabia was one of the five great *Stamm* (stem, or tribal) duchies of earlier medieval Germany—with Franconia, Saxony, Bavaria, and Lotharingia (Lorraine)—and was held by successive families. Rudolf of Rheinfelden, duke in 1057, was set up as German king in 1077 in opposition to Henry IV, who in 1079 appointed the rebel's son-in-law, Frederick I of Hohenstaufen, duke of Swabia. Frederick's grandson was elected German king as Frederick I Barbarossa in 1152; and Swabia remained a dynastic possession of the Hohenstaufen until the extinction of their male line in 1268. Thereafter, local nobles, especially the counts of Württemberg, appropriated the ducal and royal lands. The German king Rudolf of Habsburg salvaged parts of the duchy for his son, Rudolf II of Austria; but by 1313, with the death of the latter's son, the ducal title fell out of use.

In the late European Middle Ages the so-called Swabian leagues played an important part in changing struggles between cities supported by the Holy Roman emperor, territorial magnates, and petty nobility. In 1321, in the first league, 22 Swabian imperial (free) cities, including Ulm and Augsburg, banded together to support Emperor Louis IV in return for his undertaking not to mortgage any of them to a vassal; Count Ulrich III of Württemberg was induced to join them in 1340. In opposition, the Swabian knights in 1366 formed their own

league, the Schleglerbund (from the German *Schlegel*, "Mallet," or "Hammer," on their insignia). In the ensuing civil war, Eberhard II, Ulrich III's son and successor, joined by the Schleglerbund, defeated the Swabian cities in 1372.

Ulm organized a new league of 14 Swabian imperial cities in 1376 with the aims of protecting the members' status against the threat of mortgaging and safeguarding their commercial interests. In 1377 this new league defeated Eberhard II's son Ulrich at Reutlingen, and it was a force in southern Germany until Eberhard II defeated it in 1388. In 1395 Eberhard III of Württemberg toppled the Schleglerbund by taking its fortress at Heimsheim.

In 1488 a new, more comprehensive Swabian league was formed, at Esslingen, not only of 22 imperial cities but also of the Swabian knights' League of St. George's Shield, bishops, and princes (Tirol, Württemberg, the Palatinate, Mainz, Trier, Baden, Hesse, Bavaria, Ansbach, and Bayreuth). The league was governed by a federal council of three colleges of princes, cities, and knights calling upon an army of 13,000 men. It aided in the rescue of the future emperor Maximilian I, Frederick III's son, held prisoner in the Netherlands, and later was his main support in southern Germany. It helped to suppress the Peasants' Revolt (1524–25). The Reformation caused the league to be disbanded in 1534.

The name of Swabia was perpetuated in that of the Swabian *Kreis* ("circle," or administrative district), one of the zones into which Germany was divided, from the 16th century onward, for purposes of imperial administration. First organized in 1500, the Swabian *Kreis* was fully established in 1555 and lasted until the dissolution of the Holy Roman Empire in 1806. There was also a Swabian Bench of Cities in the old imperial Diet (Reichstag).

**Swabian Alp,** German SWÄBISCHE ALB, continuation of the Jura Mountains in Baden-Württemberg *Land* (state), southwestern Germany. The upland plateau extends approximately 100 miles (160 km) from the Black Forest (Schwarzwald) to the Wörnitz River at an average elevation of about 2,300 feet (700 m). The plateau rises in a steep northwestern scarp some 1,300 feet (400 m) above the valleys of the Neckar, Rems, and Fils rivers to its highest peak, the Lemberg (3,330 feet [1,015 m]), but slopes gradually toward the Danube River valley in the southeast. Composed of limestones, the range is characterized by karstic features such as sinkholes, caves, dry valleys, and underground watercourses. The region has a raw climate and poor upland soils and consequently is sparsely populated.

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**swag,** also called FESTOON, in architecture and decoration, carved ornamental motif consisting of stylized flowers, fruit, foliage, and cloth, tied together with ribbons that sag in the middle and are attached at both ends. The distinction is sometimes made between a swag and a festoon by limiting the former to festoons entirely made up of folds of cloth.

The swag, or festoon, usually carved from wood or marble, or sometimes modeled in plaster in heavy relief, is a prominent decorative motif in all classical architecture and decoration. It was freely used by both the ancient Greeks and Romans. It was also especially popular among decorators of the Renaissance, many of whom also employed painted swags. The ends of the swag are sometimes held by



Swag, detail from the monument of Cardinal Piero Riario, in the Church of SS. Apostoli, Rome, by Andrea Bregno and Mino da Fiesole, 1477

Alinari—Art Resource

carved animals, such as bulls or lions, or they may simply be tied into bows with the ribbon ends hanging down.

**Swahili language,** also called KISWAHILI, or KISWAHILI, Bantu language spoken either as a mother tongue or as a fluent second language on the east coast of Africa in an area extending from Lamu Island, Kenya, in the north to the southern border of Tanzania in the south. (The Bantu languages form a subgroup of the Benue-Congo branch of the Niger-Congo language family.)

People who speak Swahili as their sole mother tongue are usually referred to as Waswahili, but this name refers to their language only and does not denote any particular ethnic or tribal unit. Swahili is widely used as a lingua franca in: (1) Tanzania, where it is the language of administration and primary education; (2) Kenya, where it is, after English, the main language for these purposes; (3) Zaire, where a form of Swahili is one of the four languages of administration, the main language for this purpose being French; and (4) Uganda, where the main language is again English.

Swahili has been greatly influenced by Arabic; there are an enormous number of Arabic loanwords in the language, including the word *swahili,* from Arabic *sawāḥilī* (a plural adjectival form of an Arabic word meaning "of the coast"). The language dates from the contacts of Arabian traders with the inhabitants of the east coast of Africa over many centuries. Under Arab influence, Swahili originated as a lingua franca used by several closely related Bantu-speaking tribal groups. In the early 19th century, the spread of Swahili inland received a great impetus from its being the language of the Arab ivory and slave caravans, which penetrated as far north as Uganda and as far west as Zaire. Swahili was later adopted by European colonialists, especially the Germans, who used it extensively as the language of administration in Tanganyika, thus laying the foundation for its adoption as a national language of independent Tanzania. In Kenya and Uganda, other local languages also received official encouragement during the colonial period, but the tendency in these countries is now to emphasize the use of Swahili. The oldest preserved Swahili literature, which dates from the early 18th century, is written in the Arabic script, though the language is now written in the Roman alphabet.

There are about 15 main Swahili dialects, as well as several pidgin forms in use. The three most important dialects are kiUnguja (or Kiunguja), spoken on Zanzibar and in the mainland areas of Tanzania; kiMvita (or Kimvita), spoken in Mombasa and other areas of Kenya; and kiAmu (or Kiamu), spoken on the island of Lamu and adjoining parts of the coast. Standard Swahili is based on the kiUnguja dialect.

Swahili is characteristically Bantu in its grammar, and it has a large vocabulary of word roots traceable to a common Bantu stock. Swahili nouns are divided into classes on the basis of their singular and plural prefixes; prefixes are also used to bring verbs, adjectives, and demonstrative and possessive forms into agreement with the subject of a sentence. Thus, in a sentence with *wa-tu,* "people" (singular *m-tu,* "person"), all the words begin with the *w-/wa-* prefix; *e.g., wa-tu w-etu wa-le wa-kubwa wa-mekuja:* "those big people of ours have come." Verb stems may be extended by means of varying suffixes, each one with its particular nuance of meaning; *e.g., funga* ("shut"), *fungwa* ("be shut"), *fungika* ("become shut"), *fungia* ("shut for"), *fungisha* ("cause to shut"), and so on.

**Swahili literature,** Swahili also called KISWAHILI, or KISWAHILI, that body of creative writing done in Swahili, a Bantu language of Africa. The earliest preserved Swahili writing, from the early 18th century, is written in Arabic script, and subsequent writings were primarily in three main dialects: kiUnguja, kiMvita, and kiAmu. In the 1930s, British colonial authorities, with some assistance from local African scholars and writers, formally began to standardize the language, choosing the dialect spoken in Zanzibar Town (kiUnguja) as the basis for the Swahili to be used in publishing and education throughout East Africa. At first, fiction in Swahili mainly consisted of stories inspired by indigenous oral narrative traditions, Arabic tales, and translations of works by European writers. An important exception was James Mbotela's 1934 historical novel *Uhuru wa Watumwa* ("Freedom for the Slaves"), but it was the writing of Shaaban Robert (1909–62) that really gave impetus to a literature in the new Standard Swahili. The works of this Tanganyikan poet, novelist, and essayist gained wide circulation in the 1940s, '50s, and '60s and are held in high esteem in East Africa today. Two other important writers from this period were the Zanzibaris Muhammed Saleh Farsy, whose novel *Kurwa na Doto* (1960; "Kurwa and Doto") is a minor classic, and Muhammed Said Abdulla, whose first story of a series of detective adventures, *Mzimu wa Watu wa Kale* (1960; "Shrine of the Ancestors"), marked the beginning of a transition toward a Swahili fiction that reflected the East African experience of industrialization, westernization, and the struggle for self-government and development of the post-independence society. With the 1965 success of the Tanzanian Faraji Katalambulla's crime thriller *Simu ya Kifo* ("Death Call"), that transition was pretty well completed; after the mid-1960s, Swahili publishing grew dramatically.

Romances, detective fiction, and traditional tales continue to be the mainstay of the literature, but there are several novels and plays that examine historical events and contemporary social and political problems in a sophisticated and stylistically elegant manner. Swahili-language translations now also include works by African as well as Western writers. Authors who have received local and international acclaim include the novelists Euphrase Kezilahabi and Mohammed S. Mohammed and the dramatists Ebrahim Hussein and Penina O. Mlama of Tanzania, as well as the Kenyan novelists Ali Jemaadar Amir, Katama Mkangi, and P.M. Kareithi.

In addition to creative writing, there has been a long tradition of historical writing in Swahili, antedating the colonial era. In more recent times, linguistic studies and a body of literary criticism in the language have begun to develop and grow.

**Swains Island,** coral atoll, American Samoa, southwestern Pacific Ocean, 280 miles (450 km) north of Tutuila. The atoll is 15–25 feet (5–8 m) above sea level; it is circular in shape, with 8 miles (13 km) of shoreline, and encloses a freshwater lagoon. It has an area of about 1 square mile (2.6 square km). Probably first known to Europeans in the 19th century, the atoll was named for a whaling captain. It is not geographically a part of the Samoan archipelago and was originally considered one of the Tokelau Islands. The American trader Eli Jennings, who had a Samoan wife, claimed the island in 1856, and it has remained the property of the family ever

since. From 1916 to 1925 Swains was a part of the Gilbert and Ellice Islands. It became part of American Samoa in 1925. Copra is the chief product. Pop. (1999 est.) 16.

**Swakopmund,** town, northwestern Namibia, on the Atlantic coast about 20 miles (32 km) north of the port of Walvis Bay and 175 miles (280 km) west of Windhoek, Namibia's capital. During the summer, in December and January, the territorial administration moves from Windhoek to Swakopmund, where the weather is somewhat cooler. It is the country's main seaside resort, fishing being a major attraction. The Swakopmund Museum, founded in 1951, has sections on natural history, mineralogy, marine life, and history and includes a small library. The Rössing uranium mine is near Swakopmund. Pop. (2001 est.) 34,900.

**Swale,** district (borough), county of Kent, southeastern England, occupying an area of 143 square miles (369 square km) along the south side of the Thames at its mouth. Swale district also includes the Isle of Sheppey, 9 miles (14 km) long and 4 miles (6 km) wide, to the north. The island is separated from the mainland (south) by The Swale, a branch of the River Medway estuary, which gives its name to the district. Land on either side of The Swale is marshland, with both salt marsh and freshwater aquatic vegetation, that extends the length of the district. Population centres on the Isle of Sheppey are concentrated on a range of low cliffs along the northern coast bordering the Thames estuary. The estuarine marshland of the mainland ascends southward into a highly fertile and cultivated zone that borders on the chalk uplands of the North Downs. Agricultural produce grown there includes hops, apples, and cherries.

The heavy-industrialized ports of Queenborough-in-Sheppey and Sheerness on the Isle of Sheppey have deepwater harbours. Container facilities opened at Sheerness in 1972, and the town has regular ferry service to Vlissingen (Flushing), Neth.

Sittingbourne, the district seat on the mainland, is the site of an agricultural-research complex (founded in 1940). The former medieval port of Faversham east of Sittingbourne has a restored pre-19th-century street and has expanded its contemporary port facilities. Trade in timber, fertilizers, and petroleum products passes through the port. The British historian George Finlay (1799–1875) was born in Faversham. Pop. (1988 est.) 118,700.

**swallow,** any of the 74 species of the bird family Hirundinidae (order Passeriformes). A few, including the bank swallow, are called martins (*see* martin; *see also* woodswallow; for sea swallow, *see* tern). Swallows are small, with pointed narrow wings, short bills, and small weak feet; some species have forked tails. Plumage may be plain or marked with metallic blue or green; the sexes look alike in most species.



Common swallow (*Hirundo rustica*)
Stephen Dalton from the Natural History Photographic Agency—EB Inc.

Swallows spend much time in the air, capturing insects; they are among the most agile of passerine birds. For nesting, swallows may use a hole or cranny in a tree, burrow into a sandbank, or plaster mud onto a wall or ledge to house three to seven white, sometimes speckled, eggs.

Swallows occur worldwide except in the coldest regions and remotest islands. Temperate-zone species include long-distance migrants. The common swallow (*Hirundo rustica*) is almost worldwide in migration; an American species, called barn swallow, may summer in Canada and winter in Argentina. The 10 species of *Petrochelidon,* which make flask-shaped mud nests, include the cliff swallow (*P. pyrrhonota*), the bird of San Juan Capistrano Mission, in California; as with other swallows, it has strong homing instincts.

**swallow plover** (bird): *see* pratincole.

**swallow-shrike** (bird): *see* woodswallow.

**swallow-tanager** (*Tersina viridis*), bird of northern South America, the sole member of the subfamily Tersininae, family Emberizidae;



Swallow-tanager (*Tersina viridis*)
Painting by Murrell Butler

some authors give it family rank (Tersinidae). About 15 cm (6 inches) long, it resembles a tanager with long wings and a swallowlike bill. The male is light blue, with black markings; the female is mostly green. Swallow-tanagers catch insects on the wing and also eat large fruits, ejecting the seeds and filling their throat pouches with the pulp. They breed in tree holes, sandbanks, and wall crevices.

**swallowing,** also called DEGLUTITION, the act of passing food from the mouth, by way of the pharynx (or throat) and esophagus, to the stomach. Three stages are involved in swallowing food.

The first begins in the mouth. There, food is mixed with saliva for lubrication and placed on the back of the tongue. The mouth closes, and the soft portion of the roof of the mouth (soft palate) rises so that the passageway between the nasal and oral cavities is closed off. The tongue rolls backward, propelling food into the oral pharynx, a chamber behind the mouth that functions to transport food and air.

Once food enters the pharynx, the second stage of swallowing begins. Respiration is temporarily inhibited as the larynx, or voice box, rises to close the glottis (the opening to the air passage). Pressure within the mouth and pharynx pushes food toward the esophagus. At the beginning of the esophagus there is a muscular constrictor, the upper esophageal sphincter, which relaxes and opens when food approaches. Food passes from the pharynx into the esophagus; the upper esophageal sphincter then immediately closes, preventing flow of food back into the mouth.

Once food is in the esophagus, the final phase of swallowing begins. The larynx lowers, the glottis opens, and breathing resumes. From the time food leaves the mouth until it passes the upper sphincter, only about one second of time elapses, during which all these body mechanisms spontaneously occur. After passing the upper sphincter, movements in the esophagus carry food to the stomach. Rhythmic muscular contractions (peristaltic waves) and pressure within the esophagus push the food downward. Folds in the esophageal wall stretch out as materials pass by them and again contract once they have passed. At the lower end of the esophagus, the lower esophageal sphincter relaxes and food enters the stomach; the sphincter then closes again to prevent reflux of gastric juices and food materials.

Swallowing is basically an involuntary reflex; one cannot swallow unless there is saliva or some substance to be swallowed. Initially, food is voluntarily moved to the rear of the oral cavity, but once food reaches the back of the mouth, the reflex to swallow takes over and cannot be retracted.

Swallowing is influenced by bodily position. Liquids swallowed when the body is in an upright or horizontal position flow by gravity rapidly to the stomach; in the head-down position, however, liquids remain at the beginning of the esophagus and several swallows and peristaltic waves may be necessary to evacuate the liquid. If a person swallows food connected to a string with counterweights attached outside of the body, he can only overcome 5 to 10 grams of weight resistance. Dogs can swallow food with a resistance of 50 to 500 grams. Essentially, the swallowing capacity of human beings is much weaker than that of other animals. The temperature of foods also affects a person's swallowing capacity. Very cold liquids (1° to 3° C, or 34° to 37° F) slow down or completely stop peristaltic movement in the esophagus. In contrast, liquids at high temperature (58°–61° C, or 136°–142° F) increase peristaltic movements.

Afflictions affecting swallowing include paralysis of the pharynx, failure of the esophageal sphincters to open properly, and spastic contractions of the esophageal muscle walls. Any of these may be caused by physical or psychological complications.

**swallowtail butterfly,** any member of the insect subfamily Papilioninae of the cosmopolitan family Papilionidae (order Lepidoptera). The swallowtail butterflies (Papilio), found



Giant swallowtail (*Papilio cresphontes*)
Ray Glover from The National Audubon Society Collection/Photo Researchers—EB Inc.

worldwide except in the Arctic, are named for the characteristic taillike extensions of the hindwings, although many species are tailless. Colour patterns vary; many species have yellow, orange, red, green, or blue markings on an iridescent black, blue, or green background. Sexual and seasonal differences in coloration also occur. Many swallowtails mimic the coloration and patterns of butterflies that are protected by a bad taste.

The brightly coloured larvae feed on foliage. Black and yellow eyelike spots on the thorax of some larvae resemble the head of a snake. Many have scent glands and discharge a bad-smelling substance when disturbed.

**swāmī:** *see* sādhu and swāmī.

**Swāmī-Nārāyaṇī,** also spelled SWĀMINĀRĀYAṆA, Hindu reform sect with a large popular following in Gujarāt state. It arose primarily as a protest against the corrupt practices said to have developed during the 19th century among the Vallabhācārya, a prominent devotional sect renowned for the deference paid to its gurus (spiritual leaders). The sect was founded in Ahmedabad about 1804 by Swāmī Nārāyaṇa, who emphasized the observance of traditional Hindu law, particularly in matters of caste, diet, and ritual. The sect worships Krishna (Kṛṣṇa) and also the five major gods of orthodox Hinduism, and it employs the Vallabha mantra (prayer formula). The doctrines of the founder are collected along with selections from Hindu scriptures in an anthology called the *Śikṣāpātrī.*

**Swaminathan, M(onkombu) S(ambisivan)** (b. Aug. 7, 1925, Kumbakonam, Tamil Nadu, India), Indian geneticist and international administrator, renowned for his leading role in India's "Green Revolution," a program under which high-yield varieties of wheat and rice seedlings were planted in the fields of poor farmers.

Swaminathan, the son of a surgeon, was educated in India and at the University of Cambridge (Ph.D., 1952) as a geneticist. During the next two decades he held a number of research and administrative positions (mostly in the Indian civil service). While working in these positions he helped introduce Mexican semidwarf wheat plants to Indian fields and helped to bring about greater acceptance of modern farming methods. From 1972 to 1979 he was director general of the Indian Council of Agricultural Research, and he was minister of Agriculture from 1979 to 1980. He served as director general of the International Rice Research Institute (1982–88) and became president of the International Union for the Conservation of Nature and Natural Resources in 1988.

**Swammerdam, Jan** (b. Feb. 12, 1637, Amsterdam—d. Feb. 15, 1680, Amsterdam), Dutch naturalist, considered the most accurate of classical microscopists, who was the first to observe and describe red blood cells (1658).

Swammerdam completed medical studies in 1667 but never practiced medicine, devoting himself to microscopical investigations instead. Turning to the study of insects, he accurately described and illustrated the life histories and anatomy of many species. His observations of their development led him to separate insects into four major divisions, according to the degree and type of metamorphosis. Three of these divisions have been more or less retained in modern classification.

During the period he devoted to exhaustive entomological research (1667–73), he completed *A General History of Insects,* popularly recognized as a major work at the time, and the *Bible of Nature,* one of the finest collections of microscopical observations ever published. In these works he corrected the physiologist Marcello Malpighi's conceptions of the insect brain and nervous system and opposed the physician William Harvey's inconsistent interpretation of insect metamorphosis. He also demonstrated the presence of butterfly wings in caterpillars about to undergo pupation.

Studying the anatomy of the tadpole and the adult frog, he noted a cleavage in the egg and discovered valves in the lymphatic vessels, now known as Swammerdam valves. He described the ovarian follicles of mammals in the same year as the physician Reinier de Graaf (1672) and devised improved techniques for injecting wax and dyes into cadavers, which had important consequences for the study of human anatomy. His ingenious experiments showed that muscles alter in shape but not in size during contraction, contradicting the classic Greek physician Galen's popular theory that a material fluid passing through the nerves is responsible for the movement.

After his father refused to continue his financial support, Swammerdam suffered extreme privations. Subject in the last years of his life to fits of depression, he sought relief by becoming a disciple of the religious enthusiast Antoinette Bourignon.

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**swamp,** wetland ecosystem characterized by mineral soils with poor drainage and by plant life dominated by trees. The latter characteristic distinguishes a swamp from a marsh, in which plant life consists largely of grasses. Swamps are found throughout the world. They exist in areas with poor drainage and sufficient water supply to keep the ground waterlogged, and they have a high enough supply of minerals in the water to stimulate decay of organisms and prevent the accumulation of organic materials. They are often found in regions of low relief associated with rivers that supply the water. *Compare* marsh.

Rivers in mature valleys frequently have extensive marshes and swamps along their sides. Floodplains elevated only a few feet above river level, abandoned river channels, and oxbows may have standing or sluggishly flowing water for appreciable parts of the year and thus support swamps and marshes.

River swamps are abundant along the coastal plain in the southeastern United States. They are delightfully described in their primeval condition by William Bartram in his account *Travels through North and South Carolina, Georgia, East and West Florida* written in 1791. These were the swamps that Francis Marion used so successfully to escape the British forces during the Revolutionary War and the source of his nickname, "the old swamp fox."

The great Dismal Swamp, of North Carolina and Virginia, actually a mixture of waterways, swamps, and marshes, is a coastal-plain swamp, although it is not associated with a large river. The Mississippi and its lower tributaries, such as the Red River and parallel rivers in eastern Texas, have extensive swamps along the sluggish portions that flow through the coastal plain. The Paraná and Paraguay rivers in South America have extensive swamps and marshes along their courses. A mixture of swamps and marshes in Georgia called the Okefenokee Swamp is the source of the Suwannee River.

The Florida Everglades constitutes a unique marsh–swamp combination growing on a limestone base. Because the region is near sea level, the water from the abundant rains does not drain but remains on the surface. Large cypress swamps occur to the northwest of the Everglades.

Topography and water supply are the two most important features in determining the distribution of freshwater swamps. The nature of soils and bedrock is of importance in determining the drainage in a region, but wetlands may exist locally on any base from sands to impervious rock.

The flow of water through wetlands is slow because of low gradients and retarding effects of the vegetation. Dead plant matter settles rather than being washed away. The slow replacement and lack of turbulence in the water result in a low rate of oxygen supply. Decay of the dead vegetation quickly uses up what oxygen is supplied, so that the mud and bottom waters are low or lacking in oxygen content. Under these conditions, the decay of organic matter is incomplete. This causes an accumulation of the more resistant fraction (humates and tannins) in the substratum. The familiar swamp water, varying from yellow to such a deep brown that it resembles strong tea or root beer, is the result.

The number of plant species in swamps is few compared to the numbers that grow on well-watered but not waterlogged land. Cattails (*Typha*) and common reeds (*Phragmites*) are familiar swamp species around the world. Papyrus, a sedge, is widespread in the tropics. Bald cypress is an example of a tree adapted to growth in swamps, but gums, willows, alders, and maples are also common. Tropical swamps have many tree species including palms.

Salt swamps are formed by seawater flooding and draining, which exposes flat areas of intertidal land. Regularly flooded, protected areas develop mangrove swamps in tropical and subtropical regions. Mangroves will grow in pure sand at the edge of the sea. Extensive swamps develop mainly where land runoff is sufficient to bring a supply of sediments that accumulate and extend the swamp. The deltas of the Mekong, Amazon, Congo, and Ganges and the north coast of Australia and of Sumatra have notable and extensive mangrove swamps.

Tropical swamp trees often develop buttresses that apparently help support them, though buttresses are also common on many upland trees in the tropics. Generally, all swamp trees lack deep-growing roots. Roots tend to stay near the surface, probably because of the lack of oxygen in the soil. Being near the surface gives a large lateral spread to the root system, which also gives the tree support against lateral stresses from winds or water flow. The shallowness of the roots also often produces the appearance of buttresses in temperate swamp trees because the beginnings of the roots, usually hidden in the soil, are visible at the surface.

Different species of trees that grow in temporary swamps differ considerably in their resistance to submersion—*i.e.,* to lack of oxygen. This is serious during the submersion period but is not a problem in drier periods, at least in the shallow layers of the soil. In North American swamps, alders and willows will survive or even thrive on land immersed for periods as long as one month, whereas red gum survives only about two weeks. Cottonwood begins to show the effects of submergence after only two days and survives only one week.

The tops of mangrove trees shelter a diverse group of animals that are unaffected by seawater, because they never contact it. In general, swamp animals are little affected by wetland conditions except as those conditions affect the species of trees growing in the swamp. Whereas the diversity of plants is limited by the stresses that the presence of water entails, the animal diversity is more a reflection of the plant diversity than the nature of the water supply.

**swamp cricket frog,** also called SWAMP TREE FROG: *see* chorus frog.

**swamp deer,** common name for the barasingha (*q.v.*) of India and for the marsh deer (*Blastocerus dichotomus*), a large reddish brown deer of South American marshes.

**swamp eel,** any of about 15 species of slim, eel-like fish comprising the order Synbranchiformes. Swamp eels, unrelated to true eels (Anguilliformes), are found in fresh and brackish waters of the tropics. They appear to be related to the order Perciformes. They range from about 20 to 70 centimetres (8 to 28 inches) in length and either are scaleless or have very small scales. The dorsal and anal fins are low and continuous around the tail tip, and the gills often have only a single external opening, on the throat. In some species, the gills themselves are small, the fish relying on oxygen absorbed through the membranes of the throat or intestine. In the Orient, swamp eels are valued as food and are sometimes kept in ponds or rice fields.

**swamp fever:** *see* equine infectious anemia.

**Swamp Fox, The:** *see* Marion, Francis.

**swamp maple:** *see* red maple.

**swamp pheasant,** also called PHEASANT COUCAL, bird species of the cuckoo family (Cuculidae). *See* coucal.

**swan,** largest waterfowl species of subfamily Anserinae, family Anatidae (*q.v.*; order Anseriformes). Most swans are classified in



Mute swan (*Cygnus olor*) and cygnet
Arthur W. Ambler—The National Audubon Society Collection/Photo Researchers

the genus *Cygnus*. Swans are gracefully long-necked, heavy-bodied, big-footed birds that glide majestically when swimming and fly with slow wingbeats and with necks outstretched. They migrate in diagonal formation or V-formation at great heights: no other waterfowl moves as fast on the water or in the air. They feed by dabbling (not diving) in shallows for aquatic plants. Swimming or standing, the mute (*C. olor*) and black (*C. atratus*) swans often tuck one foot over the back. Male swans, called cobs, and females, called pens, look alike. Legend to the contrary, swans utter a variety of sounds from the windpipe, which in some species is looped within the breastbone (as in cranes); even the mute swan, the least vocal species, often hisses, makes soft snoring sounds, or grunts sharply. Swans are sociable except in breeding season. They mate for life. Courtship involves mutual bill dipping or head-to-head posturing. The pen incubates, on average, a half-dozen pale, unmarked eggs, on a heap of vegetation, while the cob keeps close guard; in some species he takes his turn at brooding. After repulsing an enemy, swans utter a triumph note, as geese do. The young, called cygnets, emerge short-necked and thickly downed; though capable of running and swimming a few hours after hatching, they are carefully tended for several months: in some species they may ride about on their mother's back. Immature birds wear mottled gray or brown plumage for two or more years. Swans mature in the third or fourth year and live perhaps 20 years in the wild and 50 years or more in captivity.

Of the seven or eight species—some of them probably races of a species, as indicated below by scientific names in parentheses—five are all-white, black-legged birds of the Northern Hemisphere: the mute swan, with a black knob at the base of its orange bill, curved posture of the neck, and aggressive wing arching; the trumpeter swan (*C. cygnus buccinator*), named for its far-carrying low-pitched call and having an all-black bill; the whooper swan (*C. cygnus cygnus*), a noisy bird with black bill having a conspicuous yellow base; the similar but smaller and quieter Bewick's swan (*C. columbianus bewickii*)—of which Jankowski's swan (*C. columbianus jankowskii*) may be merely the eastern race; and the whistling swan (*C. columbianus columbianus*), named for its voice, and having a black bill with, usually, a small yellow spot near the eye. Some ornithologists (especially in the United States) place the last four swans in the genus *Olor*, reserving *Cygnus* for the mute swan.

Once threatened with extinction—fewer than 100 birds were counted in the United States in 1935—the trumpeter swan has made a strong comeback in the national parks of the western United States and Canada, but the total population in the mid-1970s was only about 2,000. It is the largest swan—about 1.7 m (5½ ft) long, with a 3-m (10-ft) wingspan—but it weighs less than the mute swan, which at 23 kilograms (50 pounds) is the heaviest flying bird.

The Southern Hemisphere has the black swan (Australia) and two pink-legged forms (South America): the black-necked swan (*C. melancoriphus*), an especially bad-tempered but beautiful bird, with white body, black neck and head, and prominent red caruncle (fleshy outgrowth) on the bill; and the coscoroba (*Coscoroba coscoroba*), an all-white bird that is usually considered the smallest swan but may have affinities with the whistling duck (*q.v.*).

**Swan, Sir Joseph Wilson** (b. Oct. 31, 1828, Sunderland, Durham, Eng.—d. May 27, 1914, Warlingham, Surrey), English physicist and chemist who produced an early electric light bulb and invented the dry photographic plate,



Joseph Swan, pencil drawing by M. Agnes Cohen, 1894; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

an important improvement in photography and a step in the development of modern photographic film.

After serving his apprenticeship with a druggist in his native town, Swan became first assistant and later partner in a firm of manufacturing chemists in Newcastle. Working with wet photographic plates, he noticed that heat increased the sensitivity of the silver bromide emulsion. By 1871 he had devised a method of drying the wet plates, initiating the age of convenience in photography. Eight years later he patented bromide paper, the paper commonly used in modern photographic prints.

Some years earlier, in 1860, Swan developed a primitive electric light, one that utilized a filament of carbonized paper in an evacuated glass bulb. Lack of a good vacuum and an adequate electric source, however, resulted in a short lifetime for the bulb and inefficient light. His design was substantially the one used by Thomas A. Edison nearly 20 years later. In 1880, after the improvement of vacuum techniques, both Swan and Edison produced a practical light bulb. Three years later, while searching for a better carbon filament for his light bulb, Swan patented a process for squeezing nitrocellulose through holes to form fibres. In 1885 he exhibited his equipment and some articles made from the artificial fibres. The textile industry has utilized his process. Swan was knighted in 1904.

**Swan Hill,** city, northern Victoria, Australia, on the Murray River, northwest of Melbourne. It is the chief market centre for the southern section of the irrigated Riverina district of New South Wales. The site was named in the 1830s by the explorer Thomas (later Sir Thomas) Mitchell, who was kept sleepless there by the calls of swans. Settled in 1846 by sheepherders, the community prospered as a river port during the paddle-steamer era. Situated in an area of intense fruit, grape, wheat, dairy, and vegetable farming, the city has factories to process the crops. Other industries include engineering and plasterboard manufacture. Swan Hill holds an annual Shakespearean festival. It became a shire in 1893, a borough in 1939, and a city in 1965. Pop. (1996) 9,835.

**Swan Islands,** Spanish ISLAS DEL CISNE, two islets (Greater and Lesser Swan) in the Caribbean Sea, 97 mi (156 km) north of Honduras. Discovered by Christopher Columbus on St. Anne's day in 1502, they were named Islas Santa Ana. The islands, only 3 sq mi (8 sq km) in area, served as a pirate haunt from the 16th through the 18th century. In 1775 they appeared on a map as the Swan Islands. The notorious U.S. filibuster William Walker occupied them in 1860; following his death, Honduras staked its claim in 1861. They were placed under United States sovereignty in 1863 by the Guano Islands Act. Since then they have been prized by guano hunters and turtle fishermen. The islands were turned over to Honduras in November 1971. Weather and communication stations there are still operated by the United States by agreement with Honduras. Pop. (latest est.) 22.

**Swan River,** ephemeral river of southwestern Western Australia. It rises in the hills south of Corrigin as the Avon and flows 224 mi (360 km) northwest and southwest past Northam and Perth to the Indian Ocean at Fremantle. It is known as the Swan only along its lower 60-mi course. The rivers Helena (site of Mundaring Weir) and Canning are left-bank tributaries. Dry during much of the summer and autumn, the river runs through steep gorges and rapids on its upper course, widening at the coast to form two shallow tidal basins (Perth and Melville waters). A causeway was completed across the river at Perth in 1843 and a bridge at Fremantle in 1866. Above Perth, its banks are lined with vineyards and market gardens.

The river in its lower reaches, explored in 1697 by Willem de Vlamingh, was named for the black swans found there. Western Australia's first free settlement was made on its banks in 1829.

**Swan River,** town, western Manitoba, Canada, on the Swan River near the Sas-

katchewan border and west of Lake Winnipegosis, 310 miles (500 km) northwest of Winnipeg. In the early 1800s there was intense fur-trading rivalry in the area between the Hudson's Bay and the North West companies. Homesteaders of varied nationalities moved to the locality after the Canadian Northern Railway reached the site in 1898. The town is now a farming and lumbering centre. The Northwest Round-up and Agricultural Fair is an annual (July) event. Porcupine Provincial Forest (north) and Duck Mountain Provincial Park and Forest (south) are nearby. Inc. 1908. Pop. (1996) 3,986.

**Swan Service,** set of porcelain tableware made at the Meissen factory in Germany between 1737 and 1741 by Johann Joachim Kändler and Johann Friedrich Eberlein. Made for Heinrich, Count von Brühl, the factory di-



*Verrière* from the Swan Service modeled by Johann Joachim Kändler and Johann Friedrich Eberlein, Meissen, Ger., 1738

The Antique Porcelain Company, The Antique Company of New York, Inc.

rector, it was composed of 2,200 pieces modeled and painted in the Rococo style with such aquatic motifs as swans and water nymphs. It is probably the single finest table service ever made in porcelain.

**Swan Theatre,** Elizabethan theatre built about 1596 by Francis Langley in Bankside, London. A description and a sketch of the Swan made by Johann DeWitt of Utrecht (the sketch copied by Arend van Buchell) have proved most useful in attempts to reconstruct the form of the Elizabethan theatre. The last known mention of the Swan Theatre was in 1632.

**Swanscombe skull,** human fossil remnants, consisting of two fossil parietals and the occipital of a young female, found in well-stratified gravels of the River Thames, Swanscombe, Kent, Eng., in 1935, 1936, and 1955. Chemical tests and associated faunal remains and Acheulian hand axes date the human bones accurately to the Second (Mindel-Riss) Interglacial Period (about 200,000 years ago). Detailed study of the bones has failed to justify a specific distinction from the corresponding bones of modern human skulls, even though those of the Swanscombe skull show minor differences from those of modern man—particularly in the occipital bone. The Swanscombe skull predates Neanderthal man and is usually classified as an early subspecies of *Homo sapiens,* called *Homo sapiens heidelbergensis.*

**Swansea,** Welsh ABERTAWE, county, southwestern Wales, comprising the city of Swansea as well as the entire peninsula of Gower in the south and west, the lower valley of the River Loughor in the northwest, and the foothills of Black Mountain in the north. Gower is a rolling plateau noted for its sandy beaches and scenic rocky cliffs. The valleys of the Rivers Loughor and Tawe broaden in their lower reaches to form alluvial lowlands near the centre of the county, which contrast with the hilly moors of the northern foothills.

Swansea county lies entirely within the historic county of Glamorgan (Morgannwg). The city of Swansea is the second largest in Wales and accounts for most of the county's population. It is an important port and industrial centre and also the main commercial and service centre of southwestern Wales. The main industries are metal fabrication, automotive components, engineering, plastics, packaging, and petrochemicals. Important service activities include health care, wholesale and retail trade, transport, and financial services. The villages and towns to the north were historically coal-mining centres, but mining has virtually ceased in the county. Some of these towns have attracted light manufacturing and many serve as bases for commuters to the city of Swansea, which is the administrative centre of the county. Gower is rich in prehistoric hill forts and burial chambers, as well as 13th-century castles and churches. Much of the coast is an area of great beauty, attracting tourists year-round. The Mumbles, on the peninsula's eastern coast, is the largest resort town. The peninsula also supports agriculture, principally dairying and market gardening. Area 146 square miles (379 square km). Pop. (1998 est.) 229,500.

**Swansea,** Welsh ABERTAWE, city, Swansea county, historic county of Glamorgan (Morgannwg), southwestern Wales. It lies along the Bristol Channel at the mouth of the River Tawe. Swansea is the second largest city in Wales (after Cardiff). In the early 12th century the Norman Henry de Newburgh built a castle there, which was later destroyed by the Welsh rebel Owen Glendower. Up to the early 18th century Swansea was a small market town and a coal port. Thereafter it grew steadily as an industrial centre. Local outcrops of coal were used in the smelting of imported copper after 1717, and the industry prospered so much that by the mid-19th century Swansea was the centre of world trade in copper. The copper industry's subsequent collapse resulted mainly from foreign competition. Swansea also prospered as a port for the anthracite mines of the western coalfield in South Wales. A canal built along the Swansea valley in 1798 and railways constructed during the 19th century linked Swansea's port with the coalfield, and new docks built after 1852 increased the port's capacity. Swansea's coal exports reached a peak about 1913 but virtually ceased by the 1980s. Production of other nonferrous metals developed in and around Swansea, including lead, zinc, nickel, and especially tinplate production, but these sectors declined dramatically during the 20th century.

Aluminum production and metal fabrication developed after World War II and many other industries followed. An oil refinery at Llandarcy supplies a petrochemical plant at Baglan, near Neath. Swansea has a university college and is the chief shopping and service centre for southwestern Wales. The Royal Institution of South Wales (1835) has a museum displaying the archaeology and natural history of the area. The town centre was nearly destroyed by German bombing in 1941 but has been redeveloped. Swansea's tourist trade is based upon the extensive beaches of Swansea Bay and the attractive Gower coast. Poet Dylan Thomas was born there and celebrated the region in his work. Pop. (1991) 171,038.

**Swanson, Gloria,** original name GLORIA MAY JOSEPHINE SVENSSON (b. March 17, 1899, Chicago, Ill., U.S.—d. April 4, 1983, New York, N.Y.), American motion-picture, stage, and television actress, known primarily as a glamorous Hollywood star during the 1920s and as the fading movie queen Norma Desmond in the 1950 film *Sunset Boulevard.*

She was the only child of a civilian official of the U.S. Army transport service, whose work during Gloria's childhood took the family to Florida, Texas, and Puerto Rico. While touring the Essanay film studio during a visit to an aunt in Chicago when she was 14 years old, she asked if she could appear in a crowd scene. She enjoyed the work, stayed on as an extra, and was soon playing bit roles in two-reel comedies. Her parents separated in 1916, however, and she and her mother moved to Hollywood, where Swanson got a job at the Mack Sennett studio.

After establishing herself as both a bathing beauty and a comedienne, Swanson was hired by Cecil B. DeMille and between 1921 and 1926 achieved stardom in a series of feature films that included *Don't Change Your Husband, Male and Female, Zaza, Bluebeard's Eighth Wife,* and *Madame Sans Gene.* She then formed her own production company, making such pictures as *Sadie Thompson, Queen Kelly* (unfinished), and her first talkie, *The Trespasser.* After several lighter vehicles, she tired of the poor scripts available, stopped making films, and started several business ventures outside the motion-picture industry. In 1950 Swanson made a historic motion-picture comeback in the highly acclaimed *Sunset Boulevard.* Although she appeared in a few later films, she devoted most of the remainder of her career to television and the theatre—appearing in such plays as *Twentieth Century, Nina,* and *Butterflies are Free.* Her autobiography, *Swanson on Swanson,* was published in 1980.

**Swanton, John Reed** (b. Feb. 19, 1873, Gardiner, Maine, U.S.—d. May 2, 1958, Newton, Mass.), American anthropologist and a foremost student of North American Indian ethnology. His contributions to knowledge of the Indians of the southeastern United States significantly developed the discipline of ethnohistory.

Swanton studied with anthropologist Franz Boas at Columbia University for two years but received his Ph.D. from Harvard University in 1900. He immediately joined the Bureau of American Ethnology of the Smithsonian Institution, Washington, D.C., remaining until 1944. His first fieldwork, in British Columbia (1900–01) and southeastern Alaska (1903–04), resulted in more than 20 monographs and articles on the ethnology, folklore, and languages of the Northwest Coast Indians. His study of one particular tribe, *Contributions to the Ethnography of the Haida* (1905), is still considered definitive. His studies also led him to oppose 19th-century views on the evolution of all societies through stages of cultural development based on certain systems of kinship.

About 1905 Swanton began studying the Indians of the Southeast. Touching on all aspects of the ethnology of the region, including linguistic and theoretical problems, he largely developed the modern techniques of historical anthropology. In 16 lengthy monographs and some 100 articles, he recorded virtually everything known on the history, movements, material culture, social organization, religion, and languages of a number of the Siouan and Muskhogean tribes, including the Natchez, Chitimacha, Caddo, Creek, Choctaw, and Chickasaw. Among his major works are *Final Report of the United States DeSoto Expedition Commission* (1939), *Indians of the Southeastern United States* (1946), and *The Indian Tribes of North America* (1952).

**SWAPO:** *see* South West Africa People's Organization.

**Swartberg,** also spelled SWARTBERGE, mountain range in Western Cape province, South Africa, extending east-west for 150 mi (240 km) from near the town of Willowmore to the edge of the Witteberge, roughly parallel with the Indian Ocean coast. The Swartberg is the barrier dividing the semiarid Great Karoo (north) and Little Karoo (south) plateaus. Highest elevations range from between 5,500 and 7,500 ft (1,650 and 2,300 m). Small reservoirs amid the peaks supply water to adjacent lowland areas; and gorges, secluded valleys,

sheer rock faces, and caves are popular with the adventuresome.

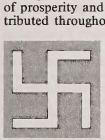
**Swarthmore,** borough, Delaware county, southeastern Pennsylvania, U.S. It is a southwestern suburb of Philadelphia. The community developed around Swarthmore College, which was founded in 1864 by the Hicksite body of the Society of Friends (nonsectarian since 1911) and named for Swarthmore Hall, home of George Fox, the society's founder. The system of honours courses was initiated at the college in 1921 by Frank Aydelotte (1880–1956), later president of the college. The restored Benjamin West House (1724), birthplace of the celebrated artist, is on the campus. Inc. 1893. Pop. (1994 est.) 6,148.

**Swartkrans,** one of three neighbouring South African sites where important fossil hominid remains have been found. *See* Sterkfontein.

**Swartz, Olof** (b. Sept. 21, 1760, Norrköping, Sweden—d. Sept. 19, 1818, Stockholm), Swedish botanist.

Swartz received his doctorate from the University of Uppsala in 1781. In 1783 he traveled to North America and the West Indies to collect specimens. He is best known for his taxonomic studies and for his work on pteridophytes (spore-bearing plants).

**swastika,** equilateral cross with arms bent at right angles, all in the same rotary direction, usually clockwise. The swastika as a symbol of prosperity and good fortune is widely distributed throughout the ancient and modern



Crux gammata (swastika)

world. The word is derived from the Sanskrit *svastika,* meaning "conducive to well-being." It was a favourite symbol on ancient Mesopotamian coinage. In Scandinavia the left-hand swastika was the sign for the god Thor's hammer. The swastika also appeared in early Christian and Byzantine art (where it became known as the gammadion cross, or crux gammata, because it could be constructed from four Greek gammas [Γ] attached to a common base), and it occurred in South and Central America (among the Maya) and in North America (principally among the Navajo).

In India the swastika continues to be the most widely used auspicious symbol of Hindus, Jainas, and Buddhists. Among the Jainas it is the emblem of their seventh Tirthankara (saint) and is also said to remind the worshiper by its four arms of the four possible places of rebirth—in the animal or plant world, in hell, on Earth, or in the spirit world.

The Hindus (and also Jainas) use the swastika to mark the opening pages of their account books, thresholds, doors, and offerings. A clear distinction is made between the right-hand swastika, which moves in a clockwise direction, and the left-hand swastika (more correctly called the *sauvastika*), which moves in a counterclockwise direction. The right-hand swastika is considered a solar symbol and imitates in the rotation of its arms the course taken daily by the Sun, which in the Northern Hemisphere appears to pass from east, then south, to west. The left-hand swastika more often stands for night, the terrifying goddess Kālī, and magical practices.

In the Buddhist tradition the swastika symbolizes the feet, or the footprints, of the Buddha. It is often placed at the beginning and end of inscriptions, and modern Tibetan Buddhists use it as a clothing decoration. With the spread of Buddhism, the swastika passed into the iconography of China and Japan, where it has been used to denote plurality, abundance, prosperity, and long life.

In Nazi Germany the swastika (German: *Hakenkreuz*), with its oblique arms turned clockwise, became the national symbol. In 1910 a poet and nationalist ideologist Guido von List had suggested the swastika as a symbol for all anti-Semitic organizations; and when the National Socialist Party was formed in 1919–20, it adopted it. On Sept. 15, 1935, the black swastika on a white circle with a red background became the national flag of Germany. This use of the swastika ended in World War II with the German surrender in May 1945, though the swastika is still favoured by neo-Nazi groups.

**Swāt River,** river in northern Pakistan, formed by the junction of the Gabrīāl and Ushu rivers at Kālām in the Kohistān region. Fed by melting snow and glaciers and receiving the drainage of the entire Swāt River valley, the river flows southward, then westward, until joined by the Panjkora River. The united stream then flows southwestward into the Peshāwar Plain and joins the Kābul River at Nisatta after a 200-mile (320-kilometre) course. The Swāt canals irrigate about 160,000 acres (65,000 hectares) in which sugarcane and wheat are the chief crops.

**Swatow,** Chinese (Wade-Giles) SHAN-T'OU, or (Pinyin) SHANTOU, city in eastern Kwangtung *sheng* (province), southern China. Swatow lies on the coast of the South China Sea a few miles west of the mouth of the Han River, which, with its tributary, the Mei River, drains most of eastern Kwangtung. The Han forms a delta, and Swatow is on an inlet that extends some 9.5 miles (15 km) inland on the southwest part of the delta. The city stands at the narrow seaward end of this inlet, where the delta on the north shore approaches the rocky promontory to the south. The harbour is impeded by a sandbar and is subject to irregular weather and typhoons. In 1922 a typhoon wrecked the port and killed some 50,000 people. In spite of these disadvantages, Swatow is the regional centre and chief port for the eastern part of Kwangtung. The Han is navigable by shallow-draft boats to Hsingning, some 20 miles (32 km) above Mei-hsien.

Until the 19th century, Swatow was only a small fishing village subordinate to the county of Ch'ao-hai. In 1858 Ch'ao-an, a few miles up the Han River, was designated a treaty port; Swatow was opened two years later as its outport. It then developed rapidly into a major port and centre of transportation and commerce. By the 1930s Swatow had an enormous junk trade with various ports on the coasts of Fukien and Kwangtung provinces, ranking second only to Canton among the southern Chinese ports. Swatow was also one of the principal ports from which Chinese emigrants went to Southeast Asia. It has been calculated that some 2,500,000 emigrants left Swatow in 1880–1909. During the second Sino-Japanese War (1937–45), the port was seriously damaged by Japanese bombardments in 1938 and was captured by the Japanese in 1939, remaining in their hands until 1945.

Swatow obtained its first railway—a short line running to Ch'ao-an—as early as 1906. It proved, however, to be uncompetitive with local junk traffic and fell into disrepair in the 1930s, as also did a narrow-gauge line to nearby Ch'eng-hai. Swatow thus depends on the Han River and on a reasonably good highway system to give it access to its very considerable hinterland, which includes parts of southern Kiangsi and southwest Fukien provinces, as well as eastern Kwangtung.

Swatow's principal exports are sugar, fruit, canned goods, and marine products. There has been much industrial development since 1949, with an unusually diversified range of industry. The major industries are food processing and canning, rice milling, and tobacco manufacture. There is also an engineering and shipbuilding industry, and chemicals are manufactured. Pop. (1990) 578,630.

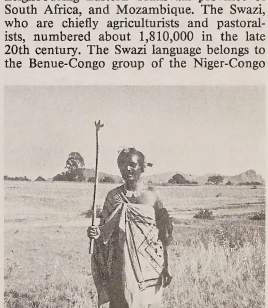
**Swatow wares,** various types of porcelain produced mostly in Fukien province, southeastern China, during the 16th and 17th centuries. Most pieces were exported to Japan, Southeast Asia, India, and the Middle East; some went to the European market. At one time it was believed that this porcelain was shipped from the port of Swatow; contemporary records, however, do not bear this out. Most pieces are large plates and bowls, decorated in underglaze blue, although some are decorated with overglaze red, green, and turquoise; there was also a limited use of black. The decoration is loosely drawn, with an uninhibited, spontaneous quality that appeals to the modern eye.

**Swayne, Noah H.,** in full NOAH HAYNES SWAYNE (b. Dec. 7, 1804, Frederick county, Va., U.S.—d. June 8, 1884, New York, N.Y.), associate justice of the United States Supreme Court (1862–81).

Swayne chose the law after briefly studying medicine and was admitted to the bar in 1823. He immediately moved from Virginia to Ohio because of his antislavery views and set up a successful practice at Coshocton. He was appointed county prosecuting attorney in 1826 and was elected to the legislature as a Jacksonian Democrat in 1829. In 1830 President Andrew Jackson appointed him U.S. attorney for the Ohio district. He moved to Columbus, where he practiced for the next 31 years.

Swayne was appointed to the U.S. Supreme Court by President Abraham Lincoln in 1862 at the urging of his predecessor John McLean and of the Ohio congressional delegation. He was a diligent worker and an ardent supporter of expanded federal powers. His most notable opinions were in *Gelpcke* v. *City of Dubuque,* in which the court declared that general judicial principles take precedence over the decisions of local tribunals in federal judicial review, and *Springer* v. *United States* (1881), which upheld the constitutionality of a federal income tax imposed during the Civil War.

**Swazi,** Bantu-speaking people inhabiting the tree-studded grasslands of Swaziland, the neighbouring Eastern Transvaal province of South Africa, and Mozambique. The Swazi, who are chiefly agriculturists and pastoralists, numbered about 1,810,000 in the late 20th century. The Swazi language belongs to the Benue-Congo group of the Niger-Congo



Swazi in typical dress

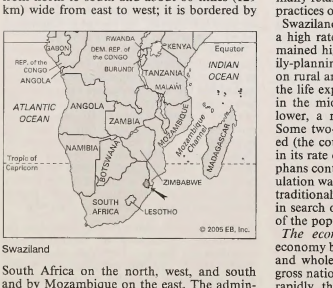
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languages; with the Zulu and the Xhosa, the Swazi form the southern Nguni ethnolinguistic group.

In Swazi culture the highest traditional political, economic, and ritual powers are shared between a hereditary male ruler and his mother or a mother substitute. Polygyny is the traditional ideal, each marriage involving the payment of a bride-price. The king's wives and children are settled in royal villages, diplomatically dispersed throughout the territory. In Swaziland many national officials are drawn from dominant clans, but a balance is maintained in central and local government between this aristocratic element and representatives of commoners. In South Africa a system of regional authorities is subdivided into tribal authorities, each of which has its own chief. Cutting through local and kinship bonds is a system that classifies men by age groups, reorganized every five to seven years, and that requires of them labour and other services. Among non-Christians, beliefs in magic and witchcraft are combined with a highly organized ancestral cult.

**Swazi** (former black state, South Africa): *see* KaNgwane.

**Swaziland,** officially KINGDOM OF SWAZILAND, Swati UMBUSO WESWATINI, landlocked country in southern Africa. The oval-shaped country is about 110 miles (175 km) long from north to south and about 80 miles (129 km) wide from east to west; it is bordered by




Swaziland

South Africa on the north, west, and south and by Mozambique on the east. The administrative and judicial capital is Mbabane, the royal capitals are Lozitha and Ludzidzini, and the legislative capital is Lobamba. Area 6,704 square miles (17,364 square km). Pop. (2003 est.) 1,007,000.

A brief treatment of Swaziland follows. For full treatment, *see* MACROPAEDIA: Southern Africa.

For current history and statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*The land.* The country can be divided into four longitudinal topographic regions from west to east. Westernmost is the Highveld, with an average elevation between 3,500 and 4,500 feet (1,100 and 1,400 m) above sea level. The Highveld covers nearly one-third of the country's total land area and includes Bulembu (Emlembe) peak (6,109 feet [1,862 m]), the highest point in the country. East of the Highveld is the Middleveld (2,000–2,500 feet [600–760 m]), covering about one-fourth of the total area. The Lowveld, or Bushveld (500–1,000 feet [150–300 m]), covering nearly two-fifths of the total area, lies to the east of the Middleveld; and east of it lies the Lubombo escarpment (2,000–2,500 feet [600–760 m]), which constitutes the remainder of the total area. The major perennial rivers, the Lomati, Usutu, Mkhondvo, and Komati, flow through all four regions in an easterly direction.

The climate varies from wet temperate, with an average of 55 inches (1,400 mm) of annual rainfall in the hilly west, to moderately dry subtropical, with 22 inches (560 mm) of annual rainfall in the east. Mean annual temperatures are 59° F (15° C) in the west and 72° F (22° C) in the east. Grasslands flourish on the higher western parts, while dry woodland savanna predominates in the lower areas of the east. Large areas in the Highveld have been planted with pine and eucalyptus trees, which provide wood pulp for the paper industry.

Swaziland's natural mineral resources are chiefly limited to asbestos and iron-ore deposits in the northwest, coal in the central east and south, and diamonds in the north. Reserves of bituminous and coking coal are sizable.

*The people.* Swaziland's population is mostly composed of ethnic Swazi, with Zulus making up the largest portion of the minority groups. The Swazi language, usually called Swati (or siSwati), belongs to the Benue-Congo group of the Niger-Congo languages. Swati and English are the official languages. Other African ethnic groups include the Tsonga as well as Shangane from Mozambique. Europeans consist mostly of Portuguese or English- and Afrikaans-speaking South Africans and usually are employed as farmers, miners, or professionals. Eurafricans (people of mixed European and African ancestry) and Asians are other minorities. A majority of the population is Christian, but many retain the traditional animist beliefs and practices of the rest of the population.

Swaziland's population traditionally has had a high rate of growth. Because birth rates remained high, the government continued family-planning programs into the 1980s, focusing on rural areas. At the turn of the 21st century, the life expectancy—which had been 51 years in the mid-1990s—had fallen to 41 years or lower, a result of the HIV/AIDS epidemic. Some two-fifths of the population was infected (the country was second only to Botswana in its rate of infection), and the number of orphans continued to rise. Two-fifths of the population was under 15 years of age. Many males traditionally have immigrated to South Africa in search of employment. Less than one-third of the population is urban.

*The economy.* Swaziland has a market economy based on light industries, agriculture, and wholesale and retail trade. Although the gross national product (GNP) is growing more rapidly than the population, the GNP per capita remains relatively low.

Agriculture accounts for approximately one-tenth of the gross domestic product (GDP) and employs about half the workforce. Subsistence farming predominates among the Swazi, whose chiefs allocate land; non-Swazis and Europeans control large estates, though since independence the Swazi nation has acquired a large share of this sector. Sugarcane is the chief cash crop. There is a large population of cattle, which are the traditional sign of wealth. Corn (maize) is the chief subsistence crop; cotton is also grown. Mineral industries are of declining importance.

Manufacturing industries account for approximately one-fourth of the GDP and employ about one-twentieth of the workforce. The Swaziland Industrial Development Corporation has attracted light and heavy industries to Matsapa, Manzini, and Nhlangano, and Swaziland's manufacturing sector is proportionally larger than those of most African countries. Manufactures include wood pulp, paper and paper products, textiles and clothing, food products and beverages, and metal products. Electricity is generated from domestic coal and hydroelectric power.

Swaziland belongs to the Common Monetary Area (formerly the South African Rand Monetary Area; consisting of South Africa, Namibia, Lesotho, and Swaziland) and the Southern African Customs Union. Its exports include sugar, wood and wood products, and canned fruits. Imports include machinery and transport equipment; minerals, fuels, and lubricants; manufactured items; and foodstuffs. Principal trading partners include South Africa (which receives more than three-quarters of Swaziland's exports and accounts for more than nine-tenths of its imports), Mozambique, and the United States.

*Government and social conditions.* Swaziland is a monarchy governed by traditional tribal institutions. Supreme power lies with the king, as head of state and head of government. He governs with the assistance of an appointed cabinet. The bicameral parliament, whose powers are purely advisory, consists of a 65-member House of Assembly and a 30-member Senate; it is restricted to debating government proposals and advising the king. The king appoints 10 members to the House of Assembly and 20 members to the Senate; the remaining members of the House of Assembly are elected from candidates nominated by traditional local councils. The remaining senators are elected by the House of Assembly. The judicial system comprises the High Court, the Court of Appeal, subordinate courts, and Swazi (traditional) courts.

With the rapid spread of HIV/AIDS, health conditions have worsened. Medical services are generally better than those of most other African countries, but these services are overwhelmed by the vast number of people suffering from AIDS-related illnesses. Tuberculosis and intestinal infections are also major health problems, as are malaria and malnutrition.

More than two-thirds of Swaziland's population is literate. Education is neither free nor compulsory. The educational system includes seven-year primary and five-year secondary schools and agricultural, industrial, and teacher-training colleges. The University of Swaziland was founded in 1964. There are several English-language daily newspapers and one in Swati. Both radio and television are broadcast.

*Cultural life.* The two main cultural events are the Incwala ("National Ceremony") and the reed dance (*umhlanga*), both held at the royal village of Lobamba. Traditional music plays an important part in Swazi social life. Songs, serving many purposes, are accompanied by rattles, shields (used for percussion), and buckhorn whistles and long reed flutes.

*History.* The Bantu-speaking Swazi people, according to traditional accounts, migrated southward along the coast of present-day Mozambique during the 18th century. One group headed westward up the Pongola valley, and about 1770 they established the nucleus of the Swazi nation. The ruling Dlamini clan consolidated power under King Sobhuza I in the 1820s and '30s, and his successor, Mswazi (Mswati) II, reputedly gave his name to the tribe. The Swazi conquered many of the tribes to the north but relinquished their territorial claims north of the Crocodile River to the Lydenburg Republic in 1846. It was at that time that Mswazi was compelled to seek British aid against the Zulus.

In 1888 European settlers in the area were granted a charter of self-government. Two years later the Swazi people consented to the establishment of a provisional government composed of British, South African, and Swazi representatives. The Swazi refused a proposal to institute South African administration in 1893, but the next year an agreement was signed establishing virtual administration by South Africa without annexation.

After the South African War and the institution of British control of Transvaal in 1903, its governor was empowered to administer Swaziland and to legislate by proclamation. In 1906 these powers were transferred to the high commissioner for Basutoland, Bechuana-

land (Botswana), and Swaziland. The Union of South Africa's request for control of Swaziland was rejected by the British in 1949.

In 1963 a constitution was promulgated providing limited self-government. In 1967 the Kingdom of Swaziland was proclaimed under British protection, and the next year full independence was achieved as a constitutional monarchy. Swaziland became closely linked with South Africa during the 1970s, and its participation in the South African Customs Union had a positive effect on its trade balance. In 1973 and again in 1977 King Sobhuza II dismissed the parliament and abolished the constitution, which in both cases was replaced by a new one two years later.

Swaziland's economy continued to prosper into the late 20th century, although its reliance on South Africa endured, along with its railway dependence on Mozambique for access to the sea. In 1982 King Sobhuza II, then the world's longest-reigning monarch, died at the age of 83. A teenage son, Prince Makhosetive, was named heir and, after a regency, was crowned King Mswati III in 1986. In the 1990s high rates of inflation and unemployment led to political protest.

**Swaziland System,** major division of rocks and time in southern Africa in Precambrian Time (3.96 billion to 540 million years ago). The system consists of a great thickness of sedimentary and metamorphic (altered) rocks with numerous intrusions of igneous bodies. Two major subdivisions of the Swaziland System are recognized, an Upper and a Lower series. Many of the units that constitute the Swaziland System contain mineral deposits of great value, including gold, copper, and uranium—a circumstance that has spurred intensive study and exploitation.

**sweat,** the moisture excreted in visible quantities through the openings of the sweat glands. *See* perspiration.

**sweat gland,** either of two types of secretory skin glands occurring only in mammals. The eccrine sweat gland, which is controlled by the sympathetic nervous system, regulates body temperature. When internal temperature rises, the eccrine glands secrete water to the skin surface, where heat is removed by evaporation. If eccrine glands are active over most of the body (as in horses, bears, and humans), they are major thermoregulatory devices. In other animals (dogs, cats, cattle, and sheep), they are active only on the pads of the paws or along the lip margins and may be entirely absent over the rest of the body; such animals often depend on panting for effective temperature control. Smaller mammals, such as rodents, cannot endure dehydration and hence possess no eccrine glands at all.

Apocrine sweat glands, which are usually associated with hair follicles, continuously secrete a fatty sweat into the gland tubule. Emotional stress causes the tubule wall to contract, expelling the fatty secretion to the skin, where local bacteria break it down into odorous fatty acids. In human beings, apocrine glands are concentrated in the underarm and in genital regions; the glands are inactive until they are stimulated by hormonal changes in puberty. In other mammals, apocrine glands are more numerous. Certain specialized glands, such as mammary glands, wax-secreting glands of the ear canal, and many mammalian scent glands, probably developed from modified apocrine glands.

**sweater,** outer garment, usually knitted or crocheted, that is worn on the upper part of the body, either pulled over the head or buttoned down the front or back. Although hand knitting of wool had been practiced for about 2,000 years, it was not until the 15th century that the first knitted shirts or tunics were produced on the English Channel islands of Guernsey and Jersey; hence the English name jersey. The knitted garments were made by the wives of fishermen and sailors from natural wool, which, by retaining its oil, protected against the cold even when damp. The use of the jersey spread throughout Europe, especially among workingmen. In the 1890s it was adopted by athletes in the United States and called a sweater.

The first sweaters were heavy, dark blue pullovers, worn before and after athletic contests to protect against cold. By the 1920s designers such as Jeanne Lanvin and Gabrielle ("Coco") Chanel introduced sweaters into their collections. Throughout the 20th century, sweaters in a variety of designs, knitted from natural and synthetic fibres, were worn by men, women, and children.

**sweating sickness,** also called ENGLISH SWEAT, a disease of unknown cause that appeared in England as an epidemic on six occasions—in 1485, 1506, 1517, 1528, 1551, and 1578. It was confined to England, except in 1528–29, when it spread to the European continent, appearing in Hamburg and passing northward to Scandinavia and eastward to Lithuania, Poland, and Russia; the Netherlands also were involved, but the disease did not spread to France or Italy.

Apart from the second outbreak, all the epidemics were severe, with a very high mortality rate. The disease was fully described by the physician John Caius, who was practicing in Shrewsbury in 1551 when an outbreak of the sweating sickness occurred. His account, *A Boke or Counseill Against the Disease Commonly Called the Sweate, or Sweatyng Sicknesse* (1552), is the main source of knowledge of this extraordinary disease.

The illness began with rigors, headache, giddiness, and severe prostration. After one to three hours, violent, drenching sweat came on, accompanied by severe headache, delirium, and rapid pulse. Death might occur from 3 to 18 hours after the first onset of symptoms; if the patient survived for 24 hours, recovery was usually complete. Occasionally there was a vesicular rash. Immunity was not conferred by an attack, and it was not unusual for patients to have several attacks. Each epidemic lasted for only a few weeks in any particular locality.

Since 1578 the only outbreaks of a disease resembling the English sweat have been those of the Picardy sweat, which occurred frequently in France between 1718 and 1861. In this illness, however, there was invariably a rash lasting for about a week, and the mortality rate was lower.

It is difficult to know what the sweating sickness really was. Caius attributed it to dirt and filth. All the epidemics occurred in late spring or summer, so it may very well have been spread by insects. The disease seemed to be more severe among the rich than among the poor, and the young and healthy were frequent victims. It is unlikely to have been a form of influenza or typhus. One 20th-century writer identified it with relapsing fever, which is spread by lice and ticks and has many characteristics in common with sweating sickness. This explanation is certainly plausible. It is improbable that sweating sickness should appear as a well-defined disease and then vanish altogether, although such disappearances, while rare, are not unknown.

**sweatshop,** workplace in which workers are employed at low wages and under unhealthy or harsh conditions. In England, the word "sweater" was used as early as 1850 to describe an employer who exacted monotonous work at very low wages. "Sweating" became widespread in the 1880s throughout Britain and parts of continental Europe and in the United States, where immigrants from eastern and southern Europe provided an influx of cheap labour. An increase in industrialization in the 20th century saw sweatshops emerge in Asia and Latin America, a trend that accelerated in the 1990s with increased demand for consumer goods in the West and a lowering of international trade barriers.

Sweatshops often involve poverty-level wages, grueling hours, unsafe or unhealthy workplace conditions, and child labour (*q.v.*). Certain social and economic conditions are necessary for sweatshops to be possible: (1) a mass of unskilled, unorganized labourers, (2) management systems that neglect the worker, and (3) lack of accountability for poor working conditions, or failure of governments to intervene on the behalf of workers.

Historically, the growth of the sweatshop can be traced to homework and the development of contracting. In the homework system, members of a family receive payment for piecework done in their own home or in a residence that has been converted into a small factory. In contracting, individual workers or groups of workers agree to do a certain job for a certain price. Sometimes they carry out this contract themselves; sometimes they let it out to subcontractors at lower prices. This arrangement can lead to labour exploitation (often of women, children, and, in the developed world, of undocumented workers or recent immigrants), irregular employment, and poor quality in the final product. When trade is brisk, workers are confined for extremely long hours in seriously overcrowded workrooms. When trade is slack, the subcontractors—whose overhead costs are far lower than those of factory employers—typically dismiss workers without consideration.

One of the earliest objectives of factory and minimum-wage legislation was to improve conditions for workers, and a number of organizations, among them the International Labour Organization (*q.v.*), have been active in attempting to raise labour standards in those countries were sweatshops are still common. Although legislation had by the middle of the 20th century outlawed sweatshop practices in most developed countries, the system remained active there in larger cities, where illicit sweatshops could be hidden in economically depressed areas. Sweatshops also persisted in less-developed countries in Asia and Latin America, where industrialization, a worldwide increase in consumer demands, and the development of international free-trade agreements led to an upswing in the number of people employed at homework and in small factory shops.

In the 19th century, sweatshops were common in the manufacturing of a wide variety of products. In the late 20th century, however, sweatshops, homework, and contracting, though prevalent throughout a range of industries, were most frequent in the garment-manufacturing and shoe industries.

**Swedberg, Emanuel:** *see* Swedenborg, Emanuel.

**Sweden,** officially KINGDOM OF SWEDEN, Swedish SVERIGE, OF KONUNGARIKET SVERIGE, nation in northern Europe, located on the Scandinavian Peninsula with Norway. Sweden is about 1,000 miles (1,600 km) long from south to north and about 310 miles (500 km) wide from west to east. It is bounded by Norway (west and northwest), Finland (northeast), the Gulf of Bothnia (east), the Baltic Sea (southeast), and the North Sea (southwest). A narrow strait separates Sweden from Denmark in the far south. The capital is Stockholm. Area 173,734 square miles (449,969 square km). Pop. (2000 est.) 8,864,000.

A brief treatment of Sweden follows. For full treatment, *see* MACROPAEDIA: Sweden.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.



Sweden

Norrland, which covers about three-fifths of the country, contains Sweden's highest peak, Mount Kebne (Kebnekaise), at 6,926 feet (2,111 m) above sea level. Norrland is Sweden's main reservoir of natural resources, with vast forests and large ore deposits. Svealand is characterized by undulating glacial gravel ridges and contains most of the country's 90,000 lakes; Vänern, with an area of 2,156 square miles (5,585 square km), is Sweden's largest and Europe's third largest lake. The Småland highlands form the interior of southern Sweden and have poor and stony soils. South of them, the plains of Skåne, by contrast, have rich soils and are the country's most densely populated agricultural area. Most of Sweden's rivers originate on its mountainous northwestern spine and drain southeastward, providing hydroelectric power in some instances.

About 15 percent of Sweden lies north of the Arctic Circle, and even Stockholm, in the south, has only brief nights during the summer and equally brief periods of daylight during the winter months. The northern interior of the country receives heavy snowfall and has severe low temperatures, while in the south the winters vary more from year to year and bring milder temperatures and much less snowfall. The summers in southern and central Sweden tend to be sunny and mild. Annual precipitation varies from more than 40 inches (1,000 mm) on the western slopes of southern Sweden to less than 28 inches (700 mm) on the east coast.

Most of Sweden is dominated by forests of fir, pine, and birch, though the south has more mixed forests with some deciduous trees. Moose, roe deer, fox, and hare are found throughout the country, and herds of domesticated reindeer are kept by Lapps, or Sami, in the northern mountains. Some of Sweden's lakes have been damaged by acid rain.

Sweden's most important mineral resource is iron ore; the largest deposits are found in areas north of the Arctic Circle. The Boliden area of Norrland is also an important mining region, with deposits of gold, copper, silver, lead, and zinc. Sweden is a producer of hydroelectric power as well.

*The people.* The population of Sweden is markedly homogeneous in ethnic stock, language, and religion. The country's official language, Swedish, belongs to the North Germanic language group and is closely related to Norwegian and Danish. Since World War II notable changes have occurred in Sweden's population makeup. By the early 1990s, about one-tenth of its inhabitants were born abroad or were the children of immigrant parents. Most of the immigrants have come from other Nordic countries, with smaller numbers from Latin America, the Middle East, Yugoslavia, Turkey, and Greece. Sweden has two minority groups of indigenous inhabitants: the Finnish-speaking people of the northeast, and the Lapp (Sami) in the northern Swedish interior. About 90 percent of the population belongs to the Evangelical Lutheran Church of Sweden, the remainder being Roman Catholic, Greek Orthodox, or Muslim.

Sweden's birth and death rates are about average for western Europe, and the growth rate is slow. Sweden's population older than 60 years is larger than its population younger than 15 years. Life expectancy is 74 years for males and 80 years for females. More than 80 percent of the population live in urban centres, and the Stockholm-Göteborg-Malmö triangle in the southern part of the country is densely populated.

*The economy.* Sweden has a developed market economy that is largely based on services, heavy industries, and international trade. The gross national product (GNP) has grown more rapidly than the population, and the GNP per capita is among the highest in the world.

Agriculture accounts for less than 4 percent of the gross domestic product (GDP) and employs a comparable percentage of the work force. Only about 7 percent of the land area is tilled, and farms are small and highly mechanized. The yields of Swedish farms are among the highest in the world. Chief crops include wheat, sugar beets, barley, oats, and potatoes. Livestock breeding and raising (particularly of pigs and cattle) and milk production are highly developed.

Forests cover more than two-thirds of the land, and forestry is carried on year-round. Sweden is a major exporter of forest products. A variety of wood products, including prefabricated houses, boards, and furniture are produced. Sweden's mineral industries are dominated by the production of iron and steel, which is largely controlled by the government. Western Europe is a major market for Swedish steel. Copper is mined in large quantities. Sweden lacks fossil fuels and must import petroleum, natural gas, coal, and enriched nuclear fuel.

Manufacturing is well-developed and diversified, accounts for about 24 percent of the GDP, and employs more than one-fifth of the labour force. Heavy industries predominate, and leading manufactures include motor vehicles, aircraft, machinery, and iron and steel. The country's light engineering centres on electronics and telecommunications equipment, metal and plastic processing, and glassware. Other industries produce pharmaceuticals and medical equipment, petrochemicals, and processed foods. Electricity is generated by hydroelectric and nuclear-power plants. Tourism is also important and is based on the country's varied landscapes and attractive image abroad.

Sweden has a highly developed rail network and an extensive road and highway system; most households own at least one car. International air service is dominated by the Scandinavian Airlines System (SAS), and domestic traffic is handled by Linjeflyg (LIN). The airports in Stockholm, Göteborg, and Malmö handle international and domestic flights.

Exports account for about one-third of Sweden's GDP. The emphasis has shifted from the export of such products such as wood pulp, sawed wood, and steel to that of automobiles, telecommunications equipment, and other finished products. Germany, the United Kingdom, the United States, Norway, Finland, and Denmark together account for more than 50 percent of Sweden's export market.

*Government and social conditions.* Sweden is a constitutional monarchy with a parliamentary form of government. Its constitution dates from 1809 and was revised in 1975. The hereditary monarch is the head of state, but the position is almost wholly symbolic. Legislative power is vested in the unicameral parliament, the Riksdag. Of its 349 total seats, 310 are directly elected and the remainder are apportioned to contending parties on the basis of votes received nationally. Members serve a three-year term of office. Executive power is exercised by the Cabinet under the leadership of the prime minister, who is chosen on the basis of his ability to command a voting majority in the Riksdag. The country's most important political party, the Social Democratic Labour Party, is closely allied with the trade unions and held power throughout much of the 20th century (1932–76 and 1982–91). Sweden successfully pursued a policy of neutrality and nonalignment throughout much of the 20th century, but it actively supports the United Nations and other international organizations. It is also a major contributor of foreign aid to developing nations.

The popular image of Sweden abroad is that of a modern welfare state pursuing quasi-socialist policies to assure "cradle-to-grave" security and an egalitarian distribution of income among its people. Sweden has built one of the world's most comprehensive networks of social services, financed by means of some of the world's highest tax rates on personal incomes. The system of social security provides almost universal benefits, and compulsory health-insurance programs reimburse all but small portions of medical fees. Despite construction and renovation programs, a chronic housing shortage persists in and around the largest cities, however.

The educational system reaches virtually all the population, as illustrated by the literacy rate of 100 percent. Attendance at comprehensive schools is compulsory for nine years, beginning at the age of seven, although a shift to age six began in 1991. There are numerous major universities and specialized colleges.

Freedom of the press, first established in 1766, is now guaranteed by the 1949 Freedom of the Press Act. Sweden's per capita newspaper circulation is among the highest in the world; financial weakness, however, has caused a steady decrease in the number of newspapers since the mid-20th century. Radio and television broadcasting is monopolized under public supervision.

*Cultural life.* Aside from the success of its quasi-socialist policies in ensuring the welfare of its citizens, Sweden's most conspicuous cultural achievements in the modern period have been the plays of August Strindberg, the motion pictures of Ingmar Bergman, and the Nobel Prizes awarded annually by the Royal Swedish Academy of Sciences and other learned bodies. The country's writers in the 20th century have included the novelist Selma Lagerlöf and the poet Harry Martinson.

*History.* Early hunters migrated to Sweden across the land bridge from Europe about 12,000 BC. Food-gathering peoples spread across southern Sweden (*c.* 3500–500 BC), followed by tribes engaged in agriculture and cattle raising (*c.* 2500 BC). Trade between Sweden and the European continent commenced about 1500 BC but was interrupted by Celtic expansion about 500 BC. Iron Age culture existed for about 800 years (400 BC–AD 400), during which time trade with the Roman Empire to the south developed. The Roman historian Tacitus gave the first description of the Germanic people known as the Sviones (Swedes), who lived in east-central Sweden and who gradually subjugated the Goths of southern Sweden (*i.e.*, Götaland). During the Viking era, Swedes secured footholds in the Baltic region and eastern Russia, and they controlled the trade routes south along the Dnieper and Volga rivers to Byzantium and the Middle East.

Sweden emerged clearly in history around the 10th century. The Swedes had resisted conversion to Christianity, but in the 11th century Olof Skötkonung became the first king of Sweden to be baptized, and the country received its own archbishopric in 1164. Sweden was still a loose federation of provinces, and its monarchy was periodically wracked by struggles between rival dynasties and between the throne and the landed nobility.

In 1397 Eric of Pomerania became king of Sweden, Norway, and Denmark, ruling until 1439 in Sweden. During the late 15th and early 16th centuries, Swedish and Danish rulers vied for control of the three-kingdom monarchy. In 1523 Gustav I Vasa became ruler of an independent Sweden, establishing a lineage that lasted until 1720. At this time the Reformation reached Sweden, and Lutheranism became the state religion. Sweden emerged in the 17th century as a great Baltic power, and the most prominent of the Vasa monarchs, Gustav II Adolf, joined the German Protestants in their wars against the Austrian Roman Catholics. Sweden's decline began under Charles XII, whose invasion of Russia was defeated in 1709. Charles's death (1718) in the Great Northern War (1700–21) marked the end of Sweden's status as a great European power.

The next half century was marked by a transition from Vasa absolutism to parliamentary government, but absolutist rule returned under Gustav III (1771–92). Sweden later entered the Napoleonic Wars as an ally of Britain, but Gustav IV's poor leadership resulted in the loss of Finland to Russia in 1808. Gustav was deposed in 1809, and during a succession crisis Jean-Baptiste Bernadotte, Napoleon's marshal, was elected crown prince (1810), taking the name Charles John. Sweden united with Norway in 1815 despite the latter's opposition. In 1818 Charles John became king as Charles XIV, establishing a new dynasty. His reign (1818–44) was marked by conservatism, but his son Oscar I (reigned 1844–59) and grandson Charles XV (reigned 1859–72) introduced liberal reforms, including free enterprise and trade, compulsory education, and representational reform of the Riksdag.

In 1905 the union of the crowns of Sweden and Norway was dissolved under the reign of Oscar II. During World War I Sweden maintained its neutrality, but trade was severely disrupted, causing extreme food shortages. The interwar period was marked by the ascendance of the Social Democratic Party, which offered a comprehensive policy to fight the economic crisis of the 1930s. Sweden declared its neutrality in World War II, though it struggled to maintain this status.

Following the war, Sweden joined the United Nations but continued its neutrality by refusing membership in the North Atlantic Treaty Organization and the European Economic Community. It also resumed its program of social reform, creating a welfare state that pioneered comprehensive and far-reaching health, educational, and social-welfare assistance.

The Social Democrats dominated politics during much of the postwar period, governing continuously until 1976, when voter backlash against high taxation enabled the Centre Party to form a coalition. However, the Social Democrats returned to government in 1982, remaining there until 1991, when a severe economic recession precipitated their defeat.

The new centre-right coalition sought to deregulate the economy and reduce the government's budget deficit. By 1994, however, the Social Democrats and their allies were back in power. Despite internal opposition within his own party and Sweden's longstanding neutrality, Socialist Prime Minister Ingvar Carlsson pursued European Union (*q.v.*; EU) membership. Sweden officially joined in 1995, though it did not adopt the euro (*q.v.*), the EU's single currency, when it was launched in 1999.

**Sweden, Church of,** Swedish SVENSKA KYRKAN, established, state-supported church of Sweden; it changed from the Roman Catholic to the Lutheran faith during the 16th-century Protestant Reformation. During the 9th century, the Swedish people gradually began to accept Christianity. The first Christian missionary sent to Sweden was St. Ansgar (801–865), a Benedictine monk and first archbishop of Hamburg. Subsequently, British and German missionaries worked in Sweden but the country did not become primarily Christian until the 12th century. In 1164 Uppsala was made the seat of an archbishopric.

The Reformation in Sweden did not involve a radical break with past church practices; the episcopal form of church government and the apostolic succession of the clergy were maintained. Gustav I Vasa, king of independent Sweden (1523–60) after the Scandinavian union of Sweden, Norway, and Denmark had broken up, wished to eliminate the extensive economic power of the Roman Catholic church in Sweden. He was aided in introducing the Reformation in Sweden by his chancellor, Laurentius Andreae, who had studied on the European continent and was aware of the new religious teachings, and by Olaus Petri, the Reformer of Sweden, who had studied with Martin Luther and Philipp Melanchthon. Ties with the Roman church were gradually weakened until 1527, when the king, with the approval of the Swedish Diet, confiscated the church's property, and the Church of Sweden became independent. Some of the clergy left Sweden rather than accept Lutheranism, but gradually the new religious teachings were accepted by the remaining clergy and the people. In 1544 Sweden was officially declared a Lutheran nation.

Petri, a teacher and preacher, was pastor (1543–52) in the Storkyrkan (the Cathedral of St. Nicolas) in Stockholm, city councilman in Stockholm, and secretary (1527) and chancellor (1531) to the king. He served the Swedish Reformation in many ways. He prepared a Swedish New Testament (1526), a hymnbook (1529), a church manual (1529), and a Swedish liturgy (1531), and he wrote several religious works. Olaus, his brother Laurentius, and Laurentius Andreae translated into Swedish the entire Bible; it was published in 1541.

Under the leadership of Laurentius Petri, first Lutheran archbishop of the Church of Sweden (1531–73), the church resisted attempts by Calvinists to influence its teachings and government. Laurentius prepared the "church order" of 1571, a book of rites and ceremonies that regulated the life of the church.

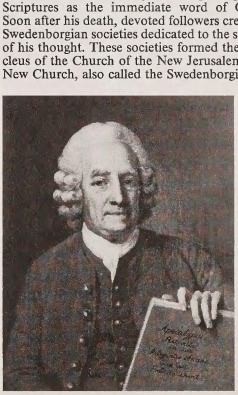
Subsequent attempts by Roman Catholics to regain power in Sweden were unsuccessful. Under King Gustav II Adolf, Lutheranism was no longer threatened, and Gustav's intervention in the Thirty Years' War has been credited with saving Protestantism in Germany.

Lutheran orthodoxy prevailed in Sweden during the 17th century. During the 18th and 19th centuries, however, Pietism, which began in Germany and emphasized personal religious experience and reform, strongly influenced Lutheranism in Sweden. As a result, educational, social-welfare, and mission activities were begun and carried on by the church. In the 20th century the church was active in the ecumenical movement. The work of Archbishop Nathan Söderblom (*q.v.*), an ecumenical leader, was eventually influential in the formation in 1948 of the World Council of Churches.

The Church of Sweden has continued as a state church, with the king as its highest authority. Other religious groups, however, have been accepted in Sweden since 1781, when an Edict of Toleration was issued. In 1952 a law was passed that allows a Swedish citizen to withdraw formally from the state church and not become a member of any church.

The country is divided into 13 dioceses, each headed by a bishop. The archbishop of Uppsala is bishop in his diocese and presiding bishop of the Church of Sweden. Bishops and archbishop are chosen by the king from candidates submitted to him by the ministers of a diocese. A synod of lay and clerical leaders of the entire church meets annually, the king having final authority to settle conflicts.

**Swedenborg, Emanuel,** original name (until 1719) EMANUEL SWEDBERG, or SVEDBERG (b. Jan. 29, 1688, Stockholm, Swed.—d. March 29, 1772, London, Eng.), Swedish scientist, Christian mystic, philosopher, and theologian who wrote voluminously in interpreting the Scriptures as the immediate word of God. Soon after his death, devoted followers created Swedenborgian societies dedicated to the study of his thought. These societies formed the nucleus of the Church of the New Jerusalem, or New Church, also called the Swedenborgians.



Swedenborg, oil painting by Per Krafft the Elder; in Gripsholm Castle, Sweden

By courtesy of Svenska Portalt arkivet, Stockholm

*Early life and works.* Swedenborg was born at Stockholm. His father, Jesper Swedberg, was a prominent member of the Swedish clergy, court chaplain, professor of theology in the University of Uppsala, and later bishop of Skara. When the family was ennobled in 1719, it took the name Swedenborg. After graduating from the University of Uppsala in 1709, Emanuel spent five years abroad. He had become fascinated by mathematics and the natural sciences, and to study them he visited England, Holland, France, and Germany, meeting some of the representatives of the new sciences there and learning practical mechanical skills. Swedenborg's inventive and mechanical genius flowered at this time, and his speculations ranged from a method of finding terrestrial longitude by the Moon to new methods of constructing docks and even to tentative suggestions for the submarine and the airplane.

He returned to Sweden in 1715 and soon began to publish that country's first scientific journal, called *Daedalus Hyperboreus,* in which he wrote numerous reports of his projects and discoveries and of the inventions of Sweden's foremost mechanical talent of the time, Christopher Polhem. King Charles XII made the young scientist an assistant to Polhem by appointing him assessor *extra ordinem* ("extraordinary") at the Royal Board of Mines. In this office, and later as assessor, he devoted himself for 30 years to the development and improvement of Sweden's metal-mining industries. At this time he devoted several years to publishing reports and treatises on various scientific and philosophical problems—*e.g.,* cosmology, corpuscular

philosophy, mathematics, and human sensory perceptions. Now and then he also found time to write poems in Latin, some of which were published. In 1718 he published the first work on algebra in the Swedish language, and in 1721 he published a work on chemistry and physics.

*Swedenborg's philosophy of nature.* Swedenborg was ennobled in 1719. After a second journey abroad in 1721–22, during which he published two Latin volumes on natural philosophy and chemistry, he wrote little or nothing for more than 10 years. But when he set out for a third European journey in 1733, it became obvious that these years had been filled with reading and reflection in addition to his ordinary work as a civil servant. In 1734 he published in Leipzig his *Opera Philosophica et Mineralia* ("Philosophical and Logical Works") in three folio volumes, the first of which, the *Principia Rerum Naturalium* ("Principles of Natural Things"), contains Swedenborg's mature philosophy of nature. In this work he reached by inductive argument several conclusions that resemble the theories of modern scientists. Swedenborg posited that matter consists of particles that are indefinitely divisible, and that these particles are in constant vortical (swirling) motion. Furthermore, these particles are themselves composed of smaller particles in motion. This idea strongly resembles the modern conception of the atom as described in terms of a nucleus and its electrons. Swedenborg's suggestion concerning the formation of planets in the solar system was a precursor of the Kant–Laplace nebular theory (*i.e.,* that the Sun and planets come from a common nebula).

*Investigation of "the Kingdom of the Soul."* After he published the *Principia* and a small work on the infinite in 1734, Swedenborg returned home. His father died in 1735, and in the next year he was granted a new leave of absence from his office as assessor. This time he went to France, Italy, and Holland. In Amsterdam he completed and published a new work in two great volumes, called *Oeconomia Regni Animalis* (1740–41; *The Economy of the Animal Kingdom*), and in November 1740 he was back in Stockholm.

*Oeconomia Regni Animalis* represents a new stage in Swedenborg's scientific career. As he had sought to find the "soul" of creation in pure motion, he now sought to understand the soul of man and to find it in its own kingdom—*i.e.,* the body. Here Swedenborg made a thorough study of human anatomy and physiology, with special attention to the blood and the brain. But he was not studying the human body as a subject per se. What he intended was to fulfill a program that he had formulated in 1734—*i.e.,* to prove the immortality of the soul to the senses themselves. He believed the soul to be the inmost life of the blood and located in the brain, specifically in the cellular cortex. Swedenborg's method as a researcher consisted mainly in collecting facts from microscopists and experimentalists and drawing his own conclusions from them. His energy and his erudition were overwhelming, and he has been given credit for some contributions to the localization of the mental processes. His anatomical works, however, remained almost unnoticed by contemporary science, and, when they were discovered by some 19th-century scholars, science had moved beyond them. *Oeconomia Regni Animalis* was followed by a whole series of sketches and small treatises in which Swedenborg attempted to round out his psychological investigations. Some of these became a part of the three volumes of the *Regnum Animale* (*The Animal Kingdom,* 2 vol.)—planned to be 17 volumes—that Swedenborg himself published in 1744–45.

*Swedenborg's religious crisis.* These years of anatomical research were concluded by a painful religious crisis from which there survives a unique document. It is usually called the *Journal of Dreams* (1743–44) and was obviously meant to be a journal of his new travels beginning in July 1743, but the rather trivial notices were suddenly interrupted. There follows instead a list of various dreams recalled from earlier years and a detailed report on his spiritual experiences, mostly at night, from March to October 1744. Some of the dreams were of a grossly sexual character and caused many pious readers quite a shock when the journal was published in 1859. But the feelings of guilt Swedenborg evidently experienced at this time were not concentrated on his sexual impulses but rather on his intellectual pride, his burning ambition to be recognized as a great man of science. On April 7, 1744, he had his first vision of Christ, which gave him a temporary rest from the temptations of his own pride and the evil spirits he believed to be around him. A definite call to abandon worldly learning occurred in April 1745, Swedenborg told his friends in his later years. The call apparently came in the form of a waking vision of the Lord. Swedenborg thereafter left his remaining works in the natural sciences unfinished.

*His theology.* For the remainder of his long career, Swedenborg devoted his enormous energy to interpreting the Bible and to relating what he had seen and heard in the world of spirits and angels. From 1749 to 1771 he wrote some 30 volumes, all of them in Latin and the major part anonymously. Among these were *Arcana Coelestia,* 8 vol. (1749–56; *Heavenly Arcana*) and *Apocalypsis Explicata,* 4 vol. (1785–89; *Apocalypse Explained*), which contain his commentaries on the internal spiritual meaning of Genesis and Exodus and on the Book of Revelation, respectively. *De Coelo et ejus Mirabilibus et de Inferno* (1758; *On Heaven and Its Wonders and on Hell*) is perhaps his best-known theological work. He gave an admirably clear summary of his theological thinking in his last work, the *Vera Christiana Religio* (1771; *True Christian Religion*), which was written when he was 83.

Swedenborg asserted that his entry into the field of theological study was in response to a divine vision and call; that his spiritual senses were opened so that he might be in the spiritual world as consciously as in the material world; and that the long series of exegetical and theological works that he wrote constituted a revelation from God for a new age of truth and reason in religion. Furthermore, he held that this new revelation of God was what was meant by the Second Coming. Because of his otherworldly experiences, Swedenborg has often been regarded either as a spiritualist "medium" or as a mystic, but in his dry, matter-of-fact accounts of the spiritual world and in his acutely reasoned theology he actually retains his lifelong attitude of the scientific and philosophic investigator.

Swedenborg consistently maintained that the infinite, indivisible power and life within all creation is God. In his theology he asserts the absolute unity of God in both essence (*essentia*) and being (*esse*). The Father, the Son, and the Holy Spirit represent a trinity of essential qualities in God; love, wisdom, and activity. This divine trinity is reproduced in human beings in the form of the trinity of soul, body, and mind. Swedenborg accepted that all creation has its origin in the divine love and wisdom and asserted that all created things are forms and effects of specific aspects of that love and wisdom and thus "correspond," on the material plane, to spiritual realities. This true order of creation, however, has been disturbed by man's misuse of his free will. He has diverted his love from God to his own ego, and thus evil has come into the world.

In order to redeem and save mankind, the divine being of God had to come into the world in the material, tangible form of a human being—*i.e.,* Jesus Christ. Christ's soul partook of the divine being itself, but in order that there might be an intimate contact of God with fallen mankind, Jesus assumed from Mary a body and a human nature comprising all the planes of human life. During the course of his life on earth, Jesus resisted every possible temptation and lived to their divine fullness the truths of the Word of God; in so doing he laid aside all the human qualities he had received from Mary, and his nature was revealed as the divine embodiment of the divine soul. Redemption, for Swedenborg, consisted in mankind being re-created in God's image through the vehicle of Christ's glorification. It was through the example of Christ's victory over all temptation and all evil that men could achieve a similar harmonious unification between their spiritual and their material aspects. Swedenborg rejected the tripersonalism of the orthodox doctrine of the Trinity (*i.e.,* the one God revealed in the Persons of Father, Son, and Holy Spirit). To him the Trinity was in one Person, the Father being the originating divine being itself, the Son the human embodiment of that divine soul, and the Holy Spirit the outflowing activity of Jesus, or the "Divine Human."

Swedenborg also rejected the orthodox conceptions of redemption. To him the redemption of mankind represented a deliverance from the domination of evil. The hells, which are the communities of the spirits of evil men in the spiritual world, were aspiring to force themselves upon men's minds, destroying their freedom to discern between truth and falsity and therefore between good and evil. By admitting into himself the evil spirits' temptations and by his complete resistance to them, Jesus broke their power; and the inflowing of the divine being into the human plane thus perfected interposed an eternal and infinitely powerful barrier between the hells and mankind. Human beings are thus saved from the forcible imposition of the hells upon themselves and are thus free to know and obey the truth. Man's salvation depends on his acceptance and response to divine truth.

In his massive exegetical and theological volumes, Swedenborg attempted to interpret the Scriptures in the light of the "correspondence" between the spiritual and the material planes. He viewed references in the Bible to mundane historical matters as symbolically communicated spiritual truths, the key to which he tried to find through detailed and voluminous commentaries and interpretations. Swedenborg died in London in 1772, where he was buried in the Swedish Church. At the request of the Swedish government, his body was removed to Uppsala cathedral in 1908.

*Influence.* Swedenborg never acted as a preacher but rather relied totally on the effect of his huge Latin volumes. The first Swedenborgian societies appeared in the 1780s, and the first independent congregation, the origin of the various Church of the New Jerusalem organizations, was founded in London by the end of that decade. Swedenborg's influence was by no means restricted to his immediate disciples. His visions and religious ideas have been a source of inspiration for a number of prominent writers, including Honoré de Balzac, Charles Baudelaire, Ralph Waldo Emerson, William Butler Yeats, and August Strindberg. His theological writings have been translated into many languages, and there is a constant flow of new editions.

BIBLIOGRAPHY. The greater part of Swedenborg's manuscripts, preserved in the library of the Royal Swedish Academy of Science in Stockholm, were lithographically published in 10 vol. in 1869–70, and in an 18-volume edition in 1901–16. Unfortunately, these editions cannot stand up to the demands of modern scholarship. Most of the biographical sources were collected, translated, and

annotated by R.L. Tafel in *Documents Concerning the Life and Character of Emanuel Swedenborg*, 2 vol. (1875–77). His letters have been published in English translation in A. Acton (ed.), *Letters and Memorials*, 2 vol. (1948–55).

For supplementary material, see E.J. Dingwall, *Very Peculiar People: Portrait Studies in the Queer, the Abnormal, and the Uncanny*, pp. 11–68 (1962); J. Hyde, *A Bibliography of the Works of Emanuel Swedenborg* (1906); I. Jonsson, *Emanuel Swedenborg* (Eng. trans. 1971); M. Lamm, *Swedenborg* (1915), in Swedish; Cyriel O. Sigstedt, *The Swedenborg Epic; The Life and Works of Emanuel Swedenborg* (1952, reprinted 1971); and Signe Toksvig, *Emanuel Swedenborg, Scientist and Mystic* (1948, reprinted 1972).

**Swedenborgians:** *see* New Church.

**Swedish language,** Swedish SVENSKA, national language of Sweden and, with Finnish, one of the two official languages of Finland. Swedish belongs to the East Scandinavian group of North Germanic languages. Until World War II, it was also spoken in parts of Estonia and Latvia. Swedish was spoken by about 9 million people in the early 21st century. It is closely related to Norwegian and Danish.

The history of Swedish from the Common Scandinavian period (600–1050) until about 1225 is known chiefly from numerous runic inscriptions. Radical changes took place in the language, especially in the sound system, during the 14th and 15th centuries. Modern Swedish is usually dated from 1526, when a translation of the New Testament was first printed. The standard language began to emerge in the 17th century, formed principally on the Svea dialects spoken in Stockholm and around Lake Mälar but with some features from the Göta dialects. The Swedish Academy, founded in 1786, published a Swedish grammar in 1836 and the first installment of a dictionary in 1898 (still in progress).

A characteristic of Swedish grammar, shared with the other Scandinavian languages, is enclitic definite articles, the placement of the definite article after the noun. Standard Swedish has no case endings in nouns except for the possessive *s* (as in English) and has only two genders (neuter, common). In most dialects, however, three genders (masculine, feminine, neuter) are still differentiated. Swedish has a tone or pitch accent, described by many speakers of English as a singsong rhythm. The vocabulary contains many loanwords from Low German and High German and, more recently, from French and English.

**Swedish literature,** the body of writings in the Swedish language.

A brief treatment of Swedish literature follows. For full treatment, *see* MACROPAEDIA: Scandinavian Literature.

Swedish literature had its beginnings in the 13th century, when Old Swedish became a language distinct from the common Norse that previously had been spoken throughout Scandinavia. The development of medieval Swedish literature was hindered by the country's gradual conversion to Catholic Christianity from the 11th century onward; this meant that Latin became the vehicle of much contemporary writing.

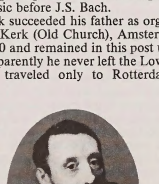
Swedish vernacular literature came into its own in the 16th century with Sweden's ardent adherence to the Protestant Reformation. The most important literary event of the period was the complete translation of the Bible into Swedish in 1541; this event inaugurated modern Swedish and provided an inexhaustible source of imagery, motifs, and metaphors for subsequent Swedish writers. During the ensuing centuries Swedish literature reflected the contemporaneous literary fashions of Europe. Georg Stiernhielm's epic *Hercules* (1658) had a great influence on later poets, and Stiernhielm is regarded as "the father of Swedish poetry." Olof von Dalin was the foremost literary representative of the Enlightenment as it affected 18th-century Sweden. Other prominent literary figures during the 18th century included the academic poet Johan Henrik Kellgren, the naturalist Carl von Linné (Carolus Linnaeus), and the mystical theologian Emanuel Swedenborg. Carl Michael Bellman was the outstanding Swedish lyric poet of the 18th century.

As elsewhere in Europe, Neoclassicism in Sweden gradually gave way to Romanticism in the early 19th century. Swedish Romanticism was as much dominated by German developments as Swedish Neoclassicism had been dominated by French models. Romanticism manifested itself in Sweden in an ardent national spirit and in a renewed interest in Sweden's past and traditions.

In the late 19th century Romanticism yielded to realism, and at this time Sweden produced a figure of world importance in the playwright August Strindberg. Strindberg's work marks the beginning of modern Swedish literature, and Strindberg himself remains the greatest writer Sweden has ever produced. In the 20th century Sweden produced such noted writers as the novelists Selma Lagerlöf and Hjalmar Bergman and the poet and novelist Pär Lagerkvist.

**Sweelinck, Jan Pieterszoon** (b. April 1562, Amsterdam, Neth.—d. Oct. 16, 1621, Amsterdam), Dutch organist and composer, one of the principal figures in the development of organ music before J.S. Bach.

Sweelinck succeeded his father as organist of the Oude Kerk (Old Church), Amsterdam, in about 1580 and remained in this post until his death. Apparently he never left the Low Countries and traveled only to Rotterdam and Antwerp.



Sweelinck, detail of an oil painting on wood by Gerrit Sweelinck; in the Haags Gemeentemuseum, The Hague

By courtesy of the Haags Gemeentemuseum, The Hague

Although he composed much sacred and secular vocal music in the polyphonic traditions of France and the Netherlands (including the *Chansons,* the *Cantiones sacrae*, and settings of the Psalms), Sweelinck was chiefly known as an organist and keyboard composer. His keyboard music includes chorale variations, toccatas and fantasias showing the influence of the Venetian organ school, and sets of variations on secular tunes.

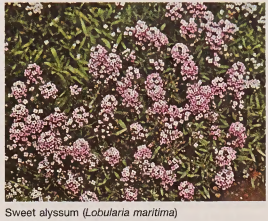
Sweelinck's fantasias are among the first organ fugues in which a single theme is subjected to augmentation, diminution, and changes of rhythm and combined with counterthemes. His secular variations drew upon popular tunes of several European countries; an example is the set of variations on *Mein junges Leben hat ein End'.*

It is possible that Sweelinck met the English composers John Bull and Peter Philips during their visits to the Low Countries; Bull's "Fantasia on a Theme of Sweelinck" was the tribute of one keyboard virtuoso to another. Sweelinck's keyboard playing was widely known. His organ pupils included the German composers Samuel Scheidt and Heinrich Scheidemann; Scheidemann's pupil J.A. Reinken handed on this tradition of organ playing to the Danish organist Dietrich Buxtehude. Many outstanding organists of the following generation, particularly in northern Germany, were pupils of Sweelinck; Handel and Bach were influenced by this northern German school of organ playing.

**sweeper,** any of the fishes of the genera *Parapriacanthus* and *Pempheris,* in the family Pempheridae (order Perciformes), all of which occur in marine or brackish waters in the Pacific, Atlantic, and Indian oceans. Sweepers have elongate-oval, compressed bodies with well-developed fins and tail. The eyes are unusually large. A few species have luminescent organs along the body. The glassy sweeper (*Pempheris schomburgki*) of the western Atlantic is the only representative along the North American coasts. No species occur in the eastern Atlantic.

*Consult the* INDEX *first*

**sweet alyssum,** also called SWEET ALISON (*Lobularia maritima; Alyssum maritimum* of some authorities), low, matting, short-lived perennial herb of the mustard family (Brassicaceae), native to the Mediterranean region.



Sweet alyssum (*Lobularia maritima*)

Joan E. Hahn—EB Inc.

Sweet alyssum is widely grown for its honey-sweet, small, clustered, white, four-petaled flowers.

The narrow, gray-green leaves are untoothed and usually bear many silvery hairs. The flowering stalks rise to 30 cm (about 1 foot), with the small, round seedpods developing on the stems below the flower heads. There are horticultural forms with lavender, pink, or purple flowers.

**sweet birch** (*Betula lenta*), also called BLACK BIRCH, CHERRY BIRCH, and RED BIRCH, North



Sweet birch (*Betula lenta*)

Walter Chandoha

American ornamental and timber tree in the family Betulaceae. Usually about 18 m (60 feet) tall, the tree may reach 24 m or more in the southern Appalachians; on poor soil it may be stunted and shrublike.

The smooth, shiny, nonpeeling outer bark, red brown on younger stems, is almost black on older trunks and deeply furrowed into irregular scales. The twigs and inner bark smell and taste like wintergreen.

The hard, close-grained wood is similar to that of yellow birch but denser and of deeper colour; both are used for veneer, flooring, furniture, doors, plywood, and vehicle parts. Sweet birch is a source of birch oil, formerly a substitute for oil of wintergreen. Birch beer is made from the sap.

**sweet corn:** *see* corn.

**sweet gum,** any of about four species of the genus *Liquidambar,* a genus of trees in the witch hazel family (Hamamelidaceae) native to North America and Asia that are valued for resin, timber, and ornament.



Sweet gum (*Liquidambar styraciflua*)
John H. Gerard from the National Audubon Society Collection/Photo Researchers

Sweet gum trees have alternate, sharply (three- to seven-lobed) palmate leaves and bear upright spikes of greenish male flowers and round, drooping clusters of female flowers on the same tree. Spiny, dark-brown balls of seeds develop and often persist through the winter. The American sweet gum, or bilsted (*L. styraciflua*), which sometimes reaches 45 metres (150 feet) in moist lowlands but is usually half that height at maturity, is grown for its handsome foliage, shade, and scarlet autumnal colour. It is also valued for its heartwood, called red gum or satin walnut, which is used for quality furniture. The trees are tapped for liquidambar balm, though a more fragrant gum is collected from the Oriental sweet gum (*L. orientalis*). The Formosan gum (*L. formosana*), with three-lobed leaves, is widely grown as a garden tree in mild climates.

*Consult the* INDEX *first*

**sweet pea** (*Lathyrus odoratus*), annual plant, of the pea family (Fabaceae), native to Italy and widely cultivated in other regions for its beautiful, fragrant flowers. The vinelike stem, which climbs by means of tendrils, is 1.2–1.8 metres (4–6 feet) long. The alternate leaves are pinnately compound (feather-like in form). The flowers, commonly white, pink, red, violet, or purple and up to 5 centimetres (2 inches) across, are borne singly or in clusters

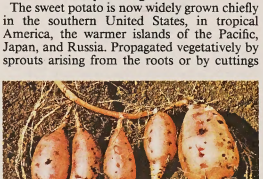


Sweet pea (*Lathyrus odoratus*)
Sven Samelius

of two to four. The fruit is a hairy pod about 5 cm long. Hundreds of varieties of sweet pea have been developed.

**sweet potato** (*Ipomoea batatas*), food plant of the morning glory family (Convolvulaceae), native to tropical America and widely cultivated in tropical and the warmer temperate climates. The sweet potato must not be confused with the common, white, or Irish potato (*see* potato; genus *Solanum,* family Solanaceae) or with the yam (*q.v.*; genus *Dioscorea,* family Dioscoreaceae), to which it is botanically unrelated. Sweet potato stems are usually long and trailing and bear lobed or unlobed leaves that vary in shape. The flowers, borne in clusters in the axils of the leaves, are funnel shaped and tinged with pink or rose violet. The edible part is the much-enlarged tuberous root, varying in shape from fusiform to oblong or pointed oval. Root colours range from white to orange, and occasionally purple inside, and from light buff to brown or rose and purplish red outside. The pulp consists largely of starch, and orange-fleshed varieties are high in carotene. Sweet potatoes are served as a cooked vegetable, in whole or mashed form, and are used as pie filling.

The sweet potato is now widely grown chiefly in the southern United States, in tropical America, the warmer islands of the Pacific, Japan, and Russia. Propagated vegetatively by sprouts arising from the roots or by cuttings



Sweet potato (*Ipomoea batatas*)
Shunji Watari

of the vines, it is best adapted to light, friable soils such as sandy loams. At least four to five months of warm weather are required for large yields. In Japan the crop has long been grown for drying and for manufacture of starch and alcohol.

**sweet potato** (musical instrument): *see* ocarina.

**sweet shrub,** any member of the genus *Calycanthus* of the family Calycanthaceae, with four species of small ornamental trees with aromatic bark and sweet-scented flowers, all native to North America.

A sweet shrub has opposite, bright-green, simple, smooth-margined leaves. The petals of the brown to purple magnolia-like flowers, borne on the branch tips, are not distinct from the sepals. The pear-shaped or egg-shaped fruits contain many dry seeds (achenes). Carolina allspice (*Calycanthus floridus*), a shrub



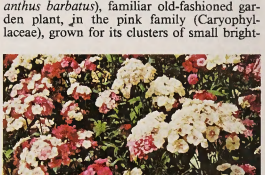
Sweet shrub (*Calycanthus*)
Arthur O. Tucker

about 3 metres (10 feet) tall, and *Calycanthus occidentalis,* a similar shrub with light-brown flowers, are cultivated in North America.

**sweet vernal grass,** also called VERNAL GRASS, any of about four species of fragrant annual and perennial grasses constituting the genus *Anthoxanthum* (family Poaceae). They are native to Europe, Asia, and North Africa.

Sweet vernal has thin, flat leaves and narrow flower clusters. Coumarin present in the leaves is released as a sweet scent in grass freshly mown for hay.

**sweet William,** also called BUNCH PINK (*Dianthus barbatus*), familiar old-fashioned garden plant, in the pink family (Caryophyllaceae), grown for its clusters of small bright-



Sweet William (*Dianthus barbatus*)
Grant Heilman

coloured flowers. It is usually treated as a garden biennial, seed sown the first year producing flowering plants the second year. The plant, growing to a height of 60 centimetres (2 feet), produces numerous flowers—white, pink, rose to violet, or sometimes bicoloured—with fringed petals.

**sweetbrier,** also called EGLANTINE (*Rosa eglanteria,* or *R. rubiginosa*), small, prickly wild rose with fragrant foliage and numerous small pink flowers. Native to Europe and western Asia, it is widely naturalized in North America, where it grows along roadsides and in pastures from Nova Scotia and Ontario southwestward to Tennessee and Kansas.

Sweetbrier can reach a height of about 2 metres (6 feet) and is useful as a screening shrub; a cultivated form, 'Duplex,' has double pink flowers. While not especially ornamental, it has been crossed with Austrian briar (*R. foetida*), to produce the Penzance hybrids with pinkish flowers with yellow centres.

Eglantine is frequently alluded to in the writings of English poets, from Chaucer onward. John Milton, in *L'Allegro,* used the term

"twisted eglantine" to denote, it is thought, the woodbine honeysuckle (*Lonicera periclymenum*), which is still called eglantine in northeastern Yorkshire.

**sweetener,** any of various natural and artificial substances that provide a sweet taste in food and beverages. In addition to their sweetening power, they may be used for such processes as food preservation, fermentation (in brewing and wine making), baking (where they contribute to texture, tenderization, and leavening), and food browning and carmelization. Natural sweeteners may be both nutritive and flavorable and thus popular both as food and flavouring. However, because common sugar and other nutritive sweeteners such as honey and corn syrup are associated with obesity and tooth decay or are even a threat to life (for diabetics), there have been efforts since the 19th century to produce nonnutritive sweeteners that are not subject to metabolism and contain little or no caloric value. Nonnutritive sweeteners, which may be either artificial (synthetic) or derived from plants, include such compounds as saccharin, aspartame, cyclamates, and thaumatin.

Sugar is a generic term for a category of carbohydrate compounds known as sucrose, or saccharose ($C_{12}H_{22}O_{11}$). A group of related compounds are corn sugar (called glucose, or dextrose), fruit sugar (fructose, or levulose), milk sugar (lactose), and malt sugar (maltose). Sucrose is a disaccharide; that is, it is made up of two simple sugars, or monosaccharides—glucose and fructose. It is one of the sweetest of sugars. If sucrose is taken as a standard of 1, the sweetness of glucose is 0.5–0.6, that of lactose is 0.27, and that of maltose is 0.6; fructose, found in fruits and honey, is the sweetest, being 1.1 to 2.0 times as sweet as sucrose.

Sucrose is commercially derived chiefly from sugarcane and sugar beets but also comes from such sources as maple trees, sugar palms (especially date palms), and sorghum. Sucrose is found in all plants: an apple is about 4 percent sucrose, 6 percent fructose, and 1 percent glucose (by weight); a grape is about 2 percent sucrose, 8 percent fructose, 7 percent glucose, and 2 percent maltose (by weight). Honey is composed principally of fructose and glucose, the composition depending on the original nectar collected by the honeybee and on the amount of processing and storage time.

In the development of low-calorie sweeteners, the problems are several and are not limited to sweetness. Some sweeteners lose their sweetness at high temperatures (making them often unsuitable in cooking) or lose the sweetness over time (giving them a short shelf life). Some nonnutritive sweeteners have an undesirable aftertaste. Sugar furthermore has functional properties not found wholly in any other sweeteners. Sugar adds bulk and texture to baked goods; it helps in forming the structure of the baked food, provides moistness, tenderness, and antitoughening characteristics, and contributes to leavening. In addition it has a preservative effect (as in jellies and preserves) and helps generally to prevent spoilage. It serves as food for fermenting organisms that are important in making such things as alcoholic beverages, breads, and pickles. In soft drinks, in addition to providing sweetness, sugar provides "mouthfeel" and body and helps to stabilize the carbon dioxide. Sugar, in sum, has many functional properties in food, and no other sweetener has so far been developed to duplicate all or even many of them.

The artificial sweetener saccharin (orthosulfobenzoic acid imide) was discovered in 1879 by two German researchers, I. Remsen and C. Fahlberg, and has about 300 to 500 times the sweetening power of cane sugar. It is manufactured on a large scale in several countries in the form of saccharin, sodium saccharin, and calcium saccharin. Although its safety was the subject of controversy during the 1970s and '80s, it is still widely used.

Cyclamates, a group of synthetic sweeteners derived from cyclohexylamine or cyclamic acid, were discovered in 1937 and are about 30 times as sweet as sucrose. Although used in several countries, cyclamates were banned in some countries (notably the United States, in 1969) after being suspected of carcinogenicity.

Aspartame, or aspartylphenylalanine (marketed as NutraSweet, Equal, Egal, or Canderal), was discovered in 1965. It has some caloric value (though negligible) and is about 150–200 times as sweet as sucrose. Its safety remains controversial, but it is now the most popular sweetening ingredient in diet soft drinks. It tends to lose its sweetness over long periods, but manufacturers have taken measures to enhance the stability through additives.

Thaumatin, a protein extracted and purified from *Thaumatococcus danielli,* a plant found in western Africa, was used widely in Japan following its approval there in 1979. It combines well with monosodium glutamate and is used in typical Japanese seasonings as well as in chewing gum.

Acesulfame potassium (marketed as Sunette) was approved in the United States in 1988. It is about 130–200 times as sweet as sucrose, has good shelf life and high stability, and was initially used in dry food mixes.

Stevioside, derived from the plant *Stevia rebaudiana,* has been used in Japan, Paraguay, and a few other countries as a low-calorie sweetener. It is about 300 times as sweet as sucrose.

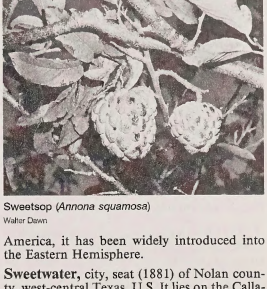
Sucralose (marketed as Splenda) is about 600 times as sweet as sucrose. It is derived from sugar and has good stability. Discovered in 1976, it was approved for use in Canada in 1991, the United States in 1998, and the European Union in 2004. Neotame, believed to be 7,000 to 13,000 times as sweet as sucrose, received U.S. approval in 2002.

In the late 20th century in the United States, high-fructose corn syrup eclipsed sucrose as the nation's leading sweetener. High-fructose corn syrup—due to its low cost, moisture retention, and solubility—was commonly used by manufacturers of soft drinks, baked goods, and frozen desserts.

**sweetfish,** also called AI, or AYU (*Plecoglossus altivelis*), delicately flavoured marine fish that migrates upstream to spawn in clear waters. It is found in East Asia and is of the family Osmeridae. The sweetfish is light yellow or olive-coloured, about 30 cm (1 foot) long, and similar to a small trout in appearance. It is distinguished by a folded tongue, a saillike dorsal fin, and teeth arranged on sawedged plates at the sides of the jaws. In Japan tame cormorants are used to catch the fish as it swims upriver.

**sweetleaf,** also called SAPPHIRE BERRY, or HORSE SUGAR (*Symplocos paniculata,* and *S. tinctoria,* respectively), either of two shrubs or small trees in the family Symplocaceae. *S. paniculata* is a shrub or small tree native to eastern Asia but cultivated in other regions. It bears white, fragrant flowers in clusters 5–7.5 cm (2–3 inches) long. The fleshy, bright blue fruit is about 1 cm in diameter. *S. tinctoria* is a shrub or small tree native to southeastern North America. The yellow, fragrant flowers are about 1 cm across and are borne in dense clusters. The oblong, orange-brown fruit is about 1 cm in diameter.

**sweetsop,** also called SUGAR APPLE (*Annona squamosa*), small tree or shrub of the custard apple, or Annonaceae, family. It has thin, oblong ovate leaves, solitary greenish flowers, and a yellowish green fruit resembling a shortened pinecone. The tuberculate fruit, the fusion of many ripened ovaries and the receptacle, is 7.5 to 10 cm (3 to 4 inches) in diameter and contains a sweet, creamy-yellow, custardlike pulp, which may be eaten raw. Native to the West Indies and tropical



Sweetsop (*Annona squamosa*)
Walter Dawn

America, it has been widely introduced into the Eastern Hemisphere.

**Sweetwater,** city, seat (1881) of Nolan county, west-central Texas, U.S. It lies on the Callahan Divide between the Colorado and Brazos rivers, about 40 miles (65 km) west of Abilene. A trading post called Blue Goose (1877) on nearby Sweetwater Creek was moved to the present site when the Texas and Pacific Railway arrived (1881). Sweetwater was incorporated in 1884, but its growth was handicapped by a severe blizzard (1885) and by a great drought (1886–87); the resulting desolation formed the background for Dorothy Scarborough's novel *The Wind* (1925). The city's recovery as a cattle, cotton, and wool centre was sustained by the arrival of the Atchison, Topeka and Santa Fe Railway (1911). Local oil resources were tapped in the 1920s, and deposits of gypsum, sand, and clay have been worked since the 1940s. The city's manufactures include apparel and electronic products. A campus of Texas State Technical College is located just west of the city.

The nearby Sweetwater, Trammell, and Oak Creek lakes are maintained for water supply and recreation. Annual fairs, expositions, and indoor rodeos are held at the Nolan County Coliseum in Newman Park, where live snakes, caught during the annual (March) Rattlesnake Roundup and used for snakebite serum and medical research, are displayed. Pioneer City County Museum displays Indian artifacts and traces the area's pioneer history. Inc. city, 1902. Pop. (2003 est.) 10,892.

**Sweetwater River,** river rising in the southern tip of Wind River Range, central Wyoming, U.S. It flows generally east for 175 miles (282 km) and empties into Pathfinder Reservoir on the North Platte River. The Oregon Trail followed the Sweetwater westward from the vicinity of Casper to South Pass. Independence Rock, a granite monolith rising 193 feet (59 m) on the north bank of the river near the reservoir, was a trail landmark. The river was supposedly named by General William Ashley in 1823 because its water tasted sweet to his trappers.

**Swein,** also spelled SWEGN (personal name): *see under* Sweyn.

**Swellendam and Graaff-Reinet,** in South Africa, historic administrative districts of the Cape of Good Hope under the rule of the Dutch East India Company. Established in 1743 and 1786, respectively, they became centres of a frontier independence movement in the 1790s. With the continuous expansion of colonial cattle farmers, the eastern frontier of Swellendam moved progressively from the

Great Brak River in 1743, to the Gamtoos (1770), and finally to the Great Fish and Bushmans rivers in 1778. Graaff-Reinet, carved out of the turbulent black-white frontier zone of Swellendam and Stellenbosch, was bounded by the Baviaans and Tarka rivers in the northeast and the Great Fish in the southeast. In 1795 the discontentment of the white inhabitants with the policies of the remote central government at Cape Town erupted in the declaration of short-lived independent republics in Swellendam and Graaff-Reinet. They were reincorporated into the Cape Colony after its conquest by the British late that year.

**swellfish:** *see* puffer.

**Swettenham, Sir Frank (Athelstane)** (b. March 28, 1850, Belper, Derbyshire, Eng.—d. June 11, 1946, London), British colonial official in Malaya who was highly influential in shaping British policy and the structure of British administration in the Malay Peninsula.

In 1871 Swettenham was sent to Singapore as a cadet in the civil service of the Straits Settlements (Singapore, Malacca, and Penang Island). He learned the Malay language and played a major role as British-Malay intermediary in the events surrounding British intervention in the peninsular Malay states in the 1870s. In 1882 he was appointed resident (adviser) to the Malay state of Selangor. He successfully promoted the development of coffee and tobacco estates in the state and helped boost tin earnings by constructing a railway from Kuala Lumpur, capital of Selangor, to the port of Klang. Subsequently he served as resident of Perak state and in 1895 secured an agreement of federation from the states of Perak, Selangor, Negri Sembilan, and Pahang; he headed the federation, with the title of resident-general. In 1897 he was knighted, and in 1901, three years before retiring, he was made high commissioner for the Malay states and governor of the Straits Settlements.

It was largely through Swettenham's efforts that the British Foreign Office reversed its policy of accepting Siamese control of the northern tier of Malay states. His portrayal of their maladministration under native rulers and his warnings of possible intervention by rival European powers led to British penetration of those states in the early 1900s.

**Sweyn,** also spelled SWEIN, or SWEGN, Danish SVEND, Norwegian SVEIN, name of rulers grouped below chronologically and indicated by the symbol •.

**•Sweyn I,** byname SWEYN FORKBEARD, Danish SVEND TVESKAEG, Norwegian SVEIN TJUGESKJEGG, or TVISKJEGG (d. Feb. 3, 1014, Gainsborough, Lincolnshire, Eng.), king of Denmark (*c.* 987–1014), a leading Viking warrior and the father of Canute I the Great, king of Denmark and England. Sweyn formed an imposing Danish North Sea empire, establishing control in Norway in 1000 and conquering England in 1013, shortly before his death.

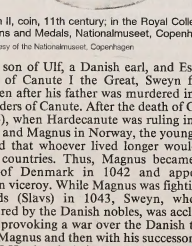


Sweyn I, coin, 10th century; in the Royal Collection of Coins and Medals, Nationalmuseet, Copenhagen
By courtesy of the Nationalmuseet, Copenhagen

The son of the Danish king Harald Bluetooth (Blåtand), Sweyn rebelled in 987 against his father, who fled to Wendland (in Germany). Sweyn began feuding with Olaf I after the latter's accession to the Norwegian throne in 995, and he allied with the Swedish king Olaf Skötkonung and with the Norwegian Erik, the earl of Lade. The three allies defeated Olaf I in the Battle of Svolder about 1000, with Sweyn becoming virtual ruler of Norway, although nominally sharing sovereignty with his allies. Sweyn then turned again to England, leading apparently punitive expeditions in 1003 and 1004 in retaliation for the St. Brice's Day massacre of Danes in England on Nov. 3, 1002.

Sweyn did not again return to England until 1013, when he led a highly successful campaign and was accepted as king throughout the country, forcing Ethelred II into exile; but he died less than a year later. Although Norway returned (1014–16) to Norwegian rule under the leadership of Olaf II Haraldsson, Sweyn's Anglo-Danish empire continued under his son and grandson until 1042.

**•Sweyn II** ESTRIDSEN, Danish SVEND ESTRIDSEN, Norwegian SVEIN ESTRIDSSON (b. *c.* 1020, Denmark—d. April 28, 1074, Denmark), king of Denmark (1047–74) who ended a short period of Norwegian domination (1042–47).



Sweyn II, coin, 11th century; in the Royal Collection of Coins and Medals, Nationalmuseet, Copenhagen
By courtesy of the Nationalmuseet, Copenhagen

The son of Ulf, a Danish earl, and Estrid, a sister of Canute I the Great, Sweyn fled to Sweden after his father was murdered in 1027 on orders of Canute. After the death of Canute (1035), when Hardecanute was ruling in Denmark and Magnus in Norway, the young kings agreed that whoever lived longer would rule both countries. Thus, Magnus became king also of Denmark in 1042 and appointed Sweyn viceroy. While Magnus was fighting the Wends (Slavs) in 1043, Sweyn, who was favoured by the Danish nobles, was acclaimed king, provoking a war over the Danish throne with Magnus and then with his successor, Harald III Hardraade (reigned 1045–66).

Although Sweyn's forces were continually defeated, Harald's troops were mainly interested in plunder and failed to conquer Denmark. The two rulers recognized each other as sovereign in their respective countries in 1064 while Harald was preparing to attack England. Strengthened by Harald's death in 1066, Sweyn sponsored a successful Danish attack on England in 1069, aiding Anglo-Saxon rebels against William I the Conqueror. Although the Danish forces achieved a favourable position, Sweyn, by an agreement with William I in 1070, withdrew his troops.

In Denmark, Sweyn worked to free the Danish Christian church from control by the archbishop of Bremen and by the English church, and he cooperated with Pope Gregory VII. Knowledgeable in history and geography, Sweyn was Adam of Bremen's main source on Scandinavian affairs in the latter's valuable *Gesta Hammahurgensis ecclesiae pontificum* (*c.* 1070–75; "History of the Archbishops of Hamburg-Bremen"). Five of Sweyn's sons succeeded to the throne, and his dynasty (the Valdemars) reigned for 300 years.

**Świdnica,** German SCHWEIDNITZ, city, Dolnośląskie *województwo* (province), southwestern Poland, on the Bystrzyca River, a tributary of the Oder. Located in the Sudeten (Sudety) foothills, the town is an economic centre for the Lower Silesia agricultural area. It has metal, chemical, wood, sugar, and textile industries.

The town began as a Slavic settlement on the crossroads of two trade routes. A castle was built there in the 12th century, and the area was annexed to the independent duchy of Świdnica in 1291. The town developed as a commercial centre until the 17th century. It passed to Prussia in 1742 and returned to Poland in 1945. Pop. (2002) 61,342.

**Świętokrzyski,** *województwo* (province), southern Poland. It is made up of the former provinces (1975–98) of Kielce and Tarnobrzeg, as well as portions of Częstochowa, Piotrków, and Radom. It comprises an upland area topped by the Świętokrzyskie Mountains, the oldest range in the country and a cradle of early Polish civilization. The mountains contain a wealth of mineral resources, such as limestone, gypsum, quartzite, sandstone, and dolomite. Not very developed by Polish standards, the economy is based on agriculture, traditional metalworking, glass and ceramics manufacturing, and power production. Industry in the region can be traced back to the Neolithic Period via ruins of a prehistoric flint mine. Main roads link the provincial capital, Kielce, to major Polish cities. A river port on the Vistula operates in Sandomierz. Other cities are Ostrowiec Świętokrzyski, Starachowice, and Skarżysko-Kamienna. Area 4,507 square miles (11,672 square km). Pop. (2003 est.) 1,294,200.

**Świętokrzyskie Mountains,** Polish GÓRY ŚWIĘTOKRZYSKIE, mountain range, part of the Wyżyna Małopolska (Polish Uplands), in south-central Poland, surrounding the city of Kielce. The highest peaks are Łysica (2,008 feet [612 m]) and Łysa Mountain (1,946 feet [593 m]), both in the Łysogóry range. The Świętokrzyskie Mountains take their name, which means "Holy Cross," from that of an old Benedictine abbey that was located on Łysa Mountain. Copper and red sandstone formerly were taken from the area, now the site of the Świętokrzyski National Park.

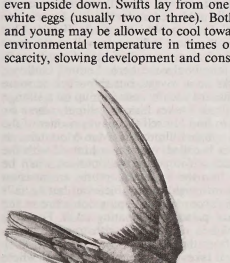
**swift,** any of about 75 species of agile, fast-flying birds of the family Apodidae (sometimes Micropodidae), in the order Apodiformes, which also includes the hummingbirds. The family is divided into the subfamilies Apodinae, or soft-tailed swifts, and Chaeturinae, or spine-tailed swifts. Almost worldwide in distribution, swifts are absent only from polar regions, southern Chile and Argentina, New Zealand, and most of Australia.

Closely resembling swallows, swifts range in length from about 9 to 23 cm (3.5 to 9 inches). They have exceptionally long wings and chunky, powerful bodies. Their compact plumage is a dull or glossy gray, brown, or black, sometimes with pale or white markings on the throat, neck, belly, or rump. The head is broad, with a short, wide, slightly curved bill. The tail, although often short, may be long and deeply forked. The feet are tiny and weak; with the aid of sharp claws they are used only to cling to vertical surfaces. A swift that lands on flat ground may be unable to regain the air. In soft-tailed forms, the hind toe is rotated forward as an aid in gripping vertical surfaces; in spine-tailed swifts, support is gained from the short needle-tipped tail feathers, and the feet are less modified.

In feeding, swifts course tirelessly back and forth, capturing insects with their large mouths

open. They also drink, bathe, and sometimes mate on the wing. They fly with relatively stiff, slow wingbeats (four to eight per second), but the scimitar-like design of the wing makes it the most efficient among birds for high-speed flight. The fastest of small birds, swifts are believed to reach 110 km (70 miles) per hour regularly; reports of speeds three times that figure are not confirmed. The only avian predators known to take swifts with regularity are some of the larger falcons.

The nest of a swift is made of twigs, buds, moss, or feathers and is glued with its sticky saliva to the wall of a cave or the inside of a chimney, rock crack, or hollow tree. A few species attach the nest to a palm frond, an extreme example being the tropical Asian palm swift (*Cypsiurus parvus*), which glues its eggs to a tiny, flat feather nest on the surface of a palm leaf, which may be hanging vertically or even upside down. Swifts lay from one to six white eggs (usually two or three). Both eggs and young may be allowed to cool toward the environmental temperature in times of food scarcity, slowing development and conserving



Chestnut-collared swift (*Cypseloides rutilus*)
Painting by H. Jon Janosik

resources. The young stay in the nest or cling near it for 6 to 10 weeks, the length of time depending largely on the food supply. Upon fledging, they resemble the adults and immediately fly adeptly.

Among the best-known swifts is the chimney swift (*Chaetura pelagica*), a spine-tailed, uniformly dark gray bird that breeds in eastern North America and winters in South America, nesting in such recesses as chimneys and hollow trees; about 17 other *Chaetura* species are known worldwide. The common swift (*Apus apus*), called simply "swift" in Great Britain, is a soft-tailed, black bird that breeds across Eurasia and winters in southern Africa, nesting in buildings and hollow trees; nine other *Apus* swifts are found throughout temperate regions of the Old World, and some *Apus* species inhabit South America. The white-collared swift (*Streptoprocne zonaris*), soft-tailed and brownish black with a narrow white collar, is found from Mexico to Argentina and on larger Caribbean islands, nesting in caves and behind waterfalls. The white-rumped swift (*Apus caffer*), soft-tailed and black with white markings, is resident throughout Africa south of the Sahara. The white-throated swift (*Aeronautes saxatalis*), soft-tailed and black with white markings, breeds in western North America and winters in southern Central America, nesting on vertical rock cliffs.

**swift,** also called GHOST MOTH, any of the approximately 300 moth species of the cosmopolitan insect family Hepialidae (order



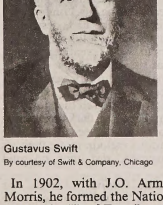
Swift (*Hepialus cupulinus*)
M.W.F. Tweedie from the Natural History Photographic Agency

Lepidoptera), including some of the largest moths, with wingspans of more than 22.5 cm (9 inches). Most European and North American species are brown or gray with silver spots on the wings; the African, New Zealand, and Australian species are brightly coloured.

Swifts are fast, though sometimes erratic, fliers. The larvae either bore in plants or live in turf feeding on grass roots (*e.g.*, genus *Porina*).

**Swift, Gustavus Franklin** (b. June 24, 1839, West Sandwich [now Sagamore], Mass., U.S.—d. March 29, 1903, Chicago, Ill.), founder of the meat-packing firm Swift & Company and promoter of the railway refrigerator car for shipping meat.

A butcher's helper at the age of 14, Swift became a buyer and slaughterer of cattle in 1859 and also opened a butcher shop in Eastham, Mass. He became the partner of James A. Hathaway, a Boston meat dealer, in 1872. Three years later Swift, the cattle buyer for the firm, transferred his headquarters to Chicago, where the centre of the cattle market had shifted. Swift felt that meatpacking would be more profitable than meat selling if a method could be devised for shipping fresh meat from Chicago to the East, instead of sending live cattle to be slaughtered on arrival, as was the custom. He therefore hired an engineer to design a refrigerator car; the finished design circulated fresh air that was chilled by passing it over ice. In 1877 Swift successfully shipped the first refrigerator carload of fresh meat to the East. Soon afterward he left Hathaway. In 1878 he formed a partnership with his brother, and in 1885, with a capital of $300,000, he incorporated the firm of Swift & Company, with himself as first president. In addition to competing successfully with Nelson Morris and Philip D. Armour, Swift established distributing houses in such cities as Tokyo, Shanghai, and Manila and packing plants at St. Louis, Mo., Kansas City, Mo., and Omaha, Neb. When Swift died 18 years later, the capitalization of his company had increased to $25,000,000.



Gustavus Swift
By courtesy of Swift & Company, Chicago

In 1902, with J.O. Armour and Edward Morris, he formed the National Packing Company—the "Beef Trust"—a combination subsequently dissolved by the U.S. Supreme Court (1905).

Swift was also a leader in turning formerly unused parts of animals into by-products such as soap, glue, fertilizer, and oleomargarine.

**Swift, Jonathan,** pseudonym ISAAC BICKERSTAFF (b. Nov. 30, 1667, Dublin, Ire.—d. Oct. 19, 1745, Dublin), Anglo-Irish author who was the foremost prose satirist in the English language. Besides the celebrated novel *Gulliver's Travels* (1726), he wrote such shorter works as *A Tale of a Tub* (1704) and "A Modest Proposal" (1729).

*Early life and education.* Swift's father, Jonathan Swift the elder, was an Englishman who had settled in Ireland after the Stuart Restoration (1660) and become steward of the King's Inns, Dublin. In 1664 he married Abigail Erick, who was the daughter of an English clergyman. In the spring of 1667 Jonathan the elder died suddenly, leaving his wife, baby daughter, and an unborn son to the care of his brothers. The younger Jonathan Swift thus grew up fatherless and dependent on the generosity of his uncles. His education was not neglected, however, and at the age of six he was sent to Kilkenny School, then the best in Ireland. In 1682 he entered Trinity College, Dublin, where he was granted his bachelor of arts degree in February 1686 *speciali gratia* ("by special favour"), his degree being a device often used when a student's record failed, in some minor respect, to conform to the regulations.

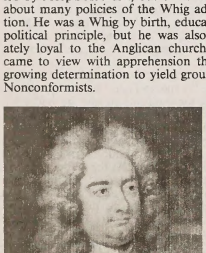
He continued in residence at Trinity College as a candidate for his master of arts degree until February 1689. But the Roman Catholic disorders that had begun to spread through Dublin after the Revolution of 1688 in Protestant England caused Swift to seek security in England, and he soon became a member of the household of a distant relative of his mother named Sir William Temple, at Moor Park, Surrey. Swift was to remain at Moor Park intermittently until Temple's death in 1699.

*Years at Moor Park.* Temple was engaged in writing his memoirs and preparing some of his essays for publication, and he had Swift act as a kind of secretary. During his residence at Moor Park, Swift twice returned to Ireland, and during the second of these visits, he took orders in the Anglican church, being ordained priest in January 1695. At the end of the same month he was appointed vicar of Kilroot, near Belfast. Swift came to intellectual maturity at Moor Park, with Temple's rich library at his disposal. Here, too, he met Esther Johnson (the future Stella), the daughter of Temple's widowed housekeeper. In 1692, through Temple's good offices, Swift received the degree of M.A. at the University of Oxford.

Between 1691 and 1694 Swift wrote a number of poems, notably six odes. But his true genius did not find expression until he turned from verse to prose satire and composed, mostly at Moor Park between 1696 and 1699, *A Tale of a Tub,* one of his major works. Published anonymously in 1704, this work was made up of three associated pieces: the *Tale* itself, a satire against "the numerous and gross corruptions in religion and learning"; the mock-heroic "Battle of the Books"; and the "Discourse Concerning the Mechanical Operation of the Spirit," which ridiculed the manner of worship and preaching of religious enthusiasts at that period. In the "Battle of the Books," Swift supports the ancients in the longstanding dispute about the relative merits of ancient versus modern literature and culture. But *A Tale of a Tub* is the most impressive of the three compositions. This work is outstanding for its exuberance of satiric wit and energy and is marked by an incomparable command of stylistic effects, largely in the nature of parody. Swift saw the realm of culture and literature threatened by zealous pedantry, while religion—which for him meant rational Anglicanism—suffered attack from both Roman Catholicism and the Non-

conformist (Dissenting) churches. In the *Tale* he proceeded to trace all these dangers to a single source: the irrationalities that disturb man's highest faculties—reason and common sense.

*Career as satirist, political journalist, and churchman.* After Temple's death in 1699, Swift returned to Dublin as chaplain and secretary to the Earl of Berkeley, who was then going to Ireland as a lord justice. During the ensuing years he was in England on some four occasions—in 1701, 1702, 1703, and 1707 to 1709—and won wide recognition in London for his personal charm and his wit as a writer. He had resigned his position as vicar of Kilroot, but early in 1700 he was preferred to several posts in the Irish church. His public writings of this period show that he kept in close touch with affairs in both Ireland and England. Among them is the essay "Discourse of the Contests and Dissensions between the Nobles and the Commons in Athens and Rome," in which Swift defended the English constitutional balance of power between the monarchy and the two houses of Parliament as a bulwark against tyranny. In London he became increasingly well known through several works: his religious and political essays; *A Tale of a Tub;* and certain impish works, including the "Bickerstaff" pamphlets of 1708–09, which put an end to the career of John Partridge, a popular astrologer, by first prophesying his death and then describing it in circumstantial detail. Swift's works brought him to the attention of a circle of Whig writers led by Joseph Addison, but Swift was uneasy about many policies of the Whig administration. He was a Whig by birth, education, and political principle, but he was also passionately loyal to the Anglican church, and he came to view with apprehension the Whigs' growing determination to yield ground to the Nonconformists.



Jonathan Swift, detail of an oil painting by Charles Jervas; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

A momentous period began for Swift when in 1710 he once again found himself in London. A Tory ministry headed by Robert Harley (later Earl of Oxford) and Henry St. John (later Viscount Bolingbroke) was replacing that of the Whigs. The new administration, bent on bringing hostilities with France to a conclusion, was also assuming a more protective attitude toward the Church of England. Swift's reactions to such a rapidly changing world are vividly recorded in his *Journal to Stella,* a series of letters written between his arrival in England in 1710 and 1713, which he addressed to Esther Johnson and her companion, Rebecca Dingley, who were now living in Dublin. The astute Harley made overtures to Swift and won him over to the Tories. But Swift did not thereby renounce his essentially Whiggish convictions regarding the nature of government. The old Tory theory of the divine right of kings had no claim upon him. The ultimate power, he insisted, derived from the people as a whole and, in the English constitution, had come to be exercised jointly by king, lords, and commons.

Swift quickly became the Tories' chief pamphleteer and political writer and, by the end of October 1710, had taken over the Tory journal, *The Examiner,* which he continued to edit until June 14, 1711. He then began preparing a pamphlet in support of the Tory drive for peace with France. This, "The Conduct of the Allies," appeared on Nov. 27, 1711, some weeks before the motion in favour of a peace was finally carried in Parliament. Swift was rewarded for his services in April 1713 with his appointment as dean of St. Patrick's Cathedral in Dublin.

*Withdrawal to Ireland.* With the death of Queen Anne in August 1714 and the accession of George I, the Tories were a ruined party, and Swift's career in England was at an end. He withdrew to Ireland, where he was to pass most of the remainder of his life. After a period of seclusion in his deanery, Swift gradually regained his energy. He turned again to verse, which he continued to write throughout the 1720s and early '30s, producing the impressive poem "Verses on the Death of Doctor Swift," among others. By 1720 he was also showing a renewed interest in public affairs. In his Irish pamphlets of this period he came to grips with many of the problems, social and economic, then confronting Ireland. His tone and manner varied from direct factual presentation to exhortation, humour, and bitter irony. Swift blamed Ireland's backward state chiefly on the blindness of the English government; but he also insistently called attention to the things that the Irish themselves might do in order to better their lot. Of his Irish writings, the "Drapier's Letters" (1724–25) and "A Modest Proposal" are the best known. The first is a series of letters attacking the English government for its scheme to supply Ireland with copper halfpence and farthings. "A Modest Proposal" is a grimly ironic letter of advice in which a public-spirited citizen suggests that Ireland's overpopulation and dire economic conditions could be alleviated if the babies of poor Irish parents were sold as edible delicacies to be eaten by the rich.

Certain events in Swift's private life must also be mentioned. Stella (Esther Johnson) had continued to live with Rebecca Dingley after moving to Ireland in 1700 or 1701. It has sometimes been asserted that Stella and Swift were secretly married in 1716, but they did not live together, and there is no evidence to support this story. It was friendship that Swift always expressed in speaking of Stella, not romantic love. The question may be asked, was this friendship strained as a result of the appearance in his life of another woman, Esther Vanhomrigh, whom he named Vanessa? He had met Vanessa during his London visit of 1707–09, and in 1714 she had, despite all his admonitions, insisted on following him to Ireland. Her letters to Swift reveal her passion for him, though at the time of her death in 1723 she had apparently turned against him because he insisted on maintaining a distant attitude toward her. Stella herself died in 1728. Scholars are still much in the dark concerning the precise relationships between these three people, and the various melodramatic theories that have been suggested rest upon no solid ground.

Swift's greatest satire, *Gulliver's Travels,* was published in 1726. It is uncertain when he began this work, but it appears from his correspondence that he was writing in earnest by 1721 and had finished the whole by August 1725. Its success was immediate. Then, and since, it has succeeded in entertaining (and intriguing) all classes of readers.

*Last years.* The closing years of Swift's life have been the subject of some misrepresentation, and stories have been told of his ungovernable temper and lack of self-control. It has been suggested that he was insane. From youth he had suffered from what is now known to have been Ménière's disease, an affliction of the semicircular canals of the ears, causing periods of dizziness and nausea. But his mental powers were in no way affected, and he remained active throughout most of the 1730s—Dublin's foremost citizen and Ireland's great patriot dean. In the autumn of 1739 a great celebration was held in his honour. He had, however, begun to fail physically and later suffered a paralytic stroke, with subsequent aphasia. In 1742 he was declared incapable of caring for himself, and guardians were appointed. After his death in 1745, he was buried in St. Patrick's Cathedral.

*Gulliver's Travels.* Swift's masterpiece was originally published under the title *Travels into Several Remote Nations of the World.* This work is the most brilliant as well as the most bitter and controversial of his satires. In each of its four books the hero, Lemuel Gulliver, embarks on a voyage; but shipwreck or some other hazard usually casts him up on a strange land. Book I takes him to Lilliput, where he wakes to find himself the giant prisoner of the six-inch-high Lilliputians. Man-Mountain, as Gulliver is called, ingratiates himself with the arrogant, self-important Lilliputians when he wades into the sea and captures an invasion fleet from neighbouring Blefescu; but he falls into disfavour when he puts out a fire in the empress' palace by urinating on it. Learning of a plot to charge him with treason, he escapes from the island.

Book II takes Gulliver to Brobdingnag, where the inhabitants are giants. He is cared for kindly by a nine-year-old girl, Glumdalclitch, but his tiny size exposes him to dangers and indignities, such as getting his head caught in a squalling baby's mouth. Also, the giants' small physical imperfections (such as large pores) are highly visible and disturbing to him. Picked up by an eagle and dropped into the sea, he manages to return home.

In Book III Gulliver visits the floating island of Laputa, whose absent-minded inhabitants are so preoccupied with higher speculations that they are in constant danger of accidental collisions. He visits the Academy of Lagado (a travesty of England's Royal Society), where he finds its lunatic savants engaged in such impractical studies as reducing human excrement to the original food. In Luggnagg he meets the Struldbriggs, a race of immortals, whose eternal senility is brutally described.

Book IV takes Gulliver to the Utopian land of the Houyhnhnms—grave, rational, and virtuous horses. There is also another race on the island, uneasily tolerated and used for menial services by the Houyhnhnms. These are the vicious and physically disgusting Yahoos. Although Gulliver pretends at first not to recognize them, he is forced at last to admit the Yahoos are human beings. He finds perfect happiness with the Houyhnhnms, but as he is only a more advanced Yahoo, he is rejected by them in general assembly and is returned to England, where he finds himself no longer able to tolerate the society of his fellow human beings.

*Gulliver's Travels'* matter-of-fact style and its air of sober reality confer on it an ironic depth that defeats oversimple explanations. Is it essentially comic, or is it a misanthropic depreciation of mankind? Swift certainly seems to use the various races and societies Gulliver encounters in his travels to satirize many of the errors, follies, and frailties that human beings are prone to. The warlike, disputatious, but essentially trivial Lilliputians in Book I and the deranged, impractical pedants and intellectuals in Book III are shown as imbalanced beings lacking common sense and even

decency. The Houyhnhnms, by contrast, are the epitome of reason and virtuous simplicity, but Gulliver's own proud identification with these horses and his subsequent disdain for his fellow humans indicates that he too has become imbalanced, and that human beings are simply incapable of aspiring to the virtuous rationality that Gulliver has glimpsed. Mankind, Swift may be suggesting, must content itself with a state that lies somewhere between the bestial and degenerate humanity of the Yahoos and the inhuman virtue and rationality of the Houyhnhnms.

*Assessment.* Swift's intellectual roots lay in the rationalism that was characteristic of late 17th-century England. This rationalism, with its strong moral sense, its emphasis on common sense, and its distrust of emotionalism, gave him the standards by which he appraised human conduct. His moral principles are scarcely original; his originality lies rather in the quality of his satiric imagination and his literary art. Swift's literary tone varies from the humorous to the savage, but each of his satiric compositions is marked by concentrated power and directness of impact. His command of a great variety of prose styles is unfailing, as is his power of inventing imaginary episodes and all their accompanying details. Swift rarely speaks in his own person; almost always he states his views by ironic indiscretion through some imagined character like Lemuel Gulliver or the morally obtuse citizen of "A Modest Proposal." Thus Swift's descriptive passages reflect the minds that are describing just as much as the things described. Pulling in different directions, this irony creates the tensions that are characteristic of Swift's best work, and reflects his vision of humanity's ambiguous position between bestiality and reasonableness. (R.Q./Ed.)

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**Swift Current,** city, southwestern Saskatchewan, Canada, on Swiftcurrent Creek (a tributary of the South Saskatchewan River) and the Trans-Canada Highway, 151 miles (243 km) west of Regina. Settled by U.S. emigrants, by Scandinavians, and by Mennonites from Germany after the arrival of the Canadian Pacific Railway in 1883, it is now a market centre serving a vast wheat-growing and cattle-ranching region. Lumbering, meatpacking, dairying, and the production of animal feed and farm implements are local industries. Oil, discovered in the vicinity in 1952, has greatly stimulated the city's economy. The first helium wells to be tapped in Canada are 9 miles (14 km) north. Swift Current is headquarters for an extensive irrigation development and is the site of one of the nation's largest experimental farms. The city's annual Frontier Days (July) is Saskatchewan's biggest rodeo. Inc. village, 1904; town, 1907; city, 1914. Pop. (1991) 14,815.

**swiftlet** (genus *Collocalia*), any of numerous species of cave-dwelling birds belonging to the swift family, Apodidae, found from southeastern Asia (India and Sri Lanka) and the Malay Peninsula through the Philippines, and eastward to the islands of the South Pacific.

The taxonomy of the 15 to 20 nearly identical species is controversial. Dull brown or



Swiftlet (*Collocalia*)
Painting by Gene M. Christman

gray above (sometimes glossed with blue or green) and paler on the rump and underparts, swiftlets are 9 to 15 cm (3.5 to 6 inches) long. They fly lower, more erratically, and more slowly than most swifts.

The swiftlet is remarkable on two counts: the nest, made chiefly or entirely of saliva, is the basis of bird's-nest soup; and, with the oilbird (*q.v.*), certain swiftlets are the only birds known to use echolocation to find their way around dark caverns, as do bats. The swiftlet's "sonar" consists of clicking sounds at frequencies of 1,500 to 5,500 hertz—audible to the human ear. They are emitted at the rate of about six per second. The nest is a small bracket, sometimes containing bits of fern or bark, that may be glued to a tree or cliff but usually is made in a mountain or coastal cave. A single colony may contain a million birds.

**swim bladder,** also called AIR BLADDER, buoyancy organ possessed by most bony fish. The swim bladder is located in the body cavity and is derived from an outpocketing of the digestive tube. It contains gas (usually oxygen) and functions as a hydrostatic, or ballast, organ, enabling the fish to maintain its depth without floating upward or sinking. It also serves as a resonating chamber to produce sound. In some species the swim bladder contains oil instead of gas. In certain primitive fish it functions as a lung or respiratory aid instead of a hydrostatic organ. The swim bladder is missing in some bottom-dwelling and deep-sea bony fish (teleosts) and in all cartilaginous fish (sharks, skates, and rays).

**swimmer's itch,** also called CUTANEOUS SCHISTOSOMIASIS, an infection of the skin marked by prickling sensations and itching, caused by invasion of the skin by larvae of trematode worms of the genus *Schistosoma,* often found in freshwater lakes and ponds.

**swimming,** in recreation and sports, the propulsion of the body through water by combined arm and leg motions and the natural flotation of the body. Swimming as an exercise is popular as an all-around body developer and is particularly useful in therapy and as exercise for physically handicapped persons. It is also taught for lifesaving purposes. For activities that involve swimming, *see also* diving, lifesaving, surfing, synchronized swimming, underwater diving, and water polo. For results of world championships, *see* Sporting Record: *Swimming. See also* Olympic Games.

*History.* Archaeological and other evidence shows swimming to have been practiced as early as 2500 BC in Egypt and thereafter in Assyrian, Greek, and Roman civilizations. In Greece and Rome swimming was a part of martial training and was, with the alphabet, also part of elementary education for males. In the Orient swimming dates back at least to the 1st century BC, there being some evidence of swimming races then in Japan. By the 17th century an imperial edict had made the teaching of swimming compulsory in the schools. Organized swimming events were held in the 19th century before Japan was opened to the Western world. Among the preliterate maritime peoples of the Pacific, swimming was evidently learned by children about the time they walked, or even before. Among the ancient Greeks there is note of occasional races, and a famous boxer swam as part of his training. The Romans built swimming pools, distinct from their baths. In the 1st century BC the Roman Gaius Maecenas is said to have built the first heated swimming pool.

The lack of swimming in Europe during the Middle Ages is explained by some authorities as having been caused by a fear that swimming spread infection and caused epidemics. There is some evidence of swimming at seashore resorts of Great Britain in the late 17th century, evidently in conjunction with water therapy. Not until the 19th century, however, did the popularity of swimming as both recreation and sport begin in earnest. When the first swimming organization was formed there in 1837, London had six indoor pools with diving boards. The first swimming championship was a 440-yard race, held in Australia in 1846 and annually thereafter. The Metropolitan Swimming Clubs of London, founded in 1869, ultimately became the Amateur Swimming Association, the governing body of British amateur swimming. National swimming federations were formed in several European countries from 1882 to 1889. In the United States swimming was first nationally organized as a sport by the Amateur Athletic Union (AAU) on its founding in 1888. The Fédération Internationale de Natation Amateur (FINA) was founded in 1909.

*Competitive swimming.* Internationally, competitive swimming came into prominence with its inclusion in the Olympic Games from their inception in 1896. Olympic events were originally only for men, but women's events were added in 1912. Before the formation of FINA, the Games included some unusual events. In 1900, for instance, when the Games' swimming events were held on the Seine River in France, a 200-metre obstacle race involved climbing over a pole and a line of boats and swimming under them. Such oddities disappeared after FINA took charge. Under FINA regulations, for both Olympic and other world competition, race lengths came increasingly to be measured in metres, and in 1969 world records for yard-measured races were abolished. The kinds of strokes allowed were reduced to freestyle (crawl), backstroke, breaststroke, and butterfly. All four strokes were used in individual medley races. Many nations have at one time or another dominated Olympic and world competition, including Hungary, Denmark, Australia, Germany, France, Great Britain, Canada, Japan, and the United States.

*Instruction and training.* The earliest instruction programs were in Great Britain in the 19th century, both for sport and for lifesaving; these programs were copied in the rest of Europe. In the United States swimming instruction for lifesaving purposes began under the auspices of the American Red Cross in 1916. Instructional work done by the various branches of the armed forces during both World Wars I and II was very effective in promoting swimming. Courses taught by community organizations and schools, extending ultimately to very young infants, became common.

The early practice of simply swimming as much as possible at every workout was replaced by interval training and repeat training by the late 1950s. Interval training consists of a series of swims of the same distance with controlled rest periods. In slow interval training, used primarily to develop endurance, the rest period is always shorter than the time taken to swim the prescribed distance. Fast interval training, used primarily to develop speed, permits rest periods long enough to allow almost complete recovery of the heart and breathing rate.

The increased emphasis on international competition led to the growing availability of 50-metre pools. Other adjuncts that improved both training and performance included wave-killing gutters for pools, racing lane markers that also reduce turbulence, cameras for underwater study of strokes, large clocks visible to swimmers, and electrically operated touch and timing devices. Since 1972 all world records have been expressed in hundredths of a second.

*Strokes.* The earliest strokes to be used were the sidestroke and the breaststroke. The sidestroke was originally used with both arms submerged. This practice was modified toward the end of the 19th century by bringing forward first one arm above the water, then the other, and then each in turn. The sidestroke was supplanted in competitive swimming by the crawl (*see* below) but is still used in lifesaving and recreational swimming. The body stays on its side and the arms propel alternately. The leg motion used in sidestroke is called the scissors kick, in which the legs open slowly, under leg backward, upper leg forward, both knees slightly bent, and toes pointed. The scissoring action of the legs coming smartly together after opening creates the forward propulsion of the kick.

The breaststroke is believed to be the oldest of strokes and is much used in lifesaving and recreational swimming as well as in competitive swimming. The stroke is especially effective in rough water. As early as the end of the 17th century, the stroke was described as consisting of a wide pull of the arms combined with a symmetrical action of the legs and simulating the movement of a swimming frog, hence the usual term frog kick. The stroke is performed lying face down in the water, the arms always remaining underwater. The early breaststroke featured a momentary glide at the completion of the frog kick. Later the competitive breaststroke eliminated the glide. In the old breaststroke, breath was taken in at the beginning of the arm stroke, but in the later style breath was taken in near the end of the arm pull.

The butterfly stroke, used only in competition, differs from the breaststroke in arm action. In the butterfly the arms are brought forward above the water. The stroke was brought to the attention of U.S. officials in 1933 during a race involving Henry Myers, who used the stroke. He insisted that his stroke conformed to the rules of breaststroke as then defined. After a period of controversy, the butterfly was recognized as a distinct competitive stroke in 1953. The frog kick originally used was abandoned for a fishtail (dolphin) kick, depending only on up-and-down movement of the legs. Later swimmers used two dolphin kicks to one arm pull. Breathing is done in sprint competition by raising the head every second or third stroke.

The backstroke began to develop early in the 20th century. In this stroke, the swimmer's body position is supine, the body being held as flat and streamlined as possible. The arms reach alternately above the head and enter the water directly in line with the shoulders, palm outward with the little finger entering the water first. The arm is pulled back to the thigh. There is a slight body roll. The kick was originally the frog kick, but it subsequently involved up-and-down leg movements as in the crawl. The backstroke is a competition stroke, but it is also used in recreational swimming as a rest from other strokes, frequently with minimum arm motion and only enough kick to maintain forward motion.

The crawl, the stroke used in competitive freestyle swimming, has become the fastest of all strokes. It is also the almost unanimous choice of stroke for covering any considerable distance. The stroke was in use in the Pacific at the end of the 19th century and was taken up by the Australian swimmer Henry Wickham about 1893. The brothers Syd and Charles Cavill of Australia popularized the stroke in Europe in 1902 and in the United States in 1903. The crawl was like the old sidestroke in its arm action, but it had a fluttering up-and-down leg action performed twice for each arm stroke. Early U.S. imitators added an extra pair of leg actions, and later as many as six kicks were used. The kicks also varied in kind. In the crawl, the body lies prone, flat on the surface of the water, with the legs kept slightly under the water. The arms move alternately, timed so that one will start pulling just before the other has finished its pull, thus making propulsion continuous. Breathing is done by turning the head to either side during recovery of the arm from that side. Since 1896 the crawl has been used in more races than any other stroke.

*Races.* In competition there are freestyle races at distances of 50, 100, 200, 400, 800, and 1,500 m; backstroke, breaststroke, and butterfly races at 100 and 200 m; individual medley races at 200 and 400 m; the freestyle relays, $4 \times 100$ m and $4 \times 200$ m; and the medley relay, $4 \times 100$ m.

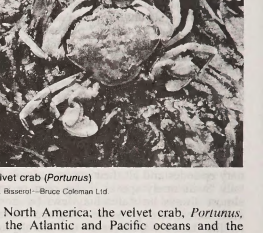
Starts are all from a standing or forward leaning position, the object being to get the longest possible glide before the stroke begins. All races are in multiples of the pool length, so that the touch before turning, which is varied for different stroke races, is important for success.

*Distance swimming.* Any swimming competition longer than 1,500 m (1,372 yards) is considered distance swimming, an activity not governed by FINA. Most long-distance races are in the 24- to 59-kilometre (15- to 37-mile) range, though some, such as the Lake George marathon (67 km) and the Lake Michigan Endurance Swim (80 km), both in the United States, have been longer. In 1954 a group of amateur and professional marathon swimmers formed the Fédération Internationale de Natation Longue Distance; and in 1963, after dissension between amateur and professional swimmers, the World Professional Marathon Swimming Federation was founded. Throughout the 1960s the latter group sanctioned about eight professional marathons annually, the countries most frequently involved being Canada, Egypt, Italy, Argentina, and the United States. The British Long Distance Swimming Association has sponsored races on inland waters of from 35.4 to 16.5 km.

Distance swimming never achieved the status of competitive swimming as regulated by FINA except for English Channel swimming, which captured the popular imagination in the second half of the 19th century. Captain Matthew Webb of Great Britain was the first to make the crossing from Dover, Eng., to Calais, France, in 1875; his time was 21 hr 45 min. The map distance was 17.75 nautical miles (33 km), but the actual distance of a Channel Swim is frequently lengthened by tides and winds. No one matched Webb's feat until 1911, when another Englishman, T.W. Burgess, made the crossing. In 1926 the American swimmer Gertrude Ederle became the first woman to swim the Channel, crossing from Cap Gris-Nez, France, to Dover in a record-setting time for man or woman of 14 hr 39 min. Since then, except for the World War II years, crossing swims have been made annually. Several swimmers have made 10 or more crossings. The Channel Swimming Association was formed in 1927 to control swims and verify times. By 1978 the record had been lowered to 7 hr 40 min by Penny Dean of the United States, and by the 1980s successful crossings had been made by swimmers as young as 12 and as old as 65. Various swimmers had crossed both ways with only brief rests between the swims.

**swimming,** in zoology, self-propulsion of an animal through water. *See* aquatic locomotion.

**swimming crab,** any member of the family Portunidae (order Decapoda of the class Crustacea). In these animals, the fifth (hindmost) pair of legs are flattened into paddles for swimming. The family includes the blue crab (*q.v.*), an edible crab of the Atlantic coast



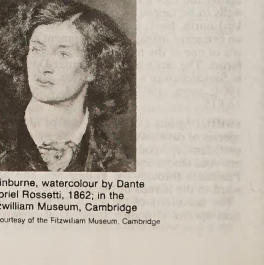
Velvet crab (*Portunus*)
S.C. Bisserot—Bruce Coleman Ltd

of North America; the velvet crab, *Portunus,* of the Atlantic and Pacific oceans and the Mediterranean Sea; and *Neptunus* of the Indian and Pacific oceans.

**swimsuit,** also called BATHING SUIT, garment designed for wearing while swimming. Sea bathing became popular in the mid-19th century when railroads first made it possible for people to get to the beach for their vacations. The first swimsuits concealed most of the body: women wore bloomers, black stockings, and a dress with short sleeves and skirt; men wore a dark-coloured, one-piece, sleeveless garment reaching to the ankles or knees. By the early 20th century, however, men had begun to wear shorts without a top. As early as 1900 Annette Kellerman, an American swimmer, wore a loose, one-piece wool bathing suit that by about 1910 became generally acceptable for the public. A clinging one-piece swimsuit for women was introduced in France after World War I, and other swimsuit accessories were abandoned.

In about 1935 women began to wear a two-piece suit consisting of a top and shorts. In 1947 the bikini, consisting of an abbreviated top and brief pants, came into fashion. Modern women's swimsuits vary in style from one- or two-piece garments to suits with skirts, but to facilitate swimming they are made of fabrics that do not sag or balloon in the water.

**Swinburne, Algernon Charles** (b. April 5, 1837, London—d. April 10, 1909, Putney, London), English poet and critic, outstanding for prosodic innovations and noteworthy as the symbol of mid-Victorian poetic revolt. The characteristic qualities of his verse



Swinburne, watercolour by Dante Gabriel Rossetti, 1862; in the Fitzwilliam Museum, Cambridge
By courtesy of the Fitzwilliam Museum, Cambridge

are insistent alliteration, unflagging rhythmic energy, sheer melodiousness, great variation of pace and stress, effortless expansion of a given theme, and evocative if rather imprecise use of imagery. His poetic style is highly individual and his command of word-colour and word-music striking. Swinburne's technical gifts and capacity for prosodic invention were extraordinary, but too often his poems' remorseless rhythms have a narcotic effect, and he has been accused of paying more attention to the melody of words than to their meaning. Swinburne was pagan in his sympathies and passionately antitheist.

Swinburne's father was an admiral, and his mother was a daughter of the 3rd earl of Ashburnham. He attended Eton and Balliol College, Oxford, which he left in 1860 without taking a degree. There he met William Morris, Edward Burne-Jones, and Dante Gabriel Rossetti and was attracted to their Pre-Raphaelite Brotherhood. An allowance from his father enabled him to follow a literary career.

In 1861 he met Richard Monckton Milnes (later Lord Houghton), who encouraged his writing and fostered his reputation. In the early 1860s Swinburne apparently suffered from an unhappy love affair about which little is known. Literary success came with the verse drama *Atalanta in Calydon* (1865), in which he attempted to re-create in English the spirit and form of Greek tragedy; his lyric powers are at their finest in this work. *Atalanta* was followed by the first series of *Poems and Ballads* in 1866, which clearly display Swinburne's preoccupation with masochism, flagellation, and paganism. This volume contains some of his finest poems, among them "Dolores" and "The Garden of Proserpine." The book was vigorously attacked for its "feverish carnality"—*Punch* referred to the poet as "Mr. Swineborn"—though it was enthusiastically welcomed by the younger generation. In 1867 Swinburne met his idol, Giuseppe Mazzini, and the poetry collection *Songs Before Sunrise* (1871), which is principally concerned with the theme of political liberty, shows the influence of that Italian patriot. The second series of *Poems and Ballads,* less hectic and sensual than the first, appeared in 1878.

During this time Swinburne's health was being undermined by alcoholism and by the excesses resulting from his abnormal temperament and masochistic tendencies; he experienced periodic fits of intense nervous excitement, from which, however, his remarkable powers of recuperation long enabled him to recover quickly. In 1879 he collapsed completely and was rescued and restored to health by his friend Theodore Watts-Dunton. The last 30 years of his life were spent at The Pines, Putney, under the guardianship of Watts-Dunton, who maintained a strict regimen and encouraged Swinburne to devote himself to writing. Swinburne eventually became a figure of respectability and adopted reactionary views. He published 23 volumes of poetry, prose, and drama during these years, but, apart from the long poem *Tristram of Lyonesse* (1882) and the verse tragedy *Marino Faliero* (1885), his most important poetry belongs to the first half of his life.

Swinburne was also an important and prolific English literary critic of the later 19th century. Among his best critical writings are *Essays and Studies* (1875) and his monographs on William Shakespeare (1880), Victor Hugo (1886), and Ben Jonson (1889). His devotion to Shakespeare and his unrivaled knowledge of Elizabethan and Jacobean drama are reflected in his early play *Chastelard* (1865). The latter work was the first of a trilogy on Mary, queen of Scots, who held a peculiar fascination for him; *Bothwell* (1874) and *Mary Stuart* (1881) followed. He also wrote on William Blake, Percy Bysshe Shelley, and Charles Baudelaire, and his elegy on the latter, *Ave Atque Vale* (1867–68), is among his finest works.

**Swindon,** town and unitary authority in the northeastern part of the geographic and historic county of Wiltshire, England. Mostly in a fertile clay valley, the unitary authority is bounded on the north by the River Thames and on the south by the steep chalk escarpment of the Marlborough Downs. Swindon was a small market town until 1841, when the Great Western Railway built its main engineering works there. During the 1950s the town grew again owing to an influx of population and industry from Greater London. The railway works closed in the mid-1980s, and insurance and automotive manufacturing are now the town's main industries. Inglesham, northeast of Swindon, has an unrestored, mostly 13th-century church. Pop. (2001) town, 155,432; unitary authority, 180,061.

**swine,** any stout-bodied, short-legged omnivorous mammal with a long, mobile snout and small tail belonging to the family Suidae. Both the domestic pig and its wild relatives are included. Swine originated in the Old World. The typical genus *Sus* is exemplified by the domesticated pig and the wild boar. *See* boar; pig; suid.

**swine fever,** also called HOG CHOLERA, serious and often fatal viral disease of swine. Characterized by high fever and exhaustion, the disease is transmitted from infected pigs via numerous carrier agents, including transport vehicles, dealers who journey from farm to farm, and farm attendants. The virus may be present in garbage used for swine feed but is destroyed by cooking.

Four days to three weeks after exposure, the disease begins with fever. Subsequent symptoms vary somewhat: loss of appetite, general depression and withdrawal from other animals, reddened and draining eyes, vomiting, constipation or diarrhea, and coughing and difficulty in respiration. In many cases a skin rash develops; the mucous membrane of the mouth and throat may become inflamed and ulcerative. The animal lies about, moving reluctantly, sometimes with a staggering gait and an arched back; later it is unable to rise and becomes comatose.

Administration of anti-hog-cholera serum in early stages of the disease may be effective, although recovery is rare. Death may occur within a few days or the illness may become chronic, the animal being a possible source of infection to other pigs.

Swine fever occurs in Europe, North America, and Africa. In countries in which control has been established, the disease must be reported, infected animals are compulsorily slaughtered, and the premises of sick animals are quarantined. Control is mainly by vaccination.

**swineherd's disease:** *see* leptospirosis.

**Swinemünde** (Poland): *see* Świnoujście.

**swing,** in music, both the rhythmic impetus of jazz music and a specific jazz style prominent between about 1935 and the early 1940s—years sometimes called the swing era. Musically, swing represents a partial dilution of the jazz tradition, for it organized musicians into larger groups (up to 16) and required them to play a far higher proportion of written music than was previously thought compatible with the fundamentally improvisatory character of jazz. It was also the first successful attempt to make jazz truly commercial—to market it on a national and eventually international scale. The swing age also marked a sociological change for jazz, which had until that time been associated in the public mind either with immorality (the brothels of New Orleans) or illegality (the gin mills of Chicago). With swing's move into the ballrooms, jazz became socially respectable.

The swing bands recruited and organized players into sections of brass, reeds, and rhythm and hired skilled orchestrators to write music for them. This method, used by the black bandleader Fletcher Henderson in his band in the 1920s, was picked up by white orchestras riding the later tide of popularity.

The musical technique used in the big bands was relatively simple. Sections were played off against each other, sometimes in counterpoint, sometimes in musical dialogue. Another popular device was the riff, a simple musical phrase reiterated until, by sheer power of repetition, it became almost hypnotic.

The swing age was in many ways an exercise in public relations. To succeed, a band or its leader had to be commercially exploitable on a national scale and therefore had to be white. Although several black orchestras—*e.g.,* those of Count Basie, Duke Ellington, Chick Webb, and Jimmie Lunceford—became famous during the period, the swing age was in the main a white preserve whose outstanding bandleaders included Benny Goodman, Harry James, Tommy and Jimmy Dorsey, and Glenn Miller. Although Goodman was designated "King of Swing," the best band was considered to be Ellington's, perhaps with Basie's next.

Concurrent with the big-band craze came a flowering of the solo art, both among small-group musicians such as the pianist Fats Waller and the tenor saxophonist Coleman Hawkins, and also among big-band players who ran after-hours careers. The great virtuosos of the second group included the saxophonists Lester Young, Johnny Hodges, Benny Carter, Chu Berry, and Willie Smith; the trumpeters Roy Eldridge, Buck Clayton, Ray Nance, and Cootie Williams; the pianists Teddy Wilson and Art Tatum; and also the guitarist Charlie Christian, bassist Jimmy Blanton, trombonists Jack Teagarden and Dickie Wells, and the singer Billie Holiday.

The swing era was the last great flowering of jazz before its period of harmonic experimentation. At its best, swing achieved an art of improvisation in which current harmonic conventions counterbalanced the stylistic individuality of its great creators.

**Swings, Pol,** byname of POLIDORE F.F. SWINGS (b. Sept. 24, 1906, Ransart, Belg.—d. Oct. 28, 1983), Belgian astrophysicist noted for his spectroscopic studies of the composition and structure of stars and comets.

In 1932 Swings was appointed professor of spectroscopy and astrophysics at his alma mater, the University of Liège, Belgium; he taught there until 1976. He was a visiting professor at the University of Chicago (1939–43, 1946–52) and took part in war research (1943–45). He also served as vice president (1952– 58) and president (1964–67) of the International Astronomical Union.

During the early 1930s Swings studied the diatomic molecules of various metals. From his findings on the spectra of ionized neon, argon, and other elements, he furnished valuable insight into the significance of theretofore inexplicable lines in the spectra of some stars.

With the Swedish physicist Bengt Edlén, Swings conducted an extensive study (1936–39) of the doubly ionized iron atom, which revealed the presence of iron in many stellar sources. While studying the spectra of comets, he discovered numerous radicals, including hydroxyl and cyanide. He showed that certain strong spectral bands (now called Swings bands) of comets are caused by tricarbon radicals. He also explained certain anomalies in cyanide spectra of the Sun by the Swings effect, the effect of the Fraunhofer lines and the Sun's radial velocity.

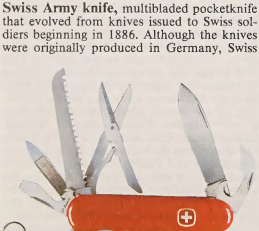
His published works include *Considerations Regarding Cometary and Interstellar Molecules* (1942) and the *Atlas of Representative Cometary Spectra* (1956), with Leo Haser.

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**Świnoujście,** German SWINEMÜNDE, town, Szczecin *województwo* (province), Poland, on a low-lying sandy island that separates the Zalew Szczeciński (Oderhaff), a lake at the mouth of the Oder River, from the Baltic Sea. A major fishing port, Świnoujście has fine beaches that make it a resort.

The town was first chronicled in 1181, though it existed earlier as a fishing settlement. It also served as a strategic stronghold for the defender of the Zalew Szczeciński. The town was invaded several times, principally by the Danes, Swedes, and Germans. It became a German industrial and naval base in the 19th century. During World War II it was devastated, but it has been rebuilt as part of the growing Szczecin–Świnoujście port complex, Poland's largest in the early 1980s in cargo handled. Pop. (2000 est.) 43,697.

**Swiss Army knife,** multibladed pocketknife that evolved from knives issued to Swiss soldiers beginning in 1886. Although the knives were originally produced in Germany, Swiss



Handyman Swiss Army Knife, from Wenger N.A.
Photography provided by Wenger N.A. The Genuine Swiss Army Knife™

cutler Karl Elsener began producing soldier's knives in 1891, equipping them with a blade, reamer, screwdriver, and can opener. The officer's knife appeared in 1897, with a second blade and a corkscrew. The knives continue to be supplied by two Swiss manufacturers, Victorinox (Elsener's firm) and Wenger, and both the military and civilian models bear the Swiss federal cross logo.

There are hundreds of models of Swiss Army knives, which among their many tools may incorporate such attachments as a saw, pliers, scissors, compass, light, tweezers, whistle, fish scaler, file, pen, wirecutter, or altimeter. Models are especially designed for specific users—campers, hunters, computer repairers, golfers, and handymen. The name has become a metaphor for a compact, ingeniously designed tool with multiple uses.

**Swiss Bank Corporation,** one of Switzerland's largest banks; it merged with UBS (the Union Bank of Switzerland; *q.v.*) in June 1998.

The bank was established in 1872 as Basler Bankverein, specializing in investment banking. In 1895 the name was changed to Basler und Zürcher Bankverein when it merged with Zürcher Bankverein. At that time the bank also began commercial banking, now its major activity. After absorbing two other Swiss banks in 1897 the bank adopted the name of Swiss Bank Corporation (SBC). SBC acquired London-based investment bank S.G. Warburg PLC in 1995, thereby gaining a lead position in the European investment banking business.

The 1998 merger of SBC and UBS made UBS AG the largest bank in Switzerland. Although SBC was the smaller of the two banks, this union was seen as a merger of equals, and Swiss Bank's managers filled the top positions in the new organization.

**Swiss cheese:** *see* Emmentaler.

**Swiss Civil Code,** French CODE CIVIL SUISSE, German SCHWEIZERISCHES ZIVILGESETZBUCH, body of private law codified by the jurist Eugen Huber at the end of the 19th century; it was adopted in 1907 and went into effect in 1912, and it remains in force, with modifications, in present-day Switzerland. Because Huber's work was completed after the Napoleonic Code (*q.v.*) of 1804 and the German Civil Code (*q.v.*) of 1896, he was able to avoid many of the difficulties that earlier codifiers had faced. Although influenced by both codes, Huber included much material indigenous to Switzerland.

The code begins with a brief introductory section setting forth the details of its application. This is followed by four books: the first covers the law of persons and includes a section on the law of associations similar in form to the German Civil Code; the second deals with family matters and, specifically, with problems of matrimonial regimes and guardianship; the third covers succession; and the last, property. A separate federal code of commercial and personal obligation went into effect in 1881, serving as a companion piece to the civil code.

During the 19th century Switzerland's 25 *cantons* had various, and often conflicting, customs. Customs often diverged even within cantons. Many of the cantons began very early to experiment with codification. In the French cantons the influence of the Napoleonic Code was apparent, but the predominance of local custom in areas such as guardianship and matrimonial regimes made for little continuity from canton to canton. In the German areas the confusion was even greater, although the Civil Code of Zürich (1853–55) served as a model for some of the later codifications.

National codification was prevented by provisions of the 1848 constitution that left problems of private law to the individual cantons. These difficulties were mitigated after 1872, when the federal government was empowered to deal with certain civil-law problems, primarily those involving commerce. The first result was the federal Code of Obligations of 1881, which regularized the law of commerce and exchange. There was still, however, no overriding code of private law. There were numerous types of succession laws. In some areas the place in which one resided took precedence over one's birthplace, but in other areas the reverse was the case.

In 1896 the federation assumed the authority to deal with matters of civil law. Huber was appointed to produce a preliminary draft, and in 1901 a commission was set up to consider it. Its draft, with very few changes from Huber's original, was adopted in 1907 and went into effect in 1912. The code introduced a land-registry system and made changes in many aspects of family and inheritance law. Above all, it provided much-needed uniformity in Swiss private law.

The Swiss Civil Code was later copied by Turkey and influenced the codes of several states, such as Peru.

**Swiss Federation of Protestant Churches,** German SCHWEIZERISCHER EVANGELISCHER KIRCHENBUND, French FÉDÉRATION DES ÉGLISES PROTESTANTES DE LA SUISSE, confederation founded in 1920 to represent the interests of the churches in social issues, government liaison, and overseas mission and aid work. Membership is open to Christian churches that have adopted the principles of the Reformation. The Federation is composed of the Evangelical and Reformed churches of 17 of Switzerland's 26 *cantons,* the Evangelical Methodist Church, the Free Church of Geneva, the Evangelical Reformed churches in the largely Catholic canton of Tessin, and Evangelical Reformed churches serving Swiss congregations in foreign countries.

Federation policies, which are decided at meetings of a governing assembly of delegates and are implemented by an executive committee, do not affect the autonomy of member churches. Member churches differ from each other in their constitutions, liturgies, and religious education, but most practice similar forms of church government with a congregational council and a legative synod. Although the federation is not a denomination in itself, it is a full member of the World Council of Churches on behalf of its member churches. It coordinates theological research, overseas aid, activities of missionary societies, church law, and educational and religious programming on radio and television. Headquarters are in Bern.

**Swiss German language,** German SCHWEIZER DEUTSCH, Swiss German SCHWYZERTÜTSCH, collective name for the great variety of Alemannic (Upper German) dialects spoken in Switzerland north of the boundary between the Romance and Germanic languages, in Liechtenstein, in the Austrian province of Vorarlberg, and in parts of Baden-Württemberg in Germany and Alsace in France. A few isolated villages south of the Alps in Italy also speak Alemannic dialects. Most of the dialects, including the main dialectal varieties spoken in the *cantons* of Zürich and Bern in Switzerland, are classified as High Alemannic, while the dialect of Basel and that of northern Alsace are classified as Low Alemannic.

Swiss German differs from standard High German in phonology (*e.g., Chind* for standard High German *Kind* "child"), grammar, and vocabulary. No dialects of Swiss German indicate case inflections for nouns except for the dialect of Zürich, in which the noun has an ending for the dative plural. Verb forms often differ greatly from standard High German (*e.g., gān* "go" for standard High German *gehen*).

Although standard High German is used by most speakers of Swiss German dialects for writing and for sermons and public lectures, Swiss German dialects are used for other purposes by all Swiss Germans, regardless of occupation, education, or social class.

**Swiss literature,** properly, the writings in the only language peculiar to Switzerland, the Rhaeto-Romanic dialect known as Romansh, though broadly it includes all works written by Swiss nationals in any of the three other languages of their country: German, French, and Italian, or the Swiss dialect forms of any one of them. The earliest literature produced in Switzerland was written in Latin.

Treated here are the writings in Romansh and Swiss dialects. For information about all other manifestations of Swiss literature, *see* MACROPAEDIA: Latin Literature; German Literature; French Literature; Italian Literature.

Romansh literature was in its origins predominantly ecclesiastical, and began in the Middle Ages. The Reformation gave it new life. In 1560 a fine translation of the New Testament was published; in 1679 the entire Bible was translated by J.A. Vulpius and J. Dorta. There is also a rich variety of popular songs, especially of the religious and political kind. Owing to its geographical distribution Romansh literature is essentially regional. Nevertheless, the anthologist Caspar Decurtins; the poets Peider Lansel, Jon Guidon, and Artur Caflisch; and the fiction writer Giachen Michel Nay achieved decidedly more than a merely local fame in the 20th century.

The fortunes of Swiss dialect literature vary according to the language situation in each section of the country. In the Ticino, dialect literature is produced with much devotion but has been of little consequence. In the French-speaking part of the country the local dialects

are on the wane. The important instances of dialect literature there belong to the past, such as the Genevan ballads commemorating the victory of the *escalade* in 1602. International fame was achieved by the various *ranz des vaches* (melodies sung, or played on the alphorn, by herdsmen).

Dialect literature flourishes mainly in the German-speaking part of the country, chiefly because there the people consistently use dialect for everyday purposes. The existence of numerous local idioms might even produce an ever-increasing variety of dialect writings. This, however, would be at cross-purposes with the determination of writers and readers to remain on common ground with German literature as a whole. Some of the best poets have expressed themselves both in High German and in their dialect. Thus, Adolf Frey published a volume of poems in the dialect of the Aargau (*Duss und undernn Rafe,* 1891), and Meinrad Lienert wrote several poems in the dialect of Schwyz. Almost every canton has its *Mundartdichter,* or local poet. There are vigorous novels in the Bernese dialect by the 20th-century writers Rudolf von Tavel and Simon Gfeller. Schaffhausen is represented in the novels of Albert Bächtold, and Joseph Reinhart wrote in the dialect of Solothurn.

**Swiss National Park,** German SCHWEIZERISCHE NATIONALPARK, French PARC NATIONAL SUISSE, Italian PARCO NAZIONALE SVIZZERO, national park in Graubünden *canton,* southeastern Switzerland, adjoining the Italian border 15 miles (24 km) northeast of Saint Moritz. Established in 1914 and enlarged in 1959, the park occupies 65 square miles (169 square km) and is made up of a magnificent area in the Central Alps and on the edge of the dolomitic Eastern Alps. It is primarily a nature reserve with scientific aims; no lumbering, grazing, flower picking, hunting, or fishing is permitted. The varied vegetation includes many rare Alpine plants. Wildlife includes ibexes, chamois, red deer, foxes, martens, marmots, eagles, and game birds. The park is crossed by good roads from which foot trails extend in many directions.

**Swissair,** byname of SWISS AIR TRANSPORT COMPANY LTD., German SCHWEIZERISCHE LUFTVERKEHR AG, French SA SUISSE POUR LA NAVIGATION AÉRIENNE, former Swiss airline formed on March 26, 1931, by the merger of Basler Luftverkehr (Balair, founded in 1925) and Ad Astra Aero (founded in 1919). Ownership was shared by national and cantonal governments and private investors. Headquarters were in Zürich. In 1981 the holding company Swissair Participation SA was created to run the nonairline subsidiaries, including hotel, restaurant, airline-catering, real-estate, travel-agency, and freight operations.

From its predecessors in 1931 Swissair inherited routes within Switzerland and from Switzerland to the German Rhineland cities and to Lyon, France. In 1932 the airline adopted the Lockheed Orion monoplane, giving it the fastest express service between Zürich, Munich, and Vienna. Suspending scheduled services during World War II, it resumed regular flights in 1946 and by 1949 had begun transatlantic service to New York City. In the 1950s routes were extended to South America and the Far East, reaching Tokyo in 1961.

At the beginning of the 21st century, Swissair was serving a network of routes covering Europe, North and South America, Africa, the Middle East, and Asia. On March 31, 2002, however, the airline, after suffering bankruptcy the previous year, ceased operations. A new, smaller airline, known simply as Swiss, formed from Crossair and some elements of Swissair, took over many of Swissair's routes.

**switching,** in communications, equipment and techniques for enabling any station in a communications system to be connected with any other station. Switching is an essential component of telephone, telegraph, data-processing, and other technologies in which it is necessary to deal rapidly with large amounts of information.

**Swithun,** SAINT, Swithun also spelled SWITHIN (b. *c.* 800—d. July 2, 862, Winchester, Hampshire, Eng.; feast day, July 15), celebrated Anglo-Saxon saint, bishop of Winchester, and royal counselor whose name is still associated with an old meteorological superstition. He served as counselor to kings Egbert and Aethelwulf of the West Saxons. On Oct. 30?, 852, he was consecrated bishop of Winchester. Nothing else is reliably known of his life.

There is a superstition that rain on St. Swithun's feast day means rain for 40 days. The first evidence for the weather prophecy seems to be a 13th- or 14th-century entry in a manuscript at Emmanuel College, Cambridge. His feast day is the day his relics were transferred in 971 to Winchester Cathedral, after reports of miracles, by Bishop Aethelwold.

After 971 Swithun's cult spread widely, and his name displaced those of Saints Peter and Paul in the dedication of the cathedral. His feast is observed in the Anglican calendar.

**Switzerland,** officially SWISS CONFEDERATION, French SUISSE, or CONFÉDÉRATION SUISSE, German SCHWEIZ, or SCHWEIZERISCHE EIDGENOSSENSCHAFT, Italian SVIZZERA, or CONFEDERAZIONE SVIZZERA, or CONFEDERAZIONE ELVETICA, Romansch SVIZZRA, or CONFEDERAZIUN HELVETICA, a landlocked country of central Europe, extending for about 135 miles (220 km) from north to south and for about 220 miles (350 km) at its widest extent from west to east. Switzerland is bordered on the west by France, on the north by Germany, on the east by Austria and Liechtenstein, and on the south by Italy. With more



Switzerland

than two-fifths of its area comprising the main ranges of the Alps and with few natural resources other than waterpower, Switzerland has managed to fashion unity out of diverse races, religions, and languages; for more than 700 years it has maintained the world's oldest democracy. The capital is Bern. Area 15,940 square miles (41,284 square km). Pop. (2002 est.) 7,282,000.

A brief treatment of Switzerland follows. For full treatment, *see* MACROPAEDIA: Switzerland.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*The land.* Switzerland is divisible into three distinct physiographic regions (northwest to southeast): the Jura Mountains; the central plateau, or the Mittelland; and the Alps. The Jura Mountains, occupying about one-eighth of the country, are sparsely forested and largely covered with meadows. The Mittelland (average elevation 1,500 feet [450 m] above sea level), occupying about one-fourth of the country, is a rich agricultural area where most of the country's economic activities and cities are concentrated. The Alps, composed of lofty crags, snowy peaks, deep gorges, and vast glaciers, reach their highest elevation at the Dufourspitze peak on the Monte Rosa massif (15,203 feet [4,634 m]) near the border with Italy, the highest point in Switzerland; more than 50 Alpine peaks rise higher than 12,000 feet (3,660 m) in elevation, including the Matterhorn (14,691 feet [4,478 m]). The central Alpine region, around the St. Gotthard Pass, is a major watershed of Europe; it is the source of two major rivers, the Rhine (which empties into the North Sea) and the Rhône (which flows into the Mediterranean Sea). The Inn River, which is a major tributary of the Danube, rises in Lake Lughino in Graubünden *canton.*

Switzerland's climate is of a transitional type. Average annual temperature ranges from 45° F (7° C) in the Mittelland to 35° F (2° C) in the mountains; average annual rainfall varies from about 20 inches (500 mm) in the Rhône valley (southwest) to about 115 inches (2,900 mm) at Säntis mountain (northeast). At elevations above 11,500 feet (3,500 m), all precipitation is in the form of snow.

The natural vegetation of Switzerland can be categorized by the varied relief. Beeches and oaks are found in the west by low-lying Lake Geneva and in the Jura Mountains. Hornbeam and larch trees grow in the Engadin and the dry Valais in the east. Spruce forests extend through the northern sub-Alpine region. Chestnut and cypress groves exist in the south. Alpine pastures grow above 7,000 feet (2,130 m) and sometimes are found above 10,000 feet (3,050 m); the highest vineyard of central Europe is located in the Alps at an elevation of 3,600 feet (1,100 m). Swiss fauna is mainly Alpine, including rabbit, fox, badger, marmot, deer, chamois, otter, and numerous varieties of bird.

Switzerland's natural mineral resources are few; some salt deposits are found near Rheinfelden in the north, and iron and manganese ore deposits in the Jura Mountains. Switzerland's shortage of mineral power sources has largely been counterbalanced by its great resource of waterpower, which in the early 21st century was harnessed by several hundred large hydroelectric plants.

*The people.* The country is separated into three linguistic regions: German in the north, central, and east; French in the west; and Italian in the south. More than three-fifths of the population speak German, about one-fifth French, and one-twelfth Italian. Romansch (Rhaeto-Romanic), a linguistic relic preserved in the mountainous regions between the Gotthard massif and the eastern Alps, is spoken by about 1 percent of the population. French, German, and Italian are official languages.

Roman Catholics slightly outnumber Protestants, and there is a small but sizable Muslim population and a tiny Jewish community. Foreign residents make up about one-fifth of the country's total population, and in some cantons the proportion is considerably higher. This has posed serious problems of unemployment. Excellent medical coverage and a high standard of living contribute to an average life expectancy—77 years for men and 83 years for women—that is among the highest in world. Because high mountains occupy so much of the terrain, the population density of the country's permanently settled areas is quite high. The major cities are Zürich, Basel, Geneva, Bern, and Lausanne.

*The economy.* Switzerland has a developed market economy that is based largely on international trade and banking, as well as light

and heavy industries. The economy is heavily dependent on foreign workers, who represent about one-fourth of the workforce. The gross national product (GNP) is growing more rapidly than the population; Switzerland's gross national product per capita is the highest of any country in the world.

Agriculture is an important sector of the economy, despite the poor soil and unproductive land. Of Switzerland's total land area, about one-tenth is devoted to cultivation; chief crops are sugar beets, potatoes, wheat, and barley. Vegetables, fruits, and viticulture are also important. Dairy cattle are grazed in meadows and pastures, which occupy about two-fifths of the land area. The income from dairying and cattle raising constitutes about three-fourths of all agricultural value. A significant portion of the marketed milk is processed to cheese, butter, and chocolate. Forests, predominantly coniferous, cover about one-third of the total land. Air pollution has damaged about one-fifth of the forests.

Switzerland's fossil fuels must be imported. Lime, cement, gypsum, salt, sand, and gravel are produced from domestic raw materials. Mineral industries are privately owned.

Manufacturing industries account for more than one-fifth of the gross domestic product (GDP) and together with mining industries employ nearly one-fifth of the workforce. Most raw materials must be imported; high-grade manufactures are exported. The country's leading manufactures include clocks, watches, precision instruments, turbines, generators, and chemicals. About three-fifths of Switzerland's domestic energy production is provided by hydroelectricity, while more than one-third is furnished by nuclear plants.

Tourism is an important industry and is vigorously promoted; it helps to offset Switzerland's usually unfavourable balance of trade. The country is one of the world's major financial centres. There are several thousand bank branches and loan offices in addition to the National Bank, which opened in 1907. Secrecy laws encouraged organized-crime syndicates to establish accounts in Swiss banks, prompting modification of Swiss banking laws to prevent abuse.

Labour unions are small and fragmented, and there are separate organizations for Roman Catholics, Protestants, white-collar workers, and bureaucrats. Foreign workers come principally from Italy; smaller numbers come from the Balkans, France, Portugal, Germany, Spain, Turkey, and Austria.

Public revenues are largely derived from tariffs, which are levied on weight rather than value, and indirect taxes. The chief indirect tax is a national value-added tax on goods and services that went into effect in 1995, replacing a national sales tax.

Much of Switzerland's trade is with the countries of the European Union (EU), with about three-fourths of its imports coming from and three-fifths of its exports going to the EU. Among its individual trading partners, Germany is its leading market. Other major partners include France, Italy, Japan, the United States, and the United Kingdom.

*Government and social conditions.* Switzerland is a federal republic composed of 20 cantons and 6 half-cantons, which hold all powers not specifically delegated to the federal authority. The country's constitution was adopted in 1848 and was extensively revised in 1874. A revised constitution also went into effect in 2000. Legislative power is vested in a bicameral Federal Assembly; the 200 members of the National Council are directly elected to a four-year term; and the 46 members of the Council of States are elected from cantons (two for each canton and one for each half-canton) to a three- or four-year term. The consent of a majority of voters and of cantons is required to pass specific types of legislation, such as constitutional amendments, but is optional for other types of laws. Executive power is exercised by the Federal Council, a seven-member collegial board elected to a four-year term by the Federal Assembly. Each councillor presides over a federal department, and one of them is elected by the Federal Assembly to serve as president for one year. The federal government has responsibility principally in national policy matters, such as internal and external security, foreign policy, and the monetary system. The major political parties are the Radical Democratic Party, the Christian Democratic People's Party, the Social Democratic Party, and the Swiss People's Party. Women were granted the franchise in 1971. Justice is primarily a cantonal function. The Federal Supreme Court is the supreme judicial power. According to Switzerland's traditional policy of neutrality, the army serves solely to preserve the independence of the country.

Switzerland's social-welfare system provides benefits and subsidized or free health care for sickness, maternity, and temporary disability; allowances for families with children; and pensions for old age, invalidism, permanent disability, and survivors.

Switzerland's literacy rate of virtually 100 percent reflects its comprehensive educational system. Because education is administered at the commune or canton level, there are 26 different systems. Education is, however, compulsory everywhere and free between the ages of 7 and 16. Secondary education may lead to further vocational study or to higher education. There are numerous private schools (primary and secondary), which provide excellent education and cater mainly to students from abroad. Higher education is provided by several universities, the oldest of which, in Bern, was established in the 15th century.

The country's news media are free from government censorship. Most newspapers are regional or local in content, although the *Tages Anzeiger* and *Neue Zürcher Zeitung* and a few others are international in orientation and counted among the world's finest. Radio and television broadcasting are supervised by the private Swiss Broadcasting Corporation and are largely noncommercial. Three distinct communications systems serve the country's three main language groups.

*Cultural life.* Switzerland can boast an impressive list of contributors to the arts and sciences. In the 20th century Le Corbusier (Charles-Édouard Jeanneret) was one of the major creative forces behind the International Style of architecture that dominated most building trends throughout the West. The country's other artists of international reputation have included the sculptor Alberto Giacometti and the painter Paul Klee. In the field of literature, Switzerland has produced Jean-Jacques Rousseau, Jacob Burckhardt, Gottfried Keller, Carl Spitteler, and a number of less well-known Romansch-language writers. The works of contemporary dramatists Friedrich Dürrenmatt and Max Frisch have been widely produced outside Switzerland. Such 20th-century composers as Othmar Schoeck and Frank Martin have gained international renown. Switzerland also has a long tradition of excellence in the sciences. Zürich's Federal Institute of Technology has produced more Nobel Prize winners than any other scientific school in the world.

*History.* Settlements of hunters, fishermen, agriculturists, and armed warriors occupied Switzerland before the Christian Era. The Romans called the region Helvetia and garrisoned strategic Alpine passes there in 58 BC. Germanic tribes began to penetrate their defenses during the 3rd century AD and by the 5th and 6th centuries were permanent residents. In the 7th century Christian missionaries began to convert many of the Helvetians. Frankish rule was established in the 9th century, and Muslim and Magyar raiders ventured into the region during the 10th. Present-day Switzerland became part of the Holy Roman Empire during the 11th century.

In 1291 the forest cantons of Uri, Schwyz, and Nidwalden (and a little later, Obwalden) formed an anti-Habsburg league that became the nucleus of the Swiss confederation. By 1353 Lucerne, Zürich, Glarus, Bern, and Zug had been added. Solothurn and Fribourg joined in 1481, followed by Basel and Schaffhausen in 1501 and Appenzell in 1513.

In the 16th century Switzerland became a centre of the Protestant Reformation, and the confederation divided along Roman Catholic and Protestant lines; armed conflict occurred. The inner group of cantons (Lucerne, Uri, Schwyz, Unterwalden, Zug, Fribourg, and Solothurn) remained Catholic, while Zürich, Bern, Basel, and Schaffhausen became Protestant. In the Peace of Westphalia (1648), following the Thirty Years' War, 13 cantons were declared no longer subject to the Holy Roman emperor.

During the 17th century Switzerland embarked upon a policy of neutrality that continued until the French Revolution. In 1798 the French occupied much of Switzerland and established the Helvetian Republic. At the end of the Napoleonic Wars, the participants of the Congress of Vienna (1815) guaranteed Swiss neutrality. In the 1840s Lucerne, Uri, Schwyz, and several other cantons attempted to form a separate federation but were defeated. A new federal state was formed in 1848 with Bern as the capital.

Switzerland continued in its neutral role, although it narrowly escaped involvement in the Franco-Prussian War (1870–71). The country remained neutral during World War I. In 1920 the League of Nations was formed with its headquarters located in Geneva. Although Switzerland remained neutral during World War II, its army was mobilized to defend the country. Following the war the Swiss government adopted several welfare state activities, such as old-age pension and health insurance. In 1959 it became a member of the European Free Trade Association, and in 1972 it signed a free-trade agreement with the European Community. Despite the backing of the main political parties, Swiss voters rejected membership in the United Nations in 1986 and membership in the European Economic Area in 1992. In March 2002 a referendum on UN membership narrowly passed, and the country officially joined in September.

**Swope, Gerard** (b. Dec. 1, 1872, St. Louis, Mo., U.S.—d. Nov. 20, 1957, New York, N.Y.), president of the General Electric Company (1922–39; 1942–44) in the United States. He greatly expanded the company's line of consumer products and pioneered profit-sharing and other benefits programs for its employees.

Fascinated by electricity early in life, Swope graduated from the Massachusetts Institute of Technology in 1895 and went to work for the Western Electric Company, becoming a director of the company in 1913. In 1919 he was appointed the first president of General Electric's international subsidiary. An excellent salesman, he substantially increased the company's foreign business and was made president of General Electric in 1922. At the time of his promotion the company primarily sold industrial electrical products, but under Swope's direction it began to develop and market such household appliances as refrigerators and vacuum cleaners.

Swope expanded General Electric's employee benefits, implementing a system of matching contributions by workers and the company. In addition to profit-sharing, he instituted cost-of-living wage adjustments as well as a form of unemployment insurance.

During his career Swope held a number of administrative and advisory posts with government. He was also associated with the early development of radio, serving as a director on the boards of the National Broadcasting Company, RCA Victor, and other firms. After his retirement from General Electric in 1939, Swope chaired the New York City Housing Authority until 1942.

**Swope, Herbert Bayard** (b. Jan. 5, 1882, St. Louis, Mo., U.S.—d. June 20, 1958, Sands Point, N.Y.), journalist who became famous as a war correspondent and editor of the *New York World*.

After graduation from high school, Swope spent a year in Europe before going to work as a reporter for the *St. Louis Post-Dispatch*. He later went to the *Chicago Tribune*, then the *New York Herald* and the *New York Morning Telegraph*, with short periods of employment at the *New York World*, which he finally joined full-time in 1909. He remained with the paper until 1929, with an interruption for service in World War I.

After serving as a crime reporter for the *World*, Swope became a war correspondent, reporting from Germany early in World War I. He came to be recognized as an authority on Germany. His articles, collected in the book *Inside the German Empire* (1917), won him a Pulitzer Price in 1917.

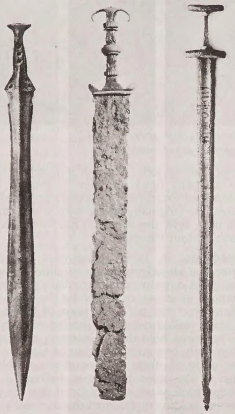
Swope came back from Germany in 1915 to become city editor of the *World*, but he returned to the front in 1916. When the United States entered the war in 1917, he was commissioned in the U.S. Navy and made assistant to Bernard Baruch on the U.S. War Industries Board. He returned to the *World* in 1920 as executive editor and, in that role, concentrated on building up a page devoted to columnists opposite the editorial page. In that period, ending with his retirement in 1929, the paper won three Pulitzer Prizes.

In retirement Swope served the U.S. government in various advisory roles and was chairman of the New York State Racing Board for 11 years, starting in 1934. During World War II, from 1942 to 1946, he served as a consultant to U.S. Secretary of War Henry L. Stimson.

**sword,** preeminent hand weapon through a long period of history, consisting of a metal blade varying in length, breadth, and configuration, but longer than a dagger (*q.v.*), and fitted with a handle or hilt usually equipped with a guard. The sword became differentiated from the dagger during the Bronze Age (*c.* 3000 BC), when copper and bronze weapons were produced with long, leaf-shaped blades and with hilts consisting of an extension of the blade in handle form. By Roman times the hilt was distinct from the short, flat blade, and by the European Middle Ages the weapon had acquired its main basic forms. The heavy sword of medieval chivalry had a large hilt, often designed to be gripped in both hands, with a large protective guard or pommel at the top. The blade was straight, double-edged, and pointed; it was fabricated by repeated firing and hammering, a process that converted the iron into mild steel by the addition of a small amount of carbon. Blades were also made of laminated strips of iron, which were hammered together. Damascus was a renowned centre of the craft.

The changes in warfare associated with the introduction of firearms did not eliminate the sword but rather proliferated its types. The discarding of body armour made it necessary for the swordsman to be able to parry with his weapon, and the thrust-and-parry rapier came into use.

The advantage of a curved blade for cutting was early appreciated in Asia, where it was long used by the Indians, Persians, and others before its introduction to Europe by the Turks. The Turkish scimitar was modified in the West to the cavalry sabre. At the other extreme of Asia, the Japanese developed a long-bladed, slightly curved version with a two-handed grip, with which an elaborate dueling cult, as well as ancestor worship, became associated.



(Left) Bronze Age sword, (centre) Roman sword in scabbard, (right) Viking sword; in the British Museum

By courtesy of the trustees of the British Museum

The introduction of repeating firearms virtually ended the value of the sword as a military weapon, though isolated instances of its use continued in 20th-century wars. As it declined in its military usefulness, the sword gained a new role in the duel, especially in Europe, out of which practice emerged the modern sport of fencing.

**sword dance,** folk dance by men, with swords or swordlike objects, displaying themes such as human and animal sacrifice for fertility, battle mime, and defense against evil spirits. There are several types. In linked-sword, or hilt-and-point, dances, each performer holds the hilt of his own sword and the point of that of the dancer behind him, the group forming intricate, usually circular, patterns. Combat dances for one or more performers emphasize battle mime and originally served as military training. Crossed-sword dances are performed over two swords or a sword and scabbard crossed on the ground. Finally, guerrilla dances in circular formation are often performed with swords.

Hilt-and-point dances are widely distributed through Europe—*e.g.*, in northern England, Basque territory, and Spain. They are often performed as part of a folk play. The plays are closely related to the English mummers plays and parallel the Greek folk play in Thrace. In the dance the swords are interlocked at one point, forming a "rose," or "lock," that is held aloft and placed around the neck of a performer in mock decapitation. Often the "beheaded" falls "dead," to be revived by a "doctor," a fool, a man-woman, or other subsidiary character. The roots of these dances are in ancient vegetation rites of death and renewal, possibly in sacrifice of a leader to ensure fertility. Even today they are believed to bring luck or well-being.

Dances of stylized battle mime survive in modern Turkey (some with rifles replacing swords), in the dirk dance of Scottish Canada, in Borneo, and elsewhere. The pyrrhic dance of ancient Greece served as an exercise of military training until late antiquity, when it degenerated into popular professional entertainment. The *hasapikos*, or butchers' dance, of Turkey and ancient and modern Greece—now a communal social dance—was in the Middle Ages a battle mime with swords performed by the butchers' guild, which adopted it from the military.

Crossed-sword dances are common in Europe (*e.g.*, Scotland, the Balkans) and also appear in India, Borneo, and other areas. Characteristically, one or more dancers execute precise, complicated steps over and between the swords. The famed Scottish solo dance Gillie Callum, which is danced to a folk melody of the same name, is first mentioned only in the early 19th century. In its close relative, the English solo Bacca pipes jig, crossed clay pipes replace the swords. There are evidences that such dances formerly included swordplay. In the Scottish Argyll broadsword dance, the four performers flourish their swords before laying them on the ground, points touching, to form a cross. Possible ancient ritual meaning is suggested by the frequent belief that if a sword is touched, even lightly, the dance must be stopped.

Guerrilla dances survive particularly in the Balkans and Turkey, long afflicted by invading armies. Typically, they are in circular formation, beginning with the leaders whirling and making whiffling sounds with their swords.



"Sword Dance of the Cutter's Guild," coloured pen drawing by an unknown artist, 1600; in the German National Museum, Nürnburg

By courtesy of the Germanisches Nationalmuseum, Nurnberg, Ger.

Improvised dance, often with battle mime, follows. The whiffling of swords also occurs in the Balkan *rusalia*, a ritual dance for healing and fertility. It also precedes several English hilt-and-point dances and possibly derives from ancient whiffling to clear the dance area of evil spirits.

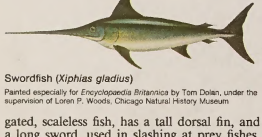
Many European sword dances were taken over by trade guilds, trade implements often replacing swords. Dances with sticks are related both to sword dances and to Morris dances (*q.v.*) and moriscas, ritual dances usually for a double file of men. Many dances of the Morris–morisca family employ swords.

**Sword of God, The** (Arab general): *see* Khālid ibn al-Walid.

**sword swallowing,** a magician's trick dating back to ancient Greece and Rome, involving the swallowing of a sword without bodily injury. Capuleius, in his *Metamorphoseon,* tells of seeing the trick in Athens, performed by a juggler on horseback. In reality, sword swallowing is not an illusion or trick. Those who practice it must first overcome their reflex gagging at objects touching the back part of their mouths. Long practice controls this reflex. The pharynx must also be conditioned. Objects introduced here cause much pain, and only after several trials can they be passed without great discomfort. The stomach is conditioned in a similar manner. Sword swallowers employ slightly varying methods. While one may swallow a sword without using any intermediate apparatus, such as a gutta-percha tip, another will take this precaution. The majority of sword swallowers employ a guiding tube which they have previously ingested, and hence their performances are less dangerous. The tube is 45–50 centimetres (17.7–19.7 inches) long and is made of very thin metal. With a width of 25 millimetres (a little less than an inch), the tube permits easy entry of flat-bladed swords. Exhibits of sword swallowing, beyond their entertainment value, have helped to further medicine by demonstrating to physicians that the pharynx could be habituated to contact, thus making experimentation and exploration of the involved organs possible.

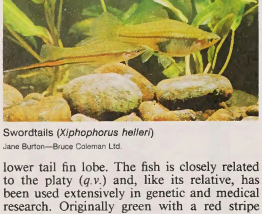
*To make the best use of the Britannica, consult the* INDEX *first*

**swordfish** (*Xiphias gladius*), prized food and game fish, probably the single species constituting the family Xiphiidae (order Perciformes), found in warm and temperate oceans around the world. The swordfish, an elongated fish, growing to about 13 centimetres (5 inches) long and characterized, in the male, by a long, swordlike extension of the lower tail fin lobe. The fish is closely related to the platy (*q.v.*) and, like its relative, has been used extensively in genetic and medical research. Originally green with a red stripe on each side, the swordtail has been bred in many colour varieties.



Swordfish (*Xiphias gladius*)
Painted especially for *Encyclopaedia Britannica* by Tom Dolan, under the supervision of Loren P. Woods, Chicago Natural History Museum

gated, scaleless fish, has a tall dorsal fin, and a long sword, used in slashing at prey fishes, extends from its snout. The sword is flat, rather than rounded as in marlins and other spear-nosed fishes, and has thus given rise to the name broadbill. The swordfish is also distinguished by its lack of pelvic fins and of teeth. It is purplish or bluish above, silvery below, and grows to a maximum length of about 4.6 metres (15 feet) and a maximum weight of about 450 kilograms (1,000 pounds).



Swordtails (*Xiphophorus helleri*)
Jane Burton—Bruce Coleman Ltd.

**swordtail** (*Xiphophorus helleri*), popular tropical fish of the live-bearer (*q.v.*) family Poeciliidae (order Atheriniformes). The swordtail is an elongated fish, growing to about 13 centimetres (5 inches) long and characterized, in the male, by a long, swordlike extension of the

**syādvāda,** in Jaina metaphysics, the doctrine that all judgments are conditional, holding good only in certain conditions, circumstances, or senses, expressed by the word *syāt* (Sanskrit: "may be"). The ways of looking at a thing (called *naya*) are infinite in number.

The Jainas hold that to interpret experience from only one *naya,* or point of view, to the exclusion of others is an error comparable to that of the seven blind men feeling an elephant, each of whom concluded that the part he was holding represented the elephant's true form. The relative pluralism of this position is implicit in the Jaina doctrine of *anekāntavāda,* or the "many-sidedness of reality." According to this doctrine, all statements can be judged as true or not true or as both true and not true and thus inexpressible, depending on the point of view. The combinations of these possibilities can be stated in seven logical alternatives called *saptabhaṅgī.*

**Sybaris,** ancient Greek city in southern Italy situated on the Gulf of Tarentum, near present Corigliano, Italy, known for its wealth and the luxury of its inhabitants, which contributed to the modern meaning of "sybaritic." Founded *c.* 720 BC by Achaeans and Troezenians in a fertile area, the city prospered quickly. Twice razed by the Crotoniates (510 and *c.* 448 BC), Sybaris was rebuilt a third time with Athenian help. Expelled by the other citizens, who renamed the city Thurii, the Sybarites founded a fourth Sybaris farther south on the Traeis (Trionto) River; its ruins were uncovered by excavations in 1949.

**Sybel, Heinrich von** (b. Dec. 2, 1817, Dusseldorf, Rhine Province, Prussia—d. Aug. 1, 1895, Marburg, Ger.), German historian who departed from the dispassionate manner of his teacher Leopold von Ranke and made himself a spokesman of nationalistic political Prussianism.

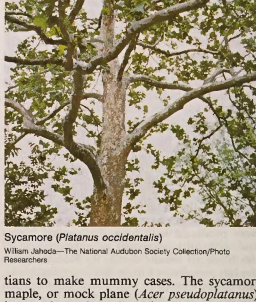
While studying in Berlin (1834–38), he learned from Ranke the critical method of evaluating historical sources, and his first book, *Geschichte des ersten Kreuzzugs* (1841; *The History and Literature of the Crusades,* 1861) is among the most distinguished products of the Ranke school. His study of German kingship, *Entstehung des deutschen Königtums* (1844), is generally considered to be of the same group.

Sybel's political interests soon separated him, at least academically, from Ranke, whose detachment he grew to despise as soulless respectability. He held professorial chairs at Marburg (1846), Munich (1856), and Bonn (1861), saying of himself that he was four-sevenths politician and three-sevenths professor, and he came to believe passionately in the historian's vocation as teacher. His involvement in contemporary politics was consistent with these views. He sat in the Hessian Landtag (1848), the Erfurt Parliament (1850), the Prussian Landtag (1862–64; 1874–80), and the Prussian Constituent Assembly of 1867. A believer in Prussia's mission to lead Germany toward unification, he was an enemy of ultramontanism and feudalism; he rejected medieval imperial policy and eventually came to support Otto von Bismarck.

Sybel's political views are clear from his later books. His greatest work, *Geschichte der Revolutionszeit von 1789 bis 1800,* 5 vol. (1853–79; *History of the French Revolution*), which was particularly valuable for its connection of French domestic events with the wider European scene, showed vigorous opposition to revolutionary ideals. His last work, *Die Begründung des deutschen Reiches durch Wilhelm I,* 7 vol. (1889–94; *The Founding of the German Empire by William I*), for which Bismarck opened the state archives, is the first detailed account of the subject. It is somewhat marred, however, by a disregard of internal affairs and by excessive Prussianism.

In forming the *Historische Zeitschrift* in 1859 in Munich, Sybel provided the model for many other periodicals. In 1875 Bismarck appointed him director of the Prussian archives, and he began a great series of publications.

**sycamore,** any of several distinct trees. In the United States it refers especially to the American plane tree (*q.v.*). The sycamore of the Bible is better termed sycamore fig (*see also* fig), notable for its use by ancient Egyptians to make mummy cases. The sycamore maple, or mock plane (*Acer pseudoplatanus*), is sometimes also called, simply, sycamore.



Sycamore (*Platanus occidentalis*)
William Jahoda—The National Audubon Society Collection/Photo Researchers

**Sycon** (sponge): *see* Scypha.

**Sydenham (of Sydenham and Toronto), Charles Poulett Thomson, Baron** (b. Sept. 13, 1799, Wimbledon, Surrey, Eng.—d. Sept. 19, 1841, Kingston, Canada West), merchant and statesman who, as British governor general of Canada in 1839–41, helped to develop that country's basic institutions of government.

The son of a merchant, Thomson joined the St. Petersburg office of his father's firm at age 16. He was member of Parliament for Dover, Kent, in 1826–30 and took up the cause of free trade and financial reform. From 1830 to 1839 he represented Manchester in Parliament. In 1830 he became vice president of the Board of Trade, treasurer of the navy, and a member of the Privy Council. He made improvements in customs duties in 1832 and in 1834 became president of the

Board of Trade, at which post he continued to work for international commercial reforms.

In 1839 Thomson became governor-general of Canada. By adroit diplomacy he secured passage in 1840 of the British parliamentary act that resulted in the union of Upper and Lower Canada (now Ontario and Quebec) the following year. He then proceeded to introduce municipal institutions in Upper Canada and to encourage public works. He also established the basic structure for responsible, or cabinet, government in the united province of Canada. He was raised to the peerage in 1840, but the title lapsed when he died childless.

**Sydenham, Thomas** (b. 1624, Wynford Eagle, Dorset, Eng.—d. Dec. 29, 1689, London), physician recognized as a founder of clinical medicine and epidemiology. Because he emphasized detailed observations of patients and maintained accurate records, he has been called "the English Hippocrates."



Sydenham, detail of an oil painting by Mary Beale, 1688; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Although his medical studies at the University of Oxford were interrupted by his participation on the parliamentary side during the English Civil Wars, Sydenham received his M.B. in 1648 and began to practice about 1656 in London, where he made an exacting study of epidemics. This formed the basis of his book on fevers (1666), later expanded into *Observationes Medicae* (1676), a standard textbook for two centuries. His treatise on gout (1683) is considered his masterpiece.

He was among the first to describe scarlet fever and to explain the nature of hysteria and St. Vitus' dance (Sydenham's chorea). Sydenham introduced laudanum (alcohol tincture of opium) into medical practice, was one of the first to use iron in treating iron-deficiency anemia, and helped popularize quinine in treating malaria.

Derided by his colleagues, Sydenham benefited immensely from a consequent detachment from the speculative theories of his time.

**Sydenham's chorea,** also called ST. VITUS' DANCE, a type of chorea that follows infection and occurs most frequently in children and adolescents. *See* chorea.

**Sydney,** city, capital of the state of New South Wales, Australia. Located on Australia's southeastern coast, Sydney is a major port in the South Pacific, noted for its beautiful harbour (Port Jackson). The city was established as a penal colony in the late 18th century and had become a major trading centre even before the first pioneers pushed inland. It is now the largest metropolitan area in Australia.

A brief treatment of Sydney follows. For full treatment, *see* MACROPAEDIA: Sydney.

The metropolitan area of Sydney stretches from the Blue Mountains in the west to the Pacific Ocean in the east and from the southern shore of Lake Macquarie in the north to south of Botany Bay. The city itself was built on the low hills that surround the harbour.

Sydney's temperate climate has a mean temperature in January of 72° F (22° C); the coolest month, July, averages 55° F (13° C). Annual rainfall averages 47 inches (1,200 mm).

The proportion of Sydney's workforce engaged in manufacturing is diminishing, while employment in services is increasing. It is a centre of finance, commerce, tourism, and culture. No single industry predominates, though oil refining has grown in importance. The government sector is also economically important, as is the port. A second port has been developed in Botany Bay.

Sydney is widely known both for its water sports and recreational facilities and for its cultural life. The universities of Sydney and New South Wales are located there, as is Macquarie University. The world-renowned Sydney Opera House, set on a promontory southeast of the Harbour Bridge, is a major centre for the performing arts, with theatres and concert and exhibition halls. It is the home of the Sydney Symphony Orchestra, Opera Australia, and dance and theatre companies. Also in the city are the Australian Museum (natural history), a zoo, an aquarium, botanic gardens, and art museums. Sydney Olympic Park was built for the 2000 Summer Olympic Games. There are three national parks within the city itself and several more nearby. Darling Harbour is a redeveloped entertainment district.

Rapid development of suburban Sydney and the absence of major highways that bypass the city have caused a persistent transport problem that is only partially mitigated by commuter ferry boats, an underground railway, and extensive metropolitan bus service. Sydney (Kingsford Smith) Airport is on the northern shore of Botany Bay. Area central business district, 2.4 square miles (6.2 square km); metropolitan area, 4,790 square miles (12,407 square km). Pop. (1998 est.) city, 3,276,207; metropolitan area, 3,986,700.

**Sydney,** ocean port and former city, part of the Cape Breton Regional Municipality (formed 1995), northeastern Nova Scotia, Canada. It lies on the southeastern arm of Sydney Harbour at the mouth of the Sydney River, on eastern Cape Breton Island.

Founded in 1785 as a haven for Loyalists and named for Thomas Townshend, Baron Sydney (later Viscount Sydney; then colonial secretary), it served as the capital of Cape Breton Island until 1820, when the island was united with Nova Scotia. The population was greatly increased during the early 19th century by the influx of large numbers of immigrants, especially from the Highlands of Scotland, and again in the early 20th century after the erection of a major steel plant. Situated in the heart of a coal-mining region, on an excellent harbour, Sydney and nearby North Sydney, Sydney Mines, and Glace Bay form the province's second largest industrial complex. There are aluminum, auto-assembly, concrete, and woodworking plants, fishing, and ship repairing. The Sydney area is the eastern terminus of the mainland portions of the Trans-Canada Highway and the Canadian National Railway; there also are ferry connections to Newfoundland. Inc. town, 1886; city, 1904. Pop. (1996) regional municipality, 117,849.

**Sydney, University of,** coeducational institution of higher learning in Sydney, nominally private but supported financially by both the Commonwealth of Australia and New South Wales. Founded in 1850, it is Australia's oldest university as well as its largest.

The university is composed of eight resident colleges: St. Paul's (Anglican), which was founded in 1854; St. John's (Roman Catholic), 1857; St. Andrew's (Presbyterian), 1870; Women's (nondenominational), 1889; Wesley (Uniting), 1910; Sancta Sophia (Roman Catholic, principally women), 1926; International House; and Mandelbaum House (principally Jewish), 1996. Women were first admitted to the university in 1881.

The university includes faculties of nursing, health sciences, pharmacy, rural management, agriculture, architecture, arts, economics, education, medicine, dentistry, veterinary science, law, engineering, and science. There are also more than 60 research centres and institutes attached to the university; these deal mainly with specialized disciplines within the sciences and medicine. Sydney has the largest university library in Australia.

**Sydney Harbour** (New South Wales): *see* Port Jackson.

**Sydney Mines,** former town, part of the Cape Breton Regional Municipality (formed 1995), Cape Breton Island, eastern Nova Scotia, Canada. It lies northeast of North Sydney and faces Sydney across the harbour. Sydney Mines was once a major coal-producing community. Mining began locally in 1766, and in 1830 systematic operations were undertaken. One mine extended about 5 miles (8 km) out under the sea. The last mine closed in 1975. Inc. 1889. Pop. (1996) regional municipality, 117,849.

**Sydney Morning Herald, The,** daily newspaper published in Sydney, Australia's oldest and one of its most influential papers.

First issued as a weekly in 1831, the *Sydney Herald* became a daily in 1840, and "Morning" was added to its name in 1842. The ownership of the paper is still in the family of one of the original founders, John Fairfax.

The paper's editorial stance is conservative. It has combined serious reporting of national and international news with coverage of popular news stories dealing with such subjects as law enforcement and police activities. The Herald won international repute for its dedication to responsible journalism, its appeal to diverse audiences, and its coverage of the arts and literature.

**Sydow, Max von,** original name CARL ADOLF VON SYDOW (b. April 10, 1929, Lund, Swed.), Swedish stage and screen actor perhaps best known for his dour, brooding characterizations in films of the Swedish director Ingmar Bergman.

Sydow studied at the Royal Dramatic Theatre School in Stockholm (1948–51). He established his reputation as one of Sweden's most promising young actors at the Norrköping-Linköping Municipal Theatre (1951–53). He then gained popularity at the Municipal Theatre in Hälsingborg (1953–55), the Municipal Theatre of Malmö (1955–60), and the Royal Dramatic Theatre in Stockholm (1960–62), where he appeared in productions as varied as William Shakespeare's *King John* and Arthur Miller's *After the Fall.*

Sydow made his film debut in a minor part in 1949. His first Bergman film was the allegory *Det sjunde inseglet* (1957; *The Seventh Seal*), in which he portrays a gaunt knight who plays a game of chess with Death. Sydow's aloof presence and the spiritual complexity of his roles contribute significantly to the gloomy atmosphere and ambiguity characteristic of Bergman's films. He also played in other Bergman films, including *Ansiktet* (1958; British title, *The Face;* American title, *The Magician*); *Jungfrukällan* (1960; *The Virgin Spring*); *Sasom i en Spegel* (1961; *Through a Glass Darkly*); *Nattvardsgästerna* (1963; *Winter Light*); *Skammen* (1968; *Shame*); and *En Passion* (1969; *The Passion of Anna*).

During the height of his career in Sweden, Sydow also appeared in a number of American films, portraying Christ in *The Greatest Story Ever Told* (1965) and a fanatical missionary in *Hawaii* (1966). His later English-language films include *The Exorcist* (1973), *Voyage of the Damned* (1976), and *Three Days of the*

*Condor* (1976). In 1981 he appeared in the Swedish film *The Flight of the Eagle*.

**syenite,** any of a class of intrusive igneous rocks essentially composed of an alkali feldspar and a ferromagnesian mineral. A special group of alkali syenites is characterized by the presence of a feldspathoid mineral such as nepheline, leucite, cancrinite, or sodalite (*see* nephelinesyenite). Chemically, syenites contain a moderate amount of silica, relatively large amounts of alkalies, and alumina. The name was first used by Pliny the Elder.

The texture of syenites, like that of granite, is granular, and these rocks differ from granite only by the absence or scarcity of quartz. The alkali feldspars present may include orthoclase, perthite, albite, or, more rarely, microcline; the ferromagnesian mineral may be biotite, hornblende, or pyroxene. In the alkali syenites, the amphiboles or pyroxenes frequently contain sodium. The more normal syenites are divisible according to their prevalent dark-coloured mineral into augite-, hornblende-, and biotite-syenites; but, like granites, syenites are also divisible according to the type of alkali feldspar into potash and soda syenites. The accessory constituents include sphene, apatite, zircon, magnetite, and pyrites. Syenites are much less common than granites and diorites. The rocks known as nordmarkite and pulaskite are soda syenites. Rocks transitional between syenites and diorites are known as monzonites.

**Syeverodonetsk,** Russian SEVERODONETSK, also spelled SEVERODONECK, city, Luhansk *oblast* (province), eastern Ukraine, in the valley of the Donets River. The city was founded in 1934 as the site of a new chemical complex, part of which was evacuated eastward during World War II. In 1951 and 1958 additional chemical industries were added, based on coke, and the complex has grown over the years. With Lysychansk and Rubizhne, it is one of Ukraine's major chemical centres. Pop. (1993 est.) 135,000.

**Sykes, Sir Mark,** 6TH BARONET (b. March 16, 1879, London, Eng.—d. Feb. 16, 1919, Paris, France), diplomat who represented Great Britain in the so-called Sykes-Picot negotiations (1915–16) concerning the dismemberment of the Ottoman Empire after World War I.

Sykes served in the South African (Boer) War (1899–1902) and was personal secretary (1904–05) to George Wyndham, British chief secretary in Ireland. After traveling in Asiatic Turkey for several years, he wrote vivid accounts of his journeys, including *Through Five Turkish Provinces* (1900) and *The Caliph's Last Heritage* (1915). He was elected to Parliament in 1911.

Early in World War I, the British government employed Sykes on diplomatic missions in the Balkans and Turkey. He then was chief British representative in the negotiations with France and tsarist Russia that resulted in a secret accord known as the Sykes-Picot Agreement (May 1916). Under its terms, Syria and Iraq were to be divided into spheres of French and British influence and even direct administration; Palestine was to be subject to international control. When made public by the Russian Revolutionary government in 1917, these arrangements infuriated the Arabs, who had been led to expect postwar independence. Until the end of the war Sykes undertook Middle Eastern missions for the British Foreign Office.

**Sykes-Picot Agreement** (May 9, 1916), secret convention made during World War I between Great Britain and France, with the assent of imperial Russia, for the dismemberment of the Ottoman Empire. The agreement led to the division of Turkish-held Syria, Iraq, Lebanon, and Palestine into various French- and British-administered areas. The agreement took its name from its negotiators, Sir Mark Sykes of Britain and Georges Picot of France.

Its provisions were as follows: (1) Russia should acquire the Armenian provinces of Erzurum, Trebizond (Trabzon), Van, and Bitlis, with some Kurdish territory to the southeast; (2) France should acquire Lebanon and the Syrian littoral, Adana, Cilicia, and the hinterland adjacent to Russia's share, that hinterland including Aintab, Urfa, Mardin, Diyarbakır, and Mosul; (3) Great Britain should acquire southern Mesopotamia, including Baghdad, and also the Mediterranean ports of Haifa and Akka (Acre); (4) between the French and the British acquisitions there should be a confederation of Arab states or a single independent Arab state, divided into French and British spheres of influence; (5) Alexandretta (Iskenderun) should be a free port; and (6) Palestine, because of the holy places, should be under an international regime.

This secret arrangement conflicted in the first place with pledges already given by the British to the Hāshimite dynast Ḥusayn ibn ʿAlī, sharif of Mecca, who was about to bring the Arabs of the Hejaz into revolt against the Turks on the understanding that the Arabs would eventually receive a much more important share of the fruits of victory. It also excited the ambitions of Italy, to whom it was communicated in August 1916, after the Italian declaration of war against Germany, with the result that it had to be supplemented, in April 1917, by the Agreement of Saint-Jean-de-Maurienne, whereby Great Britain and France promised southern and southwestern Anatolia to Italy. The defection of Russia from the war canceled the Russian aspect of the Sykes-Picot Agreement; and the Turkish Nationalists' victories after the military collapse of the Ottoman Empire led to the gradual abandonment of its projects for Anatolia. The Arabs, however, who had learned of the Sykes-Picot Agreement through the publication of it, together with other secret treaties of imperial Russia, by the Soviet Russian government late in 1917, were scandalized by it; and their resentment persisted despite the modification of its arrangements for the Arab countries by the Allies' Conference of San Remo in April 1920.

**Syktyvkar,** formerly (until 1930) UST-SYSOLSK, city and capital of Komi republic, northwestern Russia. It lies at the confluence of the Vychegda and Sysola rivers. It was founded in 1586 as Ust-Sysolsk and was made a city in 1780, but its remoteness hindered growth, and in fact it was used as a place of exile. In the 1960s a large timber-processing plant was built on Syktyvkar's northern outskirts, producing paper, pulp, hardboard, and plywood. The modern city has major shipbuilding, ship repair, sawmilling, and paper-pulp industries as well as a teacher-training institute and a branch of the Academy of Sciences. Pop. (1993 est.) 226,300.

**Sylacauga,** city, Talladega county, east-central Alabama, U.S. It is located at the southwestern corner of the Talladega National Forest (eastern section) in the Coosa River valley. The city is built upon an extensive bed of translucent cream-white marble. Quarrying and processing of this marble began in 1840, and part of it was used in the U.S. Supreme Court Building. The marble is crushed and ground in many products, including paint, resin, and asphalt tile. The city's marble industry is supplemented by textiles and light industrial development. The name Sylacauga is an Indian word meaning "buzzard roost." Inc. 1839. Pop. (1993 est.) 13,240.

**Sylhet,** originally SRIHATTA, city, northeastern Bangladesh. It lies along the right bank of the Surma River. The most important town in the Surma River valley, it is connected by road and rail with Comilla, Chhātak, and Habiganj, by road with Assam and Meghālaya, India, and by air with Dhākā. Sylhet is known for its cane products and also produces tea, matches, and vegetable oil. There are also several handicraft cottage industries. Tea estates southeast of Sylhet provide most of Bangladesh's yield.



Tea-picker in the Sylhet locality, Bangladesh
Frederic Ohringer from the Nancy Palmer Agency

Constituted a municipality in 1878, Sylhet houses a medical college and several government colleges affiliated with the University of Chittagong. It was the capital of the 14th-century raja Gaur Gobind and later served as a Muslim cultural centre. Historic sites include the Shāh Jalal Mosque and the tombs of several Muslim saints. Pop. (1991 prelim.) city, 114,284.

**syllabary,** a set of written symbols used to represent the syllables of the words of a language. Writing systems that use syllabaries wholly or in part include Japanese, Cherokee, the ancient Cretan scripts (Linear A and Linear B), and various Indic and cuneiform writing systems. Some syllabaries include separate symbols for each possible syllable that may occur in the language; others use a system of consonant symbols that include an inherent vowel. In the former type of syllabary, for example, there will be separate symbols representing *ka, ke, ki, ko,* and *ku;* whereas in the latter type of syllabary a symbol for *ka* might be paired with a symbol for the vowel *e* to represent *ke* but would stand alone when it represented *ka.* Other types of syllabaries combine syllabic symbols to represent syllables for which there is no one symbol; in such systems, for example, there may be symbols for *ka, ke, ki,* etc., but no symbols for *kan, ken, kin,* etc. Syllables of this latter type might be represented in such a system by combining the symbol for *ka* with that for *an* to form *kan* (*ka-an*), the symbol for *ke* with that for *en* to form *ken* (*ke-en*), etc.

Although syllabic writing systems are a great improvement over logographic and mixed phonetic and logographic writing systems (which may require thousands of distinct symbols), they are still much bulkier than alphabetic writing systems, which reduce the number of signs (letters) to the minimum number required for representing the sounds of a language.

**syllable,** a segment of speech that consists of a vowel, with or without one or more accompanying consonant sounds immediately preceding or following—for example, *a, I, out, too, cap, snap, check.* A syllabic consonant, such as the final *n* sound in *button* and *widen,* also constitutes a syllable. Closed (checked) syllables are those that end in a consonant; open (free) syllables end in a vowel. The role that syllables play in the production of speech is a matter of considerable debate. So too is any more precise definition of the syllable in phonetics and phonology.

**syllogism,** in logic, a valid deductive argument having two premises and a conclusion. The traditional type is the categorical syl-

logism in which both premises and the conclusion are simple declarative statements that are constructed using only three simple terms between them, each term appearing twice (as a subject and as a predicate): "All men are mortal; no gods are mortal; therefore no men are gods." The argument in such syllogisms is valid by virtue of the fact that it would not be possible to assert the premises and to deny the conclusion without contradicting oneself.

**syllogistic,** in logic, the formal analysis of logical terms and operators and the structures that make it possible to infer true conclusions from given premises. Developed in its original form by Aristotle in his *Prior Analytics* (*Analytica priora*) about 350 BC, syllogistic represents the earliest branch of formal logic.

A brief treatment of syllogistic follows. For full treatment, *see* MACROPAEDIA: Logic, History and Kinds of.

As currently understood, syllogistic comprises two domains of investigation. Categorical syllogistic, with which Aristotle concerned himself, confines itself to simple declarative statements and their variation with respect to modalities, or expressions of necessity and possibility. Noncategorical syllogistic is a form of logical inference using whole propositions as its units, an approach traceable to the Stoic logicians but not fully appreciated as a separate branch of syllogistic until the work of John Neville Keynes in the 19th century.

Knowing the truth or falsity of any given premises or conclusions does not enable one to determine the validity of an inference. In order to understand the validity of an argument, it is necessary to grasp its logical form. Traditional categorical syllogistic is the study of this problem. It begins by reducing all propositions to four basic forms.

Every ___ is (a) ___ .
No ___ is (a) ___ .
Some (*i.e.,* at least one) ___ is (a) ___ .
Some ___ is not (a) ___ .

Respectively, these forms are known as *A*, *E*, *I*, and *O* propositions, after the vowels in the Latin terms *affirmo* and *nego*. This distinction between affirmation and negation is said to be one of quality, while the difference between the universal scope of the first two forms, in contrast to the particular scope of the last two forms, is said to be one of quantity.

The expressions that fill the blanks of these propositions are called terms. These may be singular (Mary) or general (women). A very important distinction with respect to the use of general terms turns on whether their extensional or intensional attributes are in play; extension (also called denotation) designates the set of individuals to which a term applies, while intension (also called connotation) describes the set of attributes which define the term. The term that fills the first blank is called the subject of the proposition, that which fills the second is the predicate.

Using the notation of the early 20th-century logician Jan Łukasiewicz, the general terms or term variables can be expressed as lowercase Latin letters *a*, *b*, and *c*, with capitals reserved for the four syllogistic operators that specify *A*, *E*, *I*, and *O* propositions. The proposition "Every *b* is an *a*" is now written "*Aba*"; "Some *b* is an *a*" is written "*Iba*"; "No *b* is an *a*" is written "*Eba*"; and "Some *b* is not an *a*" is written "*Oba*." Careful examination of the relations obtaining between these propositions reveals that the following are true for any terms *a* and *b*.

Not both: *Aba* and *Eba*.
If *Aba*, then *Iba*.
If *Eba*, then *Oba*.
Either *Iba* or *Oba*.
*Aba* is equivalent to the negation of *Oba*.
*Eba* is equivalent to the negation of *Iba*.

Reversing the order of the terms yields the simple converse of a proposition, but when in addition an *A* proposition is changed to an *I*, or an *E* to an *O*, the result is called the limited converse of the original. The logical relations holding between propositions and their converses, often pictured graphically in a square of opposition, are as follows: *E* and *I* propositions are equivalent or equipolent to their simple converses (*i.e.*, *Eba* and *Iba*, respectively). An *A* proposition *Aba*, although not equivalent to its simple converse *Aab*, implies, but is not implied by, its limited converse *Iab*. This kind of inference is traditionally called *conversio per accidens* and holds as well in *Eba* implying *Oab*. In contrast, *Oba* neither implies nor is implied by *Oab*, and this is expressed by saying that *O* propositions do not convert. When a proposition is posed against the proposition that results from changing its quality at the same time that its second term is negated, the resulting equivalence is called obversion. A last type of inference is called contraposition and is produced by the fact that some propositions imply the proposition that results from the original proposition when both of its term variables are negated and their order reversed.

A categorical syllogism infers a conclusion from two premises. It is defined by the following four attributes. Each of the three propositions is an *A*, *E*, *I*, or *O* proposition. The subject of the conclusion (called the minor term) also occurs in one of the premises (the minor premise). The predicate of the conclusion (called the major term) also occurs in the other premise (the major premise). The two remaining term positions in the premises are filled by the same term (the middle term). Since each of the three propositions in a syllogism can take one of four combinations of quality and quantity, the categorical syllogism may exhibit any of 64 moods. Each mood may occur in any of four figures—patterns of terms within the propositions—thus yielding 256 possible forms. One of the important tasks of syllogistic has been to reduce this plurality to just the valid forms.

Aristotle accepted 14 valid moods officially and 5 unofficially; since 5 of these 19 syllogisms have universal conclusions, the number of valid moods can be increased to 24 by passing to their corresponding particular propositions (*i.e.*, from "all" to "some"). Employing an axiomatic system in which proof was by direct reduction and indirect reduction or *reductio ad impossibile,* Aristotle was able to reduce all syllogisms to those of the first figure. Today, in order to admit terms regardless of their emptiness or nonemptiness, syllogistic has become a special case of Boolean algebra in which the concepts of universal class and null class, along with the operations of class union and class intersection, are incorporated. From this standpoint the number of moods is 15. These 15 moods are the theorems of the syllogistic when interpreted in the predicate calculus.

Noncategorical syllogisms are either hypothetical or disjunctive, to which some treatments add a class of copulative syllogisms. Their treatment is distinguished from categorical syllogistic by the fact that the latter is a predicate logic analyzing terms in combination, while noncategorical syllogistic is a propositional logic that treats unanalyzed entire propositions as its units. Hypothetical syllogisms in which all propositions are of the form "p $\supset$ q" (*i.e.*, "p implies q") are called pure, as opposed to mixed hypothetical syllogisms that have one hypothetical and one categorical premise and a categorical conclusion. These latter have two valid moods. Disjunctive syllogisms are composed by an "either . . . or" operator and have two important moods. In the 20th century the understanding of noncategorical syllogisms was extended to encompass complex and compound propositions as well as the dilemma with its constructive and destructive moods.

**Sylt,** German island in the North Sea, largest and northernmost of the North Frisian Islands, occupying an area of 38 square miles (99 square km). It is connected by rail with the mainland via the Hindenburgdamm (causeway), which is 7 miles (11 km) long. More than 22 miles (35 km) long, Sylt is in some places only 0.5 mile (1 km) wide, but from the centre of its east coast a beaklike peninsula juts toward the Schleswig-Holstein mainland. A magnificent beach extends along the smooth west coast, where the Red Cliffs of glacial moraine rise to 98 ft (30 m). The island is dotted with prehistoric megalithic tombs and other structures. There are a few small farms with dairy cattle and sheep and scattered villages such as Keitum; but tourism is the economic mainstay, based on resorts such as List, Westerland, and Wenningstedt-Braderup. Pop. (1991) 20,535.

**sylvanite,** a gold and silver telluride mineral [$(Au,Ag)Te_2$] in which the ratio of gold to silver atoms is commonly close to 1:1. It is a member of the krennerite group of sulfides and is found associated with them in ore veins formed at low temperatures in Hungary, Australia, Canada, and the western United States. It forms monoclinic crystals. For detailed chemical properties, *see* sulfide mineral (table).

**Sylvester,** also spelled SILVESTER, name of Roman Catholic popes and an antipope, grouped below chronologically and indicated by the symbol •.

• **Sylvester I,** SAINT (b. Rome [Italy]—d. 335, Rome; Western feast day December 31, Eastern feast day January 2), pope from 314 to 335, whose long pontificate saw the beginnings of the Christian Roman Empire.

A presbyter when elected to succeed Pope St. Miltiades (Melchiades), Sylvester was consecrated on Jan. 31, 314. The most important event of his reign was the Council of Nicaea (May 325), which condemned the Alexandrian Christian priest Arius, founder of Arianism, a heretical doctrine teaching that the Son was neither equal with God the Father nor eternal. While the Roman emperor Constantine I the Great favoured Christianity and was a major controller of its ecclesiastical affairs, neither he nor his immediate successors gave any official recognition to papal primacy over the church. Thus, it was a rare and significant exception when Sylvester was accorded a preeminent role in the Arian crisis. Although invited, he did not attend the Council of Nicaea personally but was represented by two legates, who were treated with great honour and respect yet did not preside at the debates.

According to subsequent legend, Sylvester converted and baptized Constantine, who was the first Roman emperor to become a Christian, and miraculously cured him of leprosy, for which the emperor allegedly gave him the *Donatio Constantini* (Donation of Constantine), a grant of spiritual supremacy over the Eastern patriarchates and over all matters of faith and worship as well as temporal dominion over Rome and the entire Western world. The Donation is now universally admitted to be an 8th-century forgery, but it was important in the development of the medieval theory of church and state.

Sylvester is believed to have built at the Cemetery of St. Priscilla on the Via Salaria a church, where he was buried. His relics were transferred in 762 by Pope St. Paul I to the Church of San Silvestro in Capite, now the national church of English Catholics in Rome.

• **Sylvester II,** original name GERBERT OF AURILLAC (b. *c.* 945, near Aurillac, Auvergne, Fr.—d. May 12, 1003, Rome), French head of the Roman Catholic church (999–1003),

renowned for his scholarly achievements, his advances in education, and his shrewd political judgment.

*Early life and clerical career.* Gerbert was born of humble parentage near Aurillac in



Sylvester II, detail from the ivory vessel used at the consecration of Otto III, 996; in the Domschatzkammer des Aachener Domes, Aachen, Ger.
Leonard von Matt

the ancient French province of Auvergne. He was trained at Saint-Gerald in grammar, arithmetic, and music under the tutelage of Raymond Lavaur, who later became abbot of Aurillac, where Gerbert probably became a monk.

Gerbert was taken to Spain in 967 by Count Borrell of Barcelona and remained there three years. At the monastery of Santa María de Ripoll, which was noted for its fine library, he studied the quadrivium (the higher division of the liberal arts, which includes music, arithmetic, geometry, and astronomy) under Bishop Atto of Vich.

In 970 Gerbert accompanied Borrell to Rome, where his mathematical knowledge delighted the schismatic pope John XIII, who presented him to the Holy Roman emperor Otto I. Gerbert was then entrusted with his first royal pupil, Otto II. Lively Socratic discussions, however, convinced Gerbert that he lacked training in logic, and, when a skilled logician, Archdeacon Gerann of Reims, visited Rome, Gerbert gained permission to study in Reims under Gerann's tutelage.

Logic and dialectic so captivated Gerbert that, after being invited by Adalbero (who later ordained him) to teach at the cathedral school, he became famous for reorganizing logical and dialectical studies. Gradually, he eliminated simpler logical works and added monographs on logic by Boethius, an early 6th-century Roman philosopher.

Gerbert's fame aroused the jealousy of Otric, master of the cathedral school at Magdeburg in Saxony (presently in Germany), who denounced Gerbert to Emperor Otto II. In December 980 Otto provoked a debate in Ravenna between Gerbert and Otric on the subject of classifying knowledge. The vehement argument that resulted was terminated only when the Emperor intervened.

Otto subsequently gave Gerbert the headship of the wealthy monastery of St. Columban of Bobbio (southwest of Piacenza, Italy), and Benedict VII consecrated him abbot of the monastery. Gerbert, however, was inexperienced in administration and unfamiliar with the land law in the region of Lombardy. As a result he encountered violent hostility from monks, clerics, and nobles, who possessed much of Bobbio's extensive property through long-term civil-law land leases and refused to make contractual payments or supply troops demanded by Otto. Some even stole the abbey's agricultural products. Within Otto's palace in Pavia (west of Piacenza), nobles plotted against Gerbert and even against Otto himself.

Rebellion followed Otto's death (December 983), forcing Gerbert to flee from Bobbio and hasten to Reims. He travelled and wrote urgent letters to arouse Germans, Belgians, and Lorrainers against Henry II the Quarrelsome, duke of Bavaria, who was plotting to become king by seizing the three-year-old king Otto III. Gerbert resumed teaching at Reims but he really longed to be summoned to the imperial court.

After the deaths of the last Carolingian kings (Lothair in 986 and Louis V in 987), Adalbero and Gerbert influenced the nobles to elect Duke Hugh Capet king against the claims of the remaining Carolingian, Duke Charles of Lorraine. As Hugh's secretary and adviser, Gerbert became involved in Hugh's resistance to Charles's attempt to dethrone him. Before Adalbero died, in January 989, he indicated Gerbert as his successor, but Hugh unwisely chose Arnulf, an illegitimate son of King Lothair. In September Arnulf betrayed Reims to Charles, his uncle, who forced Gerbert to remain in the city. After eight months Gerbert managed to escape to Hugh's court, where he was falsely accused of having been the leader in "enormous crimes" of collaboration with Duke Charles.

In June 990 the bishops and Hugh appealed to Pope John XV to condemn and depose Arnulf and to approve their consecration of a new archbishop. After Hugh captured Charles and Arnulf in March 991, a council at Saint-Basle de Verzy, near Reims, degraded Arnulf. Gerbert was elected archbishop and soon became embroiled in controversies with the papacy. He administered his ecclesiastical duties capably, but the clergy's confidence in the legality of his election decreased. When a newly appointed bishop refused to be consecrated by him and instead travelled to distant Rome for consecration by the Pope, Gerbert hastened to Rome to defend the legitimacy of his election. In the meantime, however, Pope John had died, and Gerbert was heard by John's successor, Gregory V, who rejected Gerbert's plea for support.

Returning north through Pavia, he met Otto III, then 16 and recently crowned emperor. Gerbert's witty intelligence charmed Otto, who immediately made use of his talents for writing letters. They parted reluctantly after Aug. 5, 996. In January 997 a council declared that all bishops involved in Arnulf's deposition were removed from office. By April Gerbert, no longer tolerating the clergy's acceptance of these decrees, left Reims for Otto's court in Aachen (in modern Germany), never to return to France.

He became a teacher again and a musician in Otto's chapel; he also travelled with Otto to Magdeburg, where he displayed his inventiveness by constructing a timepiece (*horologium*). In October he followed Otto to Italy, where Otto had him appointed (*c.* April 998) archbishop of Ravenna, an important city for Otto's control over Italy. Gerbert instigated a new agricultural policy in Italy by having Bobbio's frustrating long-term leases quashed and restricting future leases to the lifetime of the grantor abbot or bishop; this was, perhaps, the most important legislation enacted for Italy during the reign of Otto.

*Pontificate.* Within a year after Gerbert took over the see of Ravenna, Gregory V died, and Otto was able to choose Gerbert as Gregory's successor. He was consecrated—the first Frenchman to be elevated to the throne of Peter—on April 9, 999, and took the name Sylvester II, declaring his cooperation with Otto's ideal of a renewed Christian Roman Empire.

Their unanimity is shown by numerous documents issued by papal and imperial chanceries that use similar terms. Each appeared as intercessor for a petitioner in documents of the other and also participated in councils of the other. The two men disagreed on only one important political decision, the crowning of Duke Bolesław as king of Poland. Sylvester permitted establishment of Gniezno as an archbishopric independent of the German hierarchy but refused Otto III's desire to elevate Bolesław to kingship. Sylvester did agree, however, to create Stephen king of Hungary and to erect an independent archbishopric there. Otto's sudden death, on Jan. 23, 1002, terminated their close cooperation.

To extend papal influence, Sylvester communicated with Vladimir I, the grand prince of Kiev and first Christian ruler of what became Russia; demanded that King Olaf I Tryggvason of Norway, who made Christianity the official religion of the country, abandon the use of runic writing; sent ambassadors to Dalmatia (on the Adriatic coast of the Balkans); reprimanded the Doge of Venice and the Patriarch of Grado (on the northeastern coast of Italy) for the Venetian clergy's loose morals; held semi-annual general councils; and restored Arnulf to the Reims archbishopric, ending the divisive Reims controversy. He granted Poland its first archbishop (in 1000), and he denounced simony (the buying and selling of ecclesiastical offices) and nepotism and mandated celibacy. Bishops and nobles often exerted authority over wealthy abbeys; the abbeys thus petitioned Sylvester to free them from all exterior control except that of the papacy. Included in their request was the important right to elect their own abbots. Sylvester's acquiescence reduced the power of the bishops and increased that of the pope. To strengthen the papacy still further, Sylvester began its feudalization by enfeoffing Count Daiferio of Terracina in return for military service.

Sylvester died in 1003, and immediately legends about his great learning surfaced, revealing the impression he made on contemporaries. Some attributed his learning to magical arts learned in Spain, some to the devil's coaching, some to an artificial head that answered his questions.

*Assessment.* Gerbert was a great scholar, and he was also a good teacher and devised several practical means for learning: a chart for learning rhetoric; his writing about the abacus, which became the basic work on the subject and included the use of Hindu-Arabic numerals, which he had learned in Spain; celestial globes; a hemisphere for learning the imaginary celestial circles; and auxiliary spheres, one for identifying constellations and another with planetary orbits. He acquired an astrolabe and wrote about its uses. He prepared a work on geometry that attempted to fill the gap caused by the existence of a fragmentary Euclid and that included writings by the Roman surveyors. He had an extraordinary knowledge of music and seems to have constructed several organs and also a monochord for studying music theory. His philosophical tract *De rationali et de ratione uti* ("Concerning the Rational and the Use of Reason") emphasized problems of definition and classification of knowledge.

Gerbert was an avid collector of manuscripts, which he kept locked in four or five chests; only three of these manuscripts have been identified. He also kept copies of his letters, which were written in good Latin; his original collection has disappeared, but two copies

have survived. Only one contemporary biography exists: a work written by Richer of Saint-Rémy, who believed that Gerbert was sent to Reims "by the Divinity Itself." (This account was discovered only in modern times, in the cathedral library in Bamberg, Ger.) Thus for a long time even learned men relied on legends for knowledge of Gerbert.

Eventually, however, scholars discovered and published critical editions of his writings that dispelled many of the fables that had accumulated around him.

Gerbert remains the dominating figure of the late 10th century for modern scholars, who are concerned especially with more precise dating of his letters and a more detailed understanding of his political roles, his teaching (especially in logic, dialectic, mathematics, and astronomy), his transmission of Arabic learning, his relations with Otto III, his papacy, and his influence on later ages.

(H.P.La.)

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*Articles are alphabetized word by word, not letter by letter*

**•Sylvester III,** original name JOHN OF SABINA, Italian GIOVANNI DI SABINA (b. Rome—d. March 3, 1046?), pope, or antipope, from Jan. 20 to Feb. 10, 1045.

He was bishop of Sabina when elected pope in January 1045 by a Roman faction that had driven Pope Benedict IX out of Rome. The following month, however, Benedict's supporters in turn expelled Sylvester, and Benedict then sold the papacy to the archpriest Giovanni Graziano, who became Pope Gregory VI in May 1045. Recognizing Gregory as the legitimate pope, Sylvester returned to his old bishopric.

When Benedict afterward attempted to depose Gregory, the Holy Roman emperor Henry III intervened and had Gregory convoke the Synod of Sutri (December 1046), which deposed Benedict, Sylvester (who had supposedly reclaimed the papacy against Benedict's apparent unsuitability), and Gregory, replacing them with Pope Clement II. The sentence of Sylvester's deposition survives in the documents issued by him as bishop of Sabina during 1046. He is regarded by some as an antipope.

**•Sylvester (IV),** original name MAGINULFO (b. Rome—d. 1111), antipope from 1105 to 1111. While the Investiture Controversy raged between the German king Henry V (later Holy Roman emperor) and Pope Paschal II, the imperialist faction, under Werner, margrave of Ancona, elected Maginulfo as successor to the imperialist antipope Albert (Aleric) on Nov. 18, 1105. He was the fourth in a line of antipopes set up against Paschal II.

Taking the name Sylvester, he was expelled from Rome the next day by Paschal's troops. While his adherents continued to oppose Paschal, Sylvester received some recognition from Henry, but when the King and the Pope came to terms in 1111, Sylvester's pretensions were dismissed. He was never widely supported.

**Sylvester, James Joseph** (b. Sept. 3, 1814, London—d. March 15, 1897, London), British mathematician who with Arthur Cayley founded the theory of algebraic invariants, algebraic-equation coefficients that are unaltered when the coordinate axes are translated or rotated.



James Joseph Sylvester, detail of an oil painting by A.E. Emslie, 1889; in St. John's College, Cambridge

By courtesy of the Master and Fellows of St. John's College, Cambridge

In 1838 Sylvester became professor of natural philosophy at University College, London. In 1841 he accepted the professorship of mathematics at the University of Virginia, Charlottesville, but resigned after only three months. Four years later he went to London, where he became an actuary for an insurance company, retaining his interest in mathematics only through tutoring. One of the most notable of his private pupils was Florence Nightingale. In 1846 he became a law student at the Inner Temple, and in 1850 he was admitted to the bar. While working as a lawyer Sylvester began an enthusiastic and profitable partnership with Cayley. Together, they created the theory of algebraic forms.

From 1855 to 1870 Sylvester was professor of mathematics at the Royal Military Academy, Woolwich. He went to the United States once again in 1876 to become professor of mathematics at Johns Hopkins University, Baltimore. While there he founded (1878) and became the first editor of the *American Journal of Mathematics*, introduced graduate work in mathematics into U.S. universities, and greatly stimulated the development of mathematics in that country. In 1883 he returned to England to occupy the chair of Savilian professor of geometry at Oxford University.

Sylvester was primarily an algebraist. He did brilliant work in the theory of numbers, particularly in partitions (the possible ways a number can be expressed as a sum of positive integers) and diophantine analysis (a means for finding whole-number solutions to certain algebraic equations). He worked by inspiration, and frequently it is difficult to detect a proof in what he confidently asserted. All his work is characterized by powerful imagination and inventiveness. Although he published hundreds of papers, his only book on mathematics is *Treatise on Elliptic Functions* (1876). Sylvester also wrote verse and published *Laws of Verse* (1870).

**Sylvester, Josuah** (b. 1563, Kent, Eng.—d. Sept. 28, 1618, Middelburg, Neth.), English poet-translator, best known as the translator of a popular biblical epic, the *Divine Weekes and Workes*. Translated from a French Protestant poet, Guillaume du Bartas, (1544–90), it appeared in sections in 1592 and complete in 1608. This epic on the creation, the fall of man, and other early parts of Genesis was extremely popular in England through the first half of the 17th century. Sylvester had some small influence on Dryden, Milton, and other poets.

**Sylviidae,** songbird family, order Passeriformes, consisting of the Old World warblers, almost 300 species of small, dull-coloured active birds found in a variety of habitats.

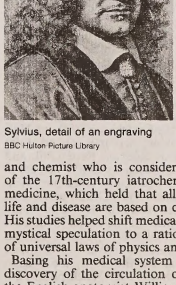
Members range in size from 9 to 26 centimetres (3.5 to 10 inches) long. They have thin bills; long nostrils with a covering flap; medium, rounded wings; and weak legs and feet. Old World warblers have 10 primary feathers in each wing, instead of nine, as in the New World wood warblers (family Parulidae). In woods, brushlands, and marshes these birds search for insects. They are good singers, though not equal to thrushes. *Sylvia* includes many common European birds, such as the garden warbler (*S. borin*), whitethroat (*S. communis*), and blackcap (*S. atricapilla*).

The family is sometimes divided into the following subfamilies: warblers proper (Sylviinae), gnatcatchers (Polioptilinae), kinglets (Regulinae), and wren-warblers (Malurinae). Some authorities list the subfamily Sylviinae in the family of Old World flycatchers (Muscicapidae). In other classifications, as here, these subfamilies are raised to family rank.

The Sylviidae belongs to the songbird suborder (Passeres).

**sylvite,** halide mineral, potassium chloride (*q.v.*; KCl), the chief source of potassium. It is rarer than halite (sodium chloride) and occurs as soft, bitter-tasting, white or grayish, glassy cubes or as masses with halite and gypsum in evaporite deposits in the vicinity of Stassfurt, Ger., and in southwestern New Mexico, U.S. It was first found (1823) as an incrustation on lava from Mt. Vesuvius.

**Sylvius, Franciscus,** also called FRANZ, or FRANÇOIS, DE LE BOË, or DU BOIS (b. March 15, 1614, Hanau, Ger.—d. Nov. 15, 1672, Leiden, Neth.), physician, physiologist, anatomist, and chemist who is considered the founder of the 17th-century iatrochemical school of medicine, which held that all phenomena of life and disease are based on chemical action. His studies helped shift medical emphasis from mystical speculation to a rational application of universal laws of physics and chemistry.



Sylvius, detail of an engraving

BBC Hulton Picture Library

Basing his medical system on the recent discovery of the circulation of the blood by the English anatomist William Harvey, while keeping it within the general framework of the classic Greek physician Galen's humoral theories, Sylvius felt that the most important processes of normal and pathological life take place in the blood and that diseases should be explained and treated chemically. Recognizing the existence of salts in living matter, he

concluded that they were the result of an interaction of acids and bases; thus, he postulated that chemical imbalances consist of either an excess of acid (acidosis) or an excess of alkali (alkalosis) in the blood, and he devised drugs to counteract these conditions.

A professor of medicine at the University of Leiden (1658–72), Sylvius was one of Europe's outstanding teachers. He was among the first to introduce ward instruction in medical education, and he instigated the construction of perhaps the first university chemistry laboratory. He was the first to distinguish between two kinds of glands: conglomerate (made up of a number of smaller units, the excretory ducts of which combine to form ducts of progressively higher order) and conglobate (forming a rounded mass, or clump). He also discovered (1641) the deep cleft (Sylvian fissure) separating the temporal (lower), frontal, and parietal (top rear) lobes of the brain.

**symbiosis,** any of several living arrangements between members of two different species, including mutualism, commensalism, and parasitism (*qq.v.*). Both positive (beneficial) and negative (unfavourable to harmful) associations are therefore included, and the members are called symbionts. The terms symbiosis and mutualism are sometimes equated and used interchangeably; this practice has resulted in some confusion.

In a very broad sense any association between two species populations that live together is symbiotic, whether the species benefit, harm, or have no effect on one another.

**symbol,** a communication element intended to simply represent or stand for a complex of person, object, group, or idea. Symbols may be presented graphically, as in the cross for Christianity, the red cross or crescent for the life-preserving agencies of Christian and Islāmic countries; representationally, as in the human figures Marianne, John Bull, and Uncle Sam standing for France, England, and the United States respectively; they may involve letters, as in K for the chemical element potassium; or they may be assigned arbitrarily, as in the mathematical symbol ∞ for infinity or the symbol $ for dollar.

In various philosophical contexts and particularly in semiotics, a branch of metalogic, very precise distinctions are made between symbol and sign. *See also* sign.

**Symbolist movement,** literary and artistic movement that originated with a group of French poets in the late 19th century, spread to painting and the theatre, and that influenced the European and American literatures of the 20th century to varying degrees. Symbolist artists sought to express individual emotional experience through the subtle and suggestive use of highly symbolized language.

*Symbolist literature.* The principal Symbolist poets include the Frenchmen Stéphane Mallarmé, Paul Verlaine, Arthur Rimbaud, Jules Laforgue, Henri de Régnier, René Ghil, and Gustave Kahn; the Belgians Émile Verhaeren and Georges Rodenbach; the Greek-born Jean Moréas; and Francis Vielé-Griffin and Stuart Merrill, who were American by birth. Rémy de Gourmont was the principal Symbolist critic, while Symbolist criteria were applied most successfully to the novel by Joris-Karl Huysmans and to the theatre by the Belgian Maurice Maeterlinck. The French poets Paul Valéry and Paul Claudel are sometimes considered to be direct 20th-century heirs of the Symbolists.

Symbolism originated in the revolt of certain French poets against the rigid conventions governing both technique and theme in traditional French poetry, as evidenced in the precise description of Parnassian poetry. The Symbolists wished to liberate poetry from its expository functions and its formalized oratory in order to describe instead the fleeting, immediate sensations of man's inner life and experience. They attempted to evoke the ineffable intuitions and sense impressions of man's inner life and to communicate the underlying mystery of existence through a free and highly personal use of metaphors and images that, though lacking in precise meaning, would nevertheless convey the state of the poet's mind and hint at the "dark and confused unity" of an inexpressible reality.

Such Symbolist forerunners as Verlaine and Rimbaud were greatly influenced by the poetry and thought of Charles Baudelaire, particularly by the poems in his *Les Fleurs du mal* (1857). They adopted Baudelaire's concept of the *correspondances* between the senses and combined this with the Wagnerian ideal of a synthesis of the arts to produce an original conception of the musical qualities of poetry. Thus, to the Symbolists, the theme within a poem could be developed and "orchestrated" by the sensitive manipulation of the harmonies, tones, and colours inherent in carefully chosen words. The Symbolists' attempt to emphasize the essential and innate qualities of the poetic medium was based on their conviction of the supremacy of art over all other means of expression or knowledge. This in turn was partly based on their idealistic conviction that underlying the materiality and individuality of the physical world was another reality whose essence could best be glimpsed through the subjective emotional responses contributing to and generated by the work of art.

Such masterpieces as Verlaine's *Romances sans paroles* (1874; *Songs Without Words*) and Mallarmé's *L'Après-midi d'un faune* (1876) sparked a growing interest in the nascent innovations of progressive French poets. The Symbolist manifesto itself was published by Jean Moréas in *Le Figaro* on Sept. 18, 1886; in it he attacked the descriptive tendencies of Realist theatre, Naturalistic novels, and Parnassian poetry. He also proposed replacing the term *décadent*, which was used to describe Baudelaire and others, with the terms *symboliste* and *symbolisme.* Many little Symbolist reviews and magazines sprang up in the late 1880s, their authors freely participating in the controversies generated by the attacks of hostile critics on the movement. Mallarmé became the leader of the Symbolists, and his *Divagations* (1897) remains the most valuable statement of the movement's aesthetics. In their efforts to escape rigid metrical patterns and to achieve freer poetic rhythms, many Symbolist poets resorted to the composition of prose poems and the use of *vers libre* (free verse), which has now become a fundamental form of contemporary poetry.

The extreme Symbolist movement in poetry reached its peak around 1890 and began to enter a precipitous decline in popularity around 1900. The atmospheric, unfocused imagery of Symbolist poetry eventually came to be seen as overrefined and affected, and the term *décadent,* which the Symbolists had once proudly flaunted, became with others a term of derision denoting mere fin-de-siecle preciosity. Symbolist works had a strong and lasting influence on much British and American literature in the 20th century, however. Their experimental techniques greatly enriched the technical repertoire of modern poetry, and Symbolist theories bore fruit both in the poetry of W.B. Yeats and T.S. Eliot and in the modern novel as represented by James Joyce and Virginia Woolf, in which word harmonies and patterns of images often take preeminence over the narrative.

One of the few successful Symbolist novels was *A rebours* (1884; *Against Nature*) by J.-K. Huysmans. The book relates the varied and surprisingly resourceful experiments



"St. Geneviève Looking over Paris," mural painting by Puvis de Chavannes, 1898; in the Panthéon, Paris
Marc Garanger

in aesthetic decadence undertaken by a bored aristocrat. The 20th-century American critic Edmund Wilson's survey of the Symbolist movement, *Axel's Castle* (1931), is considered a classic of modern literary analysis and the authoritative study of the movement.

*Symbolist painting.* Symbolism in painting took its direction from the poets and literary theorists of the movement, but it also represented a reaction against the objectivist aims of Realism and the increasingly influential movement of Impressionism. In contrast to the relatively concrete representation these movements sought, Symbolist painters favoured works based on fantasy and the imagination. The Symbolist position in painting was authoritatively defined by the young critic Albert Aurier, an enthusiastic admirer of Gauguin, in an article in the *Mercure de France* (1891). He elaborated on Moréas' contention that the purpose of art "is to clothe the idea in sensuous form" and stressed the subjective, symbolical, and decorative functions of an art that would give visual expression to the inner life. Symbolist painters turned to the mystical and even the occult in an attempt to evoke subjective states of mind by visual forms.

Such Postimpressionist painters as Paul Gauguin and Vincent Van Gogh as well as the Nabis may be regarded as Symbolists in certain aspects of their art. However, the painters who are truly representative of Symbolist aesthetic ideals include three principal figures: Gustave Moreau, Odilon Redon, and Pierre Puvis de Chavannes. Moreau was a figurative painter who created scenes based on legendary or ancient themes. His highly original style utilized brilliant, jewel-like colours to portray the ornate, sumptuous interiors of imaginary temples and palaces in which scantily clad figures are caught in statuesque poses. His work is characterized by exotic eroticism and decorative splendour. Redon explored mystical, fantastic, and often macabre themes in his paintings and graphics. His paintings stress the poetics of colour in their delicate harmonies of hues, while his subject matter was highly personal in its mythical and dreamlike figures. Puvis de Chavannes is now remembered primarily as a muralist.

*Symbolist theatre.* Dramatists also took their lead from the French Symbolist poets, especially from Mallarmé. As drama critic for

*La Dernière Mode* during the 1870s, Mallarmé opposed the dominant Realist theatre and called for a poetic theatre that would evoke the hidden mystery of man and the universe. Drama, for Mallarmé, should be a sacred rite in which the poet-dramatist revealed the correspondences between the visible and invisible worlds through the suggestive power of his poetic language. For the Symbolist playwright, the deeper truths of existence, known instinctively or intuitively, could not be directly expressed but only indirectly revealed through symbol, myth, and mood. The principal Symbolist playwrights were Maurice Maeterlinck in Belgium and Villiers de L'Isle-Adam and Paul Claudel in France. Also influenced by Symbolist beliefs were the Swedish playwright August Strindberg and the Irish poet and dramatist William Butler Yeats.

Noteworthy examples of Symbolist theatre include de L'Isle-Adam's *Axël* (first performed 1884; definitive edition 1890), Maeterlinck's *Pelléas et Mélisande* (1892), with its dream-like atmosphere, and the highly satirical *Ubu roi* (1896) by Alfred Jarry. In 1890 the French poet Paul Fort founded the Theatre d'Art, where Symbolist dramas were presented along with readings from ancient and modern poetry. When Fort retired in 1892 Aurélien-Marie Lugné-Poe continued Symbolist production at his Théâtre de l'Oeuvre well into the 20th century. (*See* Oeuvre, Théâtre de l'.) Though Symbolist theatre did not last long as a unified movement, its sharp break with the realistic tradition along with its reliance on fantasy, atmosphere, and mood influenced 20th-century playwrights and theatrical production.

**Symeon I,** byname SYMEON THE GREAT (Bulgarian tsar): *see* Simeon I.

**Symeon** OF DURHAM: *see* Simeon of Durham.

**Symeon** THE NEW THEOLOGIAN, SAINT, Symeon also spelled SIMEON (b. *c.* 949, Paphlagonia, in Asia Minor—d. March 12, 1022, Chrysopolis, near Constantinople), Byzantine monk and mystic, termed the New Theologian to mark his difference from two key figures in Greek Christian esteem, St. John the Evangelist and the 4th-century theologian St. Gregory of Nazianzus. Through his spiritual experiences and writings Symeon prepared the way for Hesychast mysticism, a 14th-century Eastern movement in contemplative prayer.

Oriented early toward monastic contemplation, Symeon in 980 became abbot of the monastery of St. Mamas, near Constantinople. He was compelled to resign this office in 1009 and retire to Chrysopolis because of his austere monastic policy and a dispute with the Patriarch of Constantinople over methods of spirituality, especially his devotion to his former monk tutor, Symeon the Studite.

Symeon the New Theologian's writings consist mainly of *catecheses* (Greek: "doctrinal and moral instructions"): sermons preached to his monks at St. Mamas; a series of short rules, *capita* (Latin: "chapters"); and the *Hymns of the Divine Loves,* describing his spiritual experiences. Symeon's mystical theology is a distinct phase of an evolutionary process in Greek spirituality that began in the late 2nd century. Its central theme is the conviction that, by applying the classical methods of mental prayer, one experiences a contemplative "vision of light," a symbolic term denoting the intuitional illumination that the mystic realizes in his encounter with the Divine Unknown. Symeon emphasized that such experience is attainable by all who earnestly immerse themselves in the life of prayer and is essential to interpreting sacred Scriptures.

**Symington, William** (b. Oct. 1763, Leadhills, Lanarkshire, Scot.—d. March 22, 1831, London), British engineer who developed (1801) a successful steam-driven paddle wheel and used it the following year to propel one of the first practical steamboats, the *Charlotte Dundas.*

Although Symington was educated for the ministry at Glasgow and Edinburgh, his inclinations led him to become a civil engineer. His working model of a steam-driven road carriage generated much enthusiasm in 1786, and within a few years he had patented several improved steam engines. His use of chains and ratchet wheels to provide rotary motion allowed far more economical operation than Watt's design. His first use of steam for marine purposes in 1787 was followed by larger experiments. In 1789 a boat propelled by an engine of his design achieved a speed of 7 mph.

In 1801 he patented a new engine utilizing a connecting rod and crank, a system that proved superior for paddle-wheel operation. This engine was used in 1802 to propel the *Charlotte Dundas* on the Forth and Clyde Canal, thus launching the first steamboat fitted for practical operations. Cautious managers caused the project to be abandoned in 1803.

**Symmachus,** SAINT (b. Sardinia—d. July 19, 514, Rome; feast day July 19), pope from 498 to 514.

Apparently a Christian convert, Symmachus was an archdeacon in the Roman Church when elected to succeed Pope Anastasius II. Concurrently, a minority had elected, with the support of a strong Byzantine party, the archpriest Laurentius. Both candidates were consecrated on Nov. 22, 498, and their respective parties appealed to the Ostrogothic king Theodoric the Great, whose decision favoured Symmachus. The Pope held a Roman synod on March 1, 499, which decided that only a majority vote triumphs.

Although Laurentius submitted and became bishop of Nocera, Italy, his supporters continued to dissent, accusing Symmachus of arbitrary decisions about the date of Easter, of despoiling the Church, and of fornications. Theodoric convoked a Roman synod in 501; during its fourth session (the Palmary Synod) the bishops decreed that there was no precedent for other bishops' passing judgment on the pope, which was ultimately in the hands of God. Theodoric, whose right to judge the issue was never acknowledged by Symmachus, was not satisfied and allowed the antipope Laurentius to return to Rome. Four years of violence ensued, during which the Laurentians took possession of many churches, although Symmachus was never dispossessed of his see.

Peace was not established until 505/506, when Theodoric ordered the Laurentian party to surrender the churches that they had confiscated. The schism, however, was finally healed during the reign of Pope St. Hormisdas, Symmachus' successor. The dispute also caused considerable fraudulent literature, subsequently known as the Symmachan Forgeries, drawn on by later exponents of the doctrine *quod prima sedes non judicatur a quoquam* ("that no one can pass judgment on the pope").

A strong supporter of orthodoxy, Symmachus engaged in the Acacian Schism (484–519), a complicated theological and political conflict between Rome and the patriarchate of Constantinople. The Byzantine emperor Anastasius I accused the Pope of favouring Manichaeism, the dualistic religious doctrine that good and evil are essentially principles of equivalent potency. In a letter of 512 Symmachus denied the imperial charges. Furthermore, he expelled the Manichaeans from Rome and burned their books. He aided the poor, for whom he built refuges, and African Catholics, who were being persecuted by the Arians (followers of the heretical doctrine that the Son was neither equal with God the Father nor eternal), and he also erected and restored several Roman churches, including the basilica of S. Agnese Fuori le Mura on the Via Aurelia.

**Symmachus, Quintus Aurelius** (b. *c.* 345—d. *c.* 402), Roman statesman, a brilliant orator and writer who was a leading opponent of Christianity.

Symmachus was the son of a consular family of great distinction and wealth. His oratorical ability brought him an illustrious official career culminating in the proconsulship of Africa in 373, the city prefecture at Rome in 384, and the consulship for 391. When the emperor Gratian (367–383), influenced by the Christian bishop of Milan, St. Ambrose, ordered the statue of Victory to be removed from the Senate house at Rome in 382, Symmachus, who was an earnest pagan, was appointed by the Senate to go to Milan to plead with the Emperor to cancel this antipagan measure; but the mission was a failure. After Gratian's murder in 383, Symmachus renewed his plea to Valentinian II (375–392) to revoke Gratian's antipagan orders; but, largely owing to the opposition of St. Ambrose, he was again unsuccessful. Symmachus' oration *De ara Victoriae* was considered so brilliant that even after 19 years the poet Prudentius found it necessary to write a reply to it. The increasingly Christian character of Valentinian's court caused Symmachus to lose much of his influence; but when Magnus Maximus drove Valentinian from Italy in 387, Symmachus, who was regarded as the leader of the Senate, was appointed to offer the new emperor the Senate's congratulations on his elevation. When Theodosius I reconquered Italy for Valentinian in 388, Symmachus was forgiven and appointed consul for 391. Under the pagan rule of Eugenius and Arbogast in 392–394 he apparently regained some of his influence and survived under Honorius until 402.

Symmachus' extant works, of which the most important are the 10 books of his *Letters*—because only fragments of his speeches survive—were edited by O. Seeck in *Monumenta Germaniae Historica,* vol. 6, part 1 (1883).

**Symmachus, Quintus Aurelius Memmius** (d. 524, Pavia, Liguria), Roman senator and patrician and a close friend of the philosopher Boethius, who married Symmachus' daughter Rusticiana and with whom he was executed for treason by the Ostrogoth king Theodoric.

Consul in 485, Symmachus was, like his son-in-law, an official of Theodoric's government. When Boethius defended the senator Albinus against an accusation of treason and was himself similarly charged, Symmachus defended Boethius. Symmachus in turn was arrested and, with Boethius, was executed.

**symmetry,** in biology, the repetition of the parts in an animal or plant in an orderly fashion. Specifically, symmetry refers to a correspondence of body parts, in size, shape, and relative position, on opposite sides of a dividing line or distributed around a central point or axis. With the exception of radial symmetry (*see* below), external form has little relation to internal anatomy, since animals of very different anatomical construction may have the same type of symmetry.

Certain animals, particularly most sponges and the ameboid protozoans, lack symmetry, having either an irregular shape different for each individual or else one undergoing constant changes of form. The vast majority of animals, however, exhibit a definite symmetrical form. Four such patterns of symmetry occur among animals: spherical, radial, biradial, and bilateral.

In spherical symmetry, illustrated only by the protozoan groups Radiolaria and Heliozoia, the body has the shape of a sphere and the parts are arranged concentrically around

or radiate from the centre of the sphere. Such an animal has no ends or sides, and any plane passing through the centre will divide the animal into equivalent halves. The spherical type of symmetry is possible only in minute animals of simple internal construction, since in spheres the interior mass is large relative to the surface area and becomes too large for efficient functioning with increase in size and complexity.

In radial symmetry the body has the general form of a short or long cylinder or bowl, with a central axis from which the body parts radiate or along which they are arranged in regular fashion. The main axis is heteropolar—*i.e.,* with unlike ends, one of which bears the mouth and is termed the oral, or anterior, end, and the other of which, called the aboral, or posterior, end, forms the rear end of the animal and may bear the anus. The main axis is hence termed the oral-aboral, or anteroposterior, axis. Except in animals having an odd number of parts arranged in circular fashion (as in the five-armed starfishes), any plane passing through this axis will divide the animal into symmetrical halves. Animals having three, five, seven, etc., parts in a circle have symmetry that may be referred to, respectively, as three-rayed, five-rayed, seven-rayed, etc.; only certain planes through the axis will divide such animals into symmetrical halves. Radial symmetry is found in the coelenterates and echinoderms.

In biradial symmetry, in addition to the anteroposterior axis, there are also two other axes or planes of symmetry at right angles to it and to each other: the sagittal, or median vertical-longitudinal, and transverse, or cross, axes. Such an animal therefore not only has two ends but also has two pairs of symmetrical sides. There are but two planes of symmetry in a biradial animal, one passing through the anteroposterior and sagittal axes and the other through the anteroposterior and transverse axes. Biradial symmetry occurs in the comb jellies.

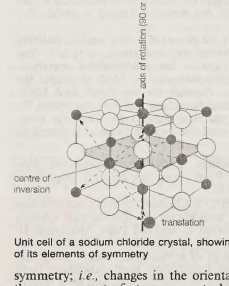
In bilateral symmetry there are the same three axes as in biradial symmetry but only one pair of symmetrical sides, the lateral sides, since the other two sides, called the dorsal (back) and ventral (belly) surfaces, are unlike. Thus, only one plane of symmetry will divide a bilateral animal into symmetrical halves, the median longitudinal, or sagittal, plane. Bilateral symmetry is characteristic of the vast majority of animals, including insects, fishes, amphibians, reptiles, birds, mammals, and most crustaceans.

The concept of symmetry is also applied in botany. A flower is considered symmetrical when each whorl consists of an equal number of parts or when the parts of any one whorl are multiples of that preceding it. Thus, a symmetrical flower may have five sepals, five petals, five stamens, and five carpels, or the number of any of these parts may be a multiple of five.

The number of parts in the pistillate whorl is frequently not in conformity with that in the other whorls, but in such cases the flower is still called symmetrical, provided that the other whorls are normal. A flower in which the parts are in twos is dimerous; in threes, fours, or fives, trimerous, tetramerous, or pentamerous, respectively. Trimerous symmetry is the rule in the monocotyledons, pentamerous the most common in the dicotyledons, although dimerous and tetramerous flowers also occur in the latter group.

When the different members of each whorl are alike, the flower is regular and is referred to as actinomorphic, or radially symmetrical, as in the petunia, buttercup, and wild rose. Differences in size or shape of the parts of a whorl make the flower irregular (as in the canna). When a flower can be divided by a single plane into two equal parts, it is zygomorphic, or bilaterally symmetrical, as in the snapdragon, orchid, and sweet pea.

**symmetry,** in crystallography, fundamental property of the orderly arrangements of atoms found in crystalline solids. Each arrangement of atoms has a certain number of elements of




Unit cell of a sodium chloride crystal, showing some of its elements of symmetry

symmetry; *i.e.,* changes in the orientation of the arrangement of atoms seem to leave the atoms unmoved. One such element of symmetry is rotation; other elements are translation, reflection, and inversion. The elements of symmetry present in a particular crystalline solid determine its shape and affect its physical properties.

Translations involve displacement of the crystal in a direction that replaces each atom by one of its identical neighbours, so that the atoms seem unmoved. Rotations turn the crystal around an axis of symmetry passing through the crystal; the only rotations compatible with translational symmetry move the crystal through an angle of 360° divided by *n,* with *n* equal to 1, 2, 3, 4, or 6. Reflections exchange the parts of the crystal on the two sides of a plane of symmetry (mirror plane) within the solid. Inversions move every atom to another position in the crystal; the old and new positions of the atom lie upon a line, at the middle of which is the centre of inversion. So-called improper rotations are rotations followed by reflections (known as rotoreflections) or rotations followed by inversions (called rotoinversions).

A crystal can be classified according to its elements of symmetry; for example, it may belong to one of 230 space groups, 32 point groups, 14 Bravais lattices, and 7 crystal systems. A crystal can be represented diagrammatically by an orderly stacking of unit cells; the shape of the unit cell determines which of the seven crystal systems the crystal belongs to. Unit cells of the same shape may have points (each representing an atom or a group of atoms) at their centres or on their faces, in addition to those at their corners. These additional lattice points divide the 7 crystal systems into 14 Bravais lattices; the Bravais lattices are subdivided into 32 crystal classes, or point groups. Each point group corresponds to one of the possible combinations of rotations, reflections, inversions, and improper rotations; with the inclusion of translational elements, 230 space groups are produced.

**symmetry,** in physics, the concept that particles such as atoms and molecules remain unchanged in properties by symmetry "operations." From the earliest days of natural philosophy (Pythagoras in the 6th century BC), symmetry has furnished insight into the laws of physics and the nature of the cosmos. The two outstanding theoretical achievements of the 20th century, relativity and quantum theory, involve notions of symmetry in a fundamental way.

The application of symmetry to physics leads to the important conclusion that certain physical laws, particularly conservation laws, are unaffected by symmetry operations on the geometric coordinates of the particles concerned, including time, when it is considered as a fourth dimension; *i.e.,* the laws remain valid at all places and times in the universe. In particle physics, considerations of symmetry can be used to derive conservation laws and to determine which particle interactions can take place and which cannot (the latter are said to be forbidden). Symmetry also has applications in many other areas of physics and chemistry—for example, in relativity and quantum theory, crystallography, and spectroscopy. Crystals and molecules may indeed be described in terms of the number and type of symmetry operations that can be performed on them. The quantitative discussion of symmetry is called group theory.

Valid symmetry operations are those that can be performed without changing the appearance of an object. The number and type of such operations depends on the geometry of the object to which the operations are applied. The meaning and variety of symmetry operations may be illustrated by considering a square lying on a table. For the square, valid operations are (1) rotation about its centre through 90, 180, 270, or 360 degrees, (2) reflection through mirror planes perpendicular to the table and running either through any two opposite corners of the square or through the midpoints of any two opposing sides, and (3) reflection through a mirror plane in the plane of the table. There are nine symmetry operations that yield a result indistinguishable from the original square. A circle would be said to have higher symmetry because, for example, it could be rotated through an infinite number of angles (not just multiples of 90 degrees) to give an identical circle.

Subatomic particles have various properties and are affected by certain forces that exhibit symmetry. An important property that gives rise to a conservation law is parity. In quantum mechanics all elementary particles and atoms may be described in terms of a wave equation. If this wave equation remains identical after simultaneous reflection of all spatial coordinates of the particle through the origin of the coordinate system, then it is said to have even parity. If such simultaneous reflection results in a wave equation that differs from the original wave equation only in sign, then the particle is said to have odd parity. The overall parity of a collection of particles, such as a molecule, is found to be unchanged with time during physical processes and reactions; this fact is expressed as the law of conservation of parity. At the subatomic level, however, parity is not conserved in reactions, owing to the weak nuclear force responsible for radioactivity.

Elementary particles are also said to have internal symmetry; these symmetries are useful in classifying particles and in leading to selection rules. Such an internal symmetry is baryon number, which is a property of a class of particles called hadrons. Hadrons with a baryon number of zero are called mesons, those with a number of +1 are baryons. By symmetry there exists another class of particles with a baryon number of −1; these are called antibaryons. Baryon number is conserved during nuclear interactions.

**Symnell, Lambert** (English impostor): *see* Simnel, Lambert.

**Symonds, John Addington** (b. Oct. 5, 1840, Bristol, Gloucestershire, Eng.—d. April 19, 1893, Rome [Italy]), English essayist,

poet, and biographer best known for his cultural history of the Italian Renaissance.

After developing symptoms of tuberculosis while a fellow at Oxford, Symonds travelled extensively for his health. He finally settled in



Symonds, chalk drawing by C. Orsi; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Davos Platz, Switz., where he did most of his writing.

Symonds' chief work, *Renaissance in Italy*, 7 vol. (1875–86), is a series of extended essays rather than a systematic history. Fluent and picturesque, it was deeply indebted to such continental interpreters of the Renaissance as Jacob Burckhardt. With the diverse range of interests of the Victorian man of letters, Symonds diffused his literary energies over English literature, Greek poetry, travel sketches, translations, and studies of such literary and artistic personalities as Shelley (1878), Ben Jonson (1886), Sir Philip Sidney (1886), Michelangelo (1893), and Walt Whitman (1893), of whom he was one of the first European admirers. His translations of *The Sonnets of Michael Angelo Buonarroti and Tommaso Campanella* (1878, first English translation of the poetry of Michelangelo) and of Cellini's autobiography, 2 vol. (1888), also were notable. Symonds' own personally revealing poetry received little critical attention; it served primarily as a release from his difficult emotional life. His *A Problem in Greek Ethics* (written, 1871; privately printed, 1883) and *A Problem in Modern Ethics* (privately printed, 1881) were two of the first serious works on the subject of homosexuality.

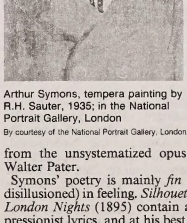
**Symons, A(lphonse) J(ames) A(lbert)** (b. 1900, London—d. Aug. 26, 1941), British author and biographer best known for his brilliant and unconventional biography *The Quest for Corvo* (1934).

Family economic difficulties obliged Symons to leave home and learn a trade at an early age. For three years he lived a life of drudgery, working as an apprentice to a furrier. His formal education was private and scanty; Symons considered himself self-educated and, as a writer, self-made. Employed as secretary and later director of the First Edition Club of London, he became a skilled bibliographer, an occupation he considered dreary and uncongenial to his personal literary and cultural aspirations.

His well-received biography *H.M. Stanley* (1933) was followed by his magnum opus, *The Quest for Corvo*, a biography of the English author and eccentric Frederick Rolfe (1860–1913), the self-styled Baron Corvo. Rolfe's life had fascinated Symons for years—an earlier work, *Frederick Baron Corvo,* had been printed privately in 1927—and his approach to the subject in *The Quest for Corvo,* subtitled "An Experiment in Biography," was novel in its anecdotal, fragmentary reconstruction of a life about which little factual evidence existed. The book won critical acclaim and came to be regarded as a masterpiece of modern biography.

Symons' other works include *Emin, Governor of Equatoria* (1928); the bibliography for the First Editions of Books by William Butler Yeats (1924); the *Anthology of 'Nineties Verse* (1928), compiled and edited by Symons; and an uncompleted biography of Oscar Wilde. *A.J.A. Symons, His Life and Speculations,* a biography by his brother Julian, was published in 1950.

**Symons, Arthur (William)** (b. Feb. 28, 1865, Milford Haven, Pembrokeshire, Eng.—d. Jan. 22, 1945, Wittersham, Kent), poet and critic, the first English champion of the French Symbolist poets, who sought to convey impressions by suggestion rather than direct statement. Symons' schooling was irregular, but, determined to be a writer, he soon found a place in the London literary journalism of the 1890s. He joined the Rhymers' Club (a group of poets including William Butler Yeats and Ernest Christopher Dowson); contributed to *The Yellow Book,* an avant-garde journal; and became editor of a new magazine, *The Savoy* (1896), with Aubrey Beardsley as art editor. Symons was versed in European literature, and his popularizing *Symbolist Movement in Literature* (1899) summed up a decade of interpretation and influenced both Yeats and T.S. Eliot. His criticism constitutes an ambitious attempt to create a general "aesthetic"



Arthur Symons, tempera painting by R.H. Sauter, 1935; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

from the unsystematized opus of the critic Walter Pater.

Symons' poetry is mainly *fin de siècle* (*i.e.*, disillusioned) in feeling. *Silhouettes* (1892) and *London Nights* (1895) contain admirable impressionist lyrics, and at his best he is sensitive to the complex moods of urban life. His translations from the French poet Paul Verlaine are notable, and he wrote elegant travel pieces. In 1908 he suffered a severe mental breakdown, and, apart from *Confessions* (1930), a moving account of his illness, his career was virtually over.

**Symons, George James** (b. Aug. 6, 1838, London—d. March 10, 1900, London), British meteorologist who strove to provide reliable observational data by imposing standards of accuracy and uniformity on meteorological measurements and by substantially increasing the number of reporting stations.

Symons was elected a member of the British Meteorological Society (later the Royal Meteorological Society) in 1856, when he was only 18 years old. He concentrated his attention on the collection of rainfall statistics and, in 1860, issued the first of his annual rainfall reports. In that year results from 168 stations were compiled in the report, but by 1899, the year before his death, more than 3,500 stations throughout the British Isles were included. Acutely aware of the problem of inconsistency introduced by the use of different types of rain gauges, he initiated a series of experiments that led to the adoption of a standard instrument. He was twice elected president of the Royal Meteorological Society and, in 1878, was elected a fellow of the Royal Society.

**sympathomimetic drug:** *see* adrenergic drug.

**symphonic poem,** also called TONE POEM, musical composition for orchestra inspired by an extra-musical idea, story, or "program," to which the title typically refers or alludes. The characteristic single-movement symphonic poem evolved from the concert-overture, an overture not attached to an opera or play yet suggestive of a literary or natural sequence of events (*e.g.*, Mendelssohn's *Fingal's Cave,* also called *Hebrides Overture*).

Both the term symphonic poem and the form itself were invented by Franz Liszt, who in works such as *Les Préludes* (1848; after Alphonse de Lamartine's *Méditations poétiques*) used thematic transformation to parallel the poetic emotions. The musical form is free, though somewhat akin to the sonata form used in the first movement of symphonies.

Specific approaches differ among composers and according to subject matter. Thus, when Richard Strauss portrays erotic adventures in *Don Juan* (1889) or chivalric adventures in *Don Quixote* (1897), he freely modifies episodic forms, such as the rondo (which is marked by a recurring theme) or variation. Moreover, Strauss pursued a more literal, imitative rendering of temporal events (*e.g.*, the last flutter of Don Juan's heart at death) as well as of incidental sounds (*e.g.*, the bleating of sheep).

Romantic literature and poetry from Dante to Byron and beyond furnished the bulk of program matter throughout the 19th century. Literature was the primary inspiration in Tchaikovsky's *Francesca da Rimini* (1876); legend in Jean Sibelius' "Swan of Tuonela" (from *Four Legends,* 1893); and nationalism in Sibelius' *Finlandia* (1900) and Bedřich Smetana's *Mé vlasti* (*My Country;* 1874–79). Philosophical themes underlie Strauss's *Also sprach Zarathustra* (*Thus Spoke Zarathustra;* 1896, after Nietzsche) and *Tod und Verklärung* (*Death and Transfiguration;* 1889). Paintings formed the inspiration for Sergey Rachmaninoff's *Isle of the Dead* (1907; after Arnold Böcklin) and Liszt's *Hunnenschlacht* (*The Battle of the Huns;* 1857, after Wilhelm von Kaulbach).

The growing importance of visual inspiration is felt especially in late 19th-century France, albeit frequently by way of literature, as in Claude Debussy's *Prélude à l'après-midi d'un faune* (*Prelude to the Afternoon of a Faun;* 1894). Eventually, the kinetic energies of the form erupted to the extent that the symphonic poem was largely superseded by the symphonic ballet. Thus, while Igor Stravinsky's early *Feu d'artifice* (*Fireworks;* 1908) was still ostensibly a symphonic poem, his subsequent scores based on Russian stories were intended for dance performance.

*Consult the* INDEX *first*

**symphony,** a lengthy form of musical composition for orchestra, usually consisting of several large sections, or movements, at least one of which probably employs sonata form.

A brief treatment of symphony follows. For full treatment, *see* MACROPAEDIA: Musical Forms and Genres.

Before 1750 the word symphony was applied to various instrumental compositions

and to instrumental preludes and interludes of some vocal compositions. In 1597 Giovanni Gabrieli published the First Book of his *Sacrae Symphoniae,* although it was not until the Second Book in 1615 that the instrumental parts were stylistically independent from the vocal writing.

In the mid-17th century Louis Couperin used the word simphonies to describe his compositions for viols and continuo, and other composers wrote "sinfonie" to be played "before concerts, motets, or spiritual madrigals with instruments as a prelude." Probably the most important pre-1750 use of the word sinfonia was in Italian opera. Even the earliest operas, such as Jacopo Peri's *Euridice* of 1600 and Claudio Monteverdi's *Orfeo* of 1607, contain excellent examples of instrumental introductions and recurring interludes designated in the score as "sinfonie." Within a century these sinfonie had become the fairly standardized "Neapolitan" overture, or the *sinfonia avanti l'opera,* which consisted of three sections, fast–slow–fast. The immense popularity of these opera overtures soon resulted in their being performed as independent concert pieces.

Between 1700 and 1740 the sinfonia became a four-movement form when Georg Monn and Georg Wagenseil of Vienna began inserting a minuet movement after the second, or slow, movement. Simultaneously sonata form was evolving and became the traditional structure of the first movement. The Italian Giovanni Battista Sammartini and Johann Stamitz of the Mannheim School were also influential in the standardization of the symphony as it would remain for many years to come.

Joseph Haydn was undoubtedly the most prolific of all symphony writers, and his works in this genre fully span what has been called the Classical era. Wolfgang Amadeus Mozart and Haydn were the two most important symphonists before Ludwig van Beethoven, and in their works the Classical symphony reached its apex. The first movement, in sonata form, was almost always allegro in tempo, although it may have had a slow introduction. Due to Haydn and Mozart, sonata form employed distinct lyric themes that could be manipulated and developed; easily identifiable opening, closing, and transitional melodic material; and standardized key-relationships through modulation. Especially in their later symphonies Mozart and Haydn achieved a refinement of detail, balance, and elegance never surpassed by any other symphony composer.

The second movement of the Classical symphony was usually slow in tempo with a choice of the form, which was often sonata or theme-and-variations. While the third movement was the rather strict minuet form, the fourth movement, or finale, was based on sonata-form principles but was often more like a rondo, probably light-hearted in character and always fast in tempo. The orchestra of the Classical symphony consisted of the pre-Classical group of two bassoons and strings, in addition to two horns, two trumpets, drums, one or two flutes, and finally two clarinets.

Beethoven, whose nine symphonies form a powerful bridge from the Classical era well into the Romantic era, was a revolutionary whose passionate involvement with the events of his time, coupled with his wealth of musical ideas and fearless independence, pushed musical composition, particularly the symphony, into new frontiers of expression. He placed new demands on the existing instruments and was the first to make symphonic use of the piccolo, the double bassoon, the triangle, the bass drum and cymbals, a third trombone, and finally a chorus and vocal soloists. He lengthened the previously less-important parts of the sonata-form movements, used more variations and fugal passages, sometimes linked movements together with no audible break in the music, and completely replaced the old minuet movement with a faster and usually more jovial scherzo. Through Beethoven's dramatic intensity, the symphony became paradoxically a means of expressing both personal emotions and universal human aspirations.

In general, 19th-century symphonists, while awed by Beethoven, followed his lead in allowing themselves more freedom from fixed forms. The German/Viennese symphonic style continued through the works of such composers as Franz Schubert, Felix Mendelssohn, Robert Schumann, Anton Bruckner, and Johannes Brahms, whose four symphonies show a marked return to Classical ideals while retaining the lush harmonies that characterized the mature Romantic sound. With the symphonies of Gustav Mahler the German/Viennese symphonic heritage emerged into the 20th century.

Meanwhile, in 1830, shortly after Beethoven's death, the young Hector Berlioz created a remarkable composition that opened the door to a new type of symphonic style. His *Symphonie fantastique* was a five-movement work in which forms were relaxed, tempi changed freely and frequently, and an enormous body of instruments were employed for often unusual orchestral effects. Berlioz was not the first either to use a recurring musical theme (cyclicism) or to use instrumental music to represent a non-musical idea (programme music), but his work shows a happy combination of the two devices that influenced many composers to follow, and which definitely led to the "symphonic poems" of Franz Liszt and Richard Strauss.

The latter half of the 19th century saw a strong rise of nationalistic expression, often characterized by a composer's drawing from the folk-music traditions of his native land. Although the symphonies of such nationalists as the Czech Antonín Dvořák and the Russians Aleksandr Borodin, Nikolay Rimsky-Korsakov, and Peter Ilich Tchaikovsky are excellent media for nationalistic expressions, the symphonies were rather traditionally structured and not particularly innovative for the form itself.

The symphonies of the 20th century are not easily categorized, as they range through various compositional styles including 12-tone, atonal, electronic, and Neoclassical. A few representative major composers are Arthur Honegger of France; Paul Hindemith of Germany; Nikolay Myaskovsky, Dmitry Shostakovich, and Sergey Prokofiev of the Soviet Union; Ralph Vaughan Williams, Frederick Delius, Sir William Walton, and Sir Michael Tippett of Great Britain; Sergey Rachmaninoff and Igor Stravinsky, emigrants from the Soviet Union; and Charles Ives, Walter Piston, and Roy Harris of the United States.

**symphony concertante:** *see* sinfonia concertante.

**symphony orchestra,** large orchestra of winds, strings, and percussion that plays symphonic works. *See* orchestra.

**symphylan,** also called SYMPHYLID, any member of the arthropod class Symphyla, commonly grouped with several other classes as myriapods. The approximately 120 species resemble small centipedes; the largest are less than 10 millimetres (0.4 inch) long. The antennae are long and many-jointed. The soft, white body is divided into 14 segments, 12 of which bear pairs of hooklike legs. All of the legs on one side move simultaneously, alternating with those on the opposite side, thus producing a twisting, turning motion.

Symphylans occur worldwide, chiefly in the tropics. They live in and eat decaying plant matter; some feed on dead insects and the tender parts of living plants. The so-called garden centipede (*Scutigerella immaculata*) of North America, Europe, and Hawaii damages beets, celery, lettuce, and other crops. *Scolopendrella* is common in North America.

**Symphyta,** one of two suborders of the insect order Hymenoptera, the other being Apocrita. Included in the group are the sawfly, horntail, and wood wasp (*qq.v.*)—the most primitive members of the order. The suborder includes several thousand species and is distributed worldwide.

The "waist," or midsection, between the abdomen and thorax, is broad in Symphyta. The females have a well-developed ovipositor, or egg-laying organ. The larvae usually resemble caterpillars and have a variable number of legs. All are phytophagous (*i.e.,* plant eating) except for members of the parasitic wood wasp family Orussidae (sometimes Oryssidae), a small, rare group.

Most species have one generation each year and spend the winter as a full-grown larva or as a pupa. Certain large species require more than one year to develop. Many forms, particularly the sawflies, are often highly destructive to food crops, timber, and other plants useful to man.

**synagogue,** also spelled SYNAGOG, in Judaism, a community house of worship that serves as a place not only for liturgical services but also for assembly and study. Its traditional functions are reflected in three Hebrew synonyms for synagogue: *bet ha-tefilla* ("house of prayer"), *bet ha-kneset* ("house of assembly"), and *bet ha-midrash* ("house of study"). The term synagogue is of Greek origin (*synagein,* "to bring together") and means a place of assembly. The Yiddish word *shul* (from German *Schule,* "school") is also used to refer to the synagogue, and in modern times, the word temple is common among some Reform and Conservative congregations.

The oldest dated evidence of a synagogue is from the 3rd century BC, but synagogues doubtless have an older history. Some scholars feel that the destruction of Solomon's Temple in 586 BC gave rise to synagogues after private homes were temporarily used for public worship and religious instructions.

Other scholars trace the origin of synagogues to the Jewish custom of having representatives of communities outside Jerusalem pray together during the two-week period when priestly representatives of their community attended ritual sacrifices in the Temple of Jerusalem.

Whatever their origin, synagogues flourished side by side with the ancient Temple cult and existed long before Jewish sacrifice and the established priesthood were terminated with the destruction of the Second Temple by Titus in AD 70. Thereafter, synagogues took on an even greater importance as the unchallenged focal point of Jewish religious life.

Literature of the 1st century refers to numerous synagogues not only in Palestine but also in Rome, Greece, Egypt, Babylonia, and Asia Minor. By the middle of that century, all sizable Jewish communities had a synagogue where regular morning, afternoon, and evening services were held, with special liturgies on the sabbath and on religious festivals.

Modern synagogues carry on the same basic functions associated with ancient synagogues but have added social, recreational, and philanthropic programs as the times demand. They are essentially democratic institutions established by a community of Jews who seek God through prayer and sacred studies. Since the liturgy has no sacrifice, no priesthood is required for public worship. Because each synagogue is autonomous, its erection, its maintenance, and its rabbi and officials reflect the desires of the local community.

There is no standard synagogue architecture. A typical synagogue contains an ark (where the scrolls of the Law are kept), an "eternal light" burning before the ark, two candelabra,

pews, and a raised platform (bimah), from which scriptural passages are read and from which, often, services are conducted. The segregation of men and women, a practice that is still observed in Orthodox synagogues, has been abandoned by Reform and Conservative congregations. A ritual bath (*mikvah*) is sometimes located on the premises.

**Synagogue Council of America,** a Jewish organization founded in 1926 to provide most congregationally affiliated Jews (regardless of individual differences) with a common voice in interfaith activities, especially those involving Christians. Council membership thus includes as Orthodox constituents the Rabbinical Council of America and the Union of Orthodox Jewish Congregations of America; as Conservative constituents, the Rabbinical Assembly of America and the United Synagogue of America; as Reform constituents, the Central Conference of American Rabbis and the Union of American Hebrew Congregations.

Though the council opposes missionary efforts aimed at converting Jews, it fosters religious understanding between Jews and Christians and works in harmony with the National Council of the Churches of Christ in the United States of America.

**synapse,** also called NEURONAL JUNCTION, the site of transmission of electric nerve impulses between two nerve cells (neurons) or between a neuron and a gland or muscle cell (effector). A synaptic connection between a neuron and a muscle cell is called a neuromuscular junction (*q.v.*).

Two types of synapses can be distinguished, the chemical and the electric. At a chemical synapse, each ending, or terminal, of a nerve fibre (presynaptic fibre) swells to form a knoblike structure that is separated from the fibre of an adjacent neuron, called a postsynaptic fibre, by a microscopic space called the synaptic cleft. The typical synaptic cleft is about 0.02 microns wide. The arrival of a nerve impulse at the presynaptic terminals causes the movement toward the presynaptic membrane of membrane-bound sacs, or synaptic vesicles, which fuse with the membrane and release a chemical substance called a neurotransmitter (*q.v.*). This substance transmits the nerve impulse to the postsynaptic fibre by diffusing across the synaptic cleft and binding to the receptor molecules on the postsynaptic membrane. The chemical binding action alters the shape of the receptors, setting off a series of reactions that open channel-shaped protein molecules. Electrically charged ions then flow through the channels into or out of the neuron. This sudden shift of electric charge across the postsynaptic membrane changes the membrane's electric polarization, producing what is called the postsynaptic potential (*q.v.*), or PSP. If there is a large enough net flow of positively charged ions into the cell, then the PSP is said to be excitatory; that is, it can lead to the generation of a new nerve impulse, called an action potential (*q.v.*).

Once they have been released and have bound to postsynaptic receptors, neurotransmitter molecules are immediately deactivated by enzymes in the synaptic cleft; they are also taken up by receptors in the presynaptic membrane and recycled. This mechanism creates a series of brief transmission events, each one taking place in only 0.5 to 4.0 milliseconds (five ten-thousandths to four one-thousandths of a second).

Whether a nerve impulse is transmitted at the chemical synapse depends upon the particular neurotransmitter and the postsynaptic receptors. A single neurotransmitter may elicit different responses from different receptors. For example, norepinephrine, a transmitter common in the autonomic nervous system, binds to some receptors that excite nervous transmission and to others that inhibit it. The membrane of a postsynaptic fibre has many different kinds of receptors, and some presynaptic terminals release more than one type of neurotransmitter. Also, each postsynaptic fibre may form hundreds of competing synapses with many neurons. These variables account for the complex responses of the nervous system to any given stimulus. The synapse, with its chemical transmitter substance, acts as a physiological valve, directing the conduction of nerve impulses in regular circuits and preventing random or chaotic stimulation of nerves.

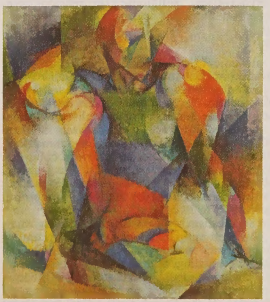
Electric synapses allow direct communications between neurons whose membranes are fused by permitting ions to flow between the cells through channels called gap junctions. Found in invertebrates and lower vertebrates, gap junctions allow faster synaptic transmission as well as the synchronization of entire groups of neurons. Gap junctions are also found in the human body, most often between cells in most body organs and between glial cells of the nervous system. Chemical transmission seems to have evolved in large, and complex vertebrate nervous systems, where transmission of multiple messages over longer distances is required.

**synchrocyclotron,** improved form of cyclotron, a device that accelerates subatomic particles to high energies (*see* cyclotron).

**Synchromism,** art movement begun by American painters Morgan Russell and Stanton Macdonald-Wright in 1912–13 that focused on colour. At the time, the two artists were living in Paris, painting abstract works they called "synchromies." Although the multicoloured forms in their paintings strongly resembled the whirling circles of the Orphist Cubist paintings of Robert Delaunay and František Kupka (*see* Orphism), Russell and Macdonald-Wright claimed originality for their works.

The first Synchromist painting, "Synchromy in Green" by Russell, was exhibited in 1913 at the Paris Salon des Indépendants. In the same year, the Synchromists held their first exhibition, in Munich, followed by one in Paris at the Galerie Bernheim-Jeune. In March 1914 their works were shown at the Carroll Gallery, New York. In a 1916 statement on Synchromism, Macdonald-Wright described how he purified his paintings to create effects through rhythmic colour forms, explaining that "color, in order to function significantly, must be used as an abstract medium."

Synchromism briefly attracted several American painters, among them Thomas Hart Benton, Patrick Henry Bruce, and Andrew Dasburg. Although Russell and Macdonald-Wright abandoned Synchromism about 1919, returning to representational works, they were important pioneers of American abstract art.



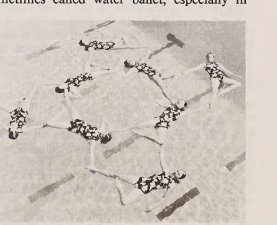
"Synchromy in Green and Orange," Synchromist painting by Stanton Macdonald-Wright, oil on canvas, 1916; in the collection of the Walker Art Center, Minneapolis, Minn.

Collection Walker Art Center, Minneapolis, Minn.

**synchronic linguistics,** the study of a language at a given point in time. The time studied may be either the present or a particular point in the past; synchronic analyses can also be made of dead languages, such as Latin. Synchronic linguistics is contrasted with diachronic linguistics (or historical linguistics; *q.v.*), the study of a language over a period of time. In the 20th century, synchronic description has come to be regarded as prior to diachronic description; the latter presupposes that synchronic descriptions at various stages of the development of a language have already been carried out. Previously, linguists had placed emphasis on diachronic linguistics. The terminological distinction between synchronic and diachronic linguistics was first made by the Swiss linguist Ferdinand de Saussure (1857–1913).

**synchronization stress** (psychology): *see* circadian rhythm stress.

**synchronized swimming,** also called WATER BALLET, exhibition swimming in which the movements of one or more swimmers are synchronized with a musical accompaniment. Because of a similarity to dance, it is sometimes called water ballet, especially in theatrical situations. The sport developed in the United States in the 1930s. Synchronized swimming is an organized amateur sport in many areas of the world under the general supervision of the Fédération Internationale de Natation Amateur (FINA; International Amateur Swimming Federation), which publishes a list of stunts (movements or figures) accepted in competition. The FINA recognized synchronized swimming in 1954. Swimmers in solo, duet, or team (four to eight persons) competition perform several required stunts together with several of their own choice. They are scored by at least three judges on execution and style, both of the individual stunts and of their musical routine as a whole.



Synchronized swimming team float pattern

By courtesy of the San Francisco Merionettes Synchronized Swim Club, Inc.

Although it was formerly a demonstration sport in the Olympics, synchronized swimming for women was admitted in full Olympic competition in 1984. Solo and duet events, lasting three and a half and four minutes, respectively, had routines based on more than 100 variations of the jackknife. Swimmers were judged on both compulsory and optional figures. *See* Olympic Games.

**synchronous motor,** alternating-current electric motor designed to run at a constant speed that varies only with the frequency of the power source. Many synchronous motors are unable to start unassisted and must have an auxiliary motor to bring them to synchronous

speed. Others have an additional, built-in start-up winding. The constant speed is maintained by applying a constant magnetic field to the rotor. Such a field may be created by applying a direct current to the rotor windings or by constructing the rotor from permanently magnetic materials. The rotor's magnetic field tends to keep it in step, revolving as fast as the changing magnetic field produced by the alternating current that drives the motor. Synchronous motors are used in low-load applications in which constant speed is crucial, as in electric clocks, timers, phonographs, and tape recorders. *See also* electric motor.

**synchrotron,** cyclic particle (electron, proton, heavy-ion) accelerator in which the particle is confined to its orbit by a magnetic field that gradually strengthens as the particle's momentum increases. Acceleration is produced by an alternating electric field that is in synchronism with orbital frequency. The synchrotron is useful when the speed of the particle is near that of light (as in the acceleration of electrons or of protons to extremely high energies), since, under such conditions, speed changes only slowly as the energy changes.

Synchrotrons have been developed to accelerate different particles and are named accordingly. Thus, the electron synchrotron accelerates electrons and the proton synchrotron accelerates protons.

The highest particle energies ever achieved have been produced with the superconducting proton synchrotron at the Fermi National Accelerator Laboratory, Batavia, Ill., U.S., which reaches 1 TeV (1 trillion electron volts). The highest-energy electron synchrotron is at CERN in Geneva; it reaches 50 GeV (50 billion electron volts).

**synchrotron radiation,** electromagnetic energy emitted by charged particles (*e.g.*, electrons and ions) that are moving at speeds close to that of light when their paths are altered, as by a magnetic field. It is so called because particles moving at such speeds in a variety of particle accelerator that is known as a synchrotron produce electromagnetic radiation of this sort.

Many kinds of astronomical objects have been found to emit synchrotron radiation as well. High-energy electrons spiraling through the lines of force of the magnetic field around the planet Jupiter, for example, give off synchrotron radiation at radio wavelengths. Synchrotron radiation at such wavelengths and at those of visible and ultraviolet light is generated by electrons moving in the magnetic field associated with the supernova remnant known as the Crab Nebula. Radio emissions of the synchrotron variety also have been detected from other supernova remnants in the Milky Way Galaxy and from extragalactic objects called quasars (*see* quasar).

Synchrotron radiation characteristically is highly polarized and continuous. Its intensity and frequency are directly related to the strength of the magnetic field and the energy of the charged particles affected by the field. Accordingly, the stronger the magnetic field and the higher the energy of the particles, the greater the intensity and frequency of the emitted radiation. Synchrotron radiation is not dependent on the temperature of a given astronomical source; a relatively cool object can release substantial amounts of electromagnetic energy in this form. Synchrotron radiation is thus often termed nonthermal radiation.

**syncopation,** in music, the displacement of regular accents associated with given metrical patterns, resulting in a disruption of the listener's expectations and the arousal of a desire for the reestablishment of metric normality; hence the characteristic "forward drive" of highly syncopated music. Syncopation may be effected by accenting normally weak beats in a measure, by resting on a normal accented beat, or by tying over a note to the next measure.

The pattern is typical of much folk-dance music, especially in eastern Europe, and its use in the Western written tradition may be traced to the 14th century. It is a characteristic element of jazz and figures prominently in the music of Igor Stravinsky and other 20th-century composers.

**syncope,** effect of temporary impairment of blood circulation to a part of the body. The term is most often used as a synonym for fainting, which is caused by insufficient blood flow to the brain as a result of a fall in blood pressure.

Fainting tends to be preceded first by paleness, nausea, and sweating and then by dilatation of the pupils, yawning, deeper and more rapid breathing, and a rapid heartbeat. The faint usually lasts from a fraction of a minute to several minutes and may be followed by headache, confusion, nervousness, and a feeling of weakness. It is usually prompted by fear, anxiety, or pain.

Carotid sinus syncope, sometimes called the tight-collar syndrome, also causes brief unconsciousness from impaired blood flow to the brain. Unlike the ordinary faint, this syncope is not preceded by pallor, nausea, and sweating. (The carotid sinus is a widened portion of the carotid artery where there are nerve endings sensitive to pressure; when they are stimulated, the heart is slowed, blood vessels dilate, and blood pressure consequently falls, causing, in turn, reduction in blood flow to the brain.) Pressure on the carotid sinuses by a tight collar, by turning the head to the side, in swallowing, or even in shaving the side of the neck over the carotid sinus may be sufficient to cause the syncope, or it may occur spontaneously. This syncope may be used diagnostically, since faintness upon massage of one carotid sinus may suggest a narrowed carotid or basilar artery on the opposite side of the neck.

Syncope involving temporary unconsciousness may also be caused by any of a number of organic (physical) diseases or disorders, such as aortic stenosis, heart failure, and a low level of sugar in the blood.

Local syncope is whitening, weakness, coldness, and numbness of a small area of the body, especially the fingers, as a result of diminished blood flow to the part. It is associated with Raynaud's disease.

**syncretism, religious:** *see* religious syncretism.

**syndicalism,** also called ANARCHO-SYNDICALISM, or REVOLUTIONARY SYNDICALISM, a movement that advocates direct action by the working class to abolish the capitalist order, including the state, and to establish in its place a social order based on workers organized in production units. The syndicalist movement flourished in France chiefly between 1900 and 1914 and had a considerable impact in Spain, Italy, England, the Latin-American countries, and elsewhere. It had ceased to be a strong, dynamic force by the end of World War I, but it remained a residual force in Europe until World War II.

Syndicalism developed out of strong anarchist and antiparliamentary traditions among the French working class. Greatly influenced by the teachings of the anarchist Pierre-Joseph Proudhon and the socialist Auguste Blanqui, it was developed as a doctrine by certain leaders of the French trade-union movement toward the end of the 19th century. In France, syndicalism is known as *syndicalisme révolutionnaire* (the word *syndicalisme* means only "trade unionism"). Syndicalist tendencies manifested themselves with increasing strength during the 1890s in the two main French labour organizations of the period—the Confédération Générale du Travail (CGT) and the Fédération des Bourses du Travail. The secretary of the latter, Fernand Pelloutier, did much to work out the characteristic tenets of syndicalism and to spread them among his workers. When these two organizations joined forces in 1902, trade unionism, and syndicalism in particular, gained an immense accession of strength.

The syndicalist, like the Marxist, was opposed to capitalism and looked forward to an ultimate class war from which the working class would emerge victorious. To the syndicalist, the state was by nature a tool of capitalist oppression and, in any event, was inevitably rendered inefficient and despotic by its bureaucratic structure. As an appendage of the capitalist order, then, the state could not be used for reform with peaceful means and must be abolished.

The structure of the ideal syndicalist community was generally envisioned somewhat as follows. The unit of organization would be the local *syndicat,* a free association of self-governing "producers." It would be in touch with other groups through the local *bourse du travail* ("labour exchange"), which would function as a combination of employment and economic planning agency. When all the producers were thus linked together by the *bourse,* its administration—consisting of elected representatives of the members—would be able to estimate the capacities and necessities of the region, could coordinate production, and, being in touch through other *bourses* with the industrial system as a whole, could arrange for the necessary transfer of materials and commodities, inward and outward.

In keeping with their conception of the state as a tool of capitalist oppression, the syndicalists shunned political means of achieving their goals. This reliance upon direct industrial action stemmed from practical considerations as well: outside the mine or factory, the syndicalists realized, political differences among workers would come into play, possibly hindering mass action. Inside, their similar employment gave workers a sense of solidarity. Georges Sorel, a leading syndicalist theoretician, developed the concept of the "social myth," which could be used to stir workers to revolutionary action. The general strike, the preeminent syndicalist tool, was conceived of in these terms. If successful, it inspires workers with a sense of power; if unsuccessful, it impresses upon them the servility of their lot and the need for better organization and wider aims.

In the United States the Industrial Workers of the World embraced a form of syndicalism but aimed for a system based on large, centralized unions rather than on local associations. The Italian Fascist dictatorship of Benito Mussolini sought to use syndicalist sentiment to gain support for its corporate state, which was in fact very much at variance with the syndicalist model in emphasizing a strong state.

After World War I, syndicalists tended to be lured away from the movement either by the Soviet model of communism or by the prospects for working-class gains offered by trade unionism and parliamentarianism in the Western republics. During the early years of Soviet power, in 1920–21, quasi-syndicalist ideas were prevalent among the trade-union communists' opposition movement, which acquired the name of "Workers' Opposition."

**syndicate,** also called CRIME SYNDICATE, in the United States, an association of racketeers in control of organized crime (*q.v.*).

**synecdoche,** figure of speech in which a part represents the whole, as in the expression "hired hands" for workmen or, less commonly, the whole represents a part, as in the use of the word "society" to mean high

society. Closely related to metonymy—the replacement of a word by one closely related to the original—synecdoche is an important poetic device for creating vivid imagery. An example is Samuel Taylor Coleridge's line in "The Rime of the Ancient Mariner," "The western wave was all aflame," in which "wave" substitutes for "sea." *See also* metonymy.

**synecology,** also called BIOCENOLOGY, BIOSOCIOLOGY, or COMMUNITY ECOLOGY, study of a group or community of organisms and their relationships to each other and to their common environment. Synecological concepts, such as those dealing with nutrient cycling and energy budgets, are based on descriptive analysis of the community. Synecology is becoming more experimental as techniques and equipment are developed to measure variables such as the uptake and transport of materials in nutrient cycles and the transformations and exchanges involved in energy relationships. *Compare* autecology.

**synesthesia,** a condition in which one type of sensory stimulation creates perception in another sense. The most common form of synesthesia is called "coloured hearing," where a person experiences a visual sensation when receiving an auditory signal (for example, hearing the musical tone C and seeing the colour red). Although tone-colour relationships are not identical for all people, there are general uniformities: the deeper a musical note, the darker the colour. Similar colour perceptions, called photisms, may accompany sensations of taste, touch, pain, smell, or temperature. Synesthesia has been used as a literary device by poets as diverse as Edgar Allan Poe, Arthur Rimbaud, Hart Crane, and Dame Edith Sitwell.

**Synge, John Millington** (b. April 16, 1871, Rathfarnham, near Dublin, Ire.—d. March 24, 1909, Dublin), leading figure in the Irish literary renaissance, a poetic dramatist of great power who portrayed the primitive life of the Aran Islands and the western Irish seaboard with sophisticated craftsmanship.

After studying at Trinity College and at the Royal Irish Academy of Music in Dublin, Synge pursued further studies from 1893 to 1897 in Germany, Italy, and France. In 1894 he abandoned his plan to become a musician and instead concentrated on languages and literature. He met William Butler Yeats while studying at the Sorbonne in Paris in 1896. Yeats inspired him with enthusiasm for the Irish renaissance and advised him to stop writing critical essays and instead to go to the Aran Islands and draw material from life. Already struggling against the progression of a lymphatic sarcoma that was to cause his death, Synge lived in the islands during part of each year (1898–1902), observing the people and learning their language, recording his impressions in *The Aran Islands* (1907) and basing his one-act plays *In the Shadow of the Glen* (first performed 1903) and *Riders to the Sea* (1904) on islanders' stories. In 1905 his first three-act play, *The Well of the Saints,* was produced.

Synge's travels on the Irish west coast inspired his most famous play, *The Playboy of the Western World* (1907). This morbid comedy deals with the moment of glory of a peasant boy who becomes a hero in a strange village when he boasts of having just killed his father, but who loses the villagers' respect when his father turns up alive. In protest against the play's unsentimental treatment of the Irishmen's love for boasting and their tendency to glamorize ruffians, the audience rioted at its opening at Dublin's Abbey Theatre. Riots of Irish-Americans accompanied its opening in New York (1911), and there were further riots in Boston and Philadelphia. Synge remained associated with the Abbey Theatre, where his plays gradually won acceptance, until his



John Millington Synge, detail of a drawing by John Butler Yeats, 1905; in the National Gallery of Ireland, Dublin
By courtesy of the National Gallery of Ireland, Dublin

death. His unfinished *Deirdre of the Sorrows,* a vigorous poetic dramatization of one of the great love stories of Celtic mythology, was performed there in 1910.

In the seven plays he wrote during his comparatively short career as a dramatist, Synge recorded the colourful and outrageous sayings, flights of fancy, eloquent invective, bawdy witticisms, and earthy phrases of the peasantry from Kerry to Donegal. In the process he created a new, musical dramatic idiom, spoken in English but vitalized by Irish syntax, ways of thought, and imagery.

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**Synge, R.L.M.,** in full RICHARD LAURENCE MILLINGTON SYNGE (b. Oct. 28, 1914, Liverpool, Eng.—d. Aug. 18, 1994, Norwich, Norfolk), British biochemist who in 1952 shared the Nobel Prize for Chemistry with A.J.P. Martin for their development of partition chromatography, notably paper chromatography.

Synge studied at Winchester College, Cambridge, and received his Ph.D. at Trinity College there in 1941. He spent his entire professional career conducting research, initially with Martin under the auspices of the Wool Industries Research Association, Leeds (1941–43). The two men developed partition chromatography, a technique that is used to separate mixtures of closely related chemicals such as amino acids for identification and further study. Synge did research at the Lister Institute of Preventive Medicine, London (1943–48), and at the Rowett Research Institute, near Aberdeen, Scot. (1948–67). He became a biochemist at the Food Research Institute, Norwich (1967–76), and was also an honorary professor of biological sciences at the University of East Anglia (1968–84).

**synod** (from Greek *synodos,* "assembly"), in the Christian church, a local or provincial assembly of bishops and other church officials meeting to resolve questions of discipline or administration.

The earliest synods can be traced to meetings held by bishops from various regions in the middle of the 2nd century. A synod of bishops from the worldwide Roman Catholic church meets in Rome at regular but infrequent intervals for the purpose of discussing matters of vital church interest, in an advisory capacity to the pope.

In some Protestant churches, the term synod has come to signify an organizational unit, as in the Presbyterian and Reformed traditions, where a synod consists of a number of presbyteries. In the Lutheran church, "synod" is used in the names of the national organizational bodies. Individual congregations group into synods.

The actions taken by individual synods sometimes have had lasting significance. In the Synod of Dort (1618–19), the Dutch Reformed Church dealt with Arminianism and sponsored many reforms aimed at personal religious renewal.

**Synod of ———:** *see under* substantive word (*e.g.,* Alexandria, Synod of).

**synodic period,** the time required for a body within the solar system, such as a planet, the Moon, or an artificial Earth satellite, to return to the same or approximately the same position relative to the Sun as seen by an observer on the Earth. The Moon's synodic period is the time between successive recurrences of the same phase; *e.g.,* between full moon and full moon. The synodic period of a planet is the time required for the Earth to overtake it as both go around the Sun—or, in the case of fast-moving Mercury or Venus, for the planet in question to overtake the Earth. The synodic period of an artificial satellite of the Earth is measured between its conjunctions (closest apparent approaches) with the Sun. *See also* sidereal period.

**Synoptic Gospels,** the Gospels of Matthew, Mark, and Luke in the New Testament. Since the 1780s, the first three books of the New Testament have been called the Synoptic Gospels because they are so similar in structure, content, and wording that they can easily be set side by side to provide a synoptic comparison of their content. (The Gospel of John has a different arrangement and offers a somewhat different perspective on Christ.) The striking similarities between the first three Gospels prompt questions regarding the actual literary relationship that exists between them. This question, called the Synoptic problem, has been elaborately studied in modern times.

**synovial tissue,** thin, loose, vascular connective tissue that makes up the membranes surrounding joints and the sheaths protecting tendons where they pass over bony prominences. Synovial tissue contains synovial cells, which secrete a viscous liquid called synovia, or synovial fluid; this liquid contains protein, salts, and hyaluronic acid and serves as a lubricant and nutrient for the joint surfaces.

**syntax,** the arrangement of words in sentences, clauses, and phrases, and the study of the formation of sentences and the relationship of their component parts. In a language such as English, the main device for showing the relationship among words is word order; *e.g.,* in "The girl loves the boy," the subject is in initial position, and the object follows the verb. Transposing them changes the meaning. In many other languages, case markers indicate the grammatical relationships. In Latin, for example, "The girl loves the boy" may be *puella puerum amat* with "the girl" in initial position, or *puerum puella amat* with "the boy" in initial position, or *amat puella puerum, amat puerum puella,* or *puella amat puerum.* The meaning remains constant because the *-um* ending on the form for "boy" indicates the object of the verb, regardless of its position in the sentence.

Sentences are constructed from phrases or groups of words that have a closer relationship to each other than to the words outside the phrase. In the sentence "My dog is playing in the yard" there is a closer relationship between the words "is playing," which together form the verb, than between the words "playing in the," which form only part of the verb and part of the phrase indicating the location of the playing.

The study of syntax also includes the investigation of the relations among sentences that are similar, such as "John saw Mary" and "Mary was seen by John." Syntax re-

ceived much attention after 1957, when the American linguist Noam Chomsky proposed a radically new theory of language, transformational grammar (*q.v.*).

**synthesis,** in philosophy, the combination of parts, or elements, in order to form a more complete view or system. The coherent whole that results is considered to show the truth more completely than would a mere collection of parts. The term synthesis also refers, in the dialectical philosophy of the 19th-century German philosopher G.W.F. Hegel, to the higher stage of truth that combines the truth of a thesis and an antithesis. Jean-Paul Sartre's philosophy underscores an existential type of synthesis. In *Being and Nothingness,* consciousness (*pour-soi*) is always trying to become being (*en-soi*), to achieve a synthesis, as it were, between *no-thing* and *some-thing*.

**synthesis, chemical:** *see* chemical synthesis.

**synthesizer, electronic sound:** *see* music synthesizer.

**synthetase:** *see* ligase.

**synthetic ammonia process:** *see* Haber-Bosch process.

**synthetic diamond,** man-made diamond that is usually produced by subjecting graphite to very high temperatures and pressures. Synthetic diamond resembles natural diamond in most fundamental properties, retaining the extreme hardness, broad transparency (when pure), high thermal conductivity, and high electrical resistivity for which diamond is highly prized. Because synthesis is an expensive process, large stones of gem quality are rarely made. Instead, most synthetic diamond is produced as grit or small crystals that are used to provide hard coatings for industrial equipment such as grinding wheels, machine tools, wire-drawing dies, quarrying saws, and mining drills. In addition, diamond films can be grown on various materials by subjecting carbon-containing gas to extreme heat; these layers can be used in cutting tools, windows for optical devices, or substrates for semiconductors.

During the first half of the 20th century the American physicist Percy Williams Bridgman conducted extensive studies of materials subjected to high pressures. His work led to the synthesis by the General Electric Company, Schenectady, N.Y., of diamonds in its laboratory in 1955. The stones were made by subjecting graphite to pressures approaching 7 gigapascals (1 million pounds per square inch) and to temperatures above 1,700° C (3,100° F) in the presence of a metal catalyst. Tons of diamonds of industrial quality have been made in variations of this process every year since 1960.

In 1961 shock-wave methods, or explosive-shock techniques, were first used to produce diamond powder, and small quantities of the material are still formed this way. Beginning in the 1950s, Russian researchers began to investigate methods for synthesizing diamond by decomposition of carbon-containing gases such as methane at high heat and low pressure. In the 1980s commercially viable versions of this chemical vapour deposition method were developed in Japan.

**synthetic division,** short method of dividing a polynomial of degree $n$ of the form $a_0x^n + a_1x^{n-1} + a_2x^{n-2} + \ldots + a_n$, in which $a_0 \neq 0$, by another of the same form but of lesser degree (usually of the form $x - a$). Based on the remainder theorem, it is sometimes called the method of detached coefficients.

To divide $2x^3 - 7x^2 + 11$ by $x - 3$, the coefficients of the dividend are written in order of diminishing powers of $x$, zeros being inserted for each missing power. The variable and its exponents are omitted throughout. The coefficient of the highest power of $x$ (2) is brought down as is, multiplied by the constant term of the divisor ($-3$) with its sign changed, and added to the coefficient following, giving $-1$. The sum $-1$ is likewise multiplied and added to the next coefficient, giving $-3$, and so on.

$$\begin{array}{rrrr|l} 2 & -7 & 0 & 11 & \\ & 6 & -3 & -9 & 3 \\ \hline 2 & -1 & -3 & 2 & \end{array}$$

The result, $2x^2 - x - 3$ with a remainder of 2, can be readily checked by long division:

$$\begin{array}{r} +2x^2 - x - 3 + \dfrac{2}{x-3} \\ x-3\,\overline{)\,2x^3 - 7x^2 + 0x + 11} \\ 2x^3 - 6x^2 \\ \hline -x^2 + 0x \\ -x^2 + 3x \\ \hline -3x + 11 \\ -3x + 9 \\ \hline 2\ (= \text{remainder}). \end{array}$$

**synthetic fibre,** man-made textile fibre produced entirely from chemical substances, unlike those man-made fibres derived from such natural substances as cellulose or protein. *See* man-made fibre.

**synthetic language,** any language in which syntactic relations within sentences are expressed by inflection (the change in the form of a word that indicates distinctions of tense, person, gender, number, mood, voice, and case) or by agglutination (word formation by means of morpheme, or word unit, clustering). Latin is an example of an inflected language; Hungarian and Finnish are examples of agglutinative languages.

Highly synthetic languages, in which a whole sentence may consist of a single word (usually a verb form) containing a large number of affixes are called polysynthetic. Eskimo and many American Indian languages are polysynthetic. *See also* agglutination; inflection. *Compare* analytic language.

**Synthetism,** in art, method of painting evolved by Paul Gauguin, Émile Bernard, Louis Anquetin, and others in the 1880s to emphasize two-dimensional flat patterns, thus breaking with Impressionist art and theory. The style shows a conscious effort to work less directly from nature and to rely more upon memory.

It was Gauguin who used the word Synthetism, by which he meant a style of art in which the form (colour planes and lines) is synthesized with the major idea or feeling of the subject. Although he had exhibited with the Impressionists until 1886, he did not share their disregard for defined forms or compositional elements. He felt that their preoccupation with the study of light effects in nature was confining, superficial, and neglectful of thought and ideas. He sought to develop a new decorative style in art based on areas of pure colour (*e.g.*, without shaded areas or modeling), a few strong lines, and an almost two-dimensional arrangement of parts. He spent the summers of 1886 and 1888 in Pont-Aven and Le Pouldu, Brittany, France, with Bernard and other disciples, where he founded the Synthetist group.

Bernard and Anquetin used the name Cloisonnism to describe their painting method, equating the design effect of large areas of pure colour and wide black outlines to the medieval cloisonné enamel technique. In addition to his interest in medieval art, Bernard enjoyed Japanese prints (ukiyo-e) and the art of primitive cultures. Synthetism was to influence the Nabis, a group of artists in the next decade, and, for a while, the work of Vincent van Gogh. *See also* Pont-Aven school.

**syntrophism,** mutual dependence of different types of organisms for the satisfaction of their respective nutritional needs. The intermediate or end products of metabolism of one organism are essential materials for another. Syntrophism is exemplified in the mixed population of an ecosystem (*q.v.*).

**Syphax** (fl. late 3rd century BC), Numidian king allied with the Carthaginians under Hannibal. Syphax was defeated and captured at the Battle of the Great Plains near Utica, in what is now Tunisia (203), by the Roman commander Gaius Laelius in Scipio Africanus' campaign of the Second Punic War. Syphax had earlier (*c.* 206) expelled his rival Masinissa, who subsequently ruled much of North Africa with Roman support.

**syphilis,** systemic disease that is caused by the spirochete bacterium *Treponema pallidum.* Syphilis is usually transmitted through sexual contact, but it occasionally occurs congenitally from infection in the mother. Another form, endemic syphilis, is nonvenereal (not related to sexual contact) in spread and is localized in parts of the world where climatic, economic, and social conditions favour its development.

The causative organism of venereal syphilis is a corkscrew-shaped bacterium with regular, tightly wound coils. This bacterium, *T. pallidum,* averages 8 to 10 microns in length. The bacterium requires moisture to exist, so continuous moisture is a necessity for the transfer of the microorganism from one person to another. The most common means of such transmission is sexual intercourse. *T. pallidum*'s dependence on moisture is the sole reason that syphilis is classed as a sexually transmitted disease. In the body's tissues, the spirochete bacteria reproduce and remain present for the lifetime of the infected person unless destroyed by treatment. Syphilis is effectively treated by the administration of penicillin, which kills the spirochetes.

The historical origin of venereal syphilis is obscure. Indisputable reference to it in European literature occurred only after the return of Columbus from the New World, and a widely held theory of a New World origin was supported when evidence of treponematosis was found in the skeletal remains of pre-Columbian American Indians. On the other hand, "leprosy" in Europe before 1500 was considered highly contagious, was associated with sexual contact, had hereditary features, and was said to respond to mercury therapy; therefore, it is likely that many cases thought to be leprosy were actually syphilis.

After the post-Columbian outbreak, much was learned about syphilis. Treatment with mercury was widespread, and in 1836 potassium iodide was introduced; but the first successful drug—Salvarsan (606)—was developed in 1909 by the German bacteriologist Paul Ehrlich. The use of antibiotics developed after the discovery by the American physician John Friend Mahoney and others, in 1943, of the effectiveness of one-week treatment of early syphilis with penicillin.

The course of untreated venereal syphilis includes three stages. The primary stage, beginning anywhere from 10 days to 10 weeks following infection, is marked by the appearance of a small, hard, painless swelling (hunterian, or hard, chancre) at the site of inoculation. The chancre enlarges and often breaks in the centre, leaving a shallow ulcer. The chancre may be so slight in colour as to go unnoticed, but the presence of spirochetes in the chancre serum is diagnostic for syphilis. Even without treatment, this sore heals within 10 to 40 days, leaving no scar.

The secondary stage produces clinical manifestations in about half the persons infected and is characterized by cutaneous lesions or rash (especially of the mucous membranes) and generalized symptoms, with involvement

of bones, joints, eyes, and the nervous system. This stage may begin four to eight weeks after the appearance of the chancre, or it may be delayed for many months; it lasts for a variable period up to several months, and the skin lesions disappear spontaneously, usually without scarring.

Following the secondary stage, a latent period ensues, ranging in length from a few months to a lifetime, during which no outward sign of syphilis is recognizable; serological tests, however, remain positive for a long period of time. Most patients with latent syphilis do not progress to the development of late symptomatic manifestations, even if untreated, but about one in four may be expected to develop tertiary syphilis.

In about half the patients showing tertiary-stage symptoms, the disease is relatively benign, but in the rest it is incapacitating or fatal. Almost any part of the body may be affected by the spirochetes. In cardiovascular syphilis, for example, large numbers of spirochetes attack the aorta (the great trunk artery carrying blood from the heart), destroying elastic tissue, predisposing to aneurysm (localized thinning and swelling), and producing degeneration of the aortic valves. Neurosyphilis mimics other neurologic disorders and can be crippling if not fatal. Paresis (*q.v.*) is due to widespread destruction of the brain by the spirochetes; tabes dorsalis, or locomotor ataxia, is produced by degeneration of the posterior columns of the spinal cord and is manifested by intense back pain, lack of muscular coordination, and wasting. Benign late syphilis is indicated by characteristic ulcerated lesions (gummas) of the skin, mucous membranes, bone, and other organs, particularly the liver, testes, and brain. These lesions are not infectious, and the term benign is used because they usually do not endanger the patient's life.

A congenitally syphilitic infant may show lesions at birth, may appear normal at birth and develop lesions within a few months, or may have no symptoms until adolescence, when late-stage manifestations usually appear.

The endemic syphilis diseases include nonvenereal syphilis as well as yaws, bejel, and pinta (*qq.v.*), which are caused by other species of *Treponema*. These forms cause early skin and mouth lesions that are indistinguishable from those caused by venereal syphilis, but, in endemic syphilis diseases, the nervous and cardiovascular systems rarely become seriously affected, and fatality is negligible.

There are several laboratory procedures for the detection of syphilis. The most commonly used tests are carried out on a sample of blood serum (serological tests for syphilis, or STS). The STS are based on their detection of one of two substances that appear in blood serum soon after the onset of the disease: syphilis reagin (an antibody-like substance) and treponemal antibody (the antibody that attacks *T. pallidum*). The STS detect syphilis reagin by initiating its reaction with a lipoidal antigen to produce a visible clumping, or flocculation, within the serum. Various modifications of flocculation tests for syphilis have been named after their originators (Wassermann, Kahn, Kline, Hinton, among others). The more widely used among them is the VRDL (venereal disease research laboratory), a rapid slide technique with a relatively high degree of sensitivity and specificity. Other serological procedures detect the treponemal antibody and use antigens made from *T. pallidum* or from chemically extracted fractions of this bacterium.

None of the STS are fully specific for syphilis; false positive reactions may be encountered in a wide variety of infections, such as infectious mononucleosis and malaria. Generally, an STS will show the presence of syphilis four to six weeks after infection or one to three weeks after the appearance of the primary lesion.

**syphilitic meningoencephalitis** (disease): *see* paresis.

**Syr Darya,** also spelled SYRDARYA, Kazak SYRDARÍYA, Tajik DARYOI SIR, Uzbek SIRDARYO, ancient name JAXARTES, river in the Central Asian republics of Uzbekistan, Tajikistan, and Kazakstan. The Syr Darya is formed by the confluence of the Naryn and Qoradaryo rivers in the eastern Fergana Valley and generally flows northwest until it empties into the Aral Sea. With a length of 1,374 miles (2,212 km)—1,876 miles (3,019 km) including the Naryn—the Syr Darya is the longest river in Central Asia, but it carries less water than the Amu Darya. Its watershed is not clearly defined except in its upper course, where it drains a basin of 178,000 square miles (462,000 square km). Most of the Syr Darya's tributaries in the Fergana Valley fail to reach it because they are used fully for irrigation.

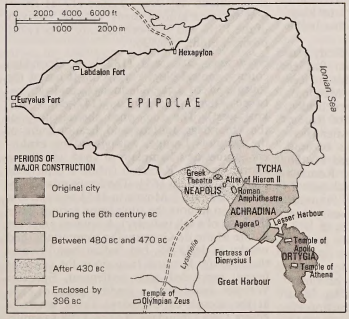
After leaving the Fergana Valley the river flows northwest, receiving the Ohangaron, Chirchiq, Keles, and Arys rivers on the right. In its middle and lower reaches it follows a meandering course through the eastern outskirts of the Kyzylkum Desert, frequently changing its bed, forming channels that often lose themselves in the sands, and overflowing its low banks at flood. It is fed in its upper mountainous basin mainly by snow and to a lesser extent by glaciers, and high water lasts from March or April to September. The Syr Darya carries a considerable amount of silt, much of which it deposits in the vicinity of Qazaly, Kazakstan. The river freezes in its lower reaches from December to March.

There are a number of hydroelectric power stations on the Syr Darya and its tributaries, of which the largest are the Farhod (in Uzbekistan), Qayroqqum (Tajikistan), and Shardara (Kazakstan) stations on the main stream and, in Uzbekistan, the Chorwoq station on the Chirchiq River and the Uchqürghon station on the Naryn River. There are also dams in Kazakstan at Qyzylorda and Qazaly. The Toktogul hydroelectric power station, which was constructed on the Naryn River in the 1970s and expanded in the '80s, regulates the river's flow. As much as 5,000,000 acres (2,000,000 hectares) of land are irrigated by the Syr Darya and its tributaries, with cotton the chief crop in the Fergana Valley and the Syr Darya's middle course and rice in the river's lower reaches.

The diversion of water from the Syr Darya for irrigation contributed to the shrinkage of the Aral Sea in the latter part of the 20th century. By the 1990s the flow of the Syr Darya along its lower reaches was much reduced during the whole year. The gradual retreat of the Aral Sea shoreline and the drying up of the Syr Darya's deltaic region exposed toxic fertilizer and salt residues to the winds, devastating local plant and animal life and causing serious health problems among the human population.

**Syracuse,** Italian SIRACUSA, capital of the Sicilian *provincia* of Siracusa, Italy. It lies on the east coast of Sicily, 33 miles (53 km) south of






*Ancient Syracuse*
(Top) Ruins of the Greek theatre of Hieron II and, above it, a nymphaeum (fountain); (bottom) periods of major construction

(Top) David J. Forbert—Shostal Assoc.; (bottom) adapted from *Westermann Grosser Atlas zur Weltgeschichte,* Georg Westermann Verlag, Braunschweig

Catania. It was the chief Greek city of ancient Sicily.

Syracuse was settled about 734 BC by Corinthians led by the aristocrat Archias, and the city soon dominated the coastal plain and hill country beyond. The original Greek settlers of the city formed an elite (*gamoroi*), while the Sicel natives (Siculi) worked the land as an oppressed class. In the early 5th century BC, the Syracusans were defeated by Hippocrates of Gela, a city lying to the west. The power of the *gamoroi* in Syracuse was subsequently ended by a democratic revolution, and in exile the *gamoroi* supported Hippocrates' successor, Gelon, who captured Syracuse and transferred his government there. Gelon ruled Syracuse from 485 to 478. His defeat of a great Carthaginian invasion in 480 at Himera confirmed his supremacy, and, under him and his brother Hieron, Syracuse attained a high point of power and cultural brilliance. A revolution in 466 overthrew Hieron's successor as tyrant, Thrasybulus, and under a democratic constitution the Syracusans survived wars against the neighbouring city of Acragas and the Siculi, although they had to abandon the territorial empire that Gelon had acquired. Most importantly, the Syracusans survived a long siege by the Athenians (415–413) that took place during the Peloponnesian War, ultimately destroying the Athenian invasion force in Sicily and weakening Athenian power in Greece itself.

A few years later Sicily faced a Carthaginian resurgence. But Syracuse was saved from the fate that overtook Acragas and other Sicilian cities by its general, Dionysius the Elder, who obtained autocratic power in 405 and ruled Syracuse as its tyrant until 367. Dionysius fought three wars against the Carthaginians, confining their territorial dominions to the western part of Sicily, and he extended Syracusan control to most of the "foot" of Italy. Under Dionysius, Syracuse became the most splendid and the best fortified of all Greek cities. Its naval power was vastly increased, too, until its fleet was the most powerful in the Mediterranean. Dionysius' son Dionysius the Younger saw a decade of peace before his autocracy was challenged by his uncle Dion, who won a brief, bloody civil war but was himself assassinated in 354. The period of civil war that followed was ended by the Corinthian Timoleon, who defeated Carthage and reordered Sicilian affairs (344–336), introducing a moderate oligarchy in Syracuse. In 317 this was overthrown by the adventurer Agathocles, who became tyrant and later king. He established a Syracusan empire that broke up at his death in 289.

In the ensuing chaotic conditions Sicily was rescued by Pyrrhus of Epirus from further Carthaginian encroachments, but his mercenaries later seized Messana (now Messina). Their defeat by Syracuse under a new leader, Hieron II, caused the intervention of Rome, with whom Hieron came to terms. After Hieron's death in 215, the Syracusans became allies of Carthage and were besieged by the Romans in 213. After its fall to the Romans in 211, Syracuse became a provincial capital.

In AD 280 Syracuse was ravaged by Frankish invaders but soon recovered a prosperity that lasted until its capture by the Arabs in 878. During the late Roman and Byzantine periods and under Norman, Swabian, and Spanish rule, Syracuse shared the vicissitudes of the rest of the island. It was shattered by an earthquake in 1693 and owes some of its finest architecture to the ensuing reconstruction efforts. The Allied invasion of Sicily in 1943 during World War II caused Syracuse some damage that was swiftly repaired in a new and greater postwar prosperity. The city is now a centre for processing local agricultural produce and has several other light industries. The harbour, with its commerce and fishery, and tourism are further sources of income.

Syracuse's nucleus is formed by the southward-projecting island of Ortygia, which half-encloses the bay known as the Great Harbour. The remains of antiquity on the continuously inhabited Ortygia are less striking than those in Neapolis, which was long a country district. Archaeological remains in Neapolis include the Greek theatre of Hieron II (3rd century BC), a Roman amphitheatre (2nd century AD), and an altar of Hieron II, pillaged in 1526 to provide building materials for defensive walls. The nymphaeum (fountain) above the theatre was one of the ancient city's sources of water. Among the most imposing remains of ancient Syracuse are the fortifications of the Epipolae Plateau, which culminate in the Euryalus fort at their western end.

The cathedral on Ortygia, with a fine Baroque facade, incorporates the Doric columns of the temple of Athena that was built as a thanks offering by the Syracusans for their victory at Himera. Architectural reliefs in painted terracotta from earlier buildings in this area are preserved in the archaeological museum. The remains of the Temple of Apollo (*c.* 565 BC) stand near the bridge from Ortygia to the mainland; another temple of the same period, that of Olympian Zeus, lies on the west side of the Great Harbour. The streets of Ortygia bear witness to the medieval and Renaissance contributions to the charm of Syracuse. The finest 14th-century facade is that of the Montalto Palace. The Bellomo and Parisio palaces incorporate elements of the 13th- to 15th-century Gothic styles. Giovanni Vermexio's Municipal Palace (1628) and Luciano Ali's Beneventano del Bosco Palace (1775) represent the best among many notable survivals of the 17th- and 18th-century city. Pop. (1991 prelim.) mun., 126,136.



Clinton Square, in downtown Syracuse, New York
© Michael Melford

**Syracuse,** city, seat (1827) of Onondaga county, central New York, U.S. It lies at the south end of Lake Onondaga, midway between Albany and Buffalo (147 miles [237 km] west). The site, once the territory of the Onondaga Indians and headquarters of the Iroquois League, was visited by explorers Samuel de Champlain in 1615 and Pierre Esprit, sieur de Radisson (while a captive of the Mohawks), in 1651. The Jesuit missionary Father Simon Le Moyne in 1654 was the first European to note the site's brine springs (later the basis of a salt industry). A mission and Fort Sainte Marie de Gannentaha were established nearby in 1655–56, but Indian hostility and the swampy location (notorious for summer fevers) precluded early settlement. Ephraim Webster established a trading post in 1786 at the mouth of Onondaga Creek where it enters Lake Onondaga, and in 1788 sawmills and gristmills were built at the site by Asa Danforth, "the father of Onondaga county." A treaty with the Indians gave the state of New York control over the brine springs, and after 1797 the saltlands were leased for salt extraction. Three villages sprang up: Webster's Landing, Salina, and Geddes. A post office, established at Webster's Landing in 1820, was named Syracuse for the ancient Greek city in Sicily.

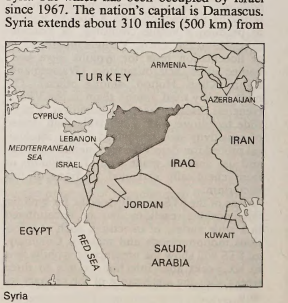
The town's growth was stimulated by construction of the Erie Canal (completed 1825) and the coming of the railroads in the 1830s. Syracuse later absorbed Salina (1847) and Geddes (1886). The saltworks supplied most of the United States' needs until 1870, when the salt industry declined; the city then began to develop a diversified economy. Manufactures now include chinaware, pharmaceuticals, jet engines, electrical machinery, air conditioners, and radio, television, and electronic equipment. Syracuse also serves as a wholesale distribution point for the central New York agricultural region.

Syracuse is the home of Syracuse University (1870), Le Moyne College (1946), Onondaga Community College (1962), the State University of New York Health Science Center (1950) and College of Environmental Science and Forestry (1911), and the Everson Museum of Art (1896). The New York State Fair has been held in Syracuse since 1841.

The Onondaga Indian Reservation is 6 miles (10 km) south, and Onondaga Lake Park includes the Salt Museum and a replica of Fort Sainte Marie de Gannentaha. Inc. village, 1825; city, 1847. Pop. (1991 est.) city, 164,474; Syracuse MSA, 662,698.

**Syrdarya** (river, Central Asia): *see* Syr Darya.

**Syria,** officially SYRIAN ARAB REPUBLIC, Arabic SŪRIYAH, or AL-JUMHŪRIYAH AL-'ARABĪYAH AS-SŪRIYAH, country located on the east coast of the Mediterranean Sea on the southwestern fringe of the Asian continent. Its area of 71,498 square miles (185,180 square km) includes territory in the Golan Heights that is recognized internationally as part of Syria but which has been occupied by Israel since 1967. The nation's capital is Damascus. Syria extends about 310 miles (500 km) from




Syria

south to north and about 290 miles (470 km) from west to east. It is bordered by Turkey (north), Iraq (east and southeast), Jordan (south), Israel and Lebanon (southwest), and the Mediterranean Sea (west). The population in 2002 was estimated to be 17,156,000.

A brief treatment of Syria follows. For full treatment, *see* MACROPAEDIA: Syria.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*The land.* Geographically, Syria consists of three main zones from west to east: the coast, the mountains, and the Syrian Desert. The coastal zone stretches north-south for only about 110 miles (180 km) between Turkey and Lebanon and varies in width from about 2 miles (3 km) in the north to about 12 miles (19 km) at its southern end. The coastal zone's numerous springs and underground water supplies make intense cultivation possible year-round, and this region is the most densely settled part of the country.

The mountain zone comprises two ranges running parallel to the coast: the An-Nuṣayrīyah (Alawite) Mountains, with an average elevation of 2,000 to 3,000 feet (600 to 900 m) above sea level in the northwest, and the Ash-Sharqī Mountains, or Anti-Lebanon Range, with an average elevation of 6,000 to 7,000 feet (1,800 to 2,100 m), in the southwest. Mount Hermon (9,232 feet [2,814 m]) in the southwest is Syria's highest point. The Orontes, the principal river of the mountainous region, flows in a northerly direction through the Ghāb Depression, a 40-mile (64-kilometre) rift valley east of the An-Nuṣayrīyah Mountains.

The undulating plains of the Syrian Desert occupy the rest of the country east of the mountain ranges. This desert zone is composed of a rock and gravel steppe region (average elevation 980 to 1,640 feet [300 to 500 m]) in the country's east-central area, and the desert proper, containing Mount Durūz, one of the world's largest basaltic outcrops (13,000 square miles [33,700 square km]) in the country's far south. The Euphrates River, rising in the highlands of eastern Turkey, traverses eastern Syria from northwest to southeast near the Iraqi border. As the largest river of Syria, it is the country's most important water source and its only navigable river. Considerable cultivation of cotton, cereals, and fruits has been made possible along the river by irrigation projects such as the Euphrates Dam in the north.

The climate varies from the Mediterranean type in the coastal zone and along the western mountains to the extremely arid type in the Syrian Desert. In the west average temperatures range from 55° F (13° C) in January (winter) to 81° F (27° C) in August (summer); the corresponding figures in the east are 41° F (5° C) and 104° F (40° C). Annual rainfall varies from 30 to 40 inches (760 to 1,270 mm) in the west to 20 inches (500 mm) in the steppe and to less than 5 inches (125 mm) in the southeast.

Pine forests are found on the An-Nuṣayrīyah Mountains, and drought-resistant shrubs such as myrtle, boxwood, turpentine, and wild olive abound in southern Syria. Hawthorns are sparsely distributed in the steppe region, date palms grow in the Euphrates River valley, and lemon and orange trees are found along the coast. Wildlife includes the wolf, hyena, wild pig, jackal, deer, gazelle, lizard, eagle, and falcon.

Syria's most important natural resource is petroleum, although its reserves are extremely small compared with some Middle Eastern countries. It also has deposits of natural gas, iron ore, asphalt, phosphate rock, and limestone.

*The people.* Arabs are the main ethnic group in Syria. Minorities include Kurds, Armenians, Turks, Circassians, and Assyrians. Arabic is the official language; French, Kurdish, Armenian, and English are also spoken. Muslims (Sunnite, 'Alawite, and Druze) constitute almost nine-tenths of the population, and Christians less than one-tenth. Syria's high birth rate and the short intervals between births in many Syrian families has had a negative effect on overall family welfare. The death rate is also high; life expectancy is 63 years for males and 67 years for females. Almost one-half of the population is younger than 15 years. The overall population density is relatively low, particularly on the desert steppe. About one-half of the population lives in urban areas.

*The economy.* Syria has a mixed economy based on agriculture, trade, and mining and manufacturing. The private sector dominates agriculture, retail trade, and certain light industries; the government controls most other sectors of the economy. The gross national product (GNP) is increasing more rapidly than the population. The GNP per capita is about average among the world's developing nations.

Agriculture accounts for about one-third of the gross domestic product (GDP) and employs a similar proportion of the work force. Land reform, which was initiated in 1963, limits proprietors to 124 acres (50 hectares) of irrigated land and 198 acres (80 hectares) of unirrigated land and has improved conditions for tenant farmers. Arable land is concentrated along the Mediterranean coast and the Orontes and Euphrates rivers, and agricultural output fluctuates sharply from year to year as a result of variations in rainfall. Water is being diverted from the Yarmūk and Euphrates rivers to expand the land under irrigation. Cash crops include cotton, which is a major source of foreign exchange, sugar beets, and tobacco. Wheat and barley are the leading staples. Pastures cover more than two-fifths of the land and support sheep, goats, and other livestock. The government controls the marketing of major agricultural commodities, and prices favour urban consumers over farmers, with the result that agricultural output has been kept low. Large quantities of milk, meat, and eggs must be imported.

Petroleum in commercial quantities was first discovered in Syria in 1956 by an American firm. The oil industry was nationalized in 1959, and production began in 1968. The state controls most exploration and production through the General Petroleum Authority, which received substantial assistance from the Soviet Union. Pipelines were built from Iraq and Saudi Arabia across Syria, but the pipeline carrying Iraqi oil to Lebanon was closed by Syria in 1982. Significant quantities of phosphate are also produced.

Manufacturing industries (including mining) account for about one-sixth of the GDP and employ somewhat less than one-seventh of the work force. Many heavy industries were nationalized between 1958 and 1965, but since 1970 private investment has been encouraged. Leading manufactures include textiles, flour, cement, shoes, and refrigerators. Electricity is chiefly generated from petroleum; approximately two-fifths is generated from water power.

The government has encouraged the development of labour unions but has limited their economic and political power. Remittances from Syrians working abroad are an important source of foreign exchange.

Expenditures for defense, particularly for the maintenance of Syrian troops in Lebanon, have strained the government's budget, and Syria has received substantial subsidies from other Arab countries since 1967. Foreign aid also was contributed by the Soviet Union. The United States and the European Economic Community (EEC) have supplied smaller amounts of foreign aid.

Syria's balance of trade has been unfavourable. Italy, France, and Japan are the country's main trading partners. Exports include crude petroleum and natural gas, chemicals, and textiles, wearing apparel, and leather. Syria's principal imports consist of machinery and equipment, foodstuffs, and chemicals.

*Government and social conditions.* Syria is a socialist republic governed by the regional (Syrian) leadership of the Arab Ba'th ("Renaissance") Socialist Party, which maintains branch organizations in many Middle Eastern countries. Syria's constitution, which was adopted in 1973, vests executive power in the president, who is directly elected to a seven-year term. The president governs with the assistance of an appointed Council of Ministers, headed by a prime minister. The president also functions as commander-in-chief of the armed forces, secretary-general of the Syrian Ba'th Party, and president of the National Progressive Front, a political organization encompassing the Ba'th and other political parties. Legislative power resides in a unicameral People's Council, an administrative body of the Ba'th Party that is composed of 250 members who are directly elected to four-year terms. The principles of Syrian law and equity are derived from Islāmic law, with some French influences. The High Constitutional Court is the supreme judicial power.

Syria's social-welfare system is limited in its coverage and level of support. Old-age, invalidism, work-injury, and survivor pensions are provided by law, and health care is free for those who cannot afford private care. Although improving, health conditions are generally poor. In rural areas a shortage of health services, sewage-disposal systems, and potable water contribute to a high incidence of infectious disease.

Education is compulsory and free for six years of public primary school. Enrollments in both primary and six-year secondary schools have increased rapidly. Vocational, teacher-training, and university education, such as at the University of Damascus (founded in 1903), are also available.

The government strictly controls all communications media. The press has been subject to direct censorship since 1956. The official Ba'th Party newspaper, *Al Ba'th*, is one of the leading papers. Radio and television broadcasting are operated by the state-owned Syrian Broadcasting and Television Corporation.

*History.* The earliest inhabitants of Syria were most likely the Natufians, a hunting-and-gathering people of about 10,000 BC. The Akkadian civilization emerged under Sargon I of Akkad (2334–2279 BC) but was destroyed by a nomadic desert people known as the Amorites between 2000 and 1800 BC. During the 16th and 15th centuries BC the Egyptians and the Hurrian peoples of Mitanni struggled for control of the area. In the 14th century BC Syria came under Hittite control, followed in the 12th century by various neo-Hittite states eventually subjugated by the Assyrians in the 8th century BC. In the 7th century BC the Assyrian vassal state of Babylonia destroyed the Assyrian Empire, but the Achaemenid Persian Empire took control of the Neo-Babylonian Empire in 539 BC. Syria and the Persian Empire fell to Alexander the Great of Macedon in 333 BC. From 301 BC the Seleucid rulers governed Syria until about 164 BC, when Parthians and Nabataean Arabs divided the country.

In 64 BC Rome annexed Syria as a province that included Palestine, with Antioch as the capital; it remained one of Rome's wealthiest provinces until about AD 300, when it became part of Byzantium. The Byzantine period (300–634) was a golden age for Syria, until Muslims invaded in 634 and established

control. In 877 Syria was annexed by the Tūlūnid dynasty of Egypt, a connection that lasted with intervals for more than six centuries. The Mamlūks of Egypt conquered the Ayyūbid state of Syria in the 13th century and remained in power until 1516, when the Ottomans conquered the country. The Ottomans held Syria almost uninterruptedly for three centuries.

During World War I Syria was a major Ottoman military base, but it was taken by the British with the help of an Arab army. After the war Syria became a French mandate. In 1925 the People's Party was formed to work for Syrian independence and national unity.

A treaty in 1936 established a Syrian republic to include the ʿAlawite and Druze states, but the outbreak of World War II prevented total independence, and Syria was then effectively controlled by Vichy France. British and Free French forces soon invaded and occupied the country, and in 1941 Syrian independence was declared. In 1943 elections were held in which Shukarī al-Kuwatlī was elected president, but his government was overthrown in a bloodless coup in 1949. The resulting government was itself overthrown in 1954 in a coup that established a brief union with Egypt in the United Arab Republic. This was upset in a 1961 coup, and in 1964 a Baʿth military dictatorship was established that managed to retain power thereafter. Syria participated in the Arab–Israeli War in 1967, losing the Golan Heights to Israel. Ḥafiz al-Assad seized power in 1970, was sworn in as president in 1971, and led Syria for the next three decades. During that time, Syria engaged in an extended occupation of Lebanon, which resulted in numerous clashes with Israel in the south of that country, and joined the U.S.-led coalition against long-time rival Iraq to evict Iraqi forces from Kuwait during the Persian Gulf War. Al-Assad died in 2000 and was succeeded by his son Bashshār.

**Syriac alphabet,** writing system used by the Syriac Christians from the 1st century AD until about the 14th century. A Semitic alphabet, Syriac was an offshoot of a cursive Aramaic script. It had 22 letters, all representing consonants, and was generally written from right to left, though occasionally vertically downward. Diacritical marks to represent vowels were introduced in the last half of the 1st millennium AD; several systems of vocalization existed, some patterned after that of Arabic, some using small Greek letters above or below the line.

There were several varieties of Syriac script; the most important of these was Estrangela, or Estrangelo, which was in almost exclusive use until about AD 500. A schism in the Syriac church at the Council of Ephesus (AD 431) resulted in the division of the Syriac language and script into two forms, western and eastern. The western variety nearly died out under Muslim Arabic domination after the 7th century, but scattered communities of Syriac Christians survived, some of which continued to use the Syriac script. Documents of the Melchite sect of Palestinian Syrians date from as late as the 14th century. The eastern, or Nestorian, script remained in use in Central Asia and Siberia until the 13th or 14th century, as attested by inscriptions on gravestones in southern Siberia. The earliest extant Syriac inscription dates from about AD 50.

**Syriac language,** Semitic language belonging to the Northern Central, or Northwestern, group; it was an important Christian literary and liturgical language from the 3rd through the 7th century. Syriac was based on the East Aramaic dialect of Edessa (present-day Urfa, in southeastern Turkey), which became one of the chief centres of Christianity in the Middle East at the end of the 2nd century.

The earliest Syriac inscriptions date from the first half of the 1st century; the earliest documents not inscribed on stone date from 243.

Because of theological disputes, Syriac-speaking Christians divided during the 5th century into Nestorians, or East Syrians, under the Persian sphere of influence, and Jacobites (who were Monophysites), or West Syrians, under the Byzantine sphere. The Nestorians were expelled from Edessa and settled in Persia. After this division the two groups developed distinct dialects differing chiefly in the pronunciation and written symbolization of vowels. *See also* Aramaic language.

**Syriac literature,** body of writings in Syriac, an eastern Aramaic Semitic language spoken in and around Edessa (modern Urfa in southeastern Turkey) from the 1st century AD until the European Middle Ages. Edessa became an intellectual capital of the Christian Orient from the late 2nd century, and Syriac literature was produced there until the language was finally superseded by Arabic in the 14th century. Apart from its obvious interest to Semitic scholars, Syriac literature is of importance for the study of Syrian Christianity, for its preservation of Greek Christian texts, and for its role as an intermediary between ancient Greek learning and the Islāmic world. Syriac was the language of an extensive literature including translations of the Bible, hymns and poems (many gnostic in outlook), translations from Greek, biblical commentaries, historical works, laws, compilations of lives of saints, and works about philosophy, grammar, medicine, and science.

The works of St. Ephraem Syrus (4th century) stood at the beginning of Syriac literature and were never surpassed by any later author. Two poetic forms were employed by him, one for spoken speech in metrical form, whether a narrative or didactic epic, the other a more artful composition in strophes to be sung by a choir or double choir. At the beginning of Nestorian Christianity came Narsai (d. *c.* 503), the greatest poet of the East Syrians. The elegance of his poetry and the beauty of his style earned him the epithet "Harp of the Holy Spirit." Among the most important works in the extensive body of Syriac historical writing is the monumental chronicle in 29 books by the patriarch Michael I. The work covers both church and secular history up until 1195 and is valuable because it incorporates many historical sources and forms a veritable depository of lost documents.

The Syrians began their literary activity by making Greek Christian writings available in Syriac. Almost all important Christian authors and documents written in Greek were translated by Syrians. This mass of Greco-Syrian translated literature is an essential source for works of Greek Christian literature that have not survived in their original language. The translators also put into Syriac most of the works of Aristotle and other ancient Greek philosophers, together with writings of the chief medical and scientific authors of ancient Greece. These translations were important in the rise of Islāmic civilization, for it was much easier to translate from Syriac into Arabic than directly from Greek into Arabic; thus, for instance, to take the works of Galen alone, 130 were translated into Arabic from Syriac and only 9 directly from Greek originals into Arabic. For this reason many works of Greek learning exerted their influence on the Muslim world through the medium of Syriac.

BIBLIOGRAPHY. An authoritative study of Syriac literature is William Wright, *A Short History of Syriac Literature* (1894, reprinted 1978).

**Syriam,** town and port, southwestern Myanmar (Burma). It is situated on the Yangon River, a tributary of the Irrawaddy River, opposite Yangon (Rangoon), the national capital. Formerly part of the Mon kingdom, Syriam subsequently became a port of the Portuguese and French. In 1756 Alaungpaya (1714–60), the Myanmar king, conquered the Mon and their French allies, whom he put into slavery; the town was destroyed in these actions and had little significance until the 20th century, when the British began drilling for oil in the Irrawaddy basin near Chauk and sent the oil to Syriam for refining. Asphalt-gathering for the weatherproofing of houses was a traditional petroleum-related activity of Mon workers. Oil production declined during World War II when Japan occupied Myanmar (then Burma), from 1941 to 1945, and again as Myanmar declared its independence from Britain in 1948. The Syriam refinery was restored in 1957 and expanded in 1979 with Japanese assistance. In 1979 a pipeline was completed between Syriam and the Mann oilfield. Syriam has a tanker terminal, and oil exploration is carried on in the Gulf of Martaban. Paved roads extend from Syriam to Yangon and Pegu. Pop. (1983) 43,153.

**Syrian Catholic Church,** an Eastern Catholic church of the Antiochene rite, in communion with Rome since the 17th century. The Christians of Syria had been Monophysites since the 5th century; that is, they rejected the rulings of the Council of Chalcedon (451) and believed in the existence of only one nature in Christ. Attempts at unification with Rome were made, without success, in 1237 and 1247. With the establishment of the Capuchins and Jesuits in Aleppo in 1626, however, conversions to Catholicism followed; and Andrew Akhidjan, a Syrian Catholic priest, was elected bishop of Aleppo (1656) and then patriarch of all Syrians (1662). Following his death and for about a century thereafter, the Catholics were severely persecuted by the Jacobites (as the Monophysite Syrians were called); not until 1782, when Michael Jarweh, the bishop of Aleppo, was elected patriarch, did a continuous series of Syrian Catholic patriarchs begin. The patriarchs resided successively in Dayr az-Zafaran, Sharfeh, Aleppo, Mardin (in Turkey), and finally Beirut. There are patriarchal vicariates or exarchies in Lebanon, Turkey, Jordan, and Egypt, five archdioceses (Aleppo, Baghdad, Damascus, Ḥimṣ, and Mosul), and one diocese (Hassakeh). Catholic Syrians observe the Liturgy of St. James in Syriac, though certain readings are in Arabic, the language spoken by the faithful.

**Syrian chant,** generic term for the vocal music of the various Syrian Christian churches, including Eastern Orthodox churches such as the Jacobites and Nestorians, and the Eastern churches in union with Rome—*e.g.,* the Maronites (mostly in Lebanon) and the Chaldeans, who are dissidents from the Nestorians. To these should be added some branches of nearly all of these groupings in the province of Malabār, India.

Knowledge of Syrian liturgical music before the last century is very limited. Inferences may be made about some older principles of musical performance, for Syrian influences on neighbouring peoples were strong; Syrian practices, for example, spread among the Greeks in the Byzantine Empire. Before its conquest by the Muslims (mid-7th century), Syria was one of the earliest and most important Christian lands in the Middle East.

Although the responsorial chanting (alternation between a soloist and a choir) found in Eastern and Western liturgies may have originated in Hebrew temple ritual, it is considered probable that antiphonal singing (alternation between two choirs) is of Syrian origin, and Syrian sources are among the earliest to document its existence. Syrian poetry and poetic forms also influenced the development of Byzantine religious poetry, establishing patterns of poetic forms that were emulated by the Greeks and other groups. Even the Byzantine *oktōechos,* a theoretical concept of eight modes according to which melodies were clas-

sified (*see* ēchos), is now viewed as an exportation from Syria, where it was known by the 6th century. It is probable that throughout the Middle East there have been similar premises for musical composition and that the basic approach to liturgical music was and is through a small number of melodic formulas. These serve as melodic skeletons, as starting points for improvisation by singers. The concept of the melodic formula is fairly elastic: it is not an unchangeable pattern but rather a theme that is subject to variations in which the basic skeleton is always recognizable, even when numerous melodic additions make immediate recognition difficult. Most of the singers are professional chanters, frequently inheriting their positions from their fathers.

It is thought by some that the subtle tonal and rhythmic intricacies encountered in modern performances of Syrian chant are remnants of a sophisticated musical tradition rooted in the early centuries of Christianity; others view the same traits as elements of Turkish influence imported into Syria in the late European Middle Ages.

**Syrian Desert,** Arabic BĀDIYAT ASH-SHĀM, arid wasteland of southwestern Asia, extending northward from the Arabian Peninsula over much of northern Saudi Arabia, eastern Jordan, southern Syria, and western Iraq. Receiving on the average less than 5 inches (125 mm) of rainfall annually and largely covered by lava flows, it formed a nearly impenetrable barrier between the populated areas of the Levant and Mesopotamia until modern times; several major motor routes and oil pipelines now bisect it. In the late 1970s, there was much oil exploration. The desert, the southern sector of which is commonly known as Al-Ḥammād, is inhabited by several nomadic tribes and breeders of Arabian horses.

**Syrian Orthodox Patriarchate of Antioch,** also called SYRIAN ORTHODOX CHURCH, or SYRIAN JACOBITE CHURCH, body of Syrian Christians who are Monophysites, acknowledging only one nature in Christ; it is administered by the Syrian patriarch of Antioch.

In the 5th and 6th centuries a large body of Christians in Syria repudiated the patriarchs of Antioch who had supported the Council of Chalcedon (451) in affirming the dual nature of Christ. Like many Copts, Ethiopians, and Armenians, these Syrians held the Monophysite doctrine that Christ is not "in two natures" (human and divine) but is "one nature out of two natures." Accordingly, they set up their own patriarchs of Antioch in opposition to the Chalcedonian patriarchs, whom they called Melchites ("Emperor's Men"). Jacob Baradaeus, bishop of Edessa (d. 578), was instrumental in organizing their community; hence, they have been termed Jacobites. The Monophysite Syrians were also called Syriani, because their doctrine was associated with the Syriac language after it had died out among Greek-speaking people; the Greek Orthodox Syrians, on the other hand, were known as Rūmī (Arabic: "Roman").

After the Arab conquest of Syria (7th century), each church in the caliphate and in Muslim states generally was treated as a millet, or religious community, governed by its own laws and courts under its own clergy. The Syriani were recognized as the West Syrian millet (the East Syrian millet being the Assyrians, or Nestorians). Since the 17th century, when a minority of them were united with Rome and became the Syrian Catholics, the rest of the West Syrians have been known as Syrian Orthodox, although they remained distinct from the Chalcedonian "Greek Orthodox" Christians of the area. Their liturgical language is the literary Syriac of Edessa, which they preserve as a living tongue, a close relative to the Aramaic spoken by Jesus Christ and his Apostles.

The Syrian Orthodox patriarch of Antioch has very seldom lived in Antioch itself; his usual residence was the monastery of Dayr az-Zafaran near Mardin, near Diyarbakır in eastern Turkey. During World War I most of the Syrian Jacobites left Turkey, and their patriarch moved to Ḥimṣ (1921) and then to Damascus (1959). They now live in Lebanon, Iraq, Turkey, and Syria, and in smaller numbers in Jordan, Egypt, and the United States.

**Syrian rite:** *see* Antiochene rite; Chaldean rite.

**Syrian Wars** (3rd century BC), five conflicts fought between the leading Hellenistic states, chiefly the Seleucid kingdom and Ptolemaic Egypt, and, in a lesser way, Macedonia. The complex and devious diplomacy that surrounded the wars was characteristic of the Hellenistic monarchies. The main issue in dispute between the Seleucids and the Ptolemies was control of southern Syria. In the First War (274–271) Ptolemy II wrested Phoenicia on the northern Syrian coast, most of Anatolia, and the Cyclades Islands from the Seleucids. In the Second War (*c.* 260–255/253) the Seleucid king Antiochus II, aided by Antigonus Gonatus of Macedonia, initiated a largely successful campaign to regain Phoenicia and Anatolia.

The Third, or Laodicean, War (*c.* 245–241) was begun by Ptolemy III to enforce earlier diplomatic arrangements disadvantageous to Seleucus II, son and successor of Antiochus II. To consolidate his position, Seleucus had to concede territory in Anatolia to the rulers of Cappadocia and Pontus. By the peace terms Ptolemy kept Seleucia Pieria in Syria and several coastal areas in Thrace.

In 236 Seleucus was forced to cede his Anatolian possessions to his brother Antiochus Hierax in the so-called War of the Brothers. Antiochus in turn lost them to the Anatolian ruler Attalus I of Pergamum. The former eastern Seleucid provinces, Bactria and Parthia, were also by this time in the hands of independent rulers. By 221 Antiochus III began to implement a policy of restoring Seleucid power, largely successful except for an abortive attack on Egypt.

In the Fourth War (219–217), which he initiated, Antiochus had to concede Coele Syria (southern Syria and Palestine) to Ptolemy IV, whose victory at Raphia in Palestine, however, was clouded by revolts in Egypt.

The Fifth War (202–200) climaxed a renewed and permanently successful Seleucid effort to wrest Coele Syria from the Ptolemies. Antiochus' subsequent Hellenizing policy in Judaea led to rebellion and independence for Judaea in 142. Weakened by constant warfare, the Hellenistic states fell under Roman control in the 2nd and 1st centuries BC.

*Consult the* INDEX *first*

**syringomyelia,** disease of the spinal cord and medulla oblongata of the brain (syringobulbia). The condition is chronic and progressive, with pathological changes in the neural tissue, characterized principally by excessive development and cavitation. There is gradual dissociated sensory loss, muscle wasting, and spasticity. The disease is of unknown cause but is thought to be a developmental defect, frequently associated with other developmental anomalies. Symptoms ordinarily appear between the ages of 10 and 30; frequency is higher among males than females.

Onset of the disease is slow. First noticeable signs may be weakness of the small hand muscles or burns or other injuries with lack of pain. This early loss of pain and temperature sense (but not that of touch) is brought about by pathology of pain and temperature fibres as they cross in the gray commissure of the spinal cord. This loss of sensation has a peculiar shawllike distribution over the arms and shoulders. The disease is slowly progressive; spasticity and hyperactive reflexes increase. Scoliosis, a lateral curvature of the spine, is frequent. Syringobulbia is manifested by tongue atrophy, dysphagia, loss of pain and temperature sensation in the face, and a variety of other neurological disorders.

There is, at present, no treatment and no cure for the disease; but, since it progresses slowly, patients may live as long as 40 years after its onset.

**syrinx,** the vocal organ of birds, located at the base of the windpipe (trachea), where the trachea divides into the bronchi (tubes that connect the trachea with the lungs). The syrinx is lacking in the New World vultures (Cathartidae), which can only hiss and grunt, but reaches great complexity in the songbirds, in which it consists of paired specialized cartilages and membranes (the inner, or medial, walls of the bronchi), controlled by as many as six pairs of minute muscles.

Sound vibrations in the tracheal air column are evidently initiated and modulated by the vibrating membranes, specialized parts of the bronchial or tracheal walls. Songbirds, and probably other birds, are able to control the right and left halves of the syrinx separately, thus singing with two independent voices.

**syrinx** (musical instrument): *see* panpipe.

**Syros,** Modern Greek SÍROS, island near the centre of the Cyclades group, in the Aegean Sea, Greece. Its chief town and port, Hermoúpolis, on a bay of the east coast, is the capital of the *nomós* (department) of Cyclades. The island, with an area of 32 square miles (84 square km), is hilly, denuded, and irregular in shape, and it reaches an elevation of 1,450 feet (442 m). The old quarter, Ano Síros, of Hermoúpolis was founded in the 13th century by Venetians on the site of a classical town. Refugees from the War of Greek Independence (1821–29) founded the adjacent contemporary port, which was important in Greek coastal trade. Industries include shipbuilding, tanning, cotton mills, weaving, and confectionary, but the main source of revenue is from maritime trade and commercial shipping. Pop. (1981) 19,668.

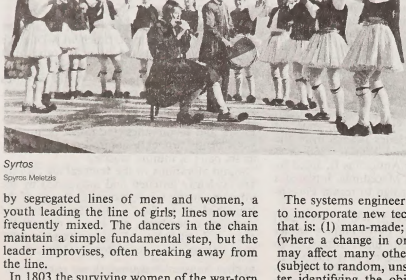
**syrphid fly:** *see* hover fly.

**Syrtis Major,** distinctive dark marking on the surface of the planet Mars, centred near 290° W and 10° N, which extends some 1,500 km (930 miles) north from the planet's equator and spans 1,000 km (620 miles) from west to east. It was noticed as early as 1659, for it appears in a drawing of Mars of that date by Christiaan Huygens. It is an extensive regional slope elongated north to south that drops 4 km (2.5 miles) from its western boundary (Aeria) to its eastern edge (Isidis). Assiduously observed for more than a century because of its seasonal and long-term variability, especially near its eastern boundary, Syrtis Major was first considered a shallow sea. Later its variability was attributed to vegetation. Closeup photographs and data returned by the U.S. Mariner and Viking planetary probes during the 1960s and '70s enabled investigators to determine that the changes are caused by wind blowing sand and dust across the surface. In the early 1980s detailed topographical maps, prepared from Earth-based spectroscopic and radar observations as well as from the space-probe photographs, indicated that Syrtis Major includes a high-altitude bulge rising to 6 km (3.7 miles) at 310° W.

**Syrtis Major** (Mediterranean Sea): *see* Sidra, Gulf of.

**Syrtis Minor** (Mediterranean Sea): *see* Gabes, Gulf of.

**syrtos,** ancient chain dance of Greece. It was described by Lucian (*c.* AD 125–190) and is still danced today in many varieties in the Greek islands. Traditionally, it was danced



*Syrtos*
Spyros Meletzis

by segregated lines of men and women, a youth leading the line of girls; lines now are frequently mixed. The dancers in the chain maintain a simple fundamental step, but the leader improvises, often breaking away from the line.

In 1803 the surviving women of the war-torn town of Souli, faced with capture by Turkish troops, danced the *syrtos* as they threw themselves off the mountain of Zálongo. The *kalamatianos,* a form of the *syrtos* and a profoundly popular national dance, is frequently danced to the ballad of Zálongo. The metre of the *kalamatianos* is $\frac{7}{8}$ (3 + 2 + 2); the *syrtos* metre is usually $\frac{2}{4}$. Both the leader and other dancers may improvise in the *kalamatianos,* the leader leaping and flourishing his handkerchief and, when he chooses, passing it to a new leader.

**Système Internationale d'Unités:** *see* International System of Units.

**systemic circulation,** in physiology, the circuit of vessels supplying oxygenated blood to and returning deoxygenated blood from the tissues of the body, as distinguished from the pulmonary circulation. Blood is pumped from the left ventricle of the heart through the aorta and arterial branches to the arterioles and through capillaries, where it reaches an equilibrium with the tissue fluid, and then drains through the venules into the veins and returns, via the venae cavae, to the right atrium of the heart. Pressure in the arterial system, resulting from heart action and distension by the blood, maintains systemic blood flow. The systemic pathway, however, consists of many circuits in parallel, each of which has its own arteriolar resistance that determines blood flow independently of the overall flow and pressure and without necessarily disrupting these. For example, the blood flow through the digestive tract increases after meals, and that through working muscles increases during exercise. *See also* pulmonary circulation.

**systems engineering,** technique of using knowledge from various branches of engineering and science to introduce technological innovations into the planning and development stages of a system.

A brief treatment of systems engineering follows. For full treatment, *see* MACROPAEDIA: Industrial Engineering and Production Management.

Systems engineering grew out of the overlapping of various engineering disciplines developed in the 19th and 20th centuries. Its first application as a specific discipline was in the organization of commercial telephone systems in the 1920s and '30s. Many systems-engineering analytic techniques were developed during World War II as methods of increasing the efficiency of military equipment deployment. Postwar growth in the field was spurred by advances in electronic control systems and by the development of computers and information theory.

The systems engineer is usually called upon to incorporate new technology into a system that is: (1) man-made; (2) large and complex (where a change in one part, or subsystem, may affect many others); and (3) stochastic (subject to random, unscheduled changes). After identifying the objectives of the current system, the systems engineer adjusts the new technology to maintain that objective.

A systems engineer draws upon his expertise in science, technology, and management to solve complex problems of cost and scheduling. One of the tools that an engineer uses to manage complex systems is a flowchart. A graphic depiction of a system, in which geometric figures represent various subsystems and arrows represent their interactions, the flowchart helps point out the interrelationships of processes within the system. A more quantitative technique uses mathematical models that reduce system interactions to mathematical equations. Probability theory, statistical analysis, and computer simulations are also tools of the systems engineer.

The classic application of systems engineering is in commercial telephony. Systems-engineering techniques are used to solve problems in such diverse fields as military and space systems and transportation and pollution control.

**systole,** period of contraction of the ventricles of the heart that occurs between the first and second heart sounds. Systole causes the ejection of blood into the aorta and pulmonary trunk. Lasting usually 0.3 to 0.4 second, ventricular systole is introduced by a very brief period of contraction, followed by the ejection phase, during which 80 to 100 cubic centimetres of blood leave each ventricle. During systole, arterial blood pressure reaches its peak (systolic blood pressure), normally about 120 millimetres of mercury in human beings; this is slightly lower than the ventricular pressure because of the distensibility of the vessel walls. Atrial systole occurs toward the end of ventricular diastole, completing the filling of the ventricles. "Systole" may also refer to the contraction stage of the contractile vacuole in protozoans. *Compare* diastole. *See also* blood pressure.

**Syvash,** also spelled SIVASH, or SIVAŠ, Russian GNILOYE MORE ("Putrid Sea"), system of shallow inlets of the Sea of Azov that penetrate the northern and eastern coasts of the Crimean Peninsula, Ukraine. Syvash is an area of marshy inlets and coves on the western margin of the Sea of Azov, from which it is separated by the Arabat Spit, a sandbar measuring from 900 feet to 5 miles (270 m to 8 km) in width. Syvash covers an area of approximately 990 square miles (2,560 square km) and is covered with mineral salts during the summer months. The salts are used in the local chemical industries of Krasnoperekopsk, a city in northwestern Crimea.

**Syzran,** city, Samara *oblast* (province), western Russia. It lies along the Volga River at the latter's confluence with the Syzran River. Founded in 1683 as a stronghold at the eastern end of the Syzran defensive line, the city is a significant river port and an important centre of the western Volga-Urals oil field. Oil refining, manufacture of chemicals, glassmaking, timber working, and food processing are the city's principal industries. Pop. (1993 est.) 175,900.

**Szabolcs-Szatmár-Bereg,** *megye* (county), extreme northeastern Hungary, occupying an area of mainly lowland country traversed by many small river courses. Lying within the *megye* is the Nyírség, a district of sandy soils and the site of Nyíregyháza (*q.v.*), the *megye* seat. Crossed by the Tisza River system, the sandy terrain has been stabilized by planting fruit and other trees. Elsewhere in the *megye* are riverine flats, some of them poorly drained swamp and marshland, though reclamation has added sizable areas of cultivable land. Fruit, grains (especially rye), rough fodder, sunflowers, and tobacco are grown in the county. Cattle, pigs, and sheep are raised, and fruit brandies, industrial alcohol, and morphine (from poppies) are important products.



Clay pit for making bricks, near Nyíregyháza in Szabolcs-Szatmár-Bereg *megye* (county), Hungary
E. Kerrikson—Ostman Agency

The county's major centres, after Nyíregyháza, include Kisvárda and Mátészalka. Area 2,293 square miles (5,938 square km). Pop. (1993 est.) 564,000.

**Szálasi, Ferenc** (b. Jan. 6, 1897, Kassa, Hung., Austria-Hungary—d. March 12, 1946, Budapest), soldier and politician who was the fascist leader of Hungary during the last days of World War II.

Following family traditions, Szálasi entered the army and became a captain on the general staff in 1925. He joined a secret organization with a racist program in 1930 and, after early retirement from the army in 1935, founded the Party of National Will. Though his party was completely unsuccessful at the polls, Szálasi continued his radical, nationalistic agitations, later helped by German support. His program was based on chauvinism and anti-Semitism.

Szálasi was repeatedly jailed by the conservative Hungarian government, but, as the war was drawing to a close and as Nazi troops moved in, Szálasi, as head of the fascist Arrow Cross Party, was made nominal leader of the country (Oct. 15, 1944). He cooperated completely with the Germans and employed his Arrow Cross thugs against Jews, leftists, and deserters until the Germans left Hungary

in April 1945. Captured by U.S. troops in Germany, Szálasi was returned to Hungary, where he was sentenced to death by the People's Tribunal and executed.

**Szamos River:** (Romania): *see* Someş River.

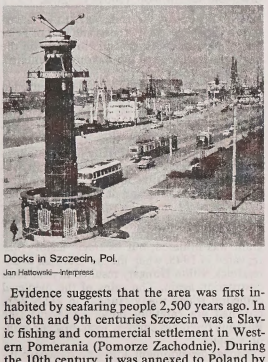
**Szápolyai, János** (king of Hungary): *see* John *under* John (Hungary).

**Szatmárnémeti** (Romania): *see* Satu Mare.

**Száva River:** *see* Sava River.

**Szczecin,** former (1975–98) *województwo* (province), northwestern Poland, now part of Zachodniopomorskie (*q.v.*) province.

**Szczecin,** German STETTIN, port city, capital of Zachodniopomorskie *województwo* (province), extreme northwestern Poland. Szczecin is situated on the western bank of the Oder River near its mouth, 40 miles (65 km) from the Baltic Sea. Shipbuilding and shipping are the main occupations.



Docks in Szczecin, Pol.
Jan Hattowski—Interpress

Evidence suggests that the area was first inhabited by seafaring people 2,500 years ago. In the 8th and 9th centuries Szczecin was a Slavic fishing and commercial settlement in Western Pomerania (Pomorze Zachodnie). During the 10th century, it was annexed to Poland by Mieszko I. The town was granted municipal autonomy in 1243, remaining capital of the dukedom of Western Pomerania. It grew and prospered, joining the Hanseatic League in 1360. In 1637 it passed to the Brandenburg Electorate, which controlled it until 1648, when it was seized by the Swedes. In 1720 it passed to Prussia and remained under German control until its transfer to Poland after World War II.

Modern development of the port of Szczecin began in 1826 with regular navigation of the Oder. The port grew steadily until World War II, mainly through its proximity to Berlin, 90 miles (145 km) to the southwest. In 1926–27 the channel through the Szczeciński Lagoon to the outport of Świnoujście (Swinemünde) was deepened. During World War II, the port was completely destroyed and the city itself was greatly depopulated. Under Polish administration the port and city were rebuilt.

Szczecin is, with Świnoujście, now Poland's largest port complex, handling some 6,000 ships annually in the early 1990s. It is an important port for cargo shipped down the Oder from the Czech Republic, Hungary, and Germany; coal is the major export. Other industries, in addition to shipbuilding, include food processing, metalworks, fertilizers, and synthetic-textile-machinery production. Power for these industries and for the northwest of Poland is supplied by the Dolna Odra power plant.

Szczecin is a cultural centre of western Poland, having four institutions of higher education, several theatres, a philharmonic orchestra, libraries, and the Museum of Western Pomerania. It is a picturesque city containing many monuments, parks, and small lakes. Pop. (2002) 415,399.

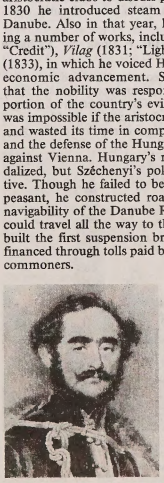
**Szczecinek,** German NEUSTETTIN, city, Zachodniopomorskie *województwo* (province), northwestern Poland. Originally a Slavic tribal stronghold, it received town rights from the duke of Pomerania in 1310. In the 17th century, Szczecinek was invaded by Brandenburg. Half of the city was destroyed during World War II.

Szczecinek is the commercial centre for the surrounding district; its industry includes dairying, lumber milling, and food processing. Located in a lakeland area, scenic environs and the boating harbour attract tourists, as do such sites as the Gothic St. Nicholas Church (16th century). Pop. (2002) 39,328.

**Szczeciński Lagoon,** Polish ZALEW SZCZECIŃSKI, German STETTINER HAFF, or ODERHAFF, lagoon (area 350 square miles [900 square km]) on the Baltic Sea coast between Mecklenburg–West Pomerania *Land* (state), Germany, and Zachodniopomorskie *województwo* (province), Poland. An extension of the Oder River's estuarine mouth, it is drained (via the Świna, Peene, and Dziwna rivers) into Pomeranian Bay and the Baltic Sea between Usedom and Wolin.

**Széchenyi, István, Count** (Gróf) (b. Sept. 21, 1791, Vienna, Austrian Empire—d. April 8, 1860, Döbling, near Vienna), reformer and writer whose practical enterprises represented an effort toward Hungarian national development before the upsurge of revolutionary radicalism in the 1840s.

Born into an old, aristocratic Hungarian family, Széchenyi fought against Napoleon I and thereafter traveled extensively in Europe. The modernity of England and France impressed him, especially when he contrasted them with his backward homeland. Resolved to improve Hungary's condition, he donated a year's income to establish the Hungarian National Academy of Sciences (1825). At Széchenyi's instigation, the Hungarian nobility formed aristocratic clubs to discuss political affairs. In 1830 he introduced steam shipping on the Danube. Also in that year, he began publishing a number of works, including *Hitel* (1830; "Credit"), *Világ* (1831; "Light"), and *Stadium* (1833), in which he voiced Hungary's need for economic advancement. Széchenyi argued that the nobility was responsible for a large portion of the country's evils; modernization was impossible if the aristocracy paid no taxes and wasted its time in complacency, frivolity, and the defense of the Hungarian constitution against Vienna. Hungary's nobility was scandalized, but Széchenyi's polemics were effective. Though he failed to better the lot of the peasant, he constructed roads, improved the navigability of the Danube River so that ships could travel all the way to the Black Sea, and built the first suspension bridge at Budapest, financed through tolls paid by both nobles and commoners.



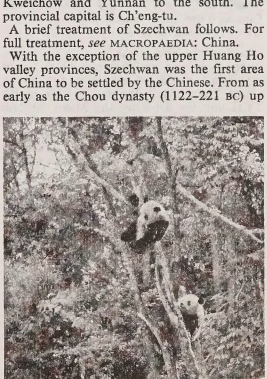
Széchenyi, lithograph by J. Kriehuber after a painting by Moritz Daffinger, 1849
By courtesy of the Bild-Archiv, Österreichische Nationalbibliothek, Vienna

In the 1840s, however, Széchenyi lost much of his following to the more radical younger generation under Lajos Kossuth. Loyal to the Habsburgs, Széchenyi condemned the attempt to Magyarize Hungary's non-Magyars; he believed that liberty would follow economic progress, whereas Kossuth argued the reverse. Entering Lajos Batthyány's cabinet in 1848, Széchenyi lost his sanity when conflict with Vienna erupted; he was removed to an asylum near Vienna. Threatened with prosecution for sedition after he published an attack on Austria's absolutist rule in Hungary (1859), he committed suicide the next year.

**Szechwan,** Wade-Giles romanization SSU-CH'UAN, Pinyin SICHUAN, *sheng* (province) in China, located in the Upper Yangtze River valley in the southwestern part of the country. Second largest of China's provinces, it is bordered by the Tibetan Autonomous Region to the west, Tsinghai province to the northwest, the provinces of Kansu and Shensi to the north, Hupeh and Honan to the east, and Kweichow and Yunnan to the south. The provincial capital is Ch'eng-tu.

A brief treatment of Szechwan follows. For full treatment, *see* MACROPAEDIA: China.

With the exception of the upper Huang Ho valley provinces, Szechwan was the first area of China to be settled by the Chinese. From as early as the Chou dynasty (1122–221 BC) up

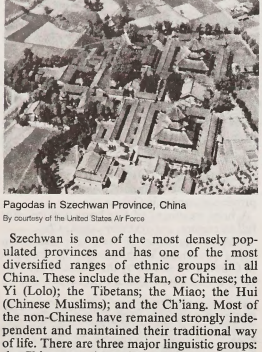


Giant panda cubs at Wolong Nature Reserve, Szechwan Province, China
Keren Su/China Span

until the Sung and Southern Sung dynasties (AD 960–1279), it was administered through various political subdivisions. Szechwan was established as a province during the Ch'ing dynasty (1644–1911). Not until 1935, after being divided into various types of independent military zones during the troubled early years of the Chinese Republic (1911–30), was the province unified under the Nationalist government. During the Sino-Japanese War (1937–45), the province served as the seat (at Chungking) of the Nationalist government; the Japanese never penetrated the area.

Szechwan is bordered on all sides by lofty highlands. In the eastern region of the province an extensive depression, called the Szechwan Basin or the Red Basin, and its peripheral highlands dominate. The land slopes toward the centre of the basin from all directions. In western Szechwan the landforms include a plateau in the north and mountains in the south. The climate in the eastern basin is milder than expected, due to its being sheltered from cold polar air masses by the surrounding mountains. The growing season lasts all year. The east is noted for its frequent fogs, many cloudy days, a relative absence of wind,

and high relative humidity. In the west, mountains also provide shelter, evidenced by the snowcapped peaks and the mild weather in the valleys below. There is heavy snowfall in the mountains during winter, but precipitation is lower than in the east.



Pagodas in Szechwan Province, China
By courtesy of the United States Air Force

Szechwan is one of the most densely populated provinces and has one of the most diversified ranges of ethnic groups in all China. These include the Han, or Chinese; the Yi (Lolo); the Tibetans; the Miao; the Hui (Chinese Muslims); and the Ch'iang. Most of the non-Chinese have remained strongly independent and maintained their traditional way of life. There are three major linguistic groups: the Chinese speak southern Mandarin; the Tibetans and Yi speak Tibeto-Burman; and the Muslims speak southern Mandarin but use Turkish or Arabic in their religious services. The population, which has an average density of over 700 persons per square mile, is unevenly distributed. About 95 percent of the people live in the eastern part of the province. Most of the population is rural, living in hilly regions where farmsteads are scattered through small and irregularly terraced fields and are often surrounded by groves of banyan, cypress, mimosa, palm, or bamboo trees. One of the outstanding features of urban settlement is the concentration of cities on river terraces. There are no fewer than 15 cities, with the most populous located along the Yangtze River from Feng-chieh to I-pin. The flood hazard is always great and many houses are perched on poles and posts. The largest city is Chungking, located in the southeast and considered the most important trading, transportation, industrial, and cultural centre in southwestern China. Other major cities in the province are Ch'eng-tu, the capital; Tzuking; I-pin; Nanch'ung; Ya-an; K'ang-ting; and Hsi-ch'ang.

Although Szechwan is usually classified as a rice region and leads all of China in the production of rice, corn (maize), and sweet potatoes, it is also a prominent producer of wheat, rapeseed, *kaoliang* (sorghum), barley, soybeans, millet, and hemp and other fibre crops. Principal cash crops include sugarcane, cotton, tobacco, silk, hemp, and tea.

It also leads the nation in total number of cattle and pigs raised. It is the only region in China in which both water buffalo of South China and oxen of North China are found together. Pig bristles from Szechwan are of international repute and have been an important foreign trade item for years. Szechwan is second only to Manchuria as a lumber region. Much of its original forest cover still exists, with a predominance of spruce, fir, and birch trees. Mineral deposits are abundant and varied. The production of brine salt is the most extensive mining activity.

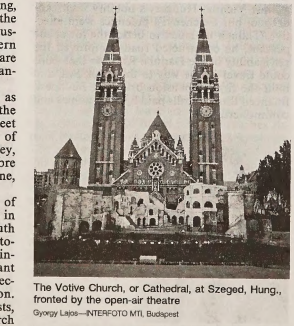
Szechwan has become the most industrialized province of southwestern China. The most important industries are iron and copper smelting, the production of machinery and electric power, coal mining, petroleum refining, and the manufacture and processing of chemicals, textiles, and food.

For centuries travel into the province has been extremely difficult; it is one of the most urgent problems facing Szechwan, where water transportation is vital. The Yangtze River is the backbone of the system: steamboats of 1,000-ton capacity can negotiate its waters, and smaller steamers travel it and its tributaries throughout the year. Railways are important for the transport of bulky products. Roads are extremely difficult to build and maintain because of the terrain. There is a constant threat of landslides, and the presence of steep slopes and hairpin turns make road construction hazardous and costly. There is air service to many parts of the province. Area 219,700 sq mi (569,000 sq km). Pop. (1983 est.) 100,220,000.

**Szechwan Basin,** Wade–Giles romanization SSU-CH'UAN P'EN-TI, Pinyin SICHUAN PENDI, also called RED BASIN, basin comprising the greater part of eastern Szechwan Province (*sheng*), southwest China. It is surrounded by high mountains, including the Tsinghai–Tibet Plateau on the south, the Yunnan–Kweichow Plateau on the south, Wu Shan (mountains) on the east, and the Ta-pa Shan on the north, which protect the interior from temperature extremes. The basin covers 88,600 sq mi (229,500 sq km) of red-brick sandstone, deeply dissected in the south by the Yangtze River and in the centre by three of its tributaries. Its floor is just under 800 ft (244 m) in elevation and its outer margins lie at about 2,000 ft. The basin, which is heavily populated, has a mild climate that permits diversified agriculture, mainly on terraced hillsides. The basin is one of China's main rice-producing areas; other products include tung oil, sugarcane, oranges, tangerines, and medicinal herbs. Industries utilize the coal, oil, natural gas, salt, manganese, sulfur, and iron ore deposits of the basin. Ch'eng-tu is the major centre of population.

**Szechwanese Alps** (China): *see* Ta-hsüeh Mountains.

**Szeged,** city with county status and the seat of Csongrád *megye* (county), southeastern Hungary. It is on the Tisza River, west (downstream) of its confluence with the Maros and a few miles from the intersection of Hungary,



The Votive Church, or Cathedral, at Szeged, Hung., fronted by the open-air theatre
György Lajos—INTERFOTO MTI, Budapest

Romania, and Serbia and Montenegro. It was a military stronghold and trade centre in the time of the Árpád kings (10th–15th century) and was sacked by the Tatars and the Turks.

The city was replanned after the devastating flood of 1879, with concentric boulevards with radial avenues. It has since been protected by dikes. Ujszeged (New Szeged) is on the left bank opposite the main Tisza bridge. The large principal square, Széchényi-tér, is flanked by the strikingly unusual neobaroque Town Hall (1883) and by public buildings. The oldest relics are the remains of the 13th-century Saint Demeter tower, discovered when an 18th-century church was demolished in 1924, and the Alsóvárosi Templom in Alsóváros (Lower Town). The city has a notable twin-spired Votive Church, or Cathedral (1912–29), the Attila József University (1872), the Albert Szent-Gyorgyi Medical University (1872; refounded 1951), the Biological Research Center of the Hungarian Academy of Sciences, and a national theatre. Since 1931 it has held an open-air cultural festival in the Votive Church square. Food processing remains important, and Szeged is still famous for its paprika and salami. Pop. (2001) 168,372.

**Székesfehérvár,** German STUHLWEISSENBURG, city with county status and seat of Fejér *megye* (county), west-central Hungary, on the northeastern fringe of the Bakony Mountains, southwest of Budapest.

A Roman settlement, Herculea, superseded an earlier Celtic village on the site; in the 10th century it was chosen by Stephen I, king of Hungary, as capital of the Hungarian kingdom. Then known as Alba Regia, it was a strong fortress with a naturally defensible hinterland of large swamps and marshes. It was occupied by the Turks in 1543, who withdrew in 1688 after looting and destroying the cathedral and palace, and for a while Székesfehérvár was depopulated. From the 18th century the town revived, and a large-scale building program was initiated; but its tragic history was repeated in 1945, when the last German counterattack within Hungary resulted in near-total destruction again. The ruins of the medieval cathedral where many Hungarian kings were crowned are carefully preserved. Some fine Baroque buildings survive, including the bishop's palace.

Postwar development added an extensive industrial base to the city's continued importance as a market centre for the truck farmers, vine growers, and horse breeders of the area. One of Europe's largest autobus factories is in Székesfehérvár. The city benefited from foreign investment in the late 20th century, as modern factories were built there. It is also a rail and road junction on the main routes between Budapest and the southwest. The Ybl Museum houses a collection of Miklós Ybl, the great Hungarian architect. Pop. (2001) 106,346.

**Szekler,** Hungarian SZÉKELY, member of a people inhabiting the upper valleys of the Mureş and Olt rivers in what was eastern Transylvania and is now Romania. They were estimated to number about 860,000 in the 1970s and are officially recognized as a distinct minority group by the Romanian government. Their origin has been much debated. According to their own tradition, repeated in Procopius' *De bello Gothico,* they were descended from Attila's Huns. It is, however, now generally accepted that they are true Hungarians, or Magyars (or at least the descendants of a Magyarized Turkic people), transplanted there to guard the frontier, their name meaning simply "frontier guards."

Their ethnic identity as distinguished from other Romanians is largely preserved by the continuing vitality of the Szekler (Szekel) language, a Hungarian dialect. Runes of ancient Turkic origin continue to be used as a written alphabet, the latinized Romanian script being largely used for official and commercial communication, however. In 1952 the former province of Mureş (with the highest concentration of Szekler population) was legally des-

ignated as the Magyar Autonomous Region. It was superseded in 1960 by the Mureş Magyar Autonomous Region, itself divided in 1968 into two nonautonomous districts, Mureş and Harghira.

**Szekszárd,** town and seat of Tolna *megye* (county), south-central Hungary. Lying close to the Sió River, south-southeast of Budapest, the town once lay along the Danube before that river was rechanneled as a result of 19th-century water regulation. Szekszárd's vineyards have been famous for centuries. The town centre stands on a hill overlooking the river; the county hall, which was built in 1823 on the site of a medieval Benedictine abbey (1061), and the Trinity Column are the town's principal architectural showpieces. Pop. (1989 est.) 39,005.

**Szell, George,** original name GYÖRGY SZÉLL (b. June 7, 1897, Budapest, Hung., Austria-Hungary—d. July 30, 1970, Cleveland, Ohio, U.S.), Hungarian-born American conductor, pianist, and composer who built the Cleveland Orchestra into a leading American orchestra during his long tenure (1946–70) there as musical director.

A child prodigy on the piano, Szell was educated in Vienna. His conducting debut came at the age of 16 with the Vienna Symphony Orchestra. Richard Strauss appointed him to the staff of the Berlin State Opera in 1915, and he was subsequently engaged by opera houses in Prague, Darmstadt, and Düsseldorf. He was first conductor at the Berlin State Opera (1924–29), at the German Theatre in Prague (1930–37), and conductor of the Scottish Orchestra (1937–39). Before World War II he appeared with orchestras in various countries, including the United States and the Soviet Union.

After the outbreak of war in 1939, Szell immigrated to the United States, conducting in

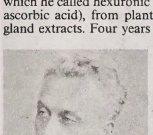


**Szell**
The Bettmann Archive

many American cities. From 1942 to 1946 he conducted at the Metropolitan Opera in New York City, and he became a naturalized U.S. citizen in 1946. That same year he took up his post as musical director of the Cleveland Orchestra, holding it until his death in 1970. Szell toured widely with that organization, winning an international reputation for the clarity, balance, and intensity of his performances of works by Wolfgang Amadeus Mozart, Ludwig van Beethoven, Franz Schubert, Johannes Brahms, and Gustav Mahler.

**Szent-Györgyi, Albert** (b. Sept. 16, 1893, Budapest, Hung., Austria-Hungary—d. Oct. 22, 1986, Woods Hole, Mass., U.S.), Hungarian biochemist whose discoveries concerning the roles played by certain organic compounds, especially vitamin C, in the oxidation of nutrients by the cell brought him the 1937 Nobel Prize for Medicine or Physiology.

Szent-Györgyi earned a medical degree from the University of Budapest in 1917. He became interested in biochemistry and pursued studies in Germany and The Netherlands in that field. While working at Cambridge University (1927, 1929) and at the Mayo Foundation, Rochester, Minn. (1928), Szent-Györgyi found and isolated an organic reducing agent, which he called hexuronic acid (now known as ascorbic acid), from plant juices and adrenal gland extracts. Four years later, as a professor



Szent-Györgyi
Boyer—H. Roger-Viollet

at the University of Szeged, Hungary (1931–45), he helped prove the acid identical to the anti-scurvy vitamin C, which had been discovered in 1907 by Axel Holst and Alfred Fröhlich.

Szent-Györgyi then turned to the study of organic compounds known to play a part in the conversion of carbohydrate breakdown products to carbon dioxide, water, and other substances necessary for the production of usable energy by the cell. His work laid the foundations for Sir Hans Krebs's elucidation of the complete conversion cycle (the Krebs cycle) two years later.

Devoting himself to a study of the biochemistry of muscular action, he discovered a protein in muscle that he named "actin," demonstrated that it—in combination with the muscle protein myosin—is responsible for muscular contraction, and showed that the compound adenosine triphosphate (ATP) is the immediate source of energy necessary for muscle contraction. Immigrating to the United States in 1947, he was immediately appointed director of the Institute for Muscle Research, Woods Hole, Mass., where he conducted research into the causes of cell division and, hence, cancer.

Szent-Györgyi wrote *The Crazy Ape* (1970), a critical and pessimistic commentary on science and the prospects for human survival on Earth. Among his scientific publications are *On Oxidation, Fermentation, Vitamins, Health, and Disease* (1940), *Chemical Physiology of Contractions in Body and Heart Muscle* (1953), and *Introduction to a Submolecular Biology* (1960).

**Szeryng, Henryk** (b. Sept. 22, 1918, Zelazowa Wola, near Warsaw [Poland]—d. March 3, 1988, Kassel, W.Ger.), Polish-born Mexican violinist noted for his performances of the major repertory.

Szeryng studied with Carl Flesch in Berlin and with Jacques Thibaud in Paris. He made his debut in 1933, and from 1933 to 1939 he was a composition student of Nadia Boulanger in Paris. During World War II he was on the staff of the Polish government-in-exile. Fluent in seven languages, he worked as a translator and traveled to Mexico to find homes for refugees. He gave more than 300 concerts for Allied troops in Europe, Asia, Africa, and North and South America. He became a professor at the University of Mexico in 1943 and a Mexican citizen in 1946.

Encouraged by Artur Rubinstein, he resumed his concert career in 1954 and soon gained recognition for his technical command and stylistic elegance. He made numerous recordings, including all of Wolfgang Amadeus Mozart's works for violin and orchestra and J.S. Bach's solo sonatas and partitas. He became a special music adviser to UNESCO in 1970 and served as a cultural ambassador for Mexico.

**Szilard, Leo** (b. Feb. 11, 1898, Budapest, Hung., Austria-Hungary—d. May 30, 1964, La Jolla, Calif., U.S.), Hungarian-born American physicist who helped conduct the first sustained nuclear chain reaction and was instrumental in initiating the Manhattan Project for the development of the atomic bomb.

In 1922 Szilard received his Ph.D. from the University of Berlin and joined the staff of the Institute of Theoretical Physics there. When the Nazis came into power in 1933, he went to Vienna and, in 1934, to London, where he joined the physics staff of the medical college of St. Bartholomew's Hospital. There, with the British physicist T.A. Chalmers, Szilard developed the first method of separating isotopes (different nuclear forms of the same element) of artificial radioactive elements. In 1937 Szilard went to the United States and taught at Columbia University.

In 1939 Szilard, Edward Teller, and Eugene Wigner persuaded Albert Einstein to write the famous letter to President Franklin D. Roosevelt advocating the immediate development of an atomic bomb. From 1942 until the end of the war he conducted nuclear research at the University of Chicago, where he helped Enrico Fermi construct the first nuclear reactor. In 1946 he became professor of biophysics at Chicago.

After the atomic bomb was first used, Szilard became an ardent promoter of the peaceful uses of atomic energy and the international control of nuclear weapons, founding the Council for a Livable World. In 1959 he received the Atoms for Peace Award. He published a collection of satirical sketches on the misuse of scientific knowledge entitled *The Voice of the Dolphins and Other Stories* (1961).

**Szold, Henrietta** (b. Dec. 21, 1860, Baltimore, Md., U.S.—d. Feb. 13, 1945, Jerusalem), founder of Hadassah, the Women's Zionist Organization of America.

The daughter of a rabbi, Szold began her career as a teacher. In 1891 she established a night school for Russian Jewish immigrants in Baltimore, one of the first of its kind in the United States. A founder of the Jewish Publication Society of America (1888), she served until 1916 as its general editor, writer, and translator of Jewish classics.

On Purim day, 1912, Szold and a group of women founded Hadassah (Hebrew for Esther, the heroine of Purim), and she was elected president. In 1916 she organized a large medical unit for Palestine, which she made her home soon after. The first woman elected to the World Zionist executive body, she held its portfolios of health and education.

Szold established Lemaan ha-Yeled (later renamed the Szold Foundation), which specialized in child welfare and research in juvenile problems. In 1933 she became director of Youth Aliyah, a worldwide movement to rescue young victims of Nazism and rehabilitate them in Israel. Hadassah later widened its scope to include education and civic programs in the United States.

**Szolnok** (county, Hungary): *see* Jász-Nagykun-Szolnok.

**Szolnok,** town and seat of Jász-Nagykun-Szolnok *megye* (county), east-central Hungary, at the confluence of the Zagyva and Tisza rivers. Under the Árpád kings (*c.* 890–1301) Szolnok was a market town and distributing centre for rock salt from the Maramureş Mountains (now in Romania). Later in the European Middle Ages it was a strategic settlement fiercely contested by Magyars and

Turks. In modern times it has developed as a transportation centre and river port, being the gateway to the trans-Tisza region. It is on the Budapest-Debrecen road, and several international rail lines converge on the great bridge over the Tisza, completed after World War II. A new railway station was built in Szolnok in 1977. In addition to having a large transit trade, Szolnok has several industries, manufacturing furniture, textiles, chemicals, and paper and cellulose products. Hotels and thermal baths are located on the riverbank over the source of subterranean waters, which are pumped from 3,140 feet (957 m) below ground and reach temperatures of 133° F (56° C). Of cultural interest are the Neoclassical Town Hall, the Szigligeti Theatre, a museum, and an artists' colony. Pop. (1994 est.) 80,859.

**Szombathely,** German STEINAMANGER, town and seat of Vas *megye* (county), northwestern Hungary. Szombathely is situated on the Gyöngyös River, near the frontier with Austria, south-southeast of Vienna and west of Budapest. The town is the successor to the Roman settlement of Savaria (Sabaria), the capital of Pannonia, founded in AD 43 by Claudius I at the intersection of two Roman roads still extant. There is in the town a mosaic Roman pavement from the 4th-century Basilica of St. Quirinus, and a Temple of Isis was uncovered in 1957. Following its 5th-century sack by the Huns, Szombathely declined for a long period. In the 18th century, Maria Theresa of Austria made the town the seat of a bishopric. The Episcopal Palace (Püspökvár) and the fine Baroque cathedral were built between 1781 and 1813. Extensive World War II damage to the cathedral was repaired in 1947. The town developed as an important agricultural centre (wines, fruit, honey) and railway junction. Industries include tanning, textiles, footwear, and the manufacture of agricultural machinery. Pop. (1994 est.) 85,932.

**Szymanowski, Karol,** in full KAROL MACIEJ SZYMANOWSKI (b. Oct. 6, 1882, Timoshovka, Ukraine, Russian Empire—d. March 29, 1937, Lausanne, Switz.), the foremost Polish composer of the early 20th century.

Szymanowski began to compose and play the piano at an early age. In 1901 he went to Warsaw and studied harmony, counterpoint, and composition privately until 1904. Finding the musical life in Warsaw limiting, he went to Berlin, where he organized the Young Polish Composers' Publishing Co. (1905–12) to publish new works by his countrymen. His compositions from this period, which include the opera *Hagith* (1913), show the influence of Strauss, Wagner, and Scriabin.

The advent of World War I caused Szymanowski to return to his homeland. Isolated from the European musical community during the period from 1914 to 1917, he composed copiously and studied Islāmic culture



Szymanowski
By courtesy of the Österreichische Nationalbibliothek, Vienna

and ancient Greek drama and philosophy. Szymanowski's works from this period, which include *Mity* (1914; "Myths"), *Metopy* (1915; "Metopes"), and *Maski* (1916; "Masques"), show great originality and diversity of style. He softened his dynamic extremes, employed coloristic orchestration, and used polytonal and atonal material while retaining the expressive melodic style of his earlier works.

With the establishment of an independent Polish state in 1918, Szymanowski became deeply interested in the Polish folk idiom and tried to create a Polish national style, a task unattempted since Chopin. He also became more conservative, abandoning his atonal vocabulary. Living in Zakopane, the regional centre of the Tatra mountain people, he adopted their tonal language, syncopated rhythms, and winding melodies in his new style. Notable works from this period include *20 Mazurkas* (1924–25) for piano and the ballet-pantomime *Harnasie* (1923–31). Szymanowski also traveled widely, promoting his works in London, Paris, and the United States and receiving international acclaim for his operas *Hagith* and *Król Roger* (1918–24; "King Roger"). In 1927 he settled in Warsaw to assume the directorship of the Warsaw Conservatory for five years with the aim of improving musical education in Poland. During the 1930s Szymanowski retreated from the direct use of folk music in his compositions, and though he continued to use folk music material, his forms and orchestration recall those of his earlier works. Among the major works from this last period are the *Symphony No. 4* (1932) and the choral works *Veni Creator* (1930) and *Litania Do Marii Panny* (1930–33; "Litany to the Virgin Mary").

**Szymborska, Wisława** (b. July 2, 1923, Bnin [now in Kórnik], near Poznań, Pol.), Polish poet who explored the philosophical, moral, and ethical issues of her life and times with intelligence, playfulness, and empathy. In 1996 she received the Nobel Prize for Literature.

Szymborska moved to Kraków in 1931 and studied literature and sociology at the Jagiellonian University between 1945 and 1948. Her first published poem, "Szukam słowa" ("I Seek the Word"), appeared in a Kraków newspaper in March 1945. Her first volume of poetry, *Dlatego zyjemy* (1952; "That's Why We Are Alive"), was an attempt to conform to Socialist Realism, the officially approved literary style of Poland's communist regime. In 1953 she joined the editorial staff of *Zycie Literackie* ("Literary Life"), a weekly magazine of intellectual interests, and remained there until 1981. During this period she gained a reputation not only as a poet but also as a book reviewer and translator of French poetry. In the 1980s she wrote for the underground press under the pseudonym Stancykówna and for a magazine in Paris.

Between 1952 and 1993 Szymborska published more than a dozen volumes of poetry. She later disowned the first two volumes, which contain poems in the style of Socialist Realism, as not indicative of her true poetic intentions. Her third volume, *Wołanie do Yeti* (1957; "Calling Out to Yeti"), marked a clear shift to a more personal style of poetry and expressed her dissatisfaction with communism (Stalinism in particular), which she



Szymborska
Wojda-Free/Sygma

compared to the Yeti, or Abominable Snowman. Subsequent volumes, such as *Sól* (1962; "Salt"), *Sto pociech* (1967; "No End of Fun"), and *Wszelki wypadek* (1972; "Could Have"), contain poems noteworthy for their precise and concrete language and their ironic detachment. A selection of her poems was translated into English and published in 1995 under the title *View with a Grain of Sand.*

**'t Hooft, Gerardus** (b. July 5, 1946, Den Helder, Neth.), Dutch physicist who, with Martinus J.G. Veltman, was awarded the 1999 Nobel Prize for Physics for their development of a mathematical model that enabled scientists to predict the properties of both the subatomic particles that constitute the universe and the fundamental forces through which they interact.

In 1972 't Hooft earned a doctorate in physics at the University of Utrecht and later became a professor there. 'T Hooft was a student of Veltman's at the University of Utrecht, and at that time the fundamental theory of particle physics, known as the standard model, did not provide for detailed calculations of physical quantities. In the 1960s scientists had formulated the electroweak theory, which showed theoretically that two of the model's fundamental forces, electromagnetism and the weak nuclear force, could be viewed as products of a single force, termed the electroweak force. The electroweak theory was without a mathematical foundation, however, and in 1969 't Hooft and Veltman undertook to change, or "renormalize," it into a workable theory. In 1971 't Hooft published two articles that represented a major advance toward the goal. The two men then used a computer designed by Veltman to formulate the needed mathematical basis. With the information, they were able to identify the properties of the *W* and *Z* particles predicted by the theory. The 't Hooft-Veltman model allowed scientists to calculate the physical properties of other particles, including the mass of the top quark, which was directly observed in 1995.

**T Tauri star,** any of a class of very young stars having a mass approximately equal to that of the Sun. So called after a prototype identified in a bright region of gas and dust known as the Hind's variable nebula, the T Tauri stars are characterized by erratic changes in brightness. They represent an early stage in stellar evolution, having only recently been formed by the rapid gravitational condensation of interstellar gas and dust. These young stars are relatively unstable, though contracting more slowly than before, and will remain in that condition until their interior temperatures become high enough to support thermonuclear reactions for energy generation. More than 500 T Tauri stars have so far been observed. The Sun is thought to have gone through the T Tauri stage in its early youth.

**Ta-ch'ing,** Pinyin DAQING, city, Heilungkiang province, China. It is situated in the north of the Sungari-Liao River basin, between Tsitsihar and Harbin, in the general vicinity of An-ta, northwest of Harbin, and it developed around the oil field of the same name, which is one of the country's most important sources of oil. The field was discovered in the late 1950s and drilling began in 1958. The Ta-ch'ing oil field produces more than one-third of China's total annual crude oil output. The growth of the oil industry in the locality was paralleled by the development of farms by the oil workers' families. Pop. (1999 est.) 811,154.

**ta-chuan,** Pinyin DAZHUAN (Chinese: "large seal"), in Chinese calligraphy, script evolved from the ancient scripts *chia-ku-wen* and *ku-wen* by the 12th century BC and developed during the Chou dynasty (1122–221 BC). It is the earliest form of script to be cultivated later into an important related art form, *chuan-shu* ("seal script"), so called because long after it had been superseded as a current writing style, it continued to be used for the carving of seals. Originally, *ta-chuan* must have been written with a brush and ink or lacquer on wood, bamboo tablets, or silk. The style is not unlike *ku-wen* and is characterized by an austere balance of straight and curvilinear lines of uniform thickness ending in blunt stops.



*Ta-chuan* from a bronze *kuei*, 779 BC, Chou dynasty; in the National Palace Museum, Taipei

By courtesy of the National Palace Museum, Taipei, Taiwan, Republic of China

**Ta hsüeh** (Chinese: "Great Learning"), Pinyin DAXUE, brief Chinese text generally attributed to the ancient sage Confucius (551–479 BC) and his disciple Tseng-tzu. For centuries the text existed only as a chapter of the *Li chi* ("Collection of Rituals"), one of the Five Classics (*Wu Ching*) of Confucianism. When Chu Hsi, a 12th-century philosopher, published the text separately as one of the "Four Books" (*Ssu shu*), it gained lasting renown.

*Ta hsüeh* states that world peace is impossible unless a ruler first regulates his own country. But no ruler can do this without first setting his own household in order. This action presupposes that he has oriented his personal life by rectifying his heart and acquiring sincerity. These virtues are the natural consequence of expanded wisdom that results from investigating all things. *Ta hsüeh* thus views good government and world peace as bound up with a ruler's personal virtue that flourishes when study develops into wisdom.

In a preface to *Ta hsüeh,* Chu Hsi explained that the treatise is a means to personal development. Each individual, he says, must cultivate benevolence (*jen*), righteousness (*i*), propriety (*li*), and wisdom (*chih*), but virtue will not be acquired in equal measure by all. Heaven, therefore, will see to it that the most virtuous man will rule. *See also* Ssu shu.

**Ta-hsüeh Mountains,** Wade-Giles romanization TA-HSÜEH SHAN, Pinyin DAXUE SHAN, English GREAT SNOW MOUNTAINS, also called SZECHWANESE ALPS, or SINO-TIBETAN CHAIN, great mountain range in the west of Szechwan province, China. These enormously high and rugged mountain chains were formed around the eastern flank of the ancient stable block of the Plateau of Tibet; their formation occurred during successive foldings that took place in the final phase of the mountain-building process of the Jurassic Period, as well as during the Cretaceous Period, and during the Himalayan orogenies that have subsequently occurred. Throughout the complex system, metamorphic rocks, schists, quartzites, and metamorphic limestones are the predominant rock formations, with massive intrusions of granite. The range forms a part of the vast belt of folding that continues southward into Southeast Asia. The area was further uplifted in Quaternary times (*i.e.,* the past 1.6 million years).

The Ta-hsüeh Mountains are not a single range, but a series of north-south ridges drained by a series of tributaries of the Yangtze River that flow north to south. The most important of the rivers are the Ya-lung to the west of the mountains and the Ta-tu to the east. The mountains are almost Himalayan in scale, with many peaks rising to more than 20,000 feet (6,100 m). The highest peak of all, Mount Kung-k'a (Minya Konka), rises to 24,790 feet (7,556 m). Much of the highest land is covered with snow, and Mount Kung-k'a has a complex of glaciers. The snow line is between 15,000 and 18,000 feet (4,600 and 5,500 m). The mountains are still thickly forested on the eastern flank, with mixed forests of birch, hemlock, poplar, and aspen below about 8,200 feet (2,500 m). From there to about 13,000 feet (4,000 m) are fir and spruce forests. In the drier northern area, grasslands or mixed forests of pine and oak are common. Above 13,000 feet, the tree cover gives way to alpine pasture and grassland. The vegetation and the climatic regime, however, vary greatly over comparatively small areas because of the influences of elevation and terrain. The area has only scattered patches of cultivated land, mostly occurring in the alluvial fans of the wider river valleys. Wheat and corn (maize) can be grown up to about 9,200 feet (2,800 m); above that elevation, hardy oats, barley, potatoes, and beans are the chief crops.

The area to the west of the mountains is inhabited mostly by Tibetans and Han Chinese. There is sometimes confusion about the names given to the various ranges. Usually the range on the Szechwan border between the Ta-tu and Ya-lung rivers is called the Ta-hsüeh Mountains, while the range beyond, between the Ya-lung and Chin-sha rivers, is known as the Sha-lu-li Mountains. The southern part of this range, however, which reaches elevations well over 20,000 feet (6,100 m) and is permanently snow-covered, is also known as the Mula Mountains.

**Ta-i** (Chinese emperor): *see* T'ang.

**Ta-li,** formerly HSIA-KUAN, Pinyin DALI, or XIAGUAN, city in western Yunnan *sheng* (province), China. It is situated at the southern end of the Erh Lake in a fertile basin about 10 miles (16 km) southeast of the original Ta-li. It has traditionally been an important centre on the routes westward from K'un-ming to the Tibet Autonomous Region and northern Myanmar (Burma); it also has routes leading south into the wild southwest region of Yunnan. It was established as a city in 1983, when Ta-li county was merged with the city of Hsia-kuan. The old cities of Ta-li and Hsia-kuan now comprise districts of the city.

Hsia-kuan was first known to the Chinese in the mid-8th century as Lung-wei-ch'eng; at that time it was a city built by Pi-lo-ko, king of the Nan-chao kingdom located in the area. After occupation of the area by the Mongols in the late 13th century, it became a customs station and tax office, known variously as Lung-wei-kuan, Ho-wei-kuan, or Hsia-kuan. It grew into an important market town for local produce and was a centre of trade between Chinese merchants and the various minority peoples living in the surrounding mountain districts. Its trade in the 19th century was largely founded on tea produced in the vicinity. It was also a tea market second only to P'u-erh in Yunnan, and tea processing became an important industry in the early years of the 20th century. Its prosperity increased still further with the construction of the Burma Road during the Sino-Japanese War (1937–45), and its commercial role subsequently increased until it became the chief collection and distribution centre in western Yunnan.

The modern city is a collector centre for cotton, tea, grain, sugar, pears, walnuts, and ham, as well as for fish from Erh Lake; these products were mainly for shipment to K'un-ming. Tourism is now the city's economic mainstay. Pop. (1999 est.) 175,847.

**Ta-lien,** formerly (1950–81) LÜ-TA, Pinyin DALIAN, or LÜ-DA, Russian DALNY, conventional and Japanese DAIREN, city and port on

the Liaotung Peninsula, Liaoning *sheng* (province), China. The former name derives from a combination of Lü-shun and Ta-lien.

When the Russians took the lease of the Liaotung Peninsula in 1898, they not only built up the existing Chinese naval base at Port Arthur as the ice-free headquarters of their Pacific fleet but also selected a minor fishing village called Ch'ing-ni-wa to be developed as a major commercial port, which they called Dalny, connected by rail with the Chinese Eastern Railway at Harbin. They laid out a spacious Western-style city and dredged the harbour and constructed wharves, piers, and breakwaters. Only the first stage was completed at the outbreak of the Russo-Japanese War in 1904. After the war the Treaty of Portsmouth (1905) transferred control of the Liaotung Peninsula to Japan. The Japanese (under whom the port was renamed Dairen) completed the Russian plan, developing a fine modern city and an efficient modern port. By 1931 Dairen was a major Chinese port, exceeded in its volume of trade only by Shanghai.

Under the Japanese, Dairen also became a major industrial centre. The city's industries included railway-, machine-, and shipbuilding, and the production of cotton textiles. After World War II the city was annexed to neighbouring Lü-shun to form the city of Lü-ta. Industry again began to grow rapidly. In 1981 the city was renamed Ta-lien, and in 1984 Talien was designated one of China's "open" cities in the new open-door policy inviting foreign investment. The city is now an industrial centre with a variety of products, including machinery, petroleum, textiles, chemicals, foods, metals, and electronics. Its annual clothing fair attracts both domestic and foreign buyers. Pop. (1999 est.) 2,000,944.

**Ta-pa Mountains,** Wade-Giles romanization TA-PA SHAN, Pinyin DABA SHAN, broadly defined, mountain range of central China lying along the border between Shensi province to the north and Szechwan province and Ch'ung-ch'ing municipality to the south that also extends northwest and southeast into Kansu and Hupeh provinces. Narrowly defined, Ta-pa Mountains designates only one section of the entire range.

In the most inclusive sense, the Ta-pa Mountains (like the Tsinling Mountains to the north, from which they are separated by the Han River valley) are an eastward continuation of the Kunlun Mountains. The Ta-pa range is composed of several constituent mountain ranges—including, from west to east, the Mo-t'ien (along the Kansu-Szechwan border), the Mi-ts'ang and Ta-pa (which together straddle the Shensi-Szechwan and Shensi–Ch'ung-ch'ing borders), and the Wutang (in Hupeh)—that form the northern rim of the Szechwan Basin. The Ta-pa Mountains are drained by a complex river system that serves as the watershed for the Yangtze River both directly and indirectly through numerous intermediate rivers, including the Han and Chia-ling. The Chia-ling River, which rises in the Tsinling Mountains and cuts through the western section of the Ta-pa Mountains, between the Mo-t'ien and Mi-ts'ang mountains, provides the main route from Shensi to Szechwan and southwestern China. The Ta-pa are not as high or massive as the Tsinling Mountains: Their average elevation is more than 6,500 feet (2,000 m) above sea level, and individual peaks reach 7,200–8,800 feet (2,200–2,700 m). Ta Shen-nung-chia, located north of the Wu-hsia Gorge, the second of the Three Gorges of the Yangtze, is the highest peak in the eastern section, reaching 10,050 feet (3,053 m). To its north is a national park, containing a virgin forest, that was established in the 1980s for the protection of wildlife.

Although the name Ta-pa Mountains is often used to refer to the entire mountain complex, it properly applies only to the smaller component Ta-pa range of the complex or to the Ta-pa Mountains and the Mi-ts'ang Mountains together, both units also known as the Pa Mountains. The Mi-ts'ang range, named for one of its major peaks, Mount Mi-ts'ang (8,110 feet [2,472 m]), is separated from the Ta-pa Mountains by the Jen River. The Ta-pa range proper is also sometimes called the Chiu-lung ("Nine Dragons") Mountains, for a major peak of that name (8,540 [2,603 m]). To the north of the Mi-ts'ang and Ta-pa ranges and to the east of Yang-hsien (in Shensi) are a series of high ridges with a north-south axis known as the Hsing-tzu Mountains.

The Ta-pa mountain complex is sparsely populated, and much of the area remains under virgin forest despite the presence of humans since the 18th century. The western extremity of the range is comparatively dry and has a lighter forest cover. Much of the range consists of dolomitic limestones.

*Articles are alphabetized word by word, not letter by letter*

**Ta-pieh Mountains,** Wade-Giles romanization TA-PIEH SHAN, Pinyin DABIE SHAN, mountain range in central China. Aligned roughly along a northwest-southeast axis, the Ta-pieh Mountains form the watershed between the upper Huai and the Yangtze rivers and also mark the boundary between Hupeh province to the south and Honan and Anhwei provinces to the north and east. The name Ta-pieh Mountains properly belongs to only the higher southeastern section of the range along the Anhwei-Hupeh border, but the term is often used to include the northwestward extension, to the west of Kuang-shui (in Hupeh), which is properly called the T'ung-pai Mountains. The ranges together are also known in the West as the Huai-yang Mountains.

The average elevation of the western half of the range is only 1,000–1,300 feet (300–400 m), with a few peaks at the extreme western end of the range reaching 3,000 feet (900 m). The southeastern end of the range, the Ta-pieh Mountains proper, forms a much more complex and formidable barrier, averaging more than 3,300 feet (1,000 m) in height. Its highest peak, Mount Huo, reaches 5,820 feet (1,774 m), and several others exceed 5,000 feet (1,500 m). Three of the ridges there extend into the Huai plain and merge into the Hua-yang Ridge, which forms the watershed of low hills between the upper Huai River and the Yangtze.

The area has a complex structure. The Ta-pieh Mountains, running northwest to southeast, represent the eastward end of the great Tsinling Mountains. The southeastern ridges are connected with the major structures of the area south of the Yangtze. As a result of the tectonic stresses between these mountain blocks, the area is subject to frequent earthquakes.

The Ta-pieh complex is still largely forested and produces great quantities of timber and bamboo. Its large stands of oak and cork oak make it China's chief cork-producing area. Agriculture is mostly limited to valleys and small mountain basins.

The main route across the Ta-pieh Mountains proper is from Ma-ch'eng (in Hupeh) to Huang-ch'uan (in Honan) in the Huai River valley. Farther west the main railroad and highway south from Wu-han (Han-k'ou) cross by relatively easy passes.

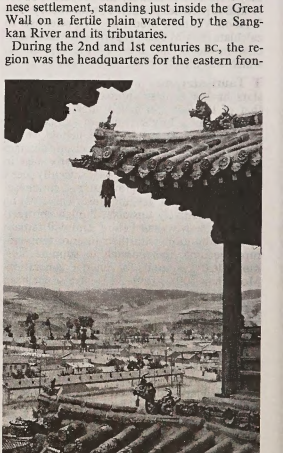
**Ta-ts'ang Ching** (Chinese: "Great Storehouse Scripture"), Japanese DAIZŌ-KYŌ, the total body of Buddhist literature deemed canonical in China and Japan and comprising works of the most varied character numbering more than 2,000 in the standard Chinese edition and more than 3,000 in the latest Japanese edition. Unlike canons of the southern Buddhist schools, this vast "storehouse" continued to expand for many centuries. It began with translations of Sanskrit texts in the 1st century, and these translations, which make up the bulk of the collection, continued to be made until the 8th or 9th century. Many of the Sanskrit works have perished and are known only from their Chinese (or Tibetan) translations.

The *Ta-ts'ang Ching* includes the Hināyāna, or Theravāda, canonical works, particularly their Sarvāstivāda (Doctrine That All Is Real) versions. All the great and minor Mahāyāna *sūtras* are there, often in multiple translations, together with numerous commentaries and dissertations, both Indian and Chinese. Also included are many late Tantric treatises, many ecclesiastical histories and hagiographic works by Chinese authors, and a considerable quantity of religious poetry composed during the Yüan and Ming dynasties (13th–17th century).

**Ta-tu,** Pinyin DADU, also spelled TAIDU, Mongol KHANBALIQ, the city of Beijing (Peking [*q.v.*]) under the Mongols.

**Ta-t'ung,** Pinyin DATONG, city, northern Shansi *sheng* (province), China. The city is situated at the northern limits of traditional Chinese settlement, standing just inside the Great Wall on a fertile plain watered by the Sangkan River and its tributaries.

During the 2nd and 1st centuries BC, the region was the headquarters for the eastern fron-



Temple at Yün-kang near Ta-t'ung, Shansi province, China
Jorgen Bisch—Black Star

tier command of the Han armies protecting the region against the militant, nomadic Hsiung-nu. After the 1st century AD the area was lost by the Chinese and was recovered by them only in the latter half of the 3rd century. In AD 398 the Toba founders of the Northern Wei dynasty established and maintained their capital there even when they controlled all of North China. The seat of their dynasty was finally transferred south to Lo-yang in Honan province at the end of the 5th century. The city of Ta-t'ung was walled in 421, the outer wall measuring some 10 miles (16 km) in circumference. Vast numbers of Chinese were forcibly removed from elsewhere in the North to settle the area. In spite of the logistic problems arising from having a capital far from the

rich revenue-producing parts of the North Chinese empire, the city was of considerable size and splendour. In addition to its palaces and official buildings, constructed by the Wei royal family, who were pious Buddhists, the extensive Buddhist cave temples of Yün-kang were also built during that period on the western outskirts of the city.

After the transfer of the capital, the city was sacked and abandoned. In the ensuing period it underwent many name changes. In the early part of the T'ang dynasty (618–907) it became the seat of Yün-chou prefecture. At that time it had only a scattering of Chinese settlers, and in the 8th century—when Ta-t'ung first appeared as the name of the principal army quartered in the area—it was the centre of an extensive program of military colonization. In 947 the area was overrun by the Khitan people and once again became an important administrative centre. Under the Khitan (whose Liao dynasty ruled until 1125) and their successors, the Chin, the city was the western capital. During the Yüan dynasty (1279–1368) it was known as Ta-t'ung. With the establishment of the Ming dynasty (1368–1644) and the resurgence of a centralized China, Ta-t'ung once again became a major Chinese strategic centre, constituting a stronghold in the line of defense against the Mongols. It was again walled in the late 14th century. From Ming times onward it was incorporated into Shansi province.

Ta-t'ung's growth as a modern city began in 1917 with the completion of the railway linking it to Peking (Beijing) and Tientsin. The line was extended westward to Hohhot and Pao-t'ou (both in Inner Mongolia) in 1920–21, after which the city was also linked with central and southern Shansi by a line to T'ai-yüan. In the 1950s its importance increased with the completion of the western rail link with Lan-chou in Kansu province and Urumchi in the Uighur Autonomous Region of Sinkiang, and of the northern line to Ulaanbaatar, Mongolia, and to Siberia. Ta-t'ung was also the centre of a local road network into Inner Mongolia; it became a collecting and commercial centre for the surrounding Chinese agrarian population and for the Mongolians in Inner Mongolia.

Ta-t'ung's main industry is coal mining. Machinery, cement, chemicals, and pharmaceuticals are also produced. Ta-t'ung preserves many ancient buildings and monuments, some dating to the Liao and Chin periods. In addition to the caves at Yün-kang, the Shan-hua and Hua-yen temples are well-known. To the north of the city is the large tomb of the mother of the founder of the Northern Wei capital. Pop. (1999 est.) 928,293.

**Ta-yeh,** Pinyin DAYE, town in eastern Hupeh *sheng* (province), China. Ta-yeh is situated on the south bank of the Yangtze River near Huang-shih and about 50 miles (80 km) southeast of Han-k'ou (Wu-han). It is situated on a stretch of plain surrounded by undulating hills on the north, west, and south. The site is low-lying and has many swamps and lakes, but to the northwest of Ta-yeh there is a belt of hills containing iron, copper, and coal deposits. It had long been understood that these deposits were known from at least the 8th century, during the T'ang dynasty; but the region was discovered to be the birthplace of the Bronze Age in China in 1973, when ruins of an ancient copper smelter and minefield were found on the T'ung-lü-shan to the south of the city. Artifacts indicate that continuous mining and smelting had occurred there during the 1,000-year span from the Western Chou (1122–771 BC) to the Western Han dynasty (206 BC–AD 25).

Ta-yeh was until 1915 the only major producer of iron ore in China, but by the 1930s it was increasingly rivaled by Japanese-controlled mines and steelworks in Manchuria (Northeast). After 1949, under the communist government, Ta-yeh became the site of a steel plant. It also has a large chemical fertilizer plant and textile mills using the cotton that grows abundantly in the surrounding plain. Pop. (1999 est.) 128,561.

**Ta Yü,** Pinyin DA YU (Chinese: "Yü the Great"), in Chinese mythology, the Tamer of the Flood, one of China's saviour-heroes and reputed founder of China's oldest dynasty, the Hsia. One legend among many recounts Ta Yü's extraordinary birth: a man called Kun was given charge of controlling a great deluge. To dam the water, he stole from heaven what seems to have been a piece of magic soil. Angered by the theft, the Lord on High issued an order for his execution. After three years, Kun's miraculously preserved body was slit open and a son brought forth. This was Ta Yü



Ta Yü, painting on silk; in the National Palace Museum, Taipei

By courtesy of the National Palace Museum, Taipei, Taiwan, Republic of China

who, after years of strenuous labour, provided outlets to the sea through dredging, with the aid of dragons, thus making the world suitable for human habitation.

**Taabwa** (people): *see* Tabwa.

**Taaffe, Eduard, Count** (Graf) **von** (b. Feb. 24, 1833, Vienna, Austria—d. Nov. 29, 1895, Ellischau, Bohemia, Austria-Hungary [now Nalžovy, Czech Republic]), statesman and twice prime minister of Austria (1868–70 and 1879–93) who controlled most of the empire's quarreling nationalities and forged a conservative coalition that remained in power longer than any other ministry during the reign of the emperor Francis Joseph.

Taaffe, who was of Irish descent and was Francis Joseph's boyhood friend, entered the Austrian civil service in 1852 and rose rapidly. After serving as governor of Upper Austria, minister of the interior, and minister of defense and public security, he became prime minister in 1868 but resigned in 1870 because his advocacy of concessions to the Czechs caused a government crisis. Again minister of the interior (1870–71 and 1879) and governor of Tirol from 1871, he returned as prime minister in August 1879, governing for the next 14 years with the support of conservative clericals and Polish and Czech landowners, a coalition that became known as Taaffe's Iron Ring. His greatest success was the restoration of a modicum of order by granting concessions to the nationalist aspirations of Poles and Czechs



Taaffe, lithograph by August Schubert

By courtesy of the Bild-Archiv, Österreichische Nationalbibliothek, Vienna

and bringing them into the Habsburg civil service. The demands of the Czech nationalists became increasingly radical, however, and Taaffe finally lost control of his coalition, resigning over the Reichsrat's (parliament's lower house) rejection of his enlarged suffrage bill in November 1893.

**Taal Lake,** lake in southwestern Luzon, Philippines, occupying a volcanic crater with a maximum width of 15 miles (24 km), at less than 10 feet (3 m) above sea level. It has an area of 94 square miles (244 square km) and is the country's third largest lake. Within the lake rises Volcano Island (984 feet [300 m]), which itself contains another small crater (Yellow Lake). Volcano Island, called Taal Volcano, has erupted 25 times since 1572, most recently in 1970.

The outer flanks of the old caldera rise gently to cliffs that reach a high point in the southeast at Mount Macalod (3,107 feet [947 m]). Taal Lake lies within a national park and is a major tourist attraction; it is most commonly



Taal Lake with Volcano Island and Yellow Lake, Luzon, Philippines

By courtesy of Philippine Airlines

viewed from Tagaytay Ridge in the north. The Pansipit River drains the lake into Balayan Bay of the South China Sea through a breach in the cliffs to the southwest.

**Taban lo Liyong:** *see* Liyong, Taban lo.

**Ṭabaqah Dam,** Ṭabaqah also spelled TABQA (Syria): *see* Euphrates Dam.

**Ṭabarī, aṭ-,** in full ABŪ JA'FAR MUḤAMMAD IBN JARĪR AṬ-ṬABARĪ (b. *c.* 839, Āmol, Ṭabaristān [Iran]—d. 923, Baghdad, Iraq), Muslim scholar, author of enormous compendiums of early Islāmic history and Qur'ānic exegesis, who made a distinct contribution to the consolidation of Sunnī thought during the 9th century. He condensed the vast wealth of exegetical and historical erudition of

the preceding generations of Muslim scholars and laid the foundations for both Qur'ānic and historical sciences. His major works were the *Qur'ān Commentary* and the *History of Prophets and Kings* (*Ta'rīkh ar-Rusūl wa al-Mulūk*).

*Life.* The young aṭ-Ṭabarī demonstrated a precocious intellect and journeyed from his native town to study in the major centres of learning in Iraq, Syria, and Egypt. Over the course of many years he collected oral and written material from numerous scholars and libraries for his later work. Aṭ-Ṭabarī enjoyed sufficient financial independence to enable him to devote the latter part of his life to teaching and writing in Baghdad, the capital of the 'Abbāsid caliphate, where he died in 923. The times in which he lived were marked by political disorder, social crisis, and philosophical-theological controversy. Discontent, of diverse cause and circumstance, brought open rebellion to the very heart of the Caliph's empire, and, like all movements of socioeconomic origin in medieval Islām, sought legitimacy in religious expression directed against the official credo of Sunnī orthodoxy.

Aṭ-Ṭabarī rejected out of hand the extreme theological positions of these opposition movements, but at the same time he also retreated from the embrace of the ultraorthodox Sunnī faction, the Ḥanbalī (a major school of Islāmic law), which was represented most powerfully in the capital itself. An independent within orthodox ranks, he established his own school of jurisprudence, which did not long survive his own death. He nevertheless made a distinct contribution to the consolidation of Sunnī thought during the 9th century. What aṭ-Ṭabarī accomplished for historical and Qur'ānic studies consisted less in the discovery and initial recording of material than in the sifting and reorganization of it. His achievement was to condense the vast wealth of exegetical and historical erudition of the preceding generations of Muslim scholars (many of whose works are not extant in their original form) and to lay the foundations for both Qur'ānic and historical sciences.

*Major works.* His life's labour began with the *Qur'ān Commentary* and was followed by the *History of Prophets and Kings*. Aṭ-Ṭabarī's *History* became so popular that the Sāmānid prince Mansūr ibn Nūḥ had it translated into Persian (*c.* 963).

In the *Commentary*, aṭ-Ṭabarī's method of composition was to follow the Qur'ān text word by word, juxtaposing all of the juridical, lexicographical, and historical explanations transmitted in reports from the Prophet Muḥammad, his companions, and their followers. To each report (Ḥadīth) was affixed a chain of "transmitters" (*isnād*) purporting to go back to the original informant. Divergent reports were seldom reconciled, the scholar's only critical tool being his judgment as to the soundness of the *isnād* and not of the content of the Ḥadīth. Thus plurality of interpretation was admitted on principle.

The *History* commenced with the Creation, followed by accounts regarding the patriarchs, prophets, and rulers of antiquity. The history of the Sāsānian kings came next. For the period of the Prophet's life, aṭ-Ṭabarī drew upon the extensive researches of 8th-century Medinan scholars. Although pre-Islāmic influences are evident in their works, the Medinan perspective of Muslim history evolved as a theocentric (god-centred) universal history of prophecy culminating in the career of Muḥammad and not as a continuum of tribal wars and values.

The sources for aṭ-Ṭabarī's *History* covering the years from the Prophet's death to the fall of the Umayyad dynasty (AD 661–750) were short monographs, each treating a major event or the circumstances attending the death of an important person. Aṭ-Ṭabarī supplemented this material with historical reports embodied in works on genealogy, poetry, and tribal affairs. Further, details of the early 'Abbāsid period were available to him in a few histories of the caliphs that unfortunately have come down only in the fragments preserved by aṭ-Ṭabarī. Almost all of these accounts reflected an Iraqi perspective of the community; coupled with this is aṭ-Ṭabarī's scant attention to affairs in Egypt, North Africa, and Muslim Spain, so that his *History* does not have the secular "universal" outlook sometimes attributed to it. From the beginning of the Muslim era (dated from 622, the date of the *hijrah*—the Prophet Muḥammad's migration from Mecca to Medina), the *History* is arranged as a set of annals according to the years after the *hijrah*. It terminates in the year 915.

*Views of history.* Obviously, aṭ-Ṭabarī could not sustain his preference for reports originating with the Prophet and the pious scholars of the early community known as *as-salaf*. His judgment of a report's reliability was now based upon the largely theoretical criterion that it should originate with either an eyewitness or a contemporary informant. This posed a problem for which aṭ-Ṭabarī had no practical solution. Oftentimes he placed separate accounts of an event side by side without editorial comment. He saw no relevance in searching for the nature and causes of events, for any ultimate explanation lay beyond history itself and was known to God alone. Prophetic tradition, like the Qur'ān, provided positive commands and injunctions from God. History pointed to the consequences of heeding or ignoring him. For aṭ-Ṭabarī, therefore, history was the divine will teaching by example. (D.Wa.)

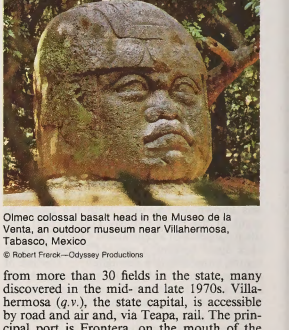
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**Ṭabarīyā, Buḥayrat** (Israel): *see* Galilee, Sea of.

**Tabasco,** state, southeastern Mexico, bounded on the northwest by the Bay of Campeche of the Gulf of Mexico, east by Campeche, southeast by Guatemala, south by Chiapas, and west by Veracruz. Tabasco's 9,756-sq-mi (25,267-sq-km) territory is generally low and flat, largely covered with lagoons and swamps but with a higher area in the south and southeast. It is drained by the Grijalva (also known as the Tabasco) and Usumacinta rivers, which, with their tributaries, act as the principal avenues of transportation.

Pre-Columbian Indian cultures included those of the Quiché Maya, Olmec, Tabasca, and Nahuatl. In 1518 Juan de Grijalva visited the area. In 19 Hernán Cortés first clashed with the Indians, and Francisco de Montejo partially subdued them in the 1530s and 1540s. Tabasco, an Indian name meaning "damp earth," became a state in 1824. Agriculture (the raising of cacao, copra, corn [maize], sugarcane, and bananas), forestry (especially mahogany and red cedar), beekeeping, fishing in the Gulf of Mexico, and cattle raising provided much of the state's income until the 1960s, when the potential petroleum wealth began to be exploited.

The state's major petrochemical facilities are at Ciudad Pemex and La Venta, utilizing oil



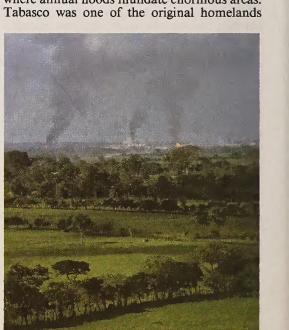
Olmec colossal basalt head in the Museo de la Venta, an outdoor museum near Villahermosa, Tabasco, Mexico

© Robert Frerck—Odyssey Productions

from more than 30 fields in the state, many discovered in the mid- and late 1970s. Villahermosa (*q.v.*), the state capital, is accessible by road and air and, via Teapa, rail. The principal port is Frontera, on the mouth of the Grijalva. Pop. (1984) 1,208,000.

**tabasco,** hot red pepper, a variety of *Capsicum frutescens* of the Solanaceae, or nightshade, family. *See* pepper.

**Tabasco Plain,** tropical lowland on the Gulf of Mexico, Tabasco state, southeastern Mexico. Occupying the coastal lowlands south of the Isthmus of Tehuantepec and north of the Yucatán Peninsula, the Tabasco Plain is a hot and humid land made up of alluvial materials deposited by the Grijalva and Usumacinta rivers and is covered with dense, tropical forest. Rainfall is heavy, and lagoons and swamps are common on the low-lying delta lands, where annual floods inundate enormous areas. Tabasco was one of the original homelands



Oil refinery on the Tabasco Plain, near Villahermosa, Mexico

© Robert Frerck—Odyssey Productions

of the Olmec, a preclassic people whose impact on succeeding Mexican and Mayan cultures was great. The first Europeans to enter the region were Juan de Grijalva (1518) and Hernán Cortés (1519), but control was not wrested from the Indians by the Spanish for another 20 years and only after bitter fight-

ing. The Tabasco Plain was the scene of more fighting during Mexico's war with France in the 1860s.

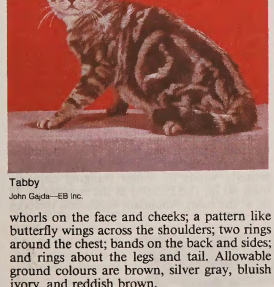
The fertile soil of the plain yields crops of bananas, coconuts, cacao, coffee, and sugarcane; various hardwoods are processed. The discovery of abundant reserves of oil in the late 1970s brought a significant influx of people to the once sparsely populated region.

**Tabataba'i, Sayyid Zia od-Din** (b. *c.* 1888—d. Aug. 29, 1969, Tehrān), Iranian statesman who led the coup d'état of 1921 in which he was made prime minister.

Tabataba'i became prominent during World War I as the editor of a pro-British newspaper, *Ra'd* ("Thunder"). In 1919 he led a quasi-diplomatic mission to negotiate a commercial agreement with the anti-Communist Russian revolutionaries at Baku. On his return to Iran he joined a secret nationalist society, Anjuman-i Fulad ("The Steel Committee"), created a coalition of anticommunist politicians, and masterminded the coup d'état of Feb. 21/22, 1921, that made him prime minister of Iran. Soon after assuming that office, he quarreled with the coup's military leader, Colonel Reza Khan (who in 1925 became shāh of Iran), and in May was forced into exile.

Tabataba'i spent the next 20 years in Palestine; after the abdication of Reza Shah in September 1941, he returned to Iran. In 1942 he was elected to the Iranian Parliament, and in 1943 he founded the pro-British, anticommunist political party Iradah-yi milli ("The National Will"), which was active until 1951, at which time Tabataba'i faded from the political scene.

**tabby,** type of dark-striped coat colouring found in both wild and domestic cats. One of the most common coat colours, the tabby pattern dates back to domestic cats in ancient Egypt. It is a recognized colour variety in purebred cats and is frequently seen in cats of mixed ancestry. Tabby colouring is highly variable but, for show cats, should consist of the following dark markings: stripes and



Tabby
John Gajda—EB Inc.

whorls on the face and cheeks; a pattern like butterfly wings across the shoulders; two rings around the chest; bands on the back and sides; and rings about the legs and tail. Allowable ground colours are brown, silver gray, bluish ivory, and reddish brown.

**tabby weave** (textiles): *see* plain weave.

**Tabernacle,** Hebrew MISHKAN ("dwelling"), in Jewish history, the portable sanctuary constructed by Moses as a place of worship for the Hebrew tribes during the period of wandering that preceded their arrival in the Promised Land. The Tabernacle no longer served a purpose after the erection of Solomon's Temple in Jerusalem in 950 BC.

Israel's earliest sanctuary was a simple tent within which, it was believed, God manifested his presence and communicated his will. The elaborate description of the Tabernacle in Exodus is believed by some to be anachronistic, for many scholars consider the narrative as having been written during or after the Babylonian Exile (586–538 BC—*i.e.*, after the destruction of the Jerusalem Temple).

The entire Tabernacle complex—whose specifications were dictated by God, according to the biblical account—consisted of a large court surrounding a comparatively small building that was the Tabernacle proper. The court, enclosed by linen hangings, had the shape of two adjacent squares. In the centre of the eastern square stood the altar of sacrifice for burnt offerings; nearby stood a basin holding water used by the priests for ritual ablutions. The corresponding position in the western square was occupied by the ark of the Law situated in the inner sanctuary of the Tabernacle.

The Tabernacle was constructed of tapestry curtains decorated with cherubim. The interior was divided into two rooms, "the holy place" and "the most holy place" (Holy of Holies). The outer room, or "holy place," contained the table on which the bread of the Presence (shewbread) was placed, the altar of incense, and the seven-branched candelabrum (menorah). The inner room, or Holy of Holies, was thought to be the actual dwelling place of the God of Israel, who sat invisibly enthroned above a solid slab of gold that rested on the Ark of the Covenant and had a cherub at each end. This Ark was a gold-covered wooden box containing the tablets of the Ten Commandments.

**Tabernacles, Feast of** (Judaism): *see* Sukkoth.

**tabes dorsalis,** also called PROGRESSIVE LOCOMOTOR ATAXIA, rare neurologic form of tertiary syphilis, involving sensory deficits, loss of neuromuscular coordination, and diminished reflexes. Symptoms of this form of neurosyphilis chiefly affect the legs and may not appear for more than 25 years after the initial infection. Untreated, tabes dorsalis usually makes unassisted walking impossible and severely debilitates the victim.

Symptoms result from degeneration of the dorsal roots of the spinal cord, giving it its name, which means "dorsal wasting." The first manifestation is usually "lightning pain," transient, stabbing pains affecting the legs; this is followed by loss of tendon reflexes and by progressive loss of muscular coordination (ataxia) causing a spasmodic, uneven walk. Victims become unable to sense pain, limb position, and temperature; these sensory deficits cause loss of bladder and sometimes bowel control, severe foot ulcerations, and Charcot joints (an osteoarthritis that typically involves the knees and hip). Neurologic deterioration also causes the pupils of the eye to lose their ability to react to changes in light.

Tabes dorsalis is seldom fatal. Elimination of the causative organism, *Treponema pallidum,* with penicillin may relieve pain but does not reverse nervous degeneration. Therapy otherwise involves support of diminished functions and prevention of further deterioration.

**Tabgatch** DYNASTY: *see* Wei dynasty.

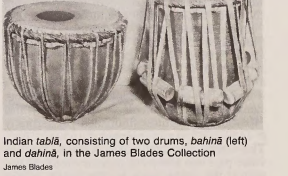
**Tabinshwehti** (b. 1512, Toungoo, Myanmar [Burma]—d. 1550, Pegu), king who unified Myanmar (reigned 1531–50). He was the second monarch of the Toungoo dynasty, which his father, Minkyinyo, had founded in 1486.

In 1535 Tabinshwehti began a military campaign against the kingdom of Pegu in southern Myanmar, capturing the city of Bassein in the Irrawaddy delta. Four years later Pegu fell, and Takayutpi, the Pegu king, fled to Prome (northwest of the present Yangon [Rangoon]). Employing Portuguese soldiers of fortune, Tabinshwehti captured the towns of Martaban and Moulmein in 1541, and in the following year he took Prome. With most of the southern princes his vassals, he dominated southern Myanmar as far south as Tavoy on the border of Siam (Thailand).

Although Tabinshwehti's campaigns in southern Myanmar were extremely savage, he adopted many Mon customs, incorporated Mon soldiers into his army, and made the ancient city of Pegu his capital in 1546. The king planned to use Myanmar as a base from which to invade Siam. His first campaign outside of Myanmar, however, was in Arakan, the kingdom to the west of the Irrawaddy delta, where he attempted to place a subservient local prince on the throne; his siege of the capital at Mrohaung was suspended after the Siamese attacked Tavoy, forcing him to return home. In 1548 he besieged Ayutthaya, the Siamese capital, but was forced to make an ignominious retreat to Myanmar.

Suffering defeat in two campaigns, Tabinshwehti gave himself up to drink, leaving to his brother-in-law, Bayinnaung, the task of suppressing a southern revolt. In 1550 Tabinshwehti was assassinated by a rival prince, who proclaimed himself king at Pegu. Bayinnaung crushed the revolt and carried on his brother-in-law's work of unifying Myanmar.

**tablā,** pair of small drums played in the chamber music of northern India. The higher-pitched drum, also called *tablā,* or sometimes *dahinā* ("right"), is a one-skinned drum usually of wood and having the profile of two



Indian *tablā,* consisting of two drums, *bahinā* (left) and *dahinā,* in the James Blades Collection
James Blades

truncated cones bulging at the centre, the lower portion shorter. Skin tension is maintained by thong lacings and wooden dowels that are tapped with a hammer in retuning. It is usually tuned to the tonic, or ground note, of the raga (melodic pattern).

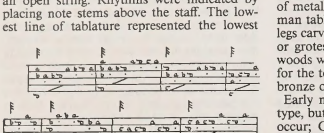
The *bahinā* ("left") is a deep kettledrum, usually of copper but also of clay or wood, with a hoop and thong lacings to maintain skin tension. Pressure from the heel of the player's hand varies the pitch. A disk of black tuning paste is placed on the skin of each drum to give it harmonic overtones. The drums are played with the fingers and hands, the *bahinā* to the player's left.

**Tablas de Daniel National Park,** nature reserve, located about 19 miles (30 km) northeast of the city of Ciudad Real, south-central Spain. The park, created in 1973, occupies 4,633 acres (1,875 hectares) and lies at the confluence of the Guadiana and Ciguela rivers, where fresh and brackish waters converge on the marshes and support both migratory and resident waterfowl year-round.

**tablature,** system of musical notation based on a player's finger position, as opposed to notes showing rhythm and pitch. Tablatures were used for lute and keyboard music during the Renaissance and Baroque eras.

Lute tablatures were of three main varieties, French, Italian (used also in Spain), and German. The French type, used *c.* 1500–*c.* 1800, proved to be the most practical and contained an important repertory of lute music. It used

a staff of five (after the late 16th century, six) horizontal lines, each of which represented a course of strings. In five-line tablature, the sixth course was printed below the staff. Stylized letters, from *b* to *i* or *k*, indicated which fret the player was to stop to produce the proper note; the letter *a* indicated plucking an open string. Rhythms were indicated by placing note stems above the staff. The lowest line of tablature represented the lowest



French lute tablature

From W. Apel, *The Notation of Polyphonic Music 900–1600*, 5th ed (1961); reproduced by permission of the Mediaeval Academy of America, Cambridge, Mass.

pitched string on the lute. Signs such as dots and slurs indicated right-hand fingerings, ornaments, and special effects. For the theorbo, a 17th-century variety of lute, special signs indicated the instrument's off-the-fingerboard bass strings.

Italian or Spanish tablature (flourished 1500–1650) resembled the French system, using six lines to represent the six courses of strings. Except in the famous lute book of Luis Milán, the lowest line represented the highest pitched string. Numbers, rather than letters, indicated which fret was to be stopped. Rhythms were shown by note stems above the diagram.

Unlike these systems, German lute tablature (flourished 1511–1620) did not provide a diagram of the strings. Instead, it used 54 or more symbols for as many possible junctions of fret and string. The symbols were aligned vertically if more than one fret should be stopped. Note stems above the symbols showed the rhythm.

Keyboard tablatures flourished in Germany *c.* 1450–*c.* 1750 and in Spain *c.* 1550–*c.* 1680. The German system was a hybrid—the top voice part was shown in ordinary musical notation, the lower parts by the letters of the musical scale (A, B, etc.). Special signs indicated when a note should be sharped (D♯ usually indicating Eb, etc.; but signs for flat notes appeared occasionally) and ornamented. Small note stems, typically joined together to resemble fences, showed rhythm. After *c.* 1570 the top line also was printed in tablature; this was called the "new German tablature," as opposed to the "old German tablature," the hybrid system. Even in the mid-18th century, J.S. Bach used tablature in his *Orgelbüchlein* (*Little Organ Book*) when it saved space.

In Spanish keyboard tablature (called *cifras,* "numbers"), each line of the staff represented a different voice part of the music. In the most commonly used system, numbers from 1 to 7 indicated the notes of the musical scale. Sharps and flats were printed above the number when necessary, and signs showed the octave in which the note occurred. Note stems above the diagram showed rhythm. Other systems numbered all notes from 1 to 42 and all white notes from 1 to 23, sharps and flats showing the black notes.

Other tablatures have been used for bowed instruments, such as the viol; for plucked instruments, such as the cittern, guitar, and zither; and also for non-Western instruments, such as the Japanese koto, a type of zither. Guitar music once employed lute tablature or a simpler notation showing chords; later it used ordinary musical notation. In the 20th century, guitar and ukulele popular music used a tablature in which a grid represented string and fret intersections and dots showed proper finger placement. Tablatures have also occasionally been used to show finger placement on flageolets and recorders.

**table,** basic article of furniture, known and used in the Western world since at least the 7th century BC, consisting of a flat slab of stone, metal, wood, or glass supported by trestles, legs, or a pillar.

Egyptian tables were made of wood, Assyrian of metal, and Grecian usually of bronze. Roman tables took on quite elaborate forms, the legs carved in the shapes of animals, sphinxes, or grotesque figures. Cedar and other exotic woods with a decorative grain were employed for the tops, and the tripod legs were made of bronze or other metals.

Early medieval tables were of a fairly basic type, but more elaborate varieties occasionally occur; Charlemagne, for example, possessed two tables of silver and one of gold, probably constructed of wood covered with thin sheets of metal. With the growing formality of life in the feudal period, tables took on a greater social significance. Although small tables were used in private apartments, in the great hall of a feudal castle the necessity of feeding a host of retainers stimulated the development of an arrangement whereby the master and his guests sat at a rectangular table on a dais surmounted by a canopy, while the rest of the household sat at tables placed at right angles to this one.

One of the few surviving examples of a large (and much restored) round table dating from the 15th century is at Winchester Castle in Hampshire, Eng. For the most part, circular tables were intended for occasional uses. The most common type of large medieval dining table was of trestle construction, consisting of massive boards of oak or elm resting on a series of central supports to which they were affixed by pegs, which could be removed and the table dismantled. Tables with attached legs, joined by heavy stretchers fixed close to the floor, appeared in the 15th century. They were of fixed size and heavy to move, but in the 16th century an ingenious device known as a draw top made it possible to double the length of the table. The top was composed of three leaves, two of which could be placed under the third and extended on runners when required. Such tables were usually made of oak or elm but sometimes of walnut or cherry. The basic principle involved is still applied to some extending tables.

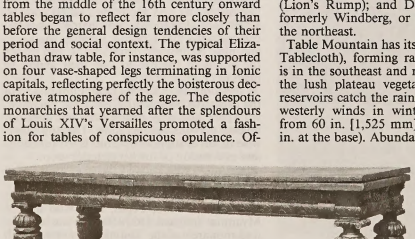
Growing technical sophistication meant that from the middle of the 16th century onward tables began to reflect far more closely than before the general design tendencies of their period and social context. The typical Elizabethan draw table, for instance, was supported on four vase-shaped legs terminating in Ionic capitals, reflecting perfectly the boisterous decorative atmosphere of the age. The despotic monarchies that yearned after the splendours of Louis XIV's Versailles promoted a fashion for tables of conspicuous opulence. Often made in Italy, these tables, which were common between the late 17th and mid-18th century, were sometimes inlaid with elaborate patterns of marquetry or rare marbles; others, such as that presented by the City of London to Charles II on his restoration as king of England, were entirely covered in silver or were made of ebony with silver mountings.

Increasing contact with the East in the 18th century stimulated a taste for lacquered tables, mostly of the occasional type. Indeed, the pattern of development in the history of the table that became apparent in this century was that, whereas the large dining table showed few stylistic changes, growing sophistication of taste and higher standards of living led to an increasing degree of specialization in occasional-table design. A whole range of particular functions was now being catered to, a tendency that persisted until at least the beginning of the 20th century. The basic type of occasional table came to be dominated by a single columnar leg and in this form influenced the emergence of the common 19th-century dining table for family use, with its circular top and solid, decoratively elaborate tripod-claw leg. The exploitation of man-made materials in the second half of the 20th century has made popular tables of plastic, metal, or fibreglass and combinations thereof.

**Table Bay,** bay of the Atlantic Ocean near the southern tip of Africa forming the harbour of Cape Town. Extending north from Cape Town to Melkbosstrand, the bay is 12 mi (19 km) long and 8 mi wide; it contains Robben Island (*q.v.*) and is overlooked by Table Mountain. Portuguese navigators were the first Europeans to see the bay (*c.* 1500). Although it was less well sheltered than other bays along the coast, it was favoured by the availability of fresh water and therefore became a place of call for ships voyaging to India and the East. The shore was permanently settled (1652) by the Dutch.

**Table Mountain,** Afrikaans TAFELBERG, flat-topped mountain, overlooking Cape Town and Table Bay, South Africa, dominating the northern end of the high, rocky Cape Peninsula. Its tabular shape results from nearly horizontal layers of sandstone, exposed by vigorous wind and water erosion. The stark, scarred, 2-mi- (3-km-) long northern face contrasts with the fertile summit plateau broken by small valleys and streams. Two subsidiary peaks are detached from the main mountain: Lion's Head (2,195 ft [669 m]) to the northwest, declining northward to Signal Hill (Lion's Rump); and Devil's Peak (3,281 ft; formerly Windberg, or Windy Mountain) to the northeast.

Table Mountain has its own cloud cover (the Tablecloth), forming rapidly when the wind is in the southeast and mainly responsible for the lush plateau vegetation. Five mountain reservoirs catch the rainfall brought by northwesterly winds in winter (ranging annually from 60 in. [1,525 mm] at the summit to 22 in. at the base). Abundant vegetation includes



Draw-top table, English, late 16th or early 17th century; in the Metropolitan Museum of Art, New York City

By courtesy of the Metropolitan Museum of Art, New York City, Fletcher Fund, 1923



Table Mountain to the south of Cape Town, S.Af.
By courtesy of the South African Tourist Corp.

disa orchids, 250 species of daisies, and silver trees; animal life includes tahrs (Himalayan goats) that are descended from escapees of a local zoo. There are a cableway (built 1929) and more than 350 classified routes to the top. The highest point is Maclear's Beacon (3,563 feet), which is named for a stone-cairn trigonometrical beacon placed on the north-eastern face by Sir Thomas Maclear in 1865.

**Table of ———:** *see under* descriptive word (*e.g.,* Ranks, Table of).

**table salt:** *see* salt.

**table tennis,** also called (trademark) PING-PONG, ball game similar in principle to lawn tennis and played on a flat table divided into two equal courts by a net fixed across its width at the middle. The object is to hit the ball so that it goes over the net and bounces on the opponent's half of the table in such a way that the opponent cannot reach it or return it correctly. The lightweight hollow ball is made of celluloid or a similar plastic and is propelled back and forth across the net by small rackets (bats, or paddles) held by the players. The game is popular all over the world. In most countries it is very highly organized as a competitive sport, especially in Europe and Asia, particularly in China and Japan.

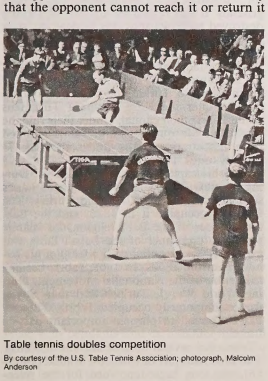


Table tennis doubles competition
By courtesy of the U.S. Table Tennis Association; photograph, Malcolm Anderson

*History.* Invented in England in the early days of the 20th century, the game was originally called Ping-Pong, a trade name. The name table tennis was adopted in 1921–22 when the old Ping-Pong Association formed in 1902 was revived. The original association had broken up about 1905, though apparently the game continued to be played in parts of England outside London and by the 1920s was being played in many countries. Led by representatives of Germany, Hungary, and England, the Fédération Internationale de Tennis de Table (International Table Tennis Federation) was founded in 1926, the founder members being England, Sweden, Hungary, India, Denmark, Germany, Czechoslovakia, Austria, and Wales. By the 1980s more than 110 national associations were members.

The first world championships were held in London in 1927, and from then until 1939 the game was dominated by players from central Europe, the men's team event being won nine times by Hungary and twice by Czechoslovakia. After World War II, until 1953, Czechoslovakia won four times and Hungary twice. These two countries produced some of the greatest players in the game. Victor Barna (five times world singles champion), Laszlo Bellak (twice a finalist), and Mike Szabados (once winner and twice finalist) all came from Hungary, as did Ferenc Sido, winner in 1953. From Czechoslovakia came Bohumil Vana, twice world champion and twice a finalist, and Ivan Andreadis, who was a great stylist and four times world doubles champion.

Another central European recognized as one of the greatest champions of all time was Richard Bergmann of Austria, who won the world singles title four times (twice as a naturalized English citizen). In the women's team event, central Europe has also been prominent. Of the 16 championships played between 1934 and 1956, Romania and Czechoslovakia won eight times. Great women players were Maria Mednyanszky (Hungary), who won the women's singles title 1926–31; Gizi Farkas (Hungary), who won the title 1946–49; and Angelica Rozeanu (Romania), with the record of six world singles titles, 1950–55.

The 1953–54 season saw the emergence of Asia as a breeding ground of champions, and from that time the men's team event has been won by either Japan or China, while the women's event also has been dominated, though to a lesser extent, by Japan and China. Japan has produced many great players, in particular Ichiro Ogimura and Toshiaki Tanaka, both twice world champions, and China, too, had a three times consecutive winner in Chuang Tse-tung. China suspended play during the Cultural Revolution (1966–69) but began to return to dominance in 1971 and by the 1980s had achieved it. North Korea also became an international force. In 1980 the first World Cup was held, and Guo Yuehua of China won the $12,500 first prize.

For world championship winners, *see* Sporting Record: *Table tennis.*

*The game.* Table tennis equipment is relatively simple and inexpensive. The table is rectangular, 9 feet by 5 feet (2.7 m by 1.5 m), its upper surface a level plane 30 inches (76 cm) above the floor. The net is 6 feet (1.8 m) long, and its upper edge along the whole length is 6 inches (15 cm) above the playing surface. The ball, which is spherical, hollow, and made of white celluloid or, since 1969, a similar plastic, weighs about 0.09 ounce (2.5 g) and has a diameter of about 1.5 inches (3.8 cm). The blade of a racket, or bat, is usually made of wood, is flat and rigid, and may be covered with a thin layer of ordinary stippled, or pimpled, rubber, which may be laid over a thin layer of sponge rubber and may have the pimples reversed. Whatever combination is used, each of the two sides of a paddle must be different in colour. The paddle may be at any size, weight, or shape.

A match consists of the best of three or the best of five games, each game being won by the player who first reaches 21 points, or who, after 20 points each, wins two clear points ahead. A point is scored when the server fails to make a good service, when either player fails to make a good return, or when either player commits a specified infraction (*e.g.,* touches the playing surface with his free hand while the ball is in play). Service changes hands after every five points until 20-all is reached, when it changes after every subsequent point.

The serve is made from behind the end of the table, the server tossing the ball upward from the palm of his free hand and striking it as it descends so that it first bounces on his own court and then, passing over the net, bounces on his opponent's court. In serving, no spin may be imparted to the ball by the fingers. This was not always so. Finger spin, especially in the United States, reached a stage where the experts could produce untakable services and the game became farcical. Finger spin was universally banned in 1937. The table tennis racket is usually gripped in one of two ways. One grip consists of "shaking hands" with the racket, as in lawn tennis, except that the table tennis racket is not held at the end of the handle. The forefinger rests along the blade on the rear (backhand) side, and the thumb rests on the forehand side. Many Asian players, including the Chinese and Japanese, use the "penholder" grip, in which the handle is held between forefinger and thumb as one would hold a pen. A penholder grip player strikes the ball only with the front side of the paddle.

Interest to the spectator lies in observing the ability of one player to defeat his opponent by well-thought-out strategy. Increasing the speed of the game, slowing it down, varying the direction of or imparting different spin or pace to the ball, and employing gentle drop shots over the net when the opponent is out of position are some of the tactics that may be used to support the strategy planned.

Slow or defensive play at one time was so dominant that, at the 1936 world championships in Prague, an hour was needed to decide a single point. Play is now restricted. If a game is unfinished 15 minutes after it has begun, the rest of that game and the remaining games of the match proceed under the Expedite System. Thereafter if the service and 12 following strokes of the server are returned by the receiver, the server loses the point. The service changes after each point.

Table tennis may be played with one player at each end of the table or with two players at each end who may be both men or both women or one of each. Worldwide, the women's game is comparable in organization to the men's, and women take part in world championships and all other organized events. Table tennis as well as being fully organized is also extremely popular as a recreational game and is so played in all types of sports clubs, social clubs, and game rooms, in the home, and even out-of-doors when conditions are reasonably calm. (V.B./Ed.)

**tablemount** (volcano): *see* guyot.

**Tabletop** (Canada): *see* Jacques Cartier, Mount.

**tableware,** utensils used at the table for holding, serving, and handling food and drink. Tableware includes various types of containers (known as hollow ware, *q.v.*), spoons and forks (flatware, *q.v.*), knives (cutlery, *q.v.*), and a variety of dishes and accessories.

**Taboga Island,** Spanish ISLA TABOGA, island in the Bay of Panama, Panama. Taboga and its small neighbour, Taboguilla Island, lie 11 miles (18 km) south of Panama City, with which they are connected by boat service. Taboga, about 2 miles (3 km) long and 1 mile (1.6 km) wide, is known for its pineapples and mangoes and is a year-round tourist resort. Visitors are attracted by its church, one of the oldest in the Western Hemisphere, by its quiet atmosphere, and by its excellent swimming and fishing. Pop. (latest est.) 1,003.

**taboo,** also spelled TABU, Tongan TABU, Maori TAPU, the prohibition of an action or the use of an object based on ritualistic distinctions of them either as being sacred and consecrated or as being dangerous, unclean, and accursed. The term *taboo* is of Polynesian

origin and was first noted by Captain James Cook during his visit to Tonga in 1771; he introduced the term into the English language, from which it achieved widespread currency. Taboos were most highly developed in the Polynesian societies of the South Pacific, but they have been present in virtually all cultures.

Taboos could include prohibitions on fishing or picking fruit at certain seasons; food taboos that restrict the diet of pregnant women; prohibitions on talking to or touching chiefs or members of other high social classes; taboos on walking or traveling in certain areas, such as forests; and various taboos that function during important life events such as birth, marriage, and death. There is an apparent inconsistency between the taboos in which notions of sacredness or holiness are apparent (*e.g.*, the head of a Polynesian chief was taboo and thus could not be touched because of his general character as a sacred leader) and taboos in which notions of uncleanliness were the motivating factor (*e.g.*, physical contact with a menstruating woman may be taboo because it is thought to be defiling, and persons who have been in physical contact with the dead may likewise be forbidden to touch food with their hands).

Generally, the prohibition that is inherent in a taboo includes the idea that a breach or defiance of the taboo will automatically be followed by some kind of trouble to the offender, such as lack of success in hunting or fishing, sickness, or the death of a relative. These misfortunes would ordinarily be regarded as accidents or bad luck, but to believers in taboos they are regarded as punishments for breaking some taboo. A person meets with an accident or has no success in a given pursuit, and, in seeking for its cause, he or others infer that he has in some manner committed a breach of taboo.

Taboos as manifested in various cultures have stimulated an extensive scholarly literature that seeks to compare, analyze, and explain them. Among the most important researchers or theorists on the topic were William Robertson Smith, Sir James G. Frazer in his work *The Golden Bough* (1907–15), Wilhelm Wundt, and Sigmund Freud in his book *Totem and Taboo* (1913). Freud provided perhaps the most ingenious explanation for the apparently irrational nature of taboos, positing that they were generated by ambivalent social attitudes and in effect represent forbidden actions for which there nevertheless exists a strong unconscious inclination. Freud directly applied this viewpoint to the most universal of all taboos, the incest taboo, which prohibits sexual relations between close blood relatives. There is no generally accepted explanation of taboos, but there is broad agreement that the taboos current in any society tend to relate to objects and actions that are significant for the social order and that belong to the general system of social control.

**Tábor,** city, Jihočeský *kraj* (region), Czech Republic. It lies along a bend in the Lužnice River 50 miles (80 km) south of Prague. Founded in 1420 by Jan Žižka and other followers of the Bohemian religious reformer Jan Hus, Tábor became the radical centre of the more militant members of the movement, known as the Taborites. These people fostered the national spirit and the preservation of the Czech language. The town has a museum (1878) of the Hussite Revolutionary Movement.

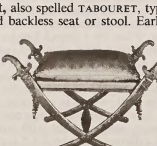
The old town lies on a steep granite ridge and is protected by the river to the south and west and by the fishpond Jordán (where local baptisms once took place) to the north. It is encircled by fortifications, still largely intact; the Bechyně Gate dates from 1420. The hub of the Old Town is Žižka Square, from which tortuous narrow streets spread out, originally planned to impede access by enemy intruders. Tábor declined in the 17th century after suffering ravages during the Thirty Years' War. It is now a road and rail junction and has plants to process wool, tobacco, and mother-of-pearl. Kaolin is quarried nearby. Pop. (1991 prelim.) 36,329.

**tabor** (drum): *see* pipe and tabor.

**Tabor, Mount,** Hebrew HAR TAVOR, Arabic JABAL AṬ-ṬUR, historic elevation of northern Israel, in Lower Galilee near the edge of the Plain of Esdraelon ('Emeq Yizre'el). Though comparatively low (1,929 feet [588 m]), it dominates the level landscape around it, leading to the biblical expression "like Tabor among the mountains" (Jeremiah 46:18). It is first mentioned in the 13th century BC in Egyptian inscriptions of the pharaoh Ramses II. Its chief Old Testament association is as the site of the triumph of the Israelite general Barak over the Canaanite leader Sisera (*c.* 11th century BC), under the inspiration of the judge and prophetess Deborah (Judges 4). Although it is not named in the New Testament, Mount Tabor is the traditional site of the Transfiguration of Jesus. The first churches on the mountain were built in the 4th century AD. At the summit of the mountain there are a Franciscan church and hospice and a Greek Orthodox church. From atop the summit, there is a panoramic view of Upper Galilee. Ruins of crusader fortifications are numerous. The mountain has fine woodlands and attracts many hikers.

**Tabora,** formerly KAZEH, town, west-central Tanzania. Lying on the Central Plateau at an elevation of 4,000 feet (1,200 m), it has a mean annual temperature of 73° F (23° C). The town has been the capital of the Nyamwezi people and was the major trade link between the coast and the Congo River basin prior to European colonial rule. As the junction point of the east-west (Dar es-Salaam–Ujiji) railway and the north-south railway to Lake Victoria, it has retained some importance as a commercial and agricultural trade centre. The chief cash crops of the surrounding agricultural area are tobacco, vegetables, and cassava. Pop. (1985 est.) 214,641.

**taboret,** also spelled TABOURET, type of armless and backless seat or stool. Early taborets



Carved and gilded taboret, signed Jacob-D.-R. Meslee, French, *c.* 1810; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London

were probably named for their cylindrical shape, which resembled a drum (Old French: *tabour*).

The name acquired a more specialized meaning in France in the late 17th century, when it referred to upholstered stools provided at the palace of Versailles for the more privileged ladies of the court of Louis XIV to sit upon in the royal presence. The elaborateness of her taboret's decoration indicated a lady's rank. In the following century taborets of various designs became fashionable as household furniture, particularly in France and England.

**Taborite,** Czech TÁBOŘI, member of a militant group of Bohemian Hussite reformers who in 1420 gave the biblical name of Tabor (Czech: Tábor) to their fortified settlement south of Prague. Like their more moderate coreligionists, the Utraquists, they were strict biblicists and insisted on receiving a Eucharist of both bread and wine, though they denied transubstantiation and the Real Presence. Nicholas of Pelhřimov, first bishop of the Taborites, headed an independent church that replaced Latin with Czech in the liturgy, allowed married clergy, and rejected all the sacraments except Baptism and the Eucharist. The Taborites' military campaigns and their destruction of churches, which took place under the leadership of Jan Žižka, Prokop Holý, and Prokop the Lesser, aroused such widespread animosity that the Utraquists finally joined Roman Catholic Czech forces to defeat the Taborite army at Lipany in 1434. Despite the deaths of Žižka (1424) and Prokop (1434), the Taborites continued their struggle until a decisive battle in 1452, when Tábor itself was captured.

**Tabqa Dam** (Syria): *see* Euphrates Dam.

**Tabrīz,** Persian TAURIS, fourth largest city of Iran, lying about 4,485 feet (1,367 m) above sea level in the extreme northwestern part of the country. The climate is continental: hot and dry in summer and severely cold in winter. The city lies in a valley surrounded by hills on three sides. It is in an earthquake zone that is liable to frequent and severe shocks.

The name Tabrīz is said to derive from *tapriz* ("causing heat to flow"), from the many thermal springs in the area. Also called Gazaca, Tabrīz was the capital of Atropatene, named for Atropates, one of Alexander the Great's generals. It was rebuilt in AD 791 after being destroyed by an earthquake. Similar disasters followed in 858, 1041, 1721, 1780, and 1927. Tabrīz was made the capital of the Mongol Il-Khan Maḥmūd Ghāzān (1295–1304) and his successor. In 1392 it was taken by Timur (Tamerlane), a Turkic conqueror, and some decades later the Kara Koyunlu Turkmens made Tabrīz their capital. Under their rule the city's Blue Mosque was built. Tabrīz retained its administrative status under the Ṣafavid dynasty until 1548, when Shāh Ṭahmāsp I moved his capital westward to Qazvin. During the next 200 years Tabrīz changed hands several times between Iran and Turkey. The Russians occupied it in 1826, and the Bāb, the founder of the Bābi religion, an Islāmic sect and forerunner of the Bahá'í faith, was executed here, together with 40,000 of his followers, in the 1850s. In 1908 Tabrīz became the centre of the Nationalist movement. During World War I, Turkish and then Soviet troops temporarily occupied Tabrīz. The city has continued to play an important part in Iranian politics.

Tabrīz has several notable ancient buildings. The Blue Mosque, or Musjed-e Kabūd (1465–66), has long been renowned for the splendour of its blue tile decoration. The citadel, or Arg, was built as a mosque before 1322 and is remarkable for its simplicity, size, and the excellent condition of its brickwork. Also noteworthy are the remains of the 12-sided tomb of Maḥmūd Ghāzān, ruler of the Mongol dynasty in Iran.

The modernization of Tabrīz has quickened since World War II, with streets widened, buildings erected, and public gardens laid out with fountains and pools. The city's newer buildings include a railway station and Tabrīz University (1946). Just outside the city is a summer resort. Tabriz is commercially important, and the principal products include carpets, textiles, cement, agricultural machinery, motorcycles, and household appliances. The city is linked by rail with Tehrān and with areas to the north, and it has an airport. Pop. (1986) 971,482.

**Tabriz carpet,** floor covering handmade in or around Tabrīz, the principal city of north-

western Iran and one of its best-known carpet-producing centres. The identification of the court carpets of the early 16th-century Ṣafa-



Persian medallion carpet from Tabrīz, early 17th century; in the Textile Museum Collection, Washington, D.C.
Textile Museum Collection, Washington, D.C.; photograph, Otto E. Nelson—EB Inc.

vid shahs who made Tabrīz their capital is no longer as simple as it once seemed. Still, the magnificent Ardabīl Carpet at the Victoria and Albert Museum in London and its mate in the Los Angeles County Museum of Art seem likely representatives of this production. More characteristic of Tabrīz carpets, however, are the many 16th- and 17th-century carpets of commercial quality, in Senna (Sehna) knotting upon a foundation of cotton, which apparently were exported to southern Europe and are now widespread in museum collections. These carpets usually show a medallion decorative scheme, ranging from a single medallion to the complexity of a star centrepiece with pendants and cartouches, reflected by quarter-medallions similarly elaborated in the corners of the field. The ground pattern often features coiled arabesque vine work.

From the mid-19th century there has been a revival of commercial carpet production in Iran, and Tabrīz has been one of the most important centres in the country, producing carpets of widely varying quality, largely destined for Europe. These new carpets are Ghiordes-knotted and have a simpler weft arrangement. The highly varied designs include medallion schemes in curvilinear draftsmanship as well as imitations of classic carpet patterns from other parts of Persia. The designs have been criticized as too regular and mechanical, and the colouring as too hard, the old vegetable dyes having been largely supplanted by European chromes and anilines. The wool is said to be harsher than that used in other Iranian centres, resulting in a stiffer, crisper pile.

Instead of using the fingers to tie the knots, it is a local custom among the weavers to use a knife with a projection like a buttonhook. By this means they can develop higher speed than the weavers in other districts and have been timed at faster than one knot per second.

**Tabrīz school,** in painting, school of miniaturists founded by the Mongol Il-Khans early in the 14th century and active through the first half of the 16th century. The style represented the first full penetration of East Asian traditions into Islāmic painting, an influence that was extreme at first but then blended with the native idiom.

The early works of the Tabrīz school were characterized by light, feathery brushstrokes, gentle rather than bright Persian colouring, and an attempt to create the illusion of spatiality. An example is a painting (dated 1330–40) from the Persian poet Ferdowsī's epic *Shāh-nāmeh* ("Book of Kings") at the Metropolitan Museum of Art, New York City. The illustration of the funeral of the ruler Esfandeyār conveys a degree of pathos unequaled in Persian art. Space and depth are suggested by the placement of the large number of figures on various levels, one above the other, a technique brought to Central Asia by the Mongols. A later illustration of the same text (1380) in the Fogg Art Museum in Cambridge, Mass., shows a maturing of the Tabrīz school. It is a scene of the Sāsānian prince Bahrām Gūr after having killed a wolf, done in brilliant hues reminiscent of Mesopotamian painting. The attempt to create three dimensions is highly successful, as is the combination of ceremonial symbolism and realistic detail.

The Tabrīz school reached its apogee just as the Il-Khans were being vanquished by the Timurids (1370–1506), the dynasty of the Islāmic conqueror Timur. The school continued to be active in this period, though it was overshadowed by the workshops in Shīrāz and Herāt (*see* Shīrāz school; Herāt school). When the Ṣafavids came to power at the beginning of the 16th century, however, the ruler Shāh Esmā'īl brought the master of the Herāt school, Behzād, to Tabrīz, and the school was revived with a radical change in style. The figures were individuals rather than types, and the colours were graded in marvelously subtle



"Muḥammad Riding Through the Night Sky" from the *Khamseh* of Neẓāmī, Tabrīz school miniature attributed to Sulṭān Muḥammad, 1539–43 (British Library, London, MS. Or. 2265)
Reproduced by permission of the British Library

shades. Following the removal of the Ṣafavid court from Tabrīz, the school began to decline, and the Kazvin and Eṣfahān schools (*see* Eṣfahān school) then became the centres of painting in Iran.

**tabu:** *see* taboo.

**Tabuaeran Atoll,** also called FANNING ATOLL, coral formation of the Northern Line Islands, part of Kiribati, in the west-central Pacific Ocean. Discovered in 1798 by an American, Edmund Fanning, the atoll is composed of several islets, with a total area of 13 square miles (35 square km), that surround a lagoon 32 miles (51 km) in circumference. It was annexed in 1888 by Britain as the site for a transpacific cable-relay station, which was in service until a new cable was installed in 1963. The island served as a district headquarters of the Gilbert and Ellice Islands Colony from 1916 until replaced in 1952 by Christmas (now called Kiritimati) Atoll. The island is owned by Fanning Island Plantations, Ltd., a copra-processing company. Pop. (2001 est.) 1,700.

**Tabūk,** oasis town, northwestern Saudi Arabia. The town is situated amid a grove of date palms. In former times it was a station on the Hejaz railway (now defunct). At the edge of the old part of Tabūk town stands a Turkish fort, built in 1694. Modern Tabūk is one of the fastest-growing industrial centres of Saudi Arabia. Pop. (2001 est.) 372,400.

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**tabula rasa** (Latin: "scraped tablet," *i.e.*, "clean slate"), in epistemology (theory of knowledge) and psychology, a supposed condition that empiricists attribute to the human mind before ideas have been imprinted on it by the reaction of the senses to the external world of objects.

Comparison of the mind to a blank writing-tablet occurs in Aristotle's *De anima* (4th century BC), and the Stoics as well as the Aristotelian Peripatetics subsequently argued for an original state of mental blankness. Both the Aristotelians and the Stoics, however, emphasized those faculties of the mind or soul that, having been only potential or inactive before receiving ideas from the senses, respond to the ideas by an intellectual process and convert them into knowledge.

A new and revolutionary emphasis on the tabula rasa occurred late in the 17th century, when the English empiricist John Locke, in his *Essay Concerning Human Understanding* (1690), argued for the mind's initial resemblance to "white paper, void of all characters," with "all the *materials* of reason and knowledge" derived from experience. Though Locke himself fell back on "reflection" as a power of the mind for the exploitation of the given "materials," his championship of the tabula rasa signaled even more radical positions by later philosophers.

**Tabulae Rudolphinae,** in astronomy: *see* Rudolphine Tables.

**Tabulata,** major division of extinct coral animals found as fossils in Ordovician to Jurassic marine rocks (505 million to 144 million years old). Tabulata is characterized by the presence of interior platforms, or tabulae, and by a general lack of vertical walls, or septa. Colonial masses of these tabulate corals sometimes comprised sizable structures.

**Tabwa,** also spelled TAABWA, also called RUNGU, a people who live mainly on the southwestern shores of Lake Tanganyika, on the high grassy plateaus of the Marungu massif in extreme southeastern Zaire. Some also live in northeasternmost Zambia and along the Luapula River. Tabwa speak a Bantu language closely related to those of neighbouring Bemba of Zambia and Luba of Zaire.

Tabwa observe matrilineal descent and have several clans and many subclans, each with independent histories, and several with different dialects. Older ethnographic maps represent these as separate "tribes," and the unity felt in modern times is a product of colonial politics. Locally obtained salt, iron, and smoked river fish were important items of precolonial trade among the Tabwa. These were replaced by European imports. The Tabwa turned to fishing and growing cash crops of potatoes, wheat, and onions for the colonial market; and cassava, corn (maize), and beans for the domestic one. Although the Tabwa produced much food for cities of the Copperbelt during colonial times, the infrastructure of roads, depots, and lake shipping eroded during the 1970s, and their area has become a backwater. Mechanized fishing on Lakes Tanganyika and Mwera is supplemented by Tabwa using lines and nets. Copper is mined in southern Tabwa territory.

**Tacapa** (Tunisia): *see* Qābis.

**Taceddin Ibrahim ibn Hizr Ahmedi:** *see* Ahmedi, Taceddin.

**Tachikawa,** city, Tokyo *to* (metropolis), Honshu, Japan. It lies along the Chūō Line (railway), east of Tokyo city. In 1922 an army airfield was constructed nearby, and large munitions and aircraft factories were concentrated in the city. After World War II the military installations were taken over by the U.S. Air Force; the air base was returned to Japan in 1977. Tachikawa is now a commercial centre and railway hub. The airfield is used by small craft. The city also serves as a residential suburb of the Tokyo–Yokohama Metropolitan Area. Pop. (1987 est.) 150,144.

**tachinid fly,** a member of any species of the insect family Tachinidae (order Diptera), with larvae that are internal parasites of other insects. Ranging in size from 2 to 18 mm (0.08 to 0.7 inch), many hairy adult tachinids superficially resemble houseflies. Most species are dull gray or black, but some are metallic green or blue.

Tachinids are of great importance in the control of destructive insects, particularly caterpillars and beetle larvae. For this reason several species have been used to combat pests. The sugarcane beetle borer population in Hawaii, for example, has been reduced by the tachinid *Ceromasia sphenophori* from New Guinea; the coconut moth in Fiji has been controlled by the Malayan tachinid *Ptychomyia remota;* and *Centeter cinerea* was transplanted to the United States to check the destructive Japanese beetle. The caterpillars of the armyworm may be up to 90 percent infested by larvae of the red-tailed tachinids (*Winthemia*).

Although most tachinids are capable of parasitizing only one or a few closely related host species of insects, a species of tachinid introduced to the United States from Europe



Tachinid fly (*Paradejeania rutiloides*)
E.S. Ross

(*Compsilura concinnata*) to control the gypsy moth and brown-tail moth attacks more than 200 species of caterpillars. The means of entering the host has become highly evolved among tachinids. Certain tachinid flies attach eggs to their victims; the larvae burrow through the skin when they hatch. Others deposit living larvae either directly upon the host or in situations that allow the larvae to attach to passing insects. Some species lay their eggs on vegetation that is then eaten by caterpillars. Tachinid maggots (larvae) usually breathe by an opening through the host's body wall or by contact with its respiratory system. The larvae may enter a resting stage (pupa) within the host or may leave the host to pupate. Most tachinid larvae destroy their hosts, but others do not. Many adult tachinids (*e.g., Paradejeania*) obtain nectar from flowers, thus serving as pollinators.

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**Táchira,** state, western Venezuela, bounded on the west by Colombia. The territory of 4,300 square miles (11,100 square km) lies in the southwestern reaches of the Andean Cordillera de Mérida. Agriculture dominates the state's economy; coffee and sugarcane are the leading commercial crops. Rural industry, closely related to agriculture, is usually carried on in the local homes. Relatively large coal deposits are found at Labatera. La Alguitrana claims the distinction of having the first oil well (1878–79) in Venezuela. San Cristóbal (*q.v.*), the state capital and leading commercial and transportation centre, is on the Pan-American Highway about 15 miles (25 km) east of the border town of San Antonio. Pop. (1988 est.) 819,079.

**Tachism,** French TACHISME (from *tache,* "spot"), style of painting practiced in Paris after World War II and through the 1950s that, like its American equivalent, Action

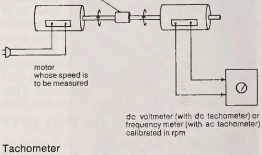


"Painting," Tachist oil painting by George Mathieu, 1952; in the Solomon R. Guggenheim Museum, New York City
By courtesy of the Solomon R. Guggenheim Museum, New York City

painting, featured the intuitive, spontaneous gesture of the artist's brushstroke. Developed by the young painters Hans Hartung, Gérard Schneider, Pierre Soulages, Frans Wols, Chao Wu-chi (Zao Wu-ki), and Georges Mathieu, Tachism was part of a larger French postwar movement known as Art Informel, which abandoned geometric abstraction in favour of a more intuitive form of expression. Art Informel was inspired by the instinctive, personal approach of contemporary American Abstract Expressionism, of which Action painting was one aspect.

Like their American counterparts, the French-educated Tachists worked with a loaded brush, producing large works of sweeping brushstrokes and of drips, blots, stains, and splashes of colour. Their works, however, are more elegant and lyrical—often including graceful lines and blended, muted colours—than the works of such American painters as Jackson Pollock and Willem de Kooning, on whom the French artists modeled themselves. The Tachists were also less indebted than were the Action painters to uninhibited psychic inspiration.

**tachometer,** device for indicating the angular (rotary) speed of a rotating shaft. The term is usually restricted to mechanical or electrical instruments that indicate instantaneous values of speed in revolutions per minute, rather than devices that count the number of revolutions in a measured time interval and indicate only average values for the interval.




Tachometer
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Mechanical tachometers utilize the fact that the centrifugal force on a rotating mass depends on the speed of rotation and can be used to stretch or compress a mechanical spring. A resonance, or vibrating-reed, tachometer uses a series of consecutively tuned reeds to determine engine speed by indicating the vibration frequency of the machine.

Electrical tachometers are of several types. The eddy-current, or drag, type is widely used in automobile speedometers; a magnet rotated with the shaft being measured produces eddy currents that are proportional to angular speed. Electric-generator tachometers work by generating either an alternating or a direct current. The stroboscope, an instrument that illuminates rotating objects so that they appear to have stopped moving, can be used as a tachometer.

**Tachos,** also called TAKHOR, TEOS, OR ZEDHOR, second king (reigned 365–360 BC) of the 30th dynasty of Egypt; he led an unsuccessful attack on the Persians in Phoenicia. Tachos was aided in the undertaking by the aged Spartan king Agesilaus II, who led a body of Greek mercenaries, and by the Athenian fleet commander Chabrias. Tachos, however, insisted on leading the Egyptian army himself, and Agesilaus, after quarreling with his ally, supported a military revolt in Egypt that placed the young pretender Nectanebo II on the throne. Tachos fled to Iran, where he died an exile.

**tachycardia,** in physiology and medicine, a heart rate of more than 100 beats per minute. Tachycardia occurs normally during and after exercise or during stress and represents no danger to healthy individuals. In some cases, however, tachycardia occurs without apparent cause and is an arrhythmia, *i.e.,* a pathological deviation from the normal heartbeat rhythm. Most arrhythmias are caused by irregularities in the electrical stimuli that cause the heart to beat. Normally these pacemaking stimuli originate in the sinoatrial node. When the point of origin of pacemaking shifts to some other site in the heart, arrhythmias result, and arrhythmias in which the heart beats at a rapid rate are termed tachycardias.

Tachycardias can be atrial, ventricular, or nodal, depending on the faulty site of origin of the pacemaking stimulus. The chief symptoms of all tachycardias are fatigue, faintness, dizziness, shortness of breath, and a sensation of thumping or palpitation in the chest. The heart can beat as many as 240 times per minute in tachycardia. Some tachycardias, such as paroxysmal tachycardia, are harmless and transitory phenomena that last a few

minutes or hours, subside spontaneously, and cause no lasting ill effects. Other types, such as multifocal atrial tachycardia or ventricular tachycardia, usually occur in persons with serious heart, lung, or circulatory disease and demand immediate medical attention. The more serious tachycardias may be precursors of atrial fibrillation or even a heart attack.

Tachycardias can be terminated by lying down and other basic physical measures, by administering an electrical shock to the heart to restore regular heart rhythm, or by the administration of such antiarrhythmic drugs as quinidine, atropine, lidocaine, or procainamide.

**tachygraphy:** *see* shorthand.

**tachylyte,** also spelled TACHYLITE, glassy igneous rocks low in silica, such as basalt or diabase. Tachylytes are black with a pitchlike or resinous lustre; in thin sections they are characteristically brown and translucent, and the glass is crowded with granules of magnetite. Tachylytes are found only under conditions that imply rapid cooling, and they are much less common than are the corresponding acid volcanic glasses, principally because of the greater fluidity and greater tendency of basic lavas to crystallize.

The principal mode of occurrence of tachylyte is as a chilled edge to thin dikes or sills of basalt or diabase; this edge may be only a millimetre or so thick and merges inward into crystalline basalt. Tachylytes of this nature are common among the igneous rocks of Tertiary age in the Inner Hebrides of Scotland. Sometimes tachylyte constitutes almost entire lava flows, as in the Hawaiian Islands; the rapid cooling of the highly fluid lavas of this region has inhibited crystallization, giving rise to vast floods of basaltic glass that contains only minor amounts of crystalline material. Lastly, tachylytes occur as scoria, or bombs, thrown out by basaltic volcanoes; these are well known at Stromboli Island and at Mount Etna in Italy, and in Iceland. Tachylytes readily undergo weathering and alteration and are converted by oxidation and hydration into palagonite, a red, brown, or yellow cryptocrystalline material.

**tachyon,** hypothetical subatomic particle whose velocity always exceeds that of light. The existence of the tachyon, though not experimentally established, appears consistent with the theory of relativity, which was originally thought to apply only to particles traveling at or less than the speed of light. Just as an ordinary particle such as an electron can exist only at speeds less than that of light, so a tachyon could exist only at speeds above that of light, at which point its mass would be real and positive. Upon losing energy, a tachyon would accelerate; the faster it traveled, the less energy it would have.

**Tacitus,** in full PUBLIUS, or GAIUS, CORNELIUS TACITUS (b. *c.* AD 56—d. *c.* 120), Roman orator and public official, probably the greatest historian and one of the greatest prose stylists who wrote in the Latin language. Among his works are the *Germania*, describing the Germanic tribes, the *Historiae* (*Histories*), concerning the Roman Empire from AD 69 to 96, and the later *Annals*, dealing with the empire in the period from AD 14 to 68.

*Early life and career.* Tacitus was born perhaps in northern Italy (Cisalpine Gaul) or, more probably, in southern Gaul (Gallia Narbonensis, or present southeastern France). Nothing is known of his parentage. Though Cornelius was the name of a noble Roman family, there is no proof that he was descended from the Roman aristocracy; provincial families often took the name of the governor who had given them Roman citizenship. In any event he grew up in comfortable circumstances, enjoyed a good education, and found the way open to a public career.

Tacitus studied rhetoric, which provided a general literary education including the practice of prose composition. This training was a systematic preparation for administrative office. Tacitus studied to be an advocate at law under two leading orators, Marcus Aper and Julius Secundus; then he began his career with a "virgintivirate" (one of 20 appointments to minor magistracies) and a military tribunate (on the staff of a legion).

In 77 Tacitus married the daughter of Gnaeus Julius Agricola. Agricola had risen in the imperial service to the consulship, in 77 or 78, and he would later enhance his reputation as governor of Britain. Tacitus appears to have made his own mark socially and was making much progress toward public distinction; he would obviously benefit from Agricola's political connections. Moving through the regular stages, he gained the quaestorship (often a responsible provincial post), probably in 81; then in 88 he attained a praetorship (a post with legal jurisdiction) and became a member of the priestly college that kept the Sibylline Books of prophecy and supervised foreign-cult practice. After this it may be assumed that he held a senior provincial post, normally in command of a legion, for four years.

When he returned to Rome, he observed firsthand the last years of the emperor Domitian's oppression of the Roman aristocracy. By 93 Agricola was dead, but by this time Tacitus had achieved distinction on his own. In 97, under the emperor Nerva, he rose to the consulship and delivered the funeral oration for Verginius Rufus, a famous soldier who had refused to compete for power in 68/69 after Nero's death. This distinction not only reflected his reputation as an orator but his moral authority and official dignity as well.

*First literary works.* In 98 Tacitus wrote two works: *De vita Julii Agricolae* and *De origine et situ Germanorum* (the *Germania*), both reflecting his personal interests. The *Agricola* is a biographical account of his father-in-law's career, with special reference to the governorship of Britain (78–84) and the later years under Domitian. It is laudatory yet circumstantial in its description, and it gives a balanced political judgment. The *Germania* is another descriptive piece, this time of the Roman frontier on the Rhine. Tacitus emphasizes the simple virtue as well as the primitive vices of the Germanic tribes, in contrast to the moral laxity of contemporary Rome, and the threat that these tribes, if they acted together, could present to Roman Gaul. Here his writing goes beyond geography to political ethnography. The work gives an administrator's appreciation of the German situation, and to this extent the work serves as a historical introduction to the Germans.

Tacitus still practiced advocacy at law—in 100 he, along with Pliny the Younger, successfully prosecuted Marius Priscus, a proconsul in Africa, for extortion—but he felt that oratory had lost much of its political spirit and its practitioners were deficient in skill. This decline of oratory seems to provide the setting for his *Dialogus de oratoribus*. The work refers back to his youth, introducing his teachers Aper and Secundus. It has been dated as early as about 80, chiefly because it is more Ciceronian in style than his other writing. But its style arises from its form and subject matter and does not point to an early stage of stylistic development. The date lies between 98 and 102; the theme fits this period. Tacitus compares oratory with poetry as a way of literary life, marking the decline of oratory in public affairs: the Roman Republic had given scope for true eloquence; the empire limited its inspiration. The work reflects his mood at the time he turned from oratory to history.

There were historians of imperial Rome before Tacitus, notably Aufidius Bassus, who recorded events from the rise of Augustus to the reign of Claudius, and Pliny the Elder, who continued this work (*a fine Aufidii Bassi*) to the time of Vespasian. In taking up history Tacitus joined the line of succession of those who described and interpreted their own period, and he took up the story from the political situation that followed Nero's death to the close of the Flavian dynasty.

*The Histories and the Annals.* The *Historiae* began at Jan. 1, 69, with Galba in power and proceeded to the death of Domitian, in 96. The work contained 12 or 14 books (it is known only that the *Histories* and *Annals*, both now incomplete, totaled 30 books). To judge from the younger Pliny's references, several books were ready by 105, the writing well advanced by 107, and the work finished by 109. Only books i–iv and part of book v, for the years 69–70, are extant. They cover the fall of Galba and Piso before Otho (book i); Vespasian's position in the East and Otho's suicide, making way for Vitellius (book ii); the defeat of Vitellius by the Danubian legions on Vespasian's side (book iii); and the opening of Vespasian's reign (books iv–v).

This text represents a small part of what must have been a brilliant as well as systematic account of the critical Flavian period in Roman history, especially where Tacitus wrote with firsthand knowledge of provincial conditions in the West and of Domitian's last years in Rome. The narrative as it now exists, with its magnificent introduction, is a powerfully sustained piece of writing that, for all the emphasis and colour of its prose, is perfectly appropriate for describing the closely knit set of events during the civil war of 69.

This was only the first stage of Tacitus' historical work. As he approached the reign of Domitian, he faced a Roman policy that, except in provincial and frontier affairs, was less coherent and predictable. It called for sharper analysis, which he often met with bitterness, anger, and pointed irony. Domitian's later despotism outraged the aristocratic tradition. It is not known, and it is the most serious gap, how Tacitus finally handled in detail Domitian's reputation. Perhaps his picture of the emperor Tiberius in the *Annals* owed something to his exercise on Domitian.

It is necessary to keep the dating of Tacitus' work in mind. He had won distinction under Nerva and enjoyed the effects of liberal policy; at the same time, he had lived through the crisis of imperial policy that occurred when Nerva and Trajan came to the succession. Under Trajan he retained his place in public affairs, and in 112–113 he crowned his administrative career with the proconsulate of Asia, the top provincial governorship. His personal career had revealed to him, at court and in administration, the play of power that lay behind the imperial facade of rule. He was especially familiar with the effect of dynastic control, which tended to corrupt the rulers, as it had in the period from Vespasian to Domitian, and to reduce the supporting nobles to servility, while only military revolt within Rome or from the frontier legions could change the situation—as it had done at the end of Nero's reign.

From what can be reconstructed from his personal career along with the implications of his subsequent historical thought, it is possible to mark an intellectual turning point in his life after which he began to probe deeper into the nature of the Roman Empire. Although in the *Agricola* he had lightly promised to continue his writing from the Flavian years into the new regime, he now moved not forward but backward. He was no longer content to record the present but felt compelled to interpret the political burden of the past from the time when Tiberius consolidated Augustus' policy of imperial government.

The *Annals* (*ab excessu divi Augusti*), follow-

ing the traditional form of yearly narrative with literary elaboration on the significant events, covered the period of the Julio-Claudian dynasty from the death of Augustus and the accession of Tiberius, in 14, to the end of Nero's reign, in 68. The work contained 18 or 16 books and was probably begun during Trajan's reign and completed early in Hadrian's reign. Only books i–iv, part of book v, most of book vi (treating the years 14–29 and 31–37 under Tiberius), and books xi–xvi, incomplete (on Claudius from 47 to 51 and Nero from 51 to 66), are extant.

In casting back to the early empire Tacitus did not wish necessarily to supersede his predecessors in the field, whose systematic recording he seemed to respect, judging from the use he made of their subject matter. His prime purpose was to reinterpret critically the Julio-Claudian dynasty, when imperial rule developed a central control that, even after the complex military coup d'état in 68–69, would continue under the Flavians. In effect, the *Annals* represents a diagnosis in narrative form of the decline of Roman political freedom, written to explain the condition of the empire he had already described in the *Histories.* Tacitus viewed the first imperial century as an entity. There was (in his eyes) a comparison to be made, for example, between the personal conduct of Tiberius and that of Domitian, not that they were the same kind of men but that they were corrupted by similar conditions of dynastic power. Yet he did not begin with Augustus, except by cold reference to his memory. The modern world tends to think of Augustus as the founder of the empire. The Romans—one may cite Appian of Alexandria and Publius Annius Florus alongside Tacitus—regarded him, at least during the first part of his career, as the last of the warlords who had dominated the republic.

In opening the *Annals,* Tacitus accepts the necessity of strong, periodic power in Roman government, providing it allowed the rise of fresh talent to take over control. That was the aristocratic attitude toward political freedom, but to secure the continuity of personal authority by dynastic convention, regardless of the qualifications for rule, was to subvert the Roman tradition and corrupt public morality. If Augustus began as a warlord, he ended by establishing a dynasty, but the decisive point toward continuing a tyrannical dynasty was Tiberius' accession.

One may, indeed, believe that Tiberius was prompted to assume imperial power because he was anxious about the military situation on the Roman frontier; but Tacitus had no doubts about the security of the Roman position, and he considered the hesitation that Tiberius displayed on taking power to be hypocritical; hence, the historical irony, in interpretation and style, of his first six books. Here, perhaps, Tacitus had some support for his interpretation. A strong, dour soldier and a suspicious man, Tiberius had little to say in his court circle about public affairs. On his death he was blamed for never saying what he thought nor meaning what he said, and Tacitus elaborated this impression. His criticism of dynastic power also stressed the effect of personality: if Tiberius was false, Claudius was weak, Nero was not only unstable but evil, and the imperial wives were dangerous. With regard to provincial administration, he knew that he could take its regular character for granted, in the earlier period as well as his own.

*Sources.* For the period from Augustus to Vespasian, Tacitus was able to draw upon earlier histories that contained material from the public records, official reports, and contemporary comment. It has been noted that the work of Aufidius Bassus and its continuation by Pliny the Elder covered these years; both historians also treated the German wars. Among other sources Tacitus consulted Servilius Nonianus (on Tiberius), Cluvius Rufus and Fabius Rusticus (on Nero), and Vipstanus Messalla (on the year 69). He also turned, as far as he felt necessary, to the Senate's records, the official journal, and such firsthand information as a speech of Claudius, the personal memoirs of Agrippina the Younger, and the military memoirs of the general Gnaeus Domitius Corbulo. For Vespasian's later years and the reigns of Titus and Domitian, he must have worked more closely from official records and reports.

In the light of his administrative and political experience, Tacitus in the *Histories* was able to interpret the historical evidence for the Flavian period more or less directly. Yet contemporary writing may lack perspective. He recognized this problem when, in the *Annals,* he revived the study of the Julio-Claudian dynasty. But to go back a century raises additional problems of historical method. Tacitus first had to determine the factual reliability and political attitude of his authorities and then to adjust his own general conception of the empire, in case it was anachronistic, to the earlier conditions. The strength of his conviction limited his judgment at both points. He underplayed the effect of immediate circumstances and overplayed the personal factor, a tendency that influenced his use of the historical sources. In particular Tiberius, who in spite of his political ineptness struggled with real difficulties, suffered in reputation from this treatment. But Tacitus did not ignore any man in power. He controls the performance of his characters; it is magnificent writing, but it is not necessarily strict history.

*Style and importance.* Because he was a conscious literary stylist, both his thought and his manner of expression gave life to his work. Greek historiography had defined ways of depicting history: one could analyze events in plain terms, set the scene with personalities, or heighten the dramatic appeal of human action. Each method had its technique, and the greater writer could combine elements from all three. The Roman "annalistic" form, after years of development, allowed this varied play of style in significant episodes. Tacitus knew the techniques and controlled them for his political interpretations; as a model he had studied the early Roman historiographer Sallust.

It is finally his masterly handling of literary Latin that impresses the reader. He wrote in the grand style, helped by the solemn and poetic usage of the Roman tradition, and he exploited the Latin qualities of strength, rhythm, and colour. His style, like his thought, avoids artificial smoothness. His writing is concise, breaking any easy balance of sentences, depending for emphasis on word order and syntactical variation and striking hard where the subject matter calls for a formidable impact. He is most pointed on the theme of Tiberius, but his technique here is only a concentrated form of the stylistic force that can be found throughout his narrative.

Tacitus' work did not provide an easy source for summaries of early imperial history, nor (one may guess) was his political attitude popular in the ruling circles; but he was read and his text copied until in the 4th century Ammianus Marcellinus continued his work and followed his style. In modern scholarship Tacitus' writings are studied seriously—with critical reservation—to reconstruct the early history of the Roman Empire. On the literary side they are appreciated as stylistic masterpieces. (A.H.McD./Ed.)

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**Tacitus,** in full MARCUS CLAUDIUS TACITUS (b. *c.* 200—d. *c.* June 276, Tyana, Cappadocia [near modern Niğde, Tur.]), Roman emperor in 275–276.

In the 40 years before Tacitus assumed power the empire was ruled by a succession of usurpers and emperors who had been career army officers. On the murder of the emperor Aurelian in 275, the army council invited the Senate to select a nobleman as head of state. The Senate delayed six months before choosing (September 275) Tacitus, an elderly and wealthy senator who had served twice as consul. During his brief reign Tacitus was engaged in continual warfare with hostile tribes in the Eastern Empire. It is uncertain whether he was murdered by his soldiers or died of disease. His successor was his half brother, Florian, who ruled for three months before being killed by his soldiers.

**Tacloban,** chartered city, northeastern Leyte, Philippines, on San Pedro Bay at the southern entrance to San Juanico Strait. It is the largest city and distributing centre in the eastern Visayas (Leyte and Samar). A port since 1874, Tacloban has a long deepwater wharf, a bulk petroleum depot, and an airport. Hemp, copra, and lumber are exported, and commercial fishing is important. The city is the seat of Divine Word University (1946) and the Leyte Institute of Technology (1966).

Tacloban was an important Allied logistical base during World War II. On Oct. 20, 1944, U.S. General Douglas MacArthur's forces landed at several points along Leyte Gulf, south of the city, which they captured on October 21. Tacloban served as temporary capital of the Philippines until Manila was regained. Red Beach, to the south at Palo, was one of the landing sites and is now a tourist attraction. Inc. city, 1952. Pop. (1990 prelim.) 138,000.

**Tacna,** southernmost *departamento* of Peru, bounded by the Pacific Ocean (southwest), Bolivia (northeast), and Chile (south). It occupies an area of 6,171 square miles (15,983 square km). In the coastal desert of the southwest, settlement depends on irrigation provided by the Locumba and Sama rivers. The northeast lies high in the Andes. The one area of concentrated settlement is around the city of Tacna (*q.v.*), the departmental capital. The department was occupied during the War of the Pacific (1880) by Chileans, who retained it until 1929.

In the irrigated lowlands, grapes and other fruits, cotton, and sugarcane are grown, and the relatively few Indian inhabitants of the highlands produce wheat, barley, and potatoes and raise sheep and alpacas. Tacna is considered to have the most varied and extensive mineral resources (notably of copper) of all Peruvian departments. The department is linked by the Pan-American Highway, by other roads, and by air to cities in coastal and Andean Peru and by road and by rail to Arica, Chile. Pop. (1990 est.) 209,800.

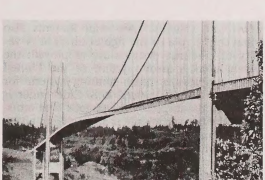
**Tacna,** capital of Tacna *departamento,* southern Peru, on the Caplina River at 1,844 feet (562 m) above sea level, in the arid Andean foothills. When the Spaniards arrived at the site in the 16th century, it was occupied by Aymara Indians. Later, the Spanish town of San Pedro de Tacna was founded, and the surrounding fertile soil and cool climate, as well as proximity to the Pacific port of Arica, Chile, contributed to its prosperity during the colonial era. Silver from Potosí, Bolivia, was also sent to Arica via Tacna. Following the depletion of the mines, Tacna languished, but it gained fame during the wars for independence from Spain, becoming the "Heroic City of Tacna" in 1826. In 1880, during the War of the Pacific, Chileans defeated Peruvian-Bolivian forces at nearby Campo de la Alianza. The Treaty of Ancón (1883) awarded both Tacna and Arica to Chile, but a final settlement in 1929 returned Tacna to Peru.

During Chilean occupation Tacna was modernized greatly. The cathedral, begun in 1872, has been completed.

The city is an agricultural processing centre. Crops include tobacco, grapes, cotton, and sugarcane; tanning, fruit canning, wine making, and liquor distilling are major activities. Tacna has an airport and is linked with Arica, 40 miles (60 km) south, by rail and the Pan-American highway. Roads also lead eastward to Andean settlements. Pop. (1990 est.) 150,-200.

**Tacoma,** city, seat (1880) of Pierce county, western Washington, U.S., on Commencement Bay of Puget Sound, 30 miles (48 km) south of Seattle. The bay was the starting point (1841) of a U.S. surveying party led by Lieutenant Charles Wilkes, who named it Commencement Bay. Settled in 1864, the site was laid out (1868) as Commencement City by General Morton M. McCarver; it was soon renamed Tacoma (the Indian name for Mount Rainier, 45 miles [72 km] southeast). Sawmills and port facilities were established, and in 1873 the Northern Pacific Railway arrived and built a terminus called New Tacoma. The two communities merged and incorporated in 1883.

Tacoma is a headquarters for lumber processing. Although its chief industries are still lumber-based, there are also shipyards, smelters, foundries, electrochemical plants, and food-processing factories. Docks and wharves line its waterfront. A gateway to Mount Rainier National Park, it is also connected to the Olympic Peninsula recreation areas via the second Tacoma Narrows Bridge (1950). (This suspension bridge replaced the famous original, which collapsed in 1940.) Fort Lewis and McChord Air Force Base are to the south. A replica of the Hudson's Bay Company's Fort Nisqually (1833) is in Point Defiance Park. Tacoma is the seat of the University of Puget Sound (1888), the Pacific Lutheran University (1890), and two community colleges. The city also serves as headquarters for the Washington State Historical Society, whose museum overlooks Commencement Bay. Pop. (1990) city, 176,664; Tacoma PMSA, 586,203.



Tacoma Narrows Bridge, Washington, twisting from high winds shortly before its collapse (1940)
F.B. Farquharson



The Narrows of Puget Sound spanned by the second Tacoma Narrows Bridge (1950) with the city of Tacoma and Mt. Rainier in the distance
Bob and Ira Spring

**Tacoma Narrows Bridge,** first suspension bridge across the Narrows of Puget Sound, connecting the Olympic Peninsula with the mainland of Washington, and a landmark failure in engineering history. Four months after its opening, on the morning of Nov. 7, 1940, in a wind of about 42 miles (68 km) per hour, the 2,800-foot (853-metre) main span, which had already exhibited a marked flexibility, went into a series of torsional oscillations the amplitude of which steadily increased until the convolutions tore several suspenders loose, and the span broke up. An investigation disclosed that the section formed by the roadway and stiffening-plate girders (rather than web trusses) did not absorb the turbulence of wind gusts; at the same time, the narrow, two-lane roadway gave the span a high degree of flexibility. This combination made the bridge highly vulnerable to aerodynamic forces, insufficiently understood at the time. The failure, which took no lives because the bridge was closed to traffic in time, spurred aerodynamic research and led to important advances. The plate girder was abandoned in suspension-bridge design; the Tacoma Narrows Bridge was replaced in 1950 by a new span stiffened with a web truss.

**Taconic orogeny,** a mountain-building event that affected the Appalachian Geosyncline along the eastern coast of the United States. Evidence for the orogeny is most pronounced in the northern Appalachians, but its effects can be noted in the Ridge and Valley Province as far south as Tennessee and in the Piedmont Province as far south as Georgia. Originally thought to have occurred at approximately the Ordovician-Silurian boundary (about 438 million years ago), the Taconic orogeny is now considered by most investigators to have consisted of several pulses that extended from the mid-Ordovician Period up into the early part of the Silurian Period.

Events ascribed to this orogeny include the development of angular unconformities in strata of the northern Appalachians, the Taconic allochthone (overthrust and displaced block) in New York, the uplift of the Green Mountains in Vermont, the development of clastic wedges of sediment (Queenston Delta in New York and the Blount Group in Tennessee), and igneous intrusion and regional metamorphism in both the northern and southern Appalachians. The Taconic orogeny may be considered an early phase of the Caledonian orogeny in western Europe.

Thrust faulting occurred in a vast zone extending from the western coast of Newfoundland, southward along the St. Lawrence valley and New York, and into Pennsylvania. This zone of thrust faulting is known as Logan's Line, after Sir William Logan, the Canadian geologist who first recognized its significance. Strata to the west of Logan's Line have been little disturbed by Paleozoic deformation, whereas east of the line, Ordovician and older strata have been extensively deformed. The Ordovician shale facies is badly crushed, faulted, and overthrust westward in masses known as klippen, one of which forms the present Taconic Range.

**Taconic Range,** part of the Appalachian mountain system, U.S., extending southward for 150 miles (240 km) from a point southwest of Brandon, Vt., to northern Putnam county, New York. It rises to Mount Equinox (3,816 feet [1,163 m]) in Vermont and includes Mount Frissell (2,380 feet [725 m]), the highest point in Connecticut. In Massachusetts the mountains constitute the western section of the Berkshire Hills. Taconic State Park, in New York, is a popular mountain recreation area. The name Taconic probably derives from an Algonkian Indian word referring to a tree, a wood, or a forest.

**taconite,** a low-grade siliceous iron formation in Minnesota, U.S., from which high-grade iron ore is derived. The iron formation consists of fine-grained silica with variable ratios of hematite and magnetite totaling less than 30 percent iron. Recovery of the iron requires fine grinding and concentration of iron-bearing phases, which in turn are formed into pellets suitable for blast furnaces. As high-grade deposits of iron ore have become depleted, taconite deposits have increased in importance as a source of iron ore.

**tactical weapons system,** system integrating tactical weapons with electronic equipment for target acquisition, aiming, or fire control or a combination of such purposes. Tactical weapons are designed for offensive or defensive use at relatively short range with relatively immediate consequences. They include weapons used for antitank assault, antiaircraft defense, battlefield support, aerial combat, or naval combat.

Unlike strategic weapons systems, which are operated by only a handful of nations, tactical weapons systems are ubiquitous: in one version or another they are manufactured by at least 15 countries, and in one form or another they occur in virtually every country that has an army, navy, air force, or guerrilla or terrorist organization of any consequence. They are generally classified according to their point of launching (surface or air) and their target location (also surface or air).

*Surface-to-surface systems.* Antitank weapons usually employ a guided missile carrying a shaped-charge warhead that is designed to blast through armour. With wire-guided missiles such as the U.S. TOW or the Franco-German HOT, a wire unreels behind the missile and the operator signals course corrections to a control mechanism inside the missile as it flies. Other missiles are guided by radio, infrared, and laser beams. The U.S. Copperhead is a laser-guided artillery projectile fired from a conventional 155-millimetre howitzer. The gunner focuses a laser on the target momentarily after the projectile is in flight, and a sensor in the weapon is imprinted with the image of the target and operates control flaps to steer the missile to it.

Battlefield support weapons include such ballistic missiles as the U.S. Lance and the French Pluton, which have ranges of about 75 miles (120 km). These systems, which can deliver nuclear warheads, incorporate vehicles to launch the missiles and to house command and fire-control computers and other equipment.

Complementing conventional artillery are truck-mounted multiple-rocket launchers,

which can decimate battlefields or truck convoys with dozens of unguided rockets carrying high explosives, antipersonnel or antiarmour bomblets, or even toxic gas.

Shipborne guided-missile systems are quite varied. Israel's Gabriel system is operated at a computerized control console by one person, who can feed targeting data to the missile before launch and, if desired, during flight. The versatile Otomat system developed by a French-Italian consortium can be used with any radar system and any fire-control system. It is shipped to the purchaser in a case that serves as a launching tube.

Underwater weapons, intended to disable submarines or surface vessels, are considered surface-to-surface systems. They include various homing or guided torpedoes using sonar tracking systems. Germany makes a wire-guided torpedo. Sweden's antisubmarine weapons system uses a missile that is preprogrammed for its course on the basis of sonar information. One of the most intricate underwater systems is a submarine-launched, rocket-propelled missile such as the U.S. Subroc and the Soviet SS-N-15. These missiles break the ocean surface, streak through the air at supersonic speed for about 30 miles (50 km), and then release a nuclear depth bomb that drops back into the water and sinks to the level of the target before exploding.

*Surface-to-air systems.* Land-based anti-aircraft systems include guided missiles for farther ranges and automatic guns for close-in fire against aircraft and missiles. Missiles are frequently mounted in clusters on a single tank or truck chassis (as with many of the Soviet SA series), towed on trailers (as with the British Rapier), or operated from an infantryman's shoulder (as with the U.S. Stinger). Missiles are frequently of the solid-propellant type and may be guided by radar or infrared sensors or by a human operator using optical tracking. In the U.S. Patriot system, as many as eight mobile missile-launching stations, each holding four missiles, may be controlled from one mobile control centre, which integrates radar sighting and tracking, identification, missile guidance, and other information.

The Swiss Flakpanzer antiaircraft tank uses a three-man crew to operate the tank, its radar-controlled firing system, and twin 35-millimetre guns that fire at the rate of 1,100 rounds per minute. Shipboard systems are essentially similar. The Italian Albatros system utilizes the existing fire-control system for a warship's guns to control an added system employing the Apside homing missile.

*Air-to-surface systems.* Most of these systems are enhancements of the role of the attack aircraft and the assault helicopter. What the weapons system brings to the aircraft and its guns or missiles is sophisticated sighting and tracking and fire-control equipment. The weapons involved vary widely in size. The Soviet AS-4 missile is more than 36 feet (11 m) long and is launched by a Tupolev bomber. It is presumed to be inertially guided until it approaches its selected target, when it homes in on the target. The French Beluga system is a cluster of small grenades encased in a bomb that is released over the target area—such as a group of tanks—where it then ejects the grenades. They descend by parachute and, if they hit on or near a tank, they detonate on impact; if they miss, they lie on the ground as mines and detonate when a tank approaches. A European consortium produces a Martel air-to-surface missile that carries a television camera in its nose, transmitting back to the control console in the airplane that released it an image of the target; the controller, by radio signals, then flies the missile to the point where a homing device takes over.

*Air-to-air systems.* Air-to-air systems also enhance the role of the fighter aircraft. A variety of guidance systems are employed: the widely used Sparrow system of the United States employs a radar homing system for guidance; the much-used U.S. Sidewinder is guided to the target by the target's heat emission. One French missile is adaptable to either radar or infrared guidance. An Israeli missile system, known as Python 3, is said to have shot down 50 Syrian aircraft in the invasion of Lebanon in 1982. When that system detects an airplane within range, it lights an indicator lamp and sounds a warning in the cockpit of the aircraft carrying the missile. The pilot then may operate the launch button, and the system does the rest. A U.S. sighting development corrects the course of a missile after launch by radio signals generated by computer from the electronically monitored motions of the pilot's eyes as he watches the target aircraft. *See also* strategic weapons system.

**tactics,** in warfare, the art and science of fighting battles on land, on sea, and in the air. It is concerned with the approach to combat; the disposition of troops and other personnel; the use made of various arms, ships, or aircraft; and the execution of movements for attack or defense.

A brief treatment of tactics follows. For full treatment, *see* MACROPAEDIA: War, Theory and Conduct of.

The great military leaders of history have been supreme tacticians who followed fluid and flexible courses on the battlefield. Their performances have been judged on the basis of how they have respected the material advantages and disadvantages of the time as applied to particular principles of war, such as security, mobility, surprise, and concentration of force, which singularly or collectively were necessary for victory. Throughout history various commanders have practiced orthodox, unorthodox, offensive, defensive, aggressive, and delaying tactics.

Tactics can be generally understood as the problems encountered in actual fighting. Tactical thinking attempts to coordinate personnel with the existing weapons technology and apply both to the terrain and enemy forces in such a way that the weapons available to a fighting force are used to best advantage. In the pre-gunpowder era, infantry equipped with spears, pikes, or swords would be massed close together. Fighting would be conducted as close to the enemy as possible in order to get the greatest and most accurate use of the various types of blades. Reserves would be stacked many ranks deep to ensure immediate replacement of fallen combatants.

Since the development of hand-held firearms, methods of grouping have evolved steadily away from close formations. Dispersing firearm-equipped soldiers serves to provide a more difficult target for enemy weapons and at the same time spreads the offensive threat over a far wider area by taking advantage of the range of gunfire.

Deployment is an important part of the tactical operation. Deployment refers to the placing of each type of weapon (or a unit of personnel using similar weapons) where it can do the most damage to the enemy or provide the most protection to one's own forces. For instance, a tactician seeking to turn the enemy's flank might position the strongest, most mobile units opposite that flank, while defensive and ponderous weapons would be positioned to protect the remaining units and the supplies. Timing and direction of attack are also important tactical considerations. At sea, direction has traditionally been crucial, especially in the era of wind-powered warships. In recent wars, timing has been a crucial factor in mounting airborne strikes so as to take advantage of the element of surprise. Methods of disengagement can also be crucial in combat, as when a deception is to be carried out or a defeated army preserved. The success of a given set of tactics not only depends on the reliability and power of the weapons involved; it also depends on the thoroughness with which troops and operators are trained in those tactics.

**Tacticus, Aelianus:** *see* Aelianus.

**tactile corpuscle** (biology): *see* Meissner corpuscle.

**Tacuarembó,** formerly SAN FRUCTUOSO, city, north-central Uruguay. The Haedo Mountains dominate the adjoining area. Orchids and hardwoods, including quebracho, algarrobo, urunday, and guayabo, grow there. Founded in 1831 by Bernabé Rivera, it was first called Villa de San Fructuoso; later, it adopted the Guaraní Indian name Tacuarembó (from a firm, slender reed endemic to the region). The city's Indian and gaucho past is represented in the Indian Museum (Museo del Indio).

Tacuarembó lies on the railway from Montevideo into Brazil and has developed essentially as a one-industry city, processing meat, wool, hides, and tallow, used to make soap and shortening. As an administrative centre, however, it employs a substantial civil service force and has begun to develop a tourist industry. Tacuarembó has a government-owned television and radio station. The cathedral of San Fructuoso (completed in 1834) dominates the main plaza. Pop. (1985) 40,513.

**Tadjoura, Gulf of,** French GOLFE DE TADJOURA, gulf indenting the coastline of Djibouti, eastern Africa, located at the extreme western end of the Gulf of Aden. It provides some shelter for the port of Djibouti on the southeastern shore of the gulf. The gulf is 35 miles (56 km) wide at the mouth and 50 miles long, with a depth of as much as 3,550 feet (1,082 m) near the centre. It is about 164 feet deep off the coast of Djibouti. The coastline is rather barren and inhospitable, inhabited mostly by pastoral nomads. Obock and Tadjoura are the only other towns of any importance along the gulf, neither of which is a major port. The closing of the Suez Canal from 1967 to 1975 decreased shipping traffic in the gulf.

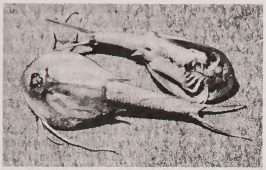
**Tadmor,** also spelled TADMUR (ancient Syria): *see* Palmyra.

**Tādoba National Park,** national park in Mahārāshtra state, western India. Extending over an area of 45 square miles (117 square km), the park consists of dense forests of sal (*Shorea*), margosa, mahua, and mango, interspersed with lakes and plains; stretches of bamboo thickets are found around Tādoba Lake, for which the park is named. It was established as a wildlife sanctuary in 1935 and declared a national park in 1955. The park has tigers, panthers, leopards, chital, jackals, gaurs (Indian bison), mouse deer, sambars, antelope, sloth bears, and crocodiles. A network of roads and observation towers facilitate wildlife viewing.

**tadpole,** also called POLLIWOG, aquatic larval stage of frogs and toads. Compared with the larvae of salamanders, tadpoles have short, oval bodies, with broad tails, small mouths, and no external gills. The internal gills are concealed by a covering known as an operculum.

Most tadpoles are vegetarians, although those of some species are carnivorous or even cannibalistic. Tadpole metamorphosis follows a pattern of gradual development of fore- and hind-limbs, resorption of the tail, shortening of the intestine, disappearance of the gills, and development of lungs. Upon completion of metamorphosis, the tadpole emerges onto land as a young frog or toad.

**tadpole shrimp** (order Notostraca), any member of a small group of crustaceans (class



(Top) Ventral and (bottom) dorsal surfaces of tadpole shrimp (*Triops longicaudatus*)
William E. Ferguson

Branchiopoda), composed of the genera *Triops* and *Lepidurus*. The approximately 15 known species are strictly freshwater forms, inhabiting lakes, ponds, and temporary pools, chiefly in Europe and North America. The common name tadpole shrimp derives from the animal's distinctive body shape—a large, oval shell-like carapace and a slender, flexible abdomen with a long, forked tail. Extending up to 100 mm (4 inches) in length, the body may have as many as 40 segments, some with several pairs of leaflike appendages. Certain species have up to 70 pairs of limbs. Tadpole shrimp typically dwell at the bottom of bodies of water, feeding on organic debris or preying on small aquatic animals and larvae. Their eggs, which are highly resistant to desiccation, may survive in the soil for many years after temporary pools have dried up; they hatch when the pools have refilled with water.

**Tadzhik** (people): *see* Tajik.

**Tadzhikistan:** *see* Tajikistan.

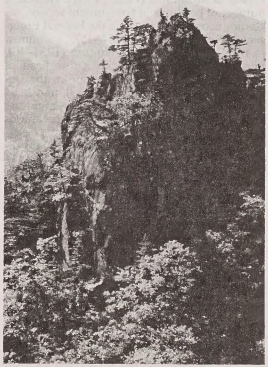
**tae kwon do** (Korean: "art of kicking and punching"), Korean art of unarmed combat that is based on the earlier form of Korean self-defense known as tae kyon and on karate. The name tae kwon do was officially adopted for this martial art in 1955 after that name had been submitted by the South Korean general Choi Hong Hi, the principal founder of tae kwon do.

Tae kwon do is characterized by the extensive use of high standing and jump kicks as well as punches and is practiced for sport, self-defense, and spiritual development. Training in tae kwon do is carried out by learning individual techniques of kicking, punching, and blocking, which are practiced in combined series of techniques in traditional sets known as *hyung*. (Proficiency in the graded series of *hyung* determines rank in the lower grades.) Students also practice basic sparring combinations (*id-bo tueryon*, "one-step sparring"); these are short, set sequences of attack and counter practiced between partners, after which the students may practice free sparring as opponents. In sparring, blows are stopped just short of contact. Tae kwon do is practiced as a sport by awarding points to correctly executed techniques during free sparring or by judging the quality of performed *hyung*. *See also* martial art.



Tae kwon do sparring match, with referee behind the contestants, 1988 Olympics, Seoul, S.Kor.
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**T'aebaek Mountains,** Korean T'AEBAEK-SANMAEK, main ridge of the Korean Peninsula, stretching along the coast of the Sea of Japan (East Sea), north to Hwangnyong Mountain (4,160 feet [1,268 m]), North Korea, and continuing south as the Kyŏngsang Range to Tadae-p'o, a suburb of Pusan, South Korea. The T'aebaek range is 300 miles (500 km) long and averages 2,600–3,300 feet (1,000 m) in height. Peaks include Kŭmgang (5,374 feet [1,638 m]), Sŏrak (5,604 feet [1,708 m]), Odae (5,128 feet [1,563 m]), and T'aebaek (5,121 feet [1,561 m]). The eastern side of the range forms a steep fault line to the coast, but the western side forms a gentle incline. Many spurs, such as the Sobaek, Charyŏng, and Kwangju mountains, stretch southwest. South Korea's most important rivers, among them the Han, Naktong, and Kŭm, originate in the T'aebaek Mountains. Mineral resources include iron, coal, tungsten, fluorite, and limestone, and there are extensive forests.



Sŏrak Peak in the T'aebaek Mountains, Kangwŏn province, South Korea
Kim—Bavaria Verlag

**Taedong River,** Korean TAEDONG-GANG, river, southern North Korea, rising in the Nangnim Mountains in Hamgyŏng-nam *do* (province). It flows 273 miles (439 km) southwestward to enter Korea Bay, an arm of the Yellow Sea, at Namp'o. With its tributaries it forms a drainage basin of 7,855 square miles (20,344 square km). Because of its deep water and the tidal influence of the Yellow Sea, it is useful for water transportation, and many river ports, such as P'yŏngyang, have been developed along its course. It is navigable for ships of 4,000 tons to Songnim and for ships of 2,000 tons to 40 miles (65 km) from the mouth of the river. Farther upstream it is extensively utilized for irrigation.

**Taegu,** also spelled TAIKU, or DAEGU, city and provincial capital, Kyŏngsang-puk *do* (province), southeastern South Korea. Taegu is Korea's third largest city and has the status of a special city, with administrative status equal to that of a province. It lies east of the confluence of the Naktong and the Kŭmho rivers and 55 miles (90 km) north-northwest of Pusan. The city lies in a valley rimmed by low mountains that reach heights of 3,500 feet (1,100 m).

For centuries Taegu was the administrative, economic, and cultural centre of southeastern Korea. During the Yi dynasty (1392–1910) it was the capital of the province of Kyŏngsang (until the province was divided into North and South Kyŏngsang in 1896) and one of the country's three big market cities. Taegu underwent explosive growth from the 1950s and increased tenfold in population in the decades after the Korean War (1950–53). The city's textile industries are particularly important, and there are also metal and machine-building industries. Taegu is best known, however, for the quality of the apples grown in the surrounding area, which are exported throughout East and Southeast Asia. The local apple-growing industry began to prosper after U.S. missionaries in the early 20th century grafted cuttings from American apple trees onto the local crab apple trees.

West of Taegu lies the Haein Temple, a Buddhist temple complex that was begun in AD 802 and contains a number of valuable religious treasures, chiefly the Tipiṭaka. The latter is a collection of more than 80,000 wooden blocks engraved with Buddhist scriptures. Carved in the 13th century, these blocks contain the most complete set of Buddhist religious texts in Asia.

Among Taegu's other attractions are the Talsong Fortress, a fort that protected Taegu for many centuries but is now a popular park, and Apsan Park, from which a cable car takes visitors up to Ap Mountain for views of the city. Taegu is home to five universities and several colleges, chief among them Kyongbuk National University (founded 1946) and Yongnam University. The city is connected with Seoul and Pusan by air, rail, and highway. Other railways and roads intersect at the city. Area 176 square miles (456 square km). Pop. (1995) 2,449,420.

**Taehan:** *see* Korea.

**Taejŏn,** also spelled DAEJEON, city and provincial capital, Ch'ungch'ŏng-nam *do* (province), southeastern South Korea. Taejŏn has the status of a special city, with administrative status equal to that of a province. Until

the end of the Yi dynasty (1392–1910) it was a poor village located on the Taejŏn River. Development began after the juncture of rail lines in 1905 and 1914. It is connected with Seoul (104 miles [167 km] to the north-northeast), Pusan, and Mokp'o by rail and highway. During the Korean War (1950–53) it was a temporary capital of the Republic of Korea, and 70 percent of the city was destroyed, but it has been rebuilt. The manufacture of cotton textiles, machinery, chemicals, and hides has been developed. Chungnam National University and five other colleges are located there. Yusŏng, 7 miles (11 km) northwest, is a hot springs bathing resort. Pop. (1995) 1,272,121.

**tael,** a Chinese unit of weight that, when applied to silver, was long used as a unit of currency. Most taels were equivalent to 1.3 ounces of silver.

China did not have a national currency until 1933, and hence external trade was conducted in foreign currencies and internal trade in ounces, or taels, of silver. The tael was seldom minted in the form of a coin but rather served as a standard unit of account; actual transactions were completed with ingots of silver, with bank notes or checks expressed in taels, or with silver coins, especially the Spanish or Mexican dollars that flowed into China in great volume in the 18th and 19th centuries. Bar silver imported into China by the Spaniards and others was remelted and cast into specially shaped ingots weighing about 50 taels; these were known as sycees and formed a considerable part of China's bank reserves until 1933.

Taels varied considerably in weight over China, depending on the scales used in a particular region or locality. The most important currency tael was the Shanghai tael, whose fine-silver equivalent was 518 grains. The Shanghai tael's exchange value fluctuated with the price of silver in London and New York City and was the basis for wholesale trade and foreign-exchange transactions in China's most important commercial city.

From ancient times the money used by the common people in small transactions was the cash, a bronze coin that was equal in value to one-thousandth of a tael. Beginning in the late 19th century, however, retail trade began to be conducted with Mexican and, later, Chinese silver dollars, fractional silver coins, and 10-cash copper pieces. Finally, in 1933 China's Nationalist government officially abolished the tael, replacing it with the new Chinese standard dollar, or yuan, which remains the basic unit of China's currency.

**Taenia,** genus of tapeworms parasitic in mammals. *See* tapeworm.

**taeniodont,** any member of an extinct order (Taeniodonta) of mammals that lived in North America throughout the Paleocene and into the middle Eocene Epoch (66.4 to 43 million years ago). The taeniodonts may have been related to early edentates (insect-eating mammals) and probably evolved from an insectivorous to an herbivorous diet. They were distinguished by high-crowned teeth extending far into the skull.

The single known family, Stylinodontidae, consists of two subfamilies, Conoryctinae and Stylinodontinae. The Conoryctinae were rather generalized forms with no special peculiarities, though they did gradually increase in size during the Paleocene from that of an opossum to that of a small bear. The Conoryctinae did not survive the close of the Paleocene Epoch. The Stylinodontinae, by contrast, became progressively more specialized. The stylinodonts culminated in forms with extremely short and broad skulls; deep, massively built lower jaws; rootless teeth; and limbs tipped by very large, long claws that were used for either grasping or digging. The animals' canine teeth were extremely large and specialized for gnawing; claws and teeth together suggest adaptation to a specialized diet, the nature of which remains unknown.

**Taeuber, Conrad; and Barnes-Taeuber, Irene,** *née* BARNES (respectively b. June 15, 1906, Hosmer, S.D., U.S.; b. Dec. 25, 1906, Meadville, Mo., U.S.—d. Feb. 24, 1974, Hyattsville, Md.), American demographers, statisticians, and social scientists whose scholarly work in census helped found the science of demography and made them authorities on population movements in the United States.

Conrad Taeuber was educated at the University of Minnesota (Ph.D., 1931). He held a number of positions in government service, including economic analyst in the Federal Emergency Relief agency (1934–35), economist in the Department of Agriculture (1935–40), principal social scientist and acting head of farm population and rural welfare in the Department of Agriculture (1942–43), and head economist in the Department of Agriculture (1943–46). He worked for the United Nations Food and Agricultural Organization (1946–51) and the U.S. Census Bureau (assistant director, 1951–68; associate director, 1968–73). From 1973 he was senior professor of demography at the Kennedy Institute of Georgetown University in Washington, D.C. After he married Irene Barnes, they collaborated on their work in the field of demography and on two publications considered to be standard works in the field.

Irene Barnes received her B.A. (1927) from the University of Missouri, her M.A. (1928) from Northwestern University, and her Ph.D. (1931) from the University of Minnesota. She married Conrad Taeuber in 1929, and they shared a professional interest in government statistics and demography until her death in 1974. Barnes-Taeuber became research associate in the Office of Population Research at Princeton University (1936–61), and then senior research demographer (1962–74). While director of the census library project for the Library of Congress and the Bureau of the Census (1941–44), she wrote *General Censuses and Vital Statistics in America* (with F.W. Notestein, 1943) and *The Population of Europe and the Soviet Union* (1943). *The Population of Japan* (with Conrad Taeuber, 1958) and *The Changing Population of the United States* (with Conrad Taeuber, 1958) are classics in demography. Her articles written for *Population Index,* a journal she edited from 1937 to 1954, are similarly valuable.

**Taewŏn-gun,** also called YI HA-ŬNG (b. 1821—d. 1898), father of the Korean king Kojong.

As regent from 1864 to 1873, Taewŏn-gun inaugurated a far-ranging reform program to strengthen the central administration; he modernized and increased its armies and rationalized the administration. Opposed to any concessions to Japan or the West, Taewŏn-gun, though out of power, helped organize the anti-Japanese outbreak in 1882. Considered a troublemaker, he was then kidnapped and taken to China for three years. By the time he returned, his power and many of his reforms had been eliminated.

**Tafari Makonnen** (Ethiopian emperor): *see* Haile Selassie.

**Tafelberg** (South Africa): *see* Table Mountain.

**Taff-Ely,** district, Mid Glamorgan county, southern Wales. Created in 1974, it comprises the upland valleys of the Taff and Ely rivers and a lower, undulating region to the south. Taff-Ely district borders the districts of Rhondda and Cynon valley to the north, Rhymney valley and Cardiff to the east, Vale of Glamorgan to the south, and Ogwr to the west. Located on a hill east of the village of Llantrisant, the earthen ramparts of the hill fort of Caerau provide evidence of Iron Age settlement. In 1245 Richard de Clare built a Norman castle in Llantrisant, and in 1326 Edward II was held in the castle after he was caught fleeing Chepstow in an attempt to escape an army led by his queen, Isabella, and her lover, the deposed baron Roger Mortimer.

Mining communities in the Taff and Ely valleys first experienced industrial growth during the exploitation of the South Wales coalfield in the late 18th and early 19th centuries. The accelerating economic decline of the Great Depression of the 1930s, and persistent unemployment resulting from the replacement of coal by oil, left the region in dire straits. Light industries and industrial estates have been established, however, particularly in such southern towns as Llantrisant and Treforest; these draw many workers who commute from the older mining towns in the north. Other settlements in southern Taff-Ely (including Creigian and Pentyrch) function as residential towns for commuters employed in Cardiff. Pontypridd, the administrative centre of the district and a shopping centre for both the Taff and Rhondda valleys, is noted for its 140-foot (43-metre) single-span bridge, built by William Edwards in 1755. The district was dissolved in 1996, and its territory was divided between Cardiff county and Rhondda Cynon Taff county borough.

**Taff Vale case** (1900–01), in Great Britain, the successful trial of a suit brought by the Taff Vale Railway Company against the Amalgamated Society of Railway Servants (ASRS) in which the courts held that a union could be sued for damages caused by the actions of its officials in industrial disputes. Opposition to the decision did much to spur the growth of the nascent British Labour Party.

In August 1900, members of the ASRS went on strike for higher wages and union recognition but settled within a fortnight when the company employed strikebreakers; the workers gained virtually nothing but the company's promise of reemployment. During the strike the company began legal action against the union, claiming that picketing was in violation of the Conspiracy and Protection of Property Act of 1875. The ASRS held that because it was neither a corporation nor an individual it could not be held liable. Justice Sir George Farwell decided against the union, and in 1901 his decision was upheld in the House of Lords. The verdict, in effect, eliminated the strike as a weapon of organized labour. Workers turned to the Labour Party for redress; between 1900 and 1906 the number of Labour members of Parliament rose from 2 to 29, and the liberal government's Trade Disputes Act of 1906 nullified the effect of the decision.

**taffeta,** fine, crisp plain-woven fabric with a faint weft, or filling-way, rib due to the greater number of warp threads than filling threads. It frequently has a lustrous surface. There are two distinct types of silk taffeta: yarn-dyed and piece-dyed. Yarn-dyed taffeta has a stiff handle and a rustle known as scroop, or froufrou. It is used for evening dresses and for underskirts for couture dresses in chiffon or georgette and is also used for academic hood linings. Piece-dyed taffeta, which is soft and washable, is a favourite fabric for linings. It is also used for electrical insulation, and a particularly strong form was much used for parachutes during World War II.

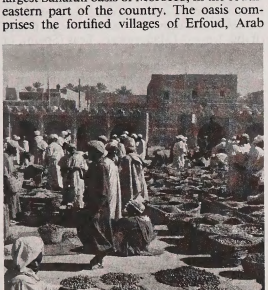
**taffy,** flavoured syrup candy of Europe and the Americas that is cooked and then rigorously worked during cooling into a hard, chewy, glossy mass. Although the great 19th-century demand for taffy gave way in the mid-

20th century to the popularity of chocolates and caramels, taffy remained widely available in its original "penny candy" form of small, colourfully wrapped pieces.

The basic recipe for taffy calls for sugar and molasses or corn syrup to be heated with water to a prescribed temperature. This cooked mass is then poured over cooling slabs and flavoured with essential oils. As it cools, the candy is rhythmically pulled, spread, and folded until it takes on a firm, satiny consistency. Saltwater taffy, once a staple of amusement parks and ocean resorts, took its name from a characteristic ingredient.

Toffee, a brittle confection of English origin, is a highly cooked mixture of syrup and butter to which nutmeats, flavourings, and colourings are commonly added during cooling.

**Tafilalt,** also spelled TAFILET, OF TAFILALET, largest Saharan oasis of Morocco, in the southeastern part of the country. The oasis comprises the fortified villages of Erfoud, Arab



Date market at Rissani, Tafilalt, Mor.
By courtesy of UNESCO: photograph, Gerda Bohm

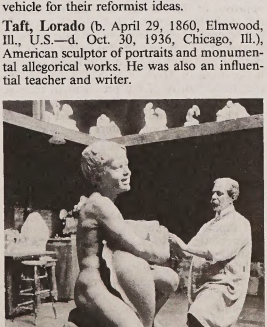
Sebbah‹du Ziz, Rissani, Seffalat, Aoufous, and Jorf, together with palm groves stretching 30 miles (50 km) along the Wadi Ziz. Its old capital was the Berber stronghold of Sijilmassa, founded in AD 757 on the Saharan caravan route from the Niger River to Tanger (Tangier). A prosperous city, it was destroyed in 1363, rebuilt by Moulāy Ismā'īl (1672–1727), and devastated in 1818 by Ait Atta nomads. The only planned village of the oasis, Rissani, was built near Sijilmassa's ruins. Tafilalt is noted for its dates, most of which it exports. It has tanning and handicraft industries, and its main trading centre is Erfoud at the base of Mount Erfoud. Pop. (1982) 151,003.

**tafsīr** (Arabic: "explanation"), the science of explanation of the Qur'ān, the sacred scripture of Islām, or of Qur'ānic commentary. So long as Muḥammad, the Prophet of Islām, was alive, no other authority for interpretations of the Qur'ānic revelations was recognized by Muslims. Upon his death, however, commentaries were needed because the text, when it achieved written form, lacked historical sequence in the arrangement of materials, suffered from ambiguity of both text and meaning, showed a variety of differing readings, was recorded in a defective script, and even contained apparent contradictions. Many Muslims in the early period sought to explain the Qur'ān on the basis of pure personal speculation, known as *tafsīr bir-ra'y,* and such interpretation, though generally disapproved, has persisted down to the present time. Others explained or embellished Qur'ānic passages using stories drawn from Christian—and especially from Jewish—sources (*Isrā'īlīyyāt*). To counter the arbitrariness of such interpretation, in the fourth Islāmic century (10th century AD) there emerged the religious science called *'ilm al-tafsīr,* a systematic exegesis of the Qur'ānic text, which proceeds verse by verse, and sometimes word by word. Over time this science developed several methods and forms of its own.

The Hungarian scholar Ignāz Goldziher traced the development of *tafsīr* through several stages. In the first, or primitive, stage, Muslims were concerned principally to establish the proper text of the Qur'ān. The second stage, known as traditional *tafsīr,* featured explanations of Qur'ānic passages based upon what the Prophet himself or his companions said these passages to mean. It relied, therefore, upon the traditions (Ḥadīth) or reports of the sayings of Muḥammad and his immediate associates. As Muslims sought to establish their identity as a religious community and to define their doctrinal stance, there arose a dogmatic type of *tafsīr.* The Qur'ān was interpreted by various sectarian groups to establish their own peculiar doctrinal positions; notable among them were the Mu'tazilah, so-called rationalists, who insisted that interpretation (*ta'wīl*) of the Qur'ān must conform with reason. Ṣūfīs (Muslim mystics) and Shī'ites with esoteric inclinations also practiced *ta'wīl,* departing sharply from a purely external analysis. (*See* Bāṭinīyah.) A British scholar, John Wansbrough, classified *tafsīr* literature according to its form and function. He distinguished five types, which he held to have appeared in roughly the following chronological order: attempts to supply a narrative context for passages, efforts to explain the implications for conduct of various passages, concern with details of the text, concern with matters of rhetoric, and allegorical interpretation.

The monumental commentary compiled by the historian aṭ-Ṭabarī (838/839–923) assembled all the traditional scholarship that had been produced until his time. It remains the most basic of all *tafsīrs.* Subsequent commentaries of note include those by az-Zamakhsharī (1075–1143), ar-Rāzī (1149–1209), al-Bayḍāwī (d. 1280), and as-Suyūṭī (1445–1505). Commentaries continue to be compiled at the present time; Muslim modernists, for example, have used them as a vehicle for their reformist ideas.

**Taft, Lorado** (b. April 29, 1860, Elmwood, Ill., U.S.—d. Oct. 30, 1936, Chicago, Ill.), American sculptor of portraits and monumental allegorical works. He was also an influential teacher and writer.



Lorado Taft, 1913
By courtesy of the Chicago Historical Society

Taft graduated from the University of Illinois and attended the École des Beaux-Arts (1880–85). His long career as teacher and public lecturer began at the Art Institute of Chicago in 1886. He was elected to the National Academy of Design in 1911 and was active in planning for public education in art, serving (1914–17) as director of the American Federation of Arts. In 1903 he published *The History of American Sculpture,* the first comprehensive work on the subject. His *Modern Tendencies in Sculpture* was published in 1921.

Taft's work is in the vein of late 19th-century academic sculpture and consists largely of allegories composed of gracefully idealized figures—*e.g.,* Fountain of the Great Lakes (1913; Art Institute of Chicago) and The Fountain of Time (1922; in Washington Park, Chicago, Illinois). Midway Studios, Taft's former home, is preserved as a national monument on the campus of the University of Chicago.

**Taft, Robert A.,** in full ROBERT ALPHONSO TAFT (b. Sept. 8, 1889, Cincinnati, Ohio, U.S.—d. July 31, 1953, New York, N.Y.), Republican leader in the U.S. Senate for 14 years (1939–53) whose espousal of traditional



Robert A. Taft, 1940
By courtesy of the Library of Congress, Washington, D.C.

conservatism won him the sobriquet "Mr. Republican"; his failure to receive the presidential nomination in 1948 and 1952 was indicative of the defeat of isolationism by the internationalist wing of the party.

The son of William Howard Taft, 27th president of the United States (1909–13), Taft was admitted to the Ohio bar in 1913. Specializing in trust and utility cases, he also became a director of several successful businesses. During World War I he served as assistant counsel for the U.S. Food Administration (1917–18) and counsel for the American Relief Administration (1919). He then served in the Ohio House of Representatives (1921–26) and in the state senate (1931–32).

Elected to the U.S. Senate in 1938, Taft soon established himself as a powerful influence in Washington D.C., denouncing the "socialist trends" of the New Deal and calling for economy in government, a balanced budget, and less centralization of power in the nation's capital. Before the Japanese attack on Pearl Harbor (December 1941), he was an outspoken anti-interventionist; afterward, he threw his weight behind the war effort but was often critical of President Franklin D. Roosevelt's war policies.

With the election of a Republican majority to Congress in 1946, Taft entered a new phase of power and prestige. He was tireless as chairman of the Republican Senate Policy Committee and well informed on the whole range of legislation before Congress. His most notable achievement was the enactment of the Taft-Hartley Labor Relations Act (1947), which placed restrictions on organized labour and, according to its sponsors, sought to balance the bargaining rights of management and

labour. Although he sponsored modified social welfare measures in housing, health, and education, he continued to oppose centralization of power in the federal government.

A steadfast isolationist, Taft opposed U.S. post-World War II involvement in world affairs through such international organizations as the North Atlantic Treaty Organization (NATO), founded in 1949. Rather, he joined former president Herbert Hoover in calling for "fortress America" and the "principle of the free hand." It was on these grounds that Taft was most determinedly opposed for the nomination to the presidency. Already a favourite-son candidate at every national convention since 1936, he came to the 1948 convention with considerable nationwide support but lost to the well-organized forces of the internationalist Thomas E. Dewey. Again in 1952 the nomination was denied him by the strong internationalist coalition, which rallied around the popular wartime general Dwight D. Eisenhower. After his party's victory at the polls Taft became majority leader and Eisenhower's chief adviser in the Senate.

**Taft, William Howard** (b. Sept. 15, 1857, Cincinnati, Ohio, U.S.—d. March 8, 1930, Washington, D.C.), 27th president of the United States (1909–13) and tenth chief justice of the United States (1921–30).

The son of Alphonso Taft, secretary of war



William Howard Taft, 1909
By courtesy of the Library of Congress, Washington, D.C.

and attorney general (1876–77) under Pres. Ulysses S. Grant, Taft graduated from Yale (1878), was admitted to the bar in Ohio (1880), and held local political offices until 1887, when he became a judge of the superior court of Ohio. He then served as solicitor general of the United States (1890–92), and judge of the U.S. Sixth Circuit Court of Appeals (1892–1900). In cases relating to labour–management disputes, Taft's opinions aroused protests because of their emphasis upon the illegality of the secondary boycott and upon the obligation of the court to restrain violence through the power of the injunction; but he did uphold the legal rights of unions, and he extended the power of the injunction to enforce anti-trust laws.

In 1900 Taft was persuaded by Pres. William McKinley to give up his judgeship to serve as chairman of the second Philippine Commission, charged with organizing civil government in the islands following the Spanish–American War (1898). Having achieved the end of military rule, he became the first civilian governor in 1901 and thereafter concentrated on the economic development of the islands. He served with great distinction and became very popular with the Philippine people. When, in 1904, he was named secretary of war by Pres. Theodore Roosevelt, he left with the stipulation that he could continue to supervise Philippine affairs.

When Roosevelt declined to run for reelection in 1908, he threw his support behind Taft, who won the Republican nomination and went on to an easy victory at the polls over the Democratic candidate, William Jennings Bryan. Taft's lack of political astuteness was soon revealed in his indifference toward the growing rift between conservatives and progressives within Republican ranks; in fact, the split was encouraged by his failure to appoint any of the liberal wing to his Cabinet. His unspectacular administration nevertheless served the cause of honest government for four years. He took steps toward the formation of an annual budget, established the federal postal-savings system, gave impetus to conservation of natural resources, and vigorously enforced anti-trust legislation. The last months of his administration were clouded by a growing breach with Roosevelt, whose increasing radicalism alienated the incumbent. When Taft reluctantly ran for a second term in 1912 against Roosevelt, who ran as a Progressive, the Democrat Woodrow Wilson took advantage of the split and won.

Taft then served as professor of law at Yale University and on the National War Labor Board (1918); he also promoted the League to Enforce Peace and became a strong supporter of U.S. participation in the League of Nations. In 1921 he reached the pinnacle of his career with his appointment as chief justice of the United States. He found the tribunal far behind in its work and promptly took steps to improve the efficiency of the judicial machinery. His influence was decisive in securing passage of the Judges Act of 1925, which enabled the Supreme Court to exercise wider discretion in its acceptance of cases and allowed it to give precedence to those of national importance.

Though Taft's opinions were regarded as traditionally conservative by most, they were actually middle-of-the-road; for instance, his approval of the use of court injunctions was limited by his insistence that injunctions could not be employed to interfere with the rights of workers to organize and strike. His most important contribution to constitutional law was his opinion in *Myers* v. *U.S.* (1926) upholding the authority of the president to remove federal officials.

In declining health, Taft resigned early in 1930 and died a month later.

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**Taft–Hartley Act,** formally LABOR–MANAGEMENT RELATIONS ACT (1947), in U.S. history, law—enacted over the veto of Pres. Harry S. Truman—amending much of the pro-union Wagner Act of 1935. A variety of factors, including the fear of Communist infiltration of labour unions, the tremendous growth in both membership and power of unions, and a series of large-scale strikes, contributed to an anti-union climate in the United States after World War II. Republican majorities in both houses of Congress—the first since 1930—sought to remedy the union abuses seen as permitted under the Wagner Act.

The Labor–Management Relations Act of 1947, sponsored by Sen. Robert A. Taft (Ohio) and Rep. Fred A. Hartley, Jr. (New Jersey), while preserving the rights of labour to organize and to bargain collectively, additionally guaranteed employees the right not to join unions (outlawing the closed shop); permitted union shops only where state law allowed and where a majority of workers voted for them; required unions to give 60 days' advance notification of a strike; authorized 80-day federal injunctions when a strike threatened to imperil national health or safety; narrowed the definition of unfair labour practices; specified unfair union practices; restricted union political contributions; and required union officers to deny under oath any Communist affiliations.

The Landrum–Griffin Act of 1959 set further union restrictions, barring secondary boycotts and limiting the right to picket.

**tag,** also called TOUCH, or TIG, children's game in which, in its simplest form, one player ("it," or "he") chases the others and tries to touch one of them, making the person touched "it." The game is known by many other names. In some games, it is pretended that the touch carries some form of contagion—*e.g.,* plague (Italy), leprosy (Madagascar), fleas (Spain), or "lurgy fever" (Great Britain). In others, a method of achieving immunity from touch is prescribed, as by touching wood, iron, or a specified colour or by holding oneself off the ground or assuming a particular position (*e.g.,* squatting). Often limitations or handicaps are imposed on the chaser: he may be required to clasp hands and imitate a horned animal (stag, bull, or goat) or squat and hop like a frog while the others caper freely around him; or those tagged may be required to clasp the spot of the touch while chasing others (French or Chinese touch, in Great Britain; *Englisch Zeck* in Germany). In some games, a ball is used as an extension of the chaser, who throws it at his intended victim. As a game progresses, the original chaser may enlist those touched to help catch the others; sometimes the captives link hands to form a chain, with the players on either end making the capture.

Suspense is an important element of certain elaborations of the game: in *ostrakinda,* described by the 2nd-century Greek writer Julius Pollux, two teams stood on either side of a line. A shell was spun or tossed in the air, and one team chased the other according to which side of the shell turned up. In another form, the chaser turns his back and walks slowly away, while the others follow at a short distance and chant a rhyme or ask a question ("What's the time, Mr. Bear?"). The chaser then turns suddenly, sometimes shouting a certain word or phrase ("Dinnertime!"), and pursues them.

In still another version, players must run from one safety zone to another across a central area where the chaser waits for them (black peter in central Europe, wall to wall in Great Britain, and pom-pom-pullaway in the United States).

**Taga Shinko** (Japanese painter): *see* Hanabusa Itcho.

**Tagalog,** second largest cultural-linguistic group in the Philippines (after the Cebuano). They form the dominant population in the city of Manila; in all provinces bordering Manila Bay except Pampanga; in Nueva Ecija to the north; and in Batangas, Laguna, Marinduque, Mindoro, and Quezon to the south. Tagalog is an Austronesian (Malayo-Polynesian) language like the other Philippine languages. The mother tongue of some 10,000,000 Filipinos, it was chosen as the basis of the national language (Pilipino) and is taught in all schools.

Most Tagalog are farmers. Their local governments, or barrios, similar to U.S. townships, are aggregations of small hamlets (*sitios*) together with the surrounding farmland. Most rice is grown in flooded, diked fields, but some is produced dry in the upland areas. The principal cash crops are sugarcane and coconuts. The importance of Manila has given the urban Tagalog leadership in commerce, finance,

manufacturing, the professions, and clerical and service operations. More than 80 percent of the people in the Tagalog provinces are Roman Catholic.

Through Manila, the Tagalog served for more than 500 years as mediators with the Chinese, Spanish, and Americans, selecting from, interpreting, and adapting these foreign cultures to the basic Indo-Malayan social pattern. The Tagalog have thus led in the modernization and Westernization that has passed in varying degrees from Luzon to all parts of the Philippine archipelago.

The Tagalog, however, have sharply resisted alien economic and political control. They initiated the anti-Spanish propaganda movement of the 19th century, and their generals led in armed revolts against Spain and the United States in 1896–1902. The principal Philippine national heroes of this period were Tagalog, and the Tagalog were among the leaders in the subsequent achievement of Philippine independence by constitutional means.

**Tagalog language,** member of the Central Philippine branch of the Austronesian (Malayo-Polynesian) language family and the base for Pilipino, an official language of the Philippines, together with English. It is most closely related to Bicol and the Bisayan (Visayan) languages—Cebuano, Hiligaynon (Ilongo), and Samar. Native Tagalog speakers form the second largest linguistic and cultural group in the Philippines and number about 14 million; they are located in central Luzon and parts of Mindanao.

Pilipino (based on Tagalog) is spoken by another 25 million persons as a second language and is increasingly used in literature, radio, and the press and as a language for government and education. Tagalog grammar is notable for its complex verbal system, including in particular three distinct types of passive constructions.

*Consult the* INDEX *first*

**Taganrog,** city and seaport, Rostov *oblast* (province), southwestern Russia. It lies on the northern coast of Taganrog Gulf of the Sea of Azov. Founded as a fortress and naval base in 1698 by Peter I the Great, Taganrog developed in the 19th century as a grain-exporting port. Although overshadowed by Rostov-na-Donu, it is still a significant port for the Donets Basin coalfield and industrial area. Steel, steel sheets and pipes, high-pressure boilers, and combine harvesters are made, and there are ship repair yards; leatherworking and other light industries are also carried on.

Taganrog is the birthplace of the writer Anton Chekhov, and the home in which he spent his early life is preserved as a museum. The city has several institutions of higher education and the A.P. Chekhov Theatre. Pop. (1992 est.) 293,000.

**Tagawa,** also spelled TAKAWA, city, Fukuoka *ken* (prefecture), Kyushu, Japan, on the upper Onga River. It was a farm village until the systematic exploitation of nearby coalfields began after 1900. Tagawa was the largest mining town in the Chikuhō coalfield region until 1970, when the last of the mines was closed. The city's main industrial product now is cement. Pop. (1990) 57,701.

**Tagaytay,** city, southwestern Luzon, Philippines. It is located on Tagaytay Ridge at about 2,000 feet (600 m) above sea level, on the northern flank of Mount Taal. The city is a weekend retreat, popular for its cool climate and outstanding view to the south of Taal Lake, with an active volcano on an island. Market gardening for the Manila area to the north is a local activity. Inc. city, 1938. Pop. (1990 prelim.) 24,000.

**Tagbilaran,** city on Bohol Island, in the Bohol (Mindanao) Sea, Philippines. Tagbilaran lies along the Bohol Strait and is sheltered by Panglao Island. It is a principal port of the area, with warehouses and distributory outlets, regular interisland service to Cebu and Mindanao islands, and a busy passenger traffic, particularly of emigrants journeying to areas on Mindanao. Access to the shallow harbour was blasted through obstructing coral reefs, and maintenance requires frequent dredging. Tagbilaran retains a rural character and is served by an airport and frequent ferry service from Cebu City. Pop. (1990 prelim.) 56,000.

**Tagdempt** (Algeria): *see* Tiaret.

**Taginae, Battle of,** also called BATTLE OF BUSTA GALLORUM (June or July 552), decisive engagement fought near what is now the town of Gualdo Tadino, Italy. In the battle the Byzantine general Narses defeated the main body of the Goths, who were led by their Christian king, Totila.

The Byzantine emperor Justinian I sent his commander in chief, the eunuch Narses, with an army of 20,000 men into Italy, where, at the Apennine village of Taginae near the Flaminian Way, he defeated the Goths; Totila, who had ordered his army to use only spears, was fatally wounded.

The victory, credited to imperial archers and described by the historian Procopius, allowed Narses to march through Italy and eventually liberate Rome.

**Taglioni, Filippo** (b. Nov. 5, 1777, Milan [Italy]—d. Feb. 11, 1871, Como), Italian dancer and choreographer who developed the Romantic style of ballets.

Taglioni's father, Carlo, and his brother, Salvatore, were also important in the dance world at the time. He made his debut in Pisa in 1794 and subsequently performed in ballets in Livorno, Florence, Venice, and Paris, where he studied with the Coulon family. In 1803 he was designated principal dancer and ballet master in Stockholm, from where over the years he toured Cassel, Vienna, Munich, Turin, Stuttgart, Berlin, Warsaw, and St. Petersburg.

Taglioni had two children, Paul and Marie, both of whom were dancers. Marie became one of the world's greatest ballerinas, and Filippo created his famous *La Sylphide* for her in 1832, the first of the "ballets blancs," or Romantic "white ballets."

**Taglioni, Marie** (b. April 23, 1804, Stockholm, Sweden—d. April 24, 1884, Marseille, France), Italian ballet dancer whose fragile, delicate dancing typified the early 19th-century Romantic style.



Marie Taglioni, engraving by R.J. Lane after a portrait by A.E. Chalon

By courtesy of the Bibliotheque de l'Opera, Paris. photograph, Pic

Trained chiefly by her father, Filippo Taglioni, she made her debut in Vienna in 1822. In her father's ballet *La Sylphide,* introduced at the Paris Opéra, March 12, 1832, she became one of the first women to dance on the extreme tips, or points, of the toes; she created a new style marked by floating leaps, such balanced poses as the arabesque, and a delicate, restrained use of the points.

The diaphanous dress she wore in *La Sylphide,* with its fitted bodice and airy, bell-like skirt, was the prototype of the tutu, the full, light skirt that, in various lengths, has remained the accepted uniform of the classical dancer for more than a century. Not only did she have Paris at her feet but audiences in London, Milan, Vienna, Berlin, and St. Petersburg hailed her as one of the greatest dancers ballet had ever produced.

**tagmemics,** a system of linguistic analysis developed by the American linguist Kenneth L. Pike in the 1950s and applied to the description of a very large number of hitherto unrecorded languages. Tagmemics differs from alternative systems of grammatical analysis in that it defines the basic units of language (tagmemes) as composite elements, one part being the "slot," or "function," and the other the "filler," or "class." For example, one such tagmeme, at the syntactic level of analysis, might be the noun-as-subject (in which the noun is a class that "fills" the subject "slot" in a construction).

**Tagore, Debendranath,** Debendranath also spelled DEVENDRANATH, Bengali DEBENDRANĀTH THĀKUR (b. May 15, 1817, Calcutta, India—d. Jan. 19, 1905, Calcutta), Hindu philosopher and religious reformer, active in the Brahmo Samaj ("Society of Brahmā," also translated as "Society of God"), which purged the Hindu religion and way of life of many abuses.

Born into a wealthy landowning family, Tagore began his formal education at the age of nine; he was instructed in India's classical language, Sanskrit, in Persian, in English, and in Western philosophy. He became a close friend of his younger fellow reformer Keshab Chunder Sen. Tagore spoke out vehemently against suttee (self-immolation of a widow on her husband's funeral pyre), a practice that was especially prevalent in Bengal. Together, Tagore and Sen attempted to raise the Indian literacy rate and to bring education within the reach of all. Unlike Sen, however, Tagore remained a more conservative Hindu, while Sen drifted toward Christianity. This philosophical break between the two men eventually resulted in a schism within the Brahmo Samaj in 1866.

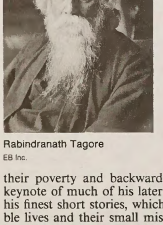
Tagore, in his zeal to erase Hindu idolatry as well as divisive and undemocratic practices, finally rejected the whole of the Vedas, the ancient Hindu scriptures, claiming that no set of writings, however venerable, could furnish complete and satisfying guidelines to human activity. Failing to find a middle path between radical rationalism and fanatical Brahman conservatism, Tagore retired from public life, although he continued to instruct a small band of followers. In 1863 he founded Santiniketan ("Abode of Peace"), a retreat in rural Bengal later made famous by his poet son Rabindranath Tagore, whose educational centre there became an international university. Until his death Tagore bore the title Maharishi ("Great Sage").

Tagore's voluminous writings were in his native Bengali. One of his books was translated into English, *Vedantic Doctrines Vindicated* (1845). His *Brahmo-Dharma* (1854; "The Religion of God"), a commentary in Bengali on the Sanskrit scriptures, is considered to be a masterpiece.

**Tagore, Rabindranath,** Bengali RABĪNDRANĀTH ṬHĀKUR (b. May 7, 1861, Calcutta, India—d. Aug. 7, 1941, Calcutta), Bengali poet, short-story writer, song composer, playwright, essayist, and painter who was awarded the Nobel Prize for Literature in 1913. Tagore introduced new prose and verse forms and the use of colloquial language into Bengali literature, thereby freeing it from traditional models based on classical Sanskrit. He was highly influential in introducing the best of Indian culture to the West and vice versa, and he is generally regarded as the outstanding creative artist of modern India.

The son of the religious reformer Debendranath Tagore, he early began to write verses, and after incomplete studies in England in the late 1870s, he returned to India. There he published several books of poetry in the 1880s and completed *Mānasī* (1890), a collection that marks the maturing of his genius. It contains some of his best-known poems, including many in verse forms new to Bengali, as well as some social and political satire that was critical of his fellow Bengalis.

In 1891 Tagore went to East Bengal (now in Bangladesh) to manage his family's estates at Shilaidah and Shazadpur for 10 years. There he often stayed in a houseboat on the Padma River (*i.e.,* the Ganges River), in close contact with village folk, and his sympathy for



Rabindranath Tagore
EB Inc.

their poverty and backwardness became the keynote of much of his later writing. Most of his finest short stories, which examine "humble lives and their small miseries," date from the 1890s and have a poignancy, laced with gentle irony, that is unique to him, though admirably captured by the director Satyajit Ray in later film adaptations. Tagore came to love the Bengali countryside, most of all the Padma River, an often-repeated image in his verse. During these years he published several poetry collections, notably *Sonār Tarī* (1894; *The Golden Boat*), and plays, notably *Chitrāṅgadā* (1892; *Chitra*). Tagore's poems are virtually untranslatable, as are his more than 2,000 songs, which remain extremely popular among all classes of Bengali society.

In 1901 Tagore founded an experimental school in rural West Bengal at Śāntiniketan ("Abode of Peace"), where he sought to blend the best in the Indian and Western traditions. He settled permanently at the school, which became Viśva-Bhārati University in 1921. Years of sadness arising from the deaths of his wife and two children between 1902 and 1907 are reflected in his later poetry, which was introduced to the West in *Gītanjali, Song Offerings* (1912). This book, containing Tagore's English prose translations of religious poems from several of his Bengali verse collections, including *Gītāñjali* (1910), was hailed by W.B. Yeats and André Gide and won him the Nobel Prize in 1913. Tagore was awarded a knighthood in 1915, but he repudiated it in 1919 as a protest against the Amritsar Massacre.

From 1912 Tagore spent long periods out of India, lecturing and reading from his work in Europe, the Americas, and East Asia and becoming an eloquent spokesman for the cause of Indian independence. Tagore's novels, though less outstanding than his poems and short stories, are also worthy of attention; the best known are *Gorā* (1910) and *Ghare-Bāire* (1916; *The Home and the World*). In the late 1920s, at nearly 70 years of age, Tagore took up painting and produced works that won him a place among India's foremost contemporary artists. (W.A.Ro./Ed.)

**Tagula** (Papua New Guinea): *see* Sudest Island.

**Tagus River,** Portuguese RIO TEJO, Spanish RÍO TAJO, longest waterway of the Iberian Peninsula. It rises in the Sierra de Albarracín of eastern Spain, at a point about 90 miles (150 km) from the Mediterranean coast, and flows westward across Spain and Portugal for 626 miles (1,007 km) to empty into the Atlantic Ocean near Lisbon. Its drainage basin of 31,505 square miles (81,600 square km) is only exceeded on the peninsula by that of the Ebro River, to the northeast. The Tagus covers the heart of Portugal and Spain and has been of vital importance to the modern economic development of the two nations.

The upper Tagus cuts into limestone rocks and flows generally southwestward through narrow, sinuous valleys with deep canyons and abundant ravines. Near Trillo (Guadalajara province) it runs more peacefully, and just before the town of Bolarque it is held back by the dams of Entrepeñas and Buendía, forming an artificial lake known as the Sea of Castile, which covers an area of 51 square miles (132 square km).

Again flowing southwestward, the river irrigates the fertile lands of Aranjuez and the areas around Toledo and Talavera de la Reina until it reaches the province of Cáceres. Here it again flows through narrow, steep-edged trenches formed by quartzites and shales. At Puente de Alcántara another dam on the river has formed one of the greatest man-made lakes in Europe, with a length of 57 miles (92 km). Less than 10 miles (16 km) downstream the river becomes the frontier between Spain and Portugal for 27 miles (43 km). It enters Portugal at Beira and the Sierra de Carbajo, then crosses the fertile region of Alto Ribatejo. After flowing across Portugal for 111 miles (179 km), it forms at Vila Franca de Xira the Tagus (or Lisbon) estuary, emptying into the Atlantic Ocean. Toledo is the only large Spanish city that lies along the river, which flows past the cities of Santarém and Lisbon in Portugal and supplies the latter with a fine natural harbour. Only the lower portion of the river is used for navigation of any importance.

The Tagus flows mostly through semiarid lands, and government efforts have been dedicated to increasing land irrigation and creating hydroelectric power in its basin. Major efforts to harness the Tagus and its tributaries for these purposes were undertaken from the 1960s, and by 1980 more than 60 dams had been built with a total installed power capacity of more than 1,200,000 kilowatts. In the highlands of the Tagus basin, coniferous trees are numerous, supporting a well-developed timber industry. About one-third of the basin's cultivated land is devoted to cereal farming, and everywhere are olive trees and vineyards. In Extremadura, in western Spain, only oaks and cork trees break the monotony of a rolling and rocky landscape.

Animal life near the river is abundant and diverse, with both European and North African species. Fishing for royal carp, luces, and black bass is possible in the artificial lakes of Entrepeñas and Buendía, and trout, barbels, and many other kinds of fish are caught in the Tagus and its tributaries. There is big-game hunting in Gredos, noted for its Pyrenean, or Spanish, ibex; in the ridges of Cuenca and Guadalajara fallow deer and chamois are found.

**Taha Hussein** (b. Nov. 14, 1889, Maghāghah, Egypt—d. Oct. 28, 1973, Cairo), outstanding figure of the modernist movement in Egyptian literature. His writings, in Arabic, include novels, stories, criticism, and social and political essays. Outside his own country he is best known through his autobiography, *al-Ayyam* (2 parts, 1929–32). The first modern Arab literary work to be acclaimed in the West, it appeared in English as *An Egyptian Childhood* (1932) and *The Stream of Days* (1943).



Taha Hussein
By courtesy of the Academy of Arabic Language, al-Jizah, Egypt

Born in modest circumstances, Taha Hussein was blinded by an illness at the age of two. In 1902 he was sent to al-Azhar seminary, Cairo, the leading orthodox centre of higher Islāmic education, but was soon at odds with its predominantly conservative authorities. In 1908 he entered the newly opened secular University of Cairo, and in 1914 he was the first to obtain a doctorate there. Further study at the Sorbonne familiarized him with the culture of the West.

Taha Hussein returned to Egypt from France to become a professor of Arabic literature at the University of Cairo; his career there was frequently stormy, for his bold views enraged religious conservatives. His application of modern critical methods in *Fi sh-Shi' al-Jahili* (1926; "On Pre-Islāmic Poetry") embroiled him in fierce polemics. In this book he contended that a great deal of the poetry reputed to be pre-Islāmic had been forged by Muslims of a later date for various reasons, one being to give credence to Qur'ānic myths. For this he was declared an apostate. In another book, *Mustaqbal al-thaqāfah fī Miṣr* (1938; *The Future of Culture in Egypt*), he expounds his belief that Egypt belongs by heritage to the same wider Mediterranean civilization that embraces Greece, Italy, and France; it advocates the assimilation of modern European culture.

Serving as minister of education (1950–52) in the last government formed by the Wafd Party before the overthrow of the monarchy, Taha Hussein vastly extended state education and abolished school fees. In his later literary work he showed increasing concern for the plight of the poor and interest in energetic governmental reforms. A further book of memoirs, *Mudhakkirat,* was published in 1967, when he was 78.

**tahajjud** (Arabic: "keeping vigil"), in Islāmic practice, the recitation of the Qur'ān (Islāmic scriptures) and prayers during the night. *Tahajjud* is generally regarded as *sunnah* (tradition) and not *farḍ* (obligation). There are many verses in the Qur'ān that encourage these nightly recitations and other verses that indicate such practices should remain "a voluntary effort" (17:79). Pious Muslims everywhere perform *tahajjud* as a form of asceticism in imitation of the Prophet Muḥammad, who continued nightly vigils even after the institution of the five daily prayers. In *fiqh* (Islāmic

jurisprudence), it is considered blameworthy to prevent those who desire to do so from practicing *tahajjud* as much as they wish. According to one tradition, *tahajjud* "loosens the knots that Satan ties in the hair of a sleeper." During Ramaḍān (the Muslim month of fasting) *tahajjud* is considered particularly meritorious, so Muslims often spend these nights in mosques praying and reciting the Qur'ān until dawn. In some Muslim countries an official nighttime *adhān* (call for prayer) has been instituted.

**Tahan, Mount,** Malay GUNUNG TAHAN, highest peak of the Malay Peninsula (7,175 feet [2,187 m]), in the Tahan Range, West Malaysia. Mount Tahan is the central feature of Taman Negara National Park and a destination for mountaineers who begin their ascent from nearby Kuala Tahan, headquarters of the park. The Tahan Range parallels the Main Range (about 60 miles [97 km] west) and extends south from Mount Tahan for about 75 miles (120 km) across the tablelands of Terengganu (formerly Trengganu). Its quartzite and shale soils allow only a sparse vegetation cover. Interrupted by the Rompin River, the range continues as isolated hills along the south-central part of the Malay Peninsula and as the Mount Faber Ridge in Singapore.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Taharqa,** also called TARKU, TARAKOS, or TIRHAKA (fl. 7th century BC), fourth king (reigned 690–664 BC) of the 25th dynasty of Egypt.

Taharqa succeeded his cousin Shebitku on the throne. Early in his reign, he supported Palestine's resistance against King Sennacherib of Assyria. In 671, however, Taharqa's army was defeated by Sennacherib's son Esarhaddon, who captured Memphis, together with its royal harem, and took a great amount of spoils; he set up a new Assyrian administration, entrusting the government and collection of tribute to the native chiefs. On Esarhaddon's withdrawal from Egypt, Taharqa returned from his refuge in Upper Egypt and massacred the Assyrian garrisons. He held control over Egypt until he was completely routed by Esarhaddon's son Ashurbanipal, after which he fled south to Nubia, where he died and was buried in a large pyramid at Nuri.

**Ṭāhirid** DYNASTY (AD 821–873), Islāmic dynasty of the land of Khorāsān (centred in northeastern Persia), which owed nominal allegiance to the 'Abbāsid caliph at Baghdad but enjoyed virtual independence. The dynasty was founded by Ṭāhir ibn al-Ḥusayn, a successful military general awarded the eastern lands by the caliph. Ṭāhir's successors pushed their dominion as far as the Indian frontier.

**Tahiti,** largest island of the Windward Group (Iles du Vent) of the Society Islands, French Polynesia, in the central South Pacific. Its nearest neighbour is Moorea, 12 miles (20 km) to the northwest. The island of Tahiti consists of two ancient eroded volcanic cones, Tahiti Nui and Tahiti Iti (the Taiarapu Peninsula), connected by the Isthmus of Taravao. Its total area is 402 square miles (1,042 square km). Papeete (*q.v.*) is the capital and administrative centre of the island and of French Polynesia.

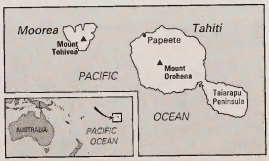


Inner court of Paul Gauguin Museum, Tahiti, French Polynesia
Shostal—EB Inc.

Apart from a fertile coastal plain, the terrain of Tahiti is jagged and mountainous, rising to Mount Orohena (7,339 feet [2,237 m]) on Tahiti Nui and to Roniu (4,340 feet [1,323 m]) on Tahiti Iti. Many swift streams, the largest of which is the Papenoo in the north, descend to the coast. The island, 33 miles (53 km) long, is fringed by coral reefs and lagoons. Natural vegetation includes coconut palms, pandanus, lantan, hibiscus, and tropical fruit trees.

Tahiti, lying within the easterly trade-winds belt, is divided into a wet southern portion (more than 100 inches [2,500 mm] of rain annually) and a drier northern (about 70 inches [1,800 mm]), the greatest amount falling from December to March. Temperatures range from 76° F (24° C) in July and August to 84° F (29° C) in January and February. This climate lends itself to the cultivation of coconuts (copra), sugarcane, vanilla, and coffee, all of which are grown on the coastal plain and are shipped from Papeete on the northwest coast.

The original Tahitians were Polynesians who arrived from another of the Society Islands, Raiatea, a Polynesian cultural diffusion centre. On Tahiti they developed political districts, closely connected with a graded system of rank and authority, resting on the extended family organized around each temple. The high chiefs (*arii nui*) exercised considerable authority, supported by supernatural sanctions and a priesthood, but their relationship with lesser




Tahiti

chiefs and people was reciprocal. This society disappeared under European influence, and intermarriage and the French policy of assimilation produced a people basically Polynesian, though with much admixture of other blood (chiefly French and Chinese) and deeply influenced by French culture. More than two-thirds of the population of French Polynesia lives on Tahiti.

In 1767 Tahiti (then usually called Otaheite) was visited by Captain Samuel Wallis, of the British navy, who named it King George III Island. It was subsequently visited by Louis-Antoine de Bougainville (1768), who claimed it for France, and by two English navigators, James Cook in 1769 and William Bligh in the HMS *Bounty* in 1788. The first permanent European settlers were members of the Protestant London Missionary Society (1797), who helped the local Pomare family to gain control of the entire island. Pomare II (1803–24) embraced Christianity, triumphed over the other Tahitian chiefs, and established a "missionary" kingdom with a scriptural code of law. Under Pomare III (1824–27) and Queen Pomare IV (1827–77), a reaction by Tahitian rivals, the effects of disease, prostitution, and drunkenness, and the influence of European traders and beachcombers challenged the missionaries' hold. Queen Pomare IV's deportation of two French Roman Catholic missionary priests in 1836 led the French to dispatch a warship in 1842 to demand reparations and to arrange a French protectorate. When Pomare V (Queen Pomare's son) abdicated in 1880, Tahiti was proclaimed a French colony. The island is now part of the Iles du Vent *circonscription* ("circumscription") within the self-governing overseas territory of French Polynesia.

Tahiti has become an important tourist centre, receiving visitors through the Papeete transpacific port and the airport of Faaa, near Papeete. Pop. (1988) 131,309.

**Tahlequah,** city, seat (1907) of Cherokee county, eastern Oklahoma, U.S., in the foothills of the Ozark Mountains, near the Illinois River and Lake Tenkiller. Settled by Cherokee Indians and made capital of the Cherokee nation (1839–1907), the townsite



The Murrell Home, Tahlequah, Okla.
Bob Taylor—EB Inc.

was laid out on Cherokee council grounds in 1843. The name, meaning "two are enough," probably recalls the meeting of two instead of three commissioners who were to find the end to the Cherokee Trail of Tears. It is now a service and processing centre for an agricultural and stock-raising area and produces lumber and machine-shop products. It is the home of Northeastern Oklahoma State University (1909) and the Cherokee Arts and Crafts Center. Cherokee government buildings still standing are the Capitol (1867–70), the National Prison (1874), and the Supreme Court (1844); the Murrell Home (1844) in Park Hill is a fine example of an antebellum mansion. Sequoyah State Park by the Arkansas River and Tsa-La-Gi, a re-created Indian village, are nearby. Pop. (1990) 10,398.

**Tahltan,** an Athabascan-speaking Indian tribe living on the upper Stikine River and other nearby streams in what is now northwestern British Columbia, Can. The country, though grassy and rocky with only sparse woodlands, has been rich in salmon and such game as caribou, moose, bears, and various other furbearing animals.

The Tahltan were nomadic, keeping only the barest of portable goods, as they gathered at the salmon runs in summer and moved through the various hunting grounds in winter. Their dwellings consisted of either leantos or huts made of poles, bark, and brush. In their central village, however, there was a more substantial 100-foot (30-m) ceremonial and residential lodge for all the chief families of the several clans.

The Tahltan were traditionally divided into six clans, headed by chiefs and grouped three and three into the Raven and the Wolf subgroups, or phratries, which had reciprocal ceremonial functions, reciprocal marital obligations (a Raven person had to marry a Wolf person), and ownership of separate hunting grounds (though in practice hunters usually did not have to observe the division). In the 18th century the Wolf added a fourth clan, making seven clans altogether.

This social organization was borrowed from their neighbours on the Pacific coast, as was

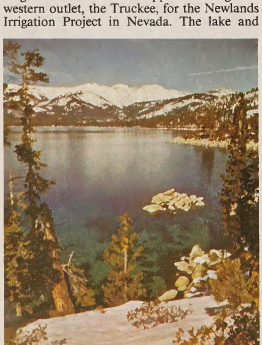
their stratification into nobles, commoners, and slaves. Another important borrowing was the potlatch, the gift-giving festival held for validating ennoblement, advancing one's prestige, or marking an event, such as a funeral. The Tahltan carried on trade (as well as some raiding and warfare) with the coastal tribes and with the Kaska to the north.

Though recognizing a sun god and a sky god, the Tahltan were more engrossed in all the supernatural powers seen in the things of nature around them, particularly the birds and beasts that constituted their food supply. The spirits seen in dreams or visions and evoked by medicine men were almost invariably animals.

Today the Tahltan, overwhelmed by European civilization, have been severely reduced in numbers; in the late 20th century only about 700 still existed.

**Ṭahmāsp I** (b. March 3, 1514, Shāhābād, near Esfahān, Ṣafavid Iran—d. 1576, Kazvin?), shāh of Iran from 1524 whose rule was marked by continuing warfare with the Ottoman Empire and the loss of large amounts of territory. Ṭahmāsp, the eldest son of Shāh Ismāʿīl I, founder of the Ṣafavid dynasty, was for a long period after coming to the throne a pawn of powerful tribal leaders. Three times (1534, 1538, and 1543) Ottoman forces invaded Iran, recovering territory lost earlier and capturing new areas. Hostility between the Ottomans and Iran was intensified by religious differences between the Shīʿī sect (Iran) and the Sunnī sect (Ottoman Empire) of Islām. Peace was concluded with the Ottomans in 1555. Ṭahmāsp spent his later years in seclusion at his palace, giving little attention to public affairs.

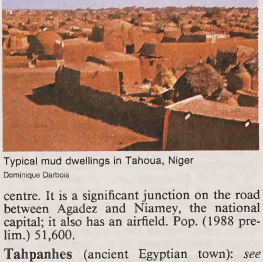
**Tahoe, Lake,** freshwater lake occupying a fault basin on the California-Nevada border in the northern Sierra Nevada, U.S. Fed by numerous small streams, it is drained by the Truckee River to Pyramid Lake, Nevada, about 60 miles (100 km) northeast. It measures 22 miles (35 km) north-south and 12 miles (19 km) east-west and has an area of 193 square miles (500 square km); its surface stands at 6,229 feet (1,899 m) above sea level, and its maximum depth is 1,640 feet (500 m). Visited in 1844 by the soldier-explorer John C. Frémont, the intensely blue lake took its name from the Washo Indian word meaning "big water." Water is supplied through its western outlet, the Truckee, for the Newlands Irrigation Project in Nevada. The lake and



Lake Tahoe in Toiyabe National Forest, Nevada
John F. Shrawder—Shostal/EB Inc.

the surrounding area of national forests have been developed as tourist resorts.

**Tahoua,** town, southern Niger. Situated on the boundary between a cultivated zone (peanuts [groundnuts]) and a drier pastoral zone (cattle, goats, and sheep), it is an important trading town. During the Sahel drought of the 1970s and 1980s it served as a refugee

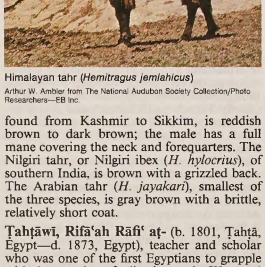


Typical mud dwellings in Tahoua, Niger
Dominique Darbois

centre. It is a significant junction on the road between Agadez and Niamey, the national capital; it also has an airfield. Pop. (1988 prelim.) 51,600.

**Tahpanhes** (ancient Egyptian town): *see* Daphnae.

**tahr** (genus *Hemitragus*), any of several wary and surefooted wild goats of the family Bovidae (order Artiodactyla). Tahrs live in herds and usually frequent steep, wooded mountainsides. They range in shoulder height from 60–106 cm (24–42 inches), depending on the species. Both sexes have short horns that curve backward and are flattened from side to side. The Himalayan tahr (*Hemitragus jemlahicus*),



Himalayan tahr (*Hemitragus jemlahicus*)
Arthur W. Ambler from The National Audubon Society Collection/Photo Researchers—EB Inc.

found from Kashmir to Sikkim, is reddish brown to dark brown; the male has a full mane covering the neck and forequarters. The Nilgiri tahr, or Nilgiri ibex (*H. hylocrius*), of southern India, is brown with a grizzled back. The Arabian tahr (*H. jayakari*), smallest of the three species, is gray brown with a brittle, relatively short coat.

**Ṭahṭāwī, Rifāʿah Rāfiʿ aṭ-** (b. 1801, Ṭahṭā, Egypt—d. 1873, Egypt), teacher and scholar who was one of the first Egyptians to grapple with the question of adjusting to the West and to provide answers in Islāmic terms.

Ṭahṭāwī's first important contact with the West occurred in 1826, when he went to Paris as a religious teacher to a group of Egyptian students there. After five years he returned to Egypt, and in 1836 he became head of the new School of Languages in Cairo. In 1841 he was placed in charge of a translation bureau, where he translated or supervised the translation of many books on history, geography, and military science. Under the khedive ʿAbbās I, who ascended the throne in 1848, Western influences were suspect, and Ṭahṭāwī was sent to Khartoum, where he taught school. On the succession of Saʿīd (1854), Ṭahṭāwī returned to Cairo, where, among other activities, he continued his own scholarly work.

Ṭahṭāwī saw the social order as being established by God and the ruler as God's representative. He believed that the only limitations on the ruler's authority were the dictates of his conscience. Although the people had no rights, the ruler should rule with justice and strive to foster their material well-being. The people in turn should conscientiously fulfill their duties as citizens, and the state should educate them to that end. Ṭahṭāwī's modernism lay in his conception of the material progress that could be possible within the framework of a harmoniously functioning government and society, achieved with the aid of Western technology.

**Tai,** also spelled DAI, peoples of mainland Southeast Asia, including the Thai, or Siamese (in central and southern Thailand), the Lao (in Laos and northern Thailand), the Shan (in northeast Myanmar [Burma]), the Lü (primarily in Yunnan province, China, but also in Myanmar, Laos, northern Thailand, and Vietnam), the Yunnan Tai (the major Tai group in Yunnan), and the tribal Tai (in northern Vietnam). All of these groups speak Tai languages.

Estimates placed the total number of Tai in the late 20th century at 75,760,000, including 45,060,000 in Thailand (including both Thai and Lao), 3,020,000 in Laos, 3,710,000 in Myanmar, 21,180,000 in China, and about 2,790,000 in Vietnam.

Most Tai are Buddhists of the Theravāda school. Among the different groups, however, there is much variation in this type of Buddhism. In the villages of many Tai groups the wat (temple compound or monastery) is both the social and the religious centre. Most young men spend a period as monks. Along with the Buddhist tradition there exist pre-Buddhist animistic beliefs; shrines are dedicated to spirits (*phi*) important in day-to-day affairs. These animistic beliefs tend to be strongest among those peoples farthest from the traditional centres of Tai Buddhism.

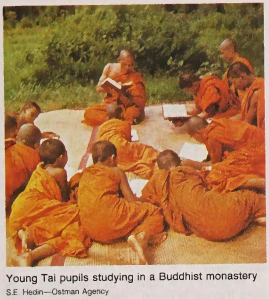
The major economic pursuit is the cultivation of rice, dry rice in the highlands and wet in the valleys.

The usual Tai household consists of a husband, wife (or wives), and unmarried children. The status of women is high. None of the Tai peoples has a caste system. Though they live in political entities varying from independent nations (Thai and Lao) to chiefdoms (in non-Tai states), the basic structure of their semi-autonomous villages is similar. Communal leadership is provided by an elected village headman, together with the Buddhist monks and elders.

The Tai appeared historically in the 1st century AD in the Yangtze River valley. Chinese pressures forced them south until they were spread throughout the northern part of Southeast Asia. Their cultural descendants in present-day China include the Pai-i, Lü, and Nua in Yunnan, the Chung-chia (or Puyi) in Kweichow Province, and the Chuang-chia (or Chuang) in Kwangsi Chuang Autonomous Region.

Tai cultural identity has remained strongest among the Shan of Myanmar, the Thai (or Siamese) of Thailand, and the Lao. The Shan inhabit most of the Shan Plateau area of Myanmar, concentrated in the autonomous Shan State. Traditionally, they have been ruled by princes (*saohpas*, or *sawbwas*) with semidivine attributes, but the princes have lost most of their former autonomy.

The Thai comprise most of the population of Thailand, living along the rivers and in the alluvial plains. Their villages have populations ranging from 300 to 3,000. Present-day Thai society consists of a lower stratum of rural dwellers above whom are the artisans, merchants, government officials, and priests.



Young Tai pupils studying in a Buddhist monastery
S.E. Hedin—Ostman Agency

The Lao live mainly in the valley of the Mekong River and its tributaries, comprising about two-thirds the population of Laos.

Tai groups living in northern Vietnam include the so-called Black Tai, White Tai, and Red Tai.

The Lü people live in southern Yunnan and in nearby areas of Burma, Thailand, and Laos. Their houses are typically built on piles seven or eight feet high. They are culturally less Sinicized than the Tai of other Chinese provinces and maintain close relations with the Tai of Burma, Thailand, and Laos.

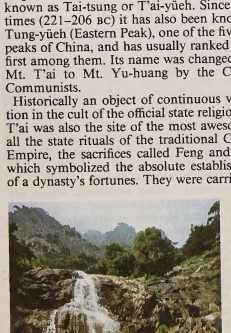
**T'ai, Mount,** Wade-Giles T'AI SHAN, also called YU-HUANG SHAN, Pinyin TAI SHAN or YUHUANG SHAN, principal peak of the range of the T'ai Shan (mountains); it lies to the north of T'ai-an city in Shantung Province, China. The T'ai range consists of a much shattered fault block, mostly composed of archaic crystalline shales and granites and some ancient limestones. Mt. T'ai itself reaches a height of 5,000 ft (1,524 m). It was originally known as Tai-tsung or T'ai-yüeh. Since Ch'in times (221–206 BC) it has also been known as Tung-yüeh (Eastern Peak), one of the five holy peaks of China, and has usually ranked as the first among them. Its name was changed from Mt. T'ai to Mt. Yu-huang by the Chinese Communists.

Historically an object of continuous veneration in the cult of the official state religion, Mt. T'ai was also the site of the most awesome of all the state rituals of the traditional Chinese Empire, the sacrifices called Feng and Shan, which symbolized the absolute establishment of a dynasty's fortunes. They were carried out at rare intervals—by the Former Han dynasty (206 BC–AD 8) in 110, 106, 102, and 98 BC; by the Later Han dynasty (AD 23–220) in AD 56; and by emperors of the T'ang dynasty (618–907) in 666 and again in 725. These sacrifices announced to Heaven and Earth alike the accomplishment of dynastic success. But Mt. T'ai was not only the seat of this imposing state ceremonial but was also a deity in its own right, to which prayers were offered in spring for a good harvest and in autumn to give thanks for a harvest completed. Since Mt. T'ai was the chief regional deity of eastern China, prayers were also offered to it in case of floods or earthquakes.

The mountain also became associated with a wide range of folklore beliefs connected with Taoism, a philosophy integral to Chinese life and thought for 2,000 years. It was considered to be the centre of the Yang (male) principle, the source of life, and from the Later Han period onward it was believed that the spirit of Mt. T'ai commanded all human fates and that after death the souls of men returned to Mt. T'ai for judgment. The name of the deity, originally Lord of Mt. T'ai (T'ai Shan Fu-chün), was, with the emergence of organized Taoism, changed to Grand Emperor of Mt. T'ai (T'ai Yüeh Ta-ti). In Ming times (1368–1644) the centre of the popular cult was transferred from the god himself to his daughter, T'ai Shan Niang-niang (The Lady of Mt. T'ai)—also called Pi-hsia Yüan-chün (The Goddess of the Variegated Clouds)—whose cult began to grow from about 1000 and who became a northern Taoist equivalent to the Buddhist Kuan-yin (Goddess of Mercy), whose cult was powerful in central and southern China.

The slopes of Mt. T'ai have remained covered with temples and shrines dedicated to the complex pantheon of minor deities with whom it is associated. In former times vast numbers of pilgrims visited it annually, and a great festival was held in the third month of the Chinese year.

**Taï, Parc National de,** national park, southwestern Ivory Coast, situated between the Liberian border (along the Cavally River) to the west and the Sassandra River to the east. Formerly a fauna reserve (decreed 1956) and prior to that a forest refuge (from 1926), it was established as a national park in 1972 and has an area of 1,351 sq mi (3,500 sq km). Its physiography consists mainly of plains that overlie granitic rock and rise to Mont Niéndkoué (2,044 ft [623 m]) in the south. The park is noted for its lowland rain forest vegetation that includes several species of ebony and palm; it is one of the last remaining areas of primeval forest in West Africa. Wildlife includes the rare pygmy hippopotamus, elephant, buffalo, pangolin, bushbuck, monkeys, panther, chimpanzee, and zebra. The park is subject to poaching along its boundaries and to timber removal, especially in the north.



Waterfall cascading down Mount T'ai, Shantung Province, China
Peter Carmichael—Aspect Picture Library, London

**Tai Chen,** Pinyin DAI ZHEN, literary name (Wade-Giles romanization) TAI TUNG-YÜAN (b. Jan. 19, 1724, Hsiu-ning, Anhwei, China—d. July 1, 1777, Peking), Chinese empirical philosopher, considered by many to have been the greatest thinker of the Ch'ing period (1644–1911/12).

Born to poor parents, Tai educated himself by reading borrowed books. Although he passed his preliminary civil service examinations, he never passed the highly stylized *chin-shih* exam, which would have given him the power and prestige of official office. But because of his reputation as a scholar, the Emperor invited him, in 1773, to become a court compiler in the Imperial Manuscript Library. In this position Tai was able to come into contact with many rare and otherwise inaccessible books. When Tai failed the civil service exam for the sixth time, in 1775, the Emperor finally made him a *chin-shih* by special decree and Tai became a member of the Imperial Academy. Altogether he wrote, edited, and collated about 50 works, dealing mainly with mathematics, philology, ancient geography, and the Confucian Classics.

In philosophy Tai attacked the dualism of the Sung thinkers, who he believed had been misled by Buddhist and Taoist influences. The Sung philosophers held that man had a material nature (*ch'i*) that was responsible for his passions and a transcendent spiritual nature (*li*) that set a limit on man's basely material nature. Against this dualism Tai posited a monistic system. He argued that *li* is the immanent structure in all things, even desires. Knowledge of *li* does not suddenly appear during meditation, as the Sung philosophers believed. It is found only after an arduous search, using precise methods, whether in literary, historical, philological, or philosophic investigation.

Tai utilized these careful investigative methods in his own research. In mathematics, he wrote a short discourse on the logarithmic theories of the English mathematician John Napier and edited a collection of seven ancient mathematical works, the last of which is his own collation. In philology, he wrote several books, including a classification of ancient pronunciation. In addition he collated the classic of the 6th century, *Shui ching chu* ("Commentary on the Classic of Waterways"), a study of 137 waterways in ancient China.

Because the Sung philosophy had the patronage of the bureaucracy, Tai's contributions were largely ignored in the years after his death. But because his stress on the need for close empirical investigation resembles the "scientific" and pragmatic appróach of Western philosophy, his ideas began to be studied again in the 20th century. In 1924 the bicentennial of Tai's birth was celebrated in Peking, and in 1936 the Chinese scholarly world paid tribute to Tai Chen with the publication of a complete and authoritative edition of his works, *Tai Tung-yüan hsien-sheng ch'üan-chi* ("Collected Writings of Mr. Tai Chen").

BIBLIOGRAPHY. Wing-tsit Chan, *A Source Book in Chinese Philosophy* (1963); Mansfield Freeman, "The Philosophy of Tai Tung-yüan," *Journal N. China Br. Royal Asiatic Soc.*, vol. 64 (1933).

**T'ai Chi,** Pinyin TAI JI (Chinese: "Great Ultimate"), in Chinese philosophy, the eternal source and cause of all reality. In the Book of Changes (*I Ching*), the ancient philosophical text in which the concept is first mentioned, T'ai Chi is the source and union of the two primary aspects of the cosmos, yang (active) and yin (passive). The Neo-Confucian philosophers of the Sung dynasty (AD 960–1279) associated T'ai Chi with *li* ("principle"), the supreme rational principle of the universe. *Li* engenders *ch'i* ("vital matter"), which is transformed through the yang and yin modes of development into the Five Elements (wood, earth, fire, metal, and water), which form the basic constituents of the physical universe.

**T'ai Chi ch'uan,** Pinyin TAIJIQUAN (Chinese: "Grand Ultimate Fist"), also called CHINESE BOXING, ancient and distinctive Chinese form of exercise or attack and defense. As exercise, T'ai Chi ch'uan is designed to provide relaxation in the process of body-conditioning exercise and is drawn from the principles of *T'ai Chi*, notably including the harmonizing of the yin and yang, respectively the passive and active principles. It employs flowing, rhythmic, deliberate movements, with carefully prescribed stances and positions, but in practice no two masters teach the system exactly alike. As a mode of attack and defense, T'ai Chi ch'uan resembles kung fu and is properly considered a martial art (*q.v.*). It may be used with or without weapons.

Freehand exercise to promote health was

practiced in China as early as the 3rd century, and, by the 5th century, monks at the Buddhist monastery of Shao Lin were performing exercises emulating the five creatures: bear, bird, deer, monkey, and tiger. The snake was added later, and, by the early Ming dynasty (1368), the yin and yang principles had been added to harmonize the whole.

There have been many schools of T'ai Chi ch'uan, and two, the Wu and the Yang, survive. Depending on school and master, the number of prescribed exercise forms varies from 24 to 108 or more. The forms are named for the image created by their execution, such as "White stork displays its wings" and "Fall back and twist like monkey." All start from one of three stances, weight forward, weight on rear foot, and horse riding, or oblique.

**Tai Chin,** Pinyin DAI JIN, also called TAI WEN-CHIN (b. 1388, Ch'ien-t'ang, Chekiang province, China—d. 1462), Chinese landscape painter of the Ming dynasty.



"Life on the River," detail of paper scroll in ink and colour by Tai Chin, mid-15th century; in the Freer Gallery of Art, Washington, D.C.
By courtesy of the Smithsonian Institution, Freer Gallery of Art, Washington, D.C.

Tai Chin was one of the leaders in the early Ming revival of the Ma-Hsia (after Ma Yüan and Hsia Kuei), or academic, style of landscape painting of the Southern Sung (1127–79), which came to be called the Che school (after Chekiang province, in which Hangchou, the Southern Sung capital, was located). The Che school was later placed within the lineage of "professional" painters and held in lesser regard in contrast to the school of literary "amateurs," who were more concerned with personal expression and who were then represented in the Wu school in which Shen Chou held an equivalent place of leadership.

The Che school artists did not merely repeat the patterns of the Southern Sung academy but rather, like other artists of other schools and traditions of the time, saw the past as providing motifs for further elaboration. Tai Chin did this with something of the same pictorial virtuosity, but the former compositional unity was replaced by a new additive and even fragmentary sense. The grouping called Che school is, like other such groupings, somewhat tenuous, and the artists within it (such as Wu Wei) often created special achievements. Paintings of the Che school probably had a major impact upon the perceptions of Japanese ink painters of the contemporary Muromachi period (1338–1573) who sought the Ma-Hsia tradition on the Chinese continent.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**T'ai-chou,** Pinyin TAIZHOU, city in Kiangsu *sheng* (province), China. T'ai-chou is situated about 30 miles (50 km) east of the city of Yang-chou on the T'ung-yang Canal, which joins it to Yang-chou (west), to the city of Nan-t'ung (southeast), and to the coastal area of northern Kiangsu (east). In 1952 a new canal with ship locks was constructed to join T'ai-chou directly with the Yangtze River, which made it a transshipment point for goods, particularly cotton and wheat, shipped to the various large cities south of the Yangtze.

T'ai-chou was traditionally the seat of a county subordinate to Yang-chou, which, until the 13th century, dominated the whole of this area. It became an independent prefecture in the early 10th century. Under the Ming dynasty (1368–1644), it was a centre of the state salt administration, and the merchants of the area were extremely wealthy.

In the 20th century, flour mills, textile works, factories manufacturing fishing nets, and other industries based on local agriculture have been established in T'ai-chou. Pop. (1990) 152,442.

**T'ai-chung,** *hsien* (county), west-central Taiwan. It is bordered by the *hsien*s of Miao-li (north), I-lan and Hua-lien (east), and Chang-hua and Nan-t'ou (south) and by the Taiwan Strait (west). Northern extensions of the Chung-yang Mountain Range rise to elevations between 8,000 and 13,000 feet (2,500 and 3,900 m) above sea level and cover most of the eastern part of the *hsien*. To the west are alluvial plains, in one of the most prosperous agricultural regions in Taiwan, where paddy rice, sugarcane, sweet potatoes, jute, hemp, and bananas are grown. Cattle and poultry are also raised. Industries produce textiles, machinery, processed foods, chemicals, and timber; gold and clay are extracted. The Ta-chia Dam, 28 miles (45 km) northeast of T'ai-chung city, supplies electricity for the surrounding region. The T'ai-chung Industrial Park, with an area of 4,900 acres (2,000 ha), has been developed for industrial expansion. Ma-ling, on the Ta-chia River, has Taiwan's first trout farm. The Chen Lan temple at Ta-chia is well known as the starting point of an annual pilgrimage to Pei-kang in southern Taiwan in honour of Matsu, goddess of the sea. The Taiwan Provincial Assembly, 6 miles south of T'ai-chung city, houses a governmental body concerned with Taiwan (island) affairs.

T'ai-chung *shih* (municipality), administratively independent, is enclosed by the *hsien* and situated in the southwest. In the 1970s an international seaport, now one of the most important ports on the west coast of Taiwan, was developed on the coast west of T'ai-chung city. Feng-yüan, the administrative seat, is well served by north-south-running railways and roads. Area 792 square miles (2,051 square km). Pop. (1992 est.) 1,294,090.

**T'ai-chung,** *shih* (municipality), west-central Taiwan, since 1959 the seat of the provincial administration of Taiwan province. T'ai-chung grew in the early 19th century as the collecting centre for a fertile agricultural basin situated between the low west-coast uplands and the central highlands. When in 1891 the provincial capital was moved from T'ai-nan to Taipei, T'ai-chung was considered as an alternative site. Under the Japanese occupation (1895–1945), most of the old town was torn down, and T'ai-chung was laid out on a broad, regular plan as a modern city. Its trade was greatly stimulated by the completion of the main railway, connecting T'ai-chung with Taipei and Chi-lung in the north and with T'ai-nan and Kao-hsiung in the south. The city became a major market for the rice, sugar, and bananas produced in the surrounding area, thus replacing Chang-hua to the southwest as the commercial centre of the region. In the 1970s, a harbour and fishing port were developed on the coast to the west of the city, and T'ai-chung was designated an export-processing zone to encourage foreign investment.

T'ai-chung grew rapidly, its population more than tripling between 1948 and 1977. It has a large percentage of refugees from the Chinese mainland among its population. Since it became the provincial capital in 1959, it has acquired administrative functions; it is also a cultural centre, with various institutions of higher education. Area 63 square miles (163 square km). Pop. (1992 est.) 779,370.

**T'ai-hang Mountains,** Wade-Giles romanization T'AI-HANG SHAN, Pinyin TAIHANG SHAN, range stretching some 250 miles (400 km) from north to south and forming the provincial boundary between Shansi and Hopeh provinces, China. Sometimes misnamed the T'ai-hsing Range by Western writers, the T'ai-hang forms the boundary between the North China Plain and the Shansi plateau.

The T'ai-hang Mountains were formed during the Jugassic mountain-building period. Soils are of the forest brown and cinnamon types. The ranges rise steeply from the North China Plain to a height of approximately 3,300–4,000 feet (1,000–1,200 m). Hsiao-wu-t'ai, in northwestern Hopeh province, reaches 9,416 feet (2,870 m) above sea level. A spur of the Great Wall extends north-south along the eastern foothills. In the south, in the northwestern part of Honan province, the T'ai-hang Mountains swing to the west to form the southwestern edge of the plateau overlooking the plain of the Huang Ho (Yellow River).

The mountains are drained to the east by numerous tributary streams of the Hai River system. Two of these, the Hu-t'o River and the Cho-chang River, break through the main range and drain the interior basins behind the mountains. The Hu-t'o River valley divides the T'ai-hang Mountains proper from the Wu-t'ai Mountains further northwest, which are structurally distinct.

The T'ai-hang Mountains throughout history presented a great obstacle to communications between Shansi and Hopeh, and "the road over T'ai-hang" became a poetic symbol for the frustrations of life. The principal routes were the so-called "eight passes of the T'ai-hang," but the most important of these was the pass at Ching-hsing, now followed by the railway from Shih-chia-chuang (Hopeh) to T'ai-yüan (Shansi).

Along the steep eastern face of the mountains are rich and easily accessible coal seams, which are mined extensively in the area in the south around Han-tan (Hopeh). The western side of the range, facing inward to the Shansi plateau, also has rich coal deposits, which are mined at Yang-ch'üan in the north and Ch'ang-chih in the south.

**T'ai Hao** (Chinese mythology): *see* Fu Hsi.

**T'ai Hsü,** Pinyin TAI XU, original name (Wade-Giles romanization LÜ P'EI-LIN (b. Jan. 8, 1890, Haining, Chekiang province, China—d. Mar. 17, 1947, Shanghai), Chinese Buddhist monk and philosopher.

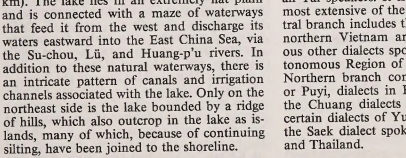
T'ai Hsü received his early training in

Buddhism in the T'ien-tung Monastery near Ningpo. In 1912 he helped organize the Association for the Advancement of Buddhism with headquarters in Nanking. During 1918 he made an extended tour of Formosa (later Taiwan) and Japan, and in 1921 he began the publication of the influential journal *Hai-ch'ao-yin* ("The Voice of the Sea Tide"). T'ai Hsü was heavily influenced by Sun Yat-sen and by the revolution of 1911. He sought to reform the education of monks and promoted social welfare activities. He made numerous attempts to form national and international Buddhist organizations and, to that end, traveled to Japan again in 1925, to Europe and the United States in 1928–29, and to South and Southeast Asia in 1939 and 1941.

T'ai Hsü was among the foremost in modern times to expound the metaphysical and soteriological aspects of Buddhism, especially the Ch'an and Wei-shih schools. He attempted to harmonize Buddhism with modern scientific and philosophical thought, and he tried to synthesize the teachings of the rival schools of Hua-yen and T'ien-t'ai to bring them into harmony with Wei-shih philosophy.

**Tai Ji** (in Chinese philosophy): *see* T'ai Chi.

**T'ai, Lake,** Wade-Giles romanization T'AI HU, Pinyin TAI HU, large lake between Chekiang and Kiangsu provinces, China. Roughly crescent-shaped, it is 45 miles (70 km) from north to south and about 37 miles (59 km) from east to west; its total surface area is about 850 square miles (2,200 square km). The lake lies in an extremely flat plain and is connected with a maze of waterways that feed it from the west and discharge its waters eastward into the East China Sea, via the Su-chou, Lü, and Huang-p'u rivers. In addition to these natural waterways, there is an intricate pattern of canals and irrigation channels associated with the lake. Only on the northeast side is the lake bounded by a ridge of hills, which also outcrop in the lake as islands, many of which, because of continuing silting, have been joined to the shoreline.



Fisherman casting his net, Lake T'ai, Kiangsu province, China
© Dennis Cox/ChinaStock

Although the surrounding area has been settled since the 1st century BC, the irrigation system mostly dates from the 7th century AD and later. Reclamation and drainage works were carried on intensively between the 10th and the 13th centuries. In the 1930s the Chinese Nationalist government established a water-conservancy authority for the lake that, soon after 1949, was replaced by the Chinese Communist government with a water-conservancy assembly.

Several of the islands in the eastern part of the lake were traditionally famous Taoist and Buddhist religious sites. Several thousand people live on the islands, raising fruit and fishing in the lake. Lake T'ai is a place of great natural beauty; and the area, particularly in the east near Su-chou in Kiangsu and in the north around Wu-hsi, attracts many tourists.

**Tai languages,** closely associated family of languages of which Thai (or Siamese), Lao (spoken in Laos), and Shan (spoken mostly in Myanmar [Burma]) are the best known. Known by different names and designations, the Tai languages are spoken in Thailand, Laos, Myanmar, Assam state in northeast India, northern Vietnam, and the southwestern part of China.

A brief treatment of the Tai languages follows. For full treatment, *see* MACROPAEDIA: Languages of the World: *Tai languages*.

The Tai languages are related to a number of other languages and groups of southern China, the most populous being the Kam-Sui languages, spoken mostly in Kweichow province, China; and the Li or Hlai languages of Hainan. The entire language family containing Tai and all its linguistic relatives is called either Tai-Kadai or simply Kadai. The former assumption that Tai and its relatives belong to the Sino-Tibetan family is now not widely accepted. The similarity between the Tai and Chinese phonological systems (especially tone) is no longer taken as criterial; and, although many lexical items are also shared with Chinese, many more—including much of the most basic vocabulary—are not. A competing proposal links Tai and its relatives with Austronesian, but this connection has not been established to the satisfaction of most scholars.

Lexical and phonological criteria indicate that Tai languages have a common genetic relation and are best classified into three dialect groups. The Southwestern branch, composed of Thai, Lao, Shan, Khün, Lü, White Tai, Black Tai, and other languages, extends through Thailand, Laos, northern Vietnam, Myanmar, and Yunnan province in China. This dialect group has expanded in the recent period and encompasses two-thirds of all Tai speakers. It is also geographically the most extensive of the three groups. The Central branch includes the Tho (Tay) dialects of northern Vietnam and Lungchow and various other dialects spoken in the Chuang Autonomous Region of Kwangsi in China. The Northern branch comprises the Chung-chia, or Puyi, dialects in Kweichow province and the Chuang dialects in Kwangsi, as well as certain dialects of Yunnan and Vietnam and the Saek dialect spoken as far south as Laos and Thailand.

These three dialect groups share a large percentage of their vocabulary, though there are words shared only between two groups. In phonological development the Northern dialects differ from the rest in not maintaining the distinction between aspirated and unaspirated voiceless stops. Aspiration found in certain of these dialects is the result of later borrowing and secondary developments. The Central dialects differ from the other groups in the treatment of certain Proto-Tai consonant clusters, such as *tr* and *thr*.

The words of Tai languages are mostly monosyllabic. The many polysyllabic words derive mainly from compounds and loanwords. Syllables are composed of an initial consonant or consonant cluster followed by a vowel or vowel cluster. Syllables can sometimes be closed by a nasal or unreleased stop consonant. Each syllable has a tone—*i.e.*, the syllable must be pronounced with a certain pitch level and contour in all contexts.

Contact with the many different languages abounding in the same area of Southeast Asia has led to the adoption of many words from different sources. Thai and Lao have borrowed extensively from Khmer and the Indic languages of Sanskrit and Pāli, and the Central and Northern dialect groups are much influenced by Chinese loans. The vocabulary of the commonly shared core of Tai languages, presumably stemming from an earlier proto-language, does not use inflection for morphological alternation. The chief Tai method of forming new words is compounding, but reduplication is quite common. Old processes of derivation involving the alternation of consonants or tone, or both, have ceased to be active. Some Tai languages have developed prefixes by abbreviating forms that were once full words; prefixes and infixes are also common in the Indic and Khmer loans into the more southerly Tai languages.

Word order is generally subject–verb–object (SVO), and modifiers such as adjectives and possessive nouns follow the word they modify. The verb plus object (verb phrase) functions as predicate. Words translatable as English adjectives also commonly function as predicate and can be negated, and hence are considered a type of verb. Nouns may also function as predicate in certain contexts. Numbers and demonstratives cannot be used directly with nouns but must be used with a classifier, a word similar in function to English *head* in *fifty head of cattle*. Particles, short words that occur mostly at the end of the sentence, indicate meanings such as completion or continuation of action, question or command, emphasis or uncertainty, and degree of politeness or intimacy.

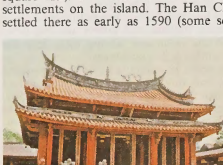
Two different types of writing systems have been used for Tai languages. The Central and Northern dialect groups have used Chinese characters, some modified, since the 18th century or maybe much earlier, primarily for the writing of songs. The other type of writing system, which first occurs in the 13th century, derives from the Southern Indic type of scripts. There are many forms of this type of script, and they are used by a number of languages in the Southwestern group as well as by such neighbouring languages as Mon, Khmer, and Burmese. Modern Thai is written in a script with 42 consonant signs, 35 vowel and vowel cluster signs, and 4 tone markers. Similar types of writing systems are used in Lao, Lü, White Tai, Black Tai, and so on. Some scripts, such as those used by Shan, Ahom, and Nüa (Te-hung Tai of Yunnan, China), have in their traditional forms insufficient vowel signs and few or no tone markers. The Shan and Nüa scripts now also exist in reformed and augmented versions that distinguish all vowels and tones.

**T'ai-nan,** *hsien* (county), southwestern Taiwan, with an area of 778 square miles (2,016 square km). It is bordered by Chia-i *hsien* (north), by Kao-hsiung *hsien* (southeast), and by T'ai-nan *shih* (municipality) and the Taiwan Strait (west). In the mid-17th century, what is now T'ai-nan *hsien* was part of the territory ruled by Cheng Ch'eng-kung (Koxinga), who established Chinese control over Taiwan and had his capital at T'ai-nan city.

Agriculture is the mainstay of the *hsien*'s economy; irrigated rice, sugarcane, sweet potatoes, and fruits are grown on the fertile alluvial coastal plains that constitute most of the region. The major industries are processing of food and fish; the manufacture of textiles, paper, machinery, chemicals, and gunny bags; and the milling of sugar and rice. Asbestos, dolomite, zircon, and salt are extracted, and oil and natural-gas fields are located in the central part of the *hsien*. Taiwan's only international research institute, the Asian Vegetable Research and Development Center, is at Shan-hua, and the Yang-k'ang Industrial Park is at Wang-hsing. T'ou-

she village is known for the religious celebrations of local aborigines. Ts'eng-wen Hsi Shu-k'u (reservoir), in the northern part of the *hsien*, provides irrigation for a 336-square-mile (870-square-kilometre) area and supplies water for the scenic man-made Shan-hu (Coral) Reservoir, 9 miles (15 km) south of Hsin-ying, the administrative seat. Pop. (1989 est.) 1,009,036.

**T'ai-nan,** *shih* (municipality), southwestern Taiwan, with an area of 68 square miles (176 square km). It is one of the oldest urban settlements on the island. The Han Chinese settled there as early as 1590 (some sources



Confucian temple in T'ai-nan, Taiwan
Shostal—EB Inc.

say earlier), when it was known as T'ai-yüan, Ta-yüan, or T'ai-wan—a name that was later extended to the whole island. The Dutch arrived in the city in 1623 and stayed until they were driven out in 1662 by Cheng Ch'eng-kung (Koxinga), a man of mixed Chinese-Japanese parentage who made T'ai-nan his administrative centre and briefly ruled the island before he died. During the last years of the Ming dynasty (1368–1644) and after, a great number of Chinese fleeing disorders in China emigrated to southern Taiwan and settled on the southwestern plain. In 1683, when the Ch'ing dynasty (1644–1911) reestablished Chinese control over Taiwan, T'ai-nan remained the administrative capital of the island. It was fortified in the 18th century after a series of rebellions. Under Chinese rule during the 19th century, T'ai-nan grew into a prosperous city, said in 1880 to have had 60,000 people, and became the commercial and educational centre of Taiwan. After the transfer of the capital to Taipei in 1891, T'ai-nan became primarily a commercial city. During the Japanese occupation (1895–1945), it was connected to the north and to the port of Kao-hsiung by rail. The old town walls were demolished and the city limits greatly expanded. T'ai-nan continued to expand after the Japanese withdrawal.

T'ai-nan is the main market for the produce of the southwestern plain, dealing in sugarcane, rice, fruit, and peanuts (groundnuts). The productivity of the agricultural area north of the city was greatly increased by the construction of the Chia-nan irrigation scheme, which waters some 1,900 square miles (5,000 square km). The system, which includes some 10,868 miles (17,490 km) of canals and irrigation channels, was designed and constructed by the Japanese between 1920 and 1930 and has since been improved. The city is also a centre of the coastal salt industry and of fisheries. Other products include textiles, rubber goods, sugar, chemicals, plastics, light-engineering and aluminum products, electrical appliances, and processed foods. T'ai-nan has many traditional handicrafts, notably goldsmithing and silversmithing, and attracts many tourists. Its traditional outport is An-p'ing. Pop. (1989 est.) 668,867.

**T'ai-pei,** northernmost *hsien* (county), Taiwan, occupying an area of 792 square miles (2,051 square km). It is bordered by I-lan *hsien* (southeast), T'ao-yüan *hsien* (southwest), and the East China Sea (north). Taipei (*q.v.*) *shih* (municipality) and Chi-lung (Keelung) *shih,* administratively independent cities, are located within the northern part of the *hsien.* The Hsüeh-shan Mountain Range in the southeast, with an average elevation of 4,590 feet (1,400 m), gradually gives way to the alluvial river basins and coastal plains in the north. In the extreme north the Ch'i-hsing Mountains rise to 3,675 feet (1,120 m). The T'ai-pei basin, drained by the Tan-shui (Tamsui) River, is fertile; citrus fruits, tea, rice, and sweet potatoes are grown. The Chi-lung and T'ai-pei coalfields are in the central part of the county; bauxite, clay, sulfur, iron-ore, copper, and mercury deposits are also worked. Industries produce wood and paper products, textiles, machinery, chemicals, canned food, and fertilizers. Three nuclear reactors are located in the northern coastal belt and provide a major portion of Taiwan's electricity. The *hsien* developed rapidly after it became the refuge and headquarters of Chiang Kai-shek's Nationalist Chinese regime in 1949 following its defeat in the Chinese revolution. The Lin-k'ou and Jui-fang industrial parks are near Taipei city. The Yeh-liu Sea Park is on the northern coast of the county, and the Wu-lai Forest Recreational Area, with Taiwan's only passenger cableway, is 18 miles (30 km) south of Taipei city. Pan-ch'iao is the administrative seat. Pop. (1989 est.) 2,903,199.

**T'ai-pei** (city): *see* Taipei.

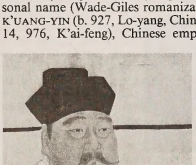
**T'ai Shan** (mountain, China): *see* T'ai, Mount.

**T'ai-shang Hsüan-yüan Huang-ti,** also called T'AI-SHANG LAO-CHÜN (Chinese philosopher): *see* Lao-tzu.

**T'ai-ti** (Chinese emperor): *see* Sun Ch'üan.

**T'ai-tsu** (Chinese emperor; d. 912): *see* Chu Wen.

**T'ai-tsu,** Pinyin TAIZU (temple name), personal name (Wade-Giles romanization) CHAO K'UANG-YIN (b. 927, Lo-yang, China—d. Nov. 14, 976, K'ai-feng), Chinese emperor (960–



T'ai-tsu, detail of a portrait; in the National Palace Museum, Taipei
By courtesy of the National Palace Museum, Taipei, Taiwan, Republic of China

976), military leader, and statesman who founded the Sung dynasty (960–1279). He began the reunification of China, a project largely completed by his younger brother and successor, T'ai-tsung.

*Early life and rise to power.* Chao K'uang-yin (who posthumously received the dynastic temple name of T'ai-tsu, or "Grand Ancestor") was the second son of a military officer, Chao Hung-yin. At the time of his birth, China was in chaos. The once-great T'ang dynasty, fragmented by rebellions, had been extinguished in 907. A succession of warlords—Chinese, part Chinese, or foreign—claimed the imperial throne briefly in devastated North China, while the more prosperous south was divided among satraps who were independent in fact and sometimes in name. The boy's forebears had in three previous generations won a certain standing as military leaders under one or another imperial claimant, and his father reached a post of high command before his death in 956. The wisdom and foresight of Chao K'uang-yin's remarkable mother influenced his decisions even after her death in 961.

At about age 20 Chao joined a leader whose adoptive father soon afterward established the Later Chou dynasty at K'ai-feng; Chao's patron succeeded to the throne in 954 and fought to extend his sway into South China and to eliminate a rival who, established to the north in Shansi and supported by the Khitan empire, laid claim to the rule of China. Through a series of daring and successful actions, Chao quickly rose to the chief command of the Later Chou forces.

In 959 Chao's patron died and was followed on the throne by his son, a child. Shortly after the armies of the Khitan and their Chinese allies prepared a concerted invasion. Chao marched northward to meet them. Discontent arose among Chao's troops, who in the crisis did not wish a child as ruler. When the army was encamped for the night at a bridge outside the capital, the officers awakened Chao (who had drunk well before retiring), hailed him as emperor, robed him in imperial yellow, mounted him on horseback, and urged him to return and take over the government; the records, which are unverifiable on this point, imply that Chao lacked forewarning of the coup. On the officers' pledge of obedience and promise not to molest the existing imperial family and its councillors, the public buildings, and the homes of the people, Chao complied. He named his dynasty the Sung.

In rapid succession the dissident Chinese states now came under the new emperor's control. In 963 two submitted voluntarily and two more were conquered. By 976 all but the northern rival house were mastered, and its Khitan backers had seen more than one defeat. In that year the Sung armies were mobilized against this last rival when the emperor T'ai-tsu died at the age of 49. Within three years his younger brother T'ai-tsung, who succeeded him, completed the unification of China (except for a small area near Peking that remained in Khitan hands).

*T'ai-tsu's policies and personality.* The task of unification had not been easy, and in parts of China revolts of local autonomists further complicated it. Yet the Sung founder had also turned his mind to ways of avoiding the dangers that had been fatal to the T'ang and to encourage the success of his dynasty. T'ai-tsu's policies no doubt owed much to his personality, a striking combination of qualities that inspired in his generation and later a multitude of anecdotes about him. Though some of these may include fictional elements, they convey the impression he made on his countrymen. A highly skilled archer and horseman in his youth, Chao survived daredevil equestrian exploits unscathed. As emperor he said that destiny had given him the throne and would determine his life or death; man could not deflect it. Despite remonstrances of his advisers, he persisted in going about incognito to observe conditions among the people. He rejected indignantly the gift of a sword stick for protection in emergency. His tastes were simple; when shown the inlaid urinals captured from the former Szechwan princeling, he had them destroyed. He visited his ministers informally and frankly admitted to them his chagrin over his own errors. In his last year he declined the title of unifier and pacifier that was offered him.

T'ai-tsu was strict in holding his officials to account in important matters; his councillors held him in awe. On the other hand, he ac-

cepted minor faults or impertinences with a laugh. He was slow to entertain suspicion. He sometimes acted impetuously, and some have suggested, on rather limited evidence, that he indulged in wine to excess. On occasion, when severely provoked by a presumptuous official or subject, he was given to outbursts of violent rage. At such times, however, his temper cooled quickly, and he then softened penalties he had given in anger and even compensated the unfortunate culprit for abuses suffered.

T'ai-tsu was active by nature. Even as emperor he conducted military campaigns personally from time to time. Rather than simply approving governmental papers in finished form, as T'ang emperors had done, he let his ministers submit rough drafts to him for preliminary criticism.

The functional arrangements of T'ai-tsu's government reflected both his active disposition and his refusal to pretend infallibility. He continued the existing system by which three ministers were directly responsible to him for different aspects of administration (fiscal, military, and general), thus limiting the power of each. By generously granting them consideration and responsibility, however, he encouraged a certain balance between the functions of ruler and minister. The control of the central government over the local was also strengthened. Beginning in 963, the administration of the prefectures was cautiously but steadily transferred from the unruly military to civil officials. Court officials were sent to govern subprefectures. From 965 taxes were remitted directly to the national treasury. The first fiscal intendants—forerunners of the Sung "circuit" system—were established to supervise local functionaries. To counter the military threat to the state's integrity, T'ai-tsu transferred the best troops to the capital and on suitable opportunities induced the most powerful commanders to accept retirement.

*Reform of the examination.* T'ai-tsu's policies were clearly directed toward the creation of a bureaucracy based on demonstrated abilities rather than birth or favour. This is evident in his steps to strengthen the examination system. By 963 he had forbidden court officials to recommend candidates and had forbidden graduates to consider examiners their patrons. He ordered reexaminations on the petition of a rejected candidate or on even a hint of favour in the selection of graduates. By 973 he had established the final examination in the imperial palace to verify the rankings and had ordered the list of successful competitors to be announced publicly. He began to award larger numbers of degrees.

A mildness and humanitarian tone pervade T'ai-tsu's policies, which on the whole conform to the Confucian ethos. He extended clemency toward defeated opponents rather consistently. He showed concern for the adherents of the dynasty he displaced. His generals were repeatedly admonished to shun avoidable harm to the citizens of places they occupied and even to spare captured soldiers and leaders; among the latter was the poet-prince Li Yü. His own ministers who lost his favour were treated well. In his legal reforms, though he dealt more severely with corruption and irresponsibility of officials in several measures, he lightened the punishments for violations of the state controls over salt and wine and required a review of all capital sentences by the high court at the capital. His early measures also show a special concern with improving the economic lot of the poorer citizens and easing their burdens of taxation.

*The legacy of T'ai-tsu.* In his 16-year reign, T'ai-tsu laid the foundations for the essential political institutions of a remarkable epoch. The political order of his dynasty combined to a surpassing degree freedom of discussion, innovation in bureaucratic methods, internal reform, peace, and stability. This atmosphere undoubtedly facilitated the pioneering in economic techniques, scientific advances, and achievements in philosophy, art, and literature that distinguished the Sung period.

When T'ai-tsu died, the construction of the new state was far from finished. The ensuing peace and prosperity would also bring new problems calling for new solutions. Of the succeeding emperors, none quite matched him in stature or in character. But Confucian ancestral piety reinforced the attraction of his proven policies. The traditions of his active concern in administration and of close association with the bureaucracy's leaders persisted in greater or lesser degree among later Sung rulers. Subsequent developments on the whole moved in directions indicated by T'ai-tsu. Their benefits were scarcely unadulterated; safeguards against the ambitions of military commanders, for example, perhaps hampered Sung armies in meeting powerful foreign invaders. Still, the efforts of his successors to further popular welfare, to find and train the best talent for the civil service, and to defend the state's stability and the unbroken rule of the dynasty for three centuries no doubt owe much to T'ai-tsu's concepts of statecraft.

(E.A.K.)

*To make the best use of the Britannica, consult the* INDEX *first*

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**T'ai-tsu,** Pinyin TAIZU (temple name, or *miao-hao*), personal name (*hsing-ming*) A-KU-TA, also called WAN-YEN MIN (b. 1069, Manchuria, China—d. 1123, China), leader of the nomadic Juchen tribes who occupied north and east Manchuria. He founded the Chin, or Juchen, dynasty (1115–1234) and conquered all of North China. The Juchen were originally vassals of the Mongol-speaking Khitan tribes who had occupied part of North China and had taken the dynastic name of Liao (907–1125). Dissatisfied with this relationship, A-ku-ta's father had been preparing a revolt when he died in 1100.

In 1112, when the last emperor of the Liao visited the Juchen homeland and ordered the tribal chiefs to dance for him, A-ku-ta refused to comply. He threw off his allegiance to the Liao and in 1115 declared himself emperor. The Sung rulers (960–1279), hoping to gain back Chinese territory occupied by the Liao, made an alliance with A-ku-ta. Aided by this union, A-ku-ta overran the entire Liao empire within a few years. When the Sung objected to their share of the spoils, A-ku-ta's troops continued south, occupying the Sung capital and forcing the dynasty to reestablish itself farther south in what is usually referred to as the Southern Sung (1127–1279).

The Juchen were beset by internal dissensions after A-ku-ta's death and eventually contented themselves with control of the north for the next 108 years, while the Sung ruled in the south. A-ku-ta, who had adopted the Chinese personal name Wan-yen Min, was given the posthumous title of T'ai-tsu ("Grand Progenitor").

**T'ai-tsu** (Chinese emperor; d. 1398): *see* Hung-wu.

**T'ai-tsu** (Manchurian chieftain; d.1626): *see* Nurhachi.

**T'ai-tsung** (Chinese emperor, 1360–1424): *see* Yung-lo.

**T'ai-tsung,** Pinyin TAIZONG (temple name, or *miao-hao*), personal name (*hsing-ming*) LI SHIH-MIN (b. 600, China—d. 649, China), Chinese ruler, the second emperor (626–649) of the T'ang dynasty (618–907) and second son of the dynastic founder, Kao-tsu.

Traditional historians portrayed T'ai-tsung as the driving force behind his father's uprising against the doomed Sui dynasty in 617. But powerful evidence shows that his was a minor role. In the initial campaign to take the Sui capital, he and his elder brother, Li Chien-ch'eng, were both T'ang commanders. Li Shih-min distinguished himself as a general and strategist and was largely responsible for the conquest of the eastern capital of Lo-yang and the eastern plain. In 621 the emperor delegated to him control of both military and civil administration in the east, with his headquarters at Lo-yang. There he built up his own regional administration and an entourage of talented officials.

While Li Shih-min consolidated his power in Lo-yang, his elder brother was implicated in an attempted coup but was absolved, poached gifted officials from Li Shih-min's administration, and made at least one attempt on his life. In 626 their relations reached a crisis point. Li Shih-min went to the capital to see off a third brother, Li Yüan-chi, who was placed in command of an expedition against the Turks; his elder and younger brothers are said to have plotted to murder him. Li Shih-min, with a few followers, seized the Hsüan-wu gate (the northern entrance to the emperor's palace), ambushed and killed his brothers, and then peremptorily informed the emperor. Two months later, Kao-tsu abdicated in his favour.

*T'ai-tsung the emperor.* With this coup began the reign of T'ai-tsung. His image would be revered for more than a millennium not



T'ai-tsung, detail of a portrait; in the National Palace Museum, Taipei

By courtesy of the National Palace Museum, Taipei, Taiwan, Republic of China

only by Chinese monarchs but by Japanese and Korean statesmen and by the rulers of China's neighbouring peoples to the north. It is not easy to separate the real T'ai-tsung from the myths that he himself encouraged and that his own historians incorporated into the dynastic record. They were presented in a vivid and idealized account of his court, the *Chen-kuan cheng-yao,* written in 708–10, as a utopian model of ideal government. It gives a picture of a powerful and decisive emperor governing with the aid of a group of talented and well-chosen chief ministers. It shows him as responsive to their outspoken exhortations and remonstrance and as empathetic toward the feelings of his people.

At first, T'ai-tsung's style of government closely approached his ideal picture. He was still a very young man, a usurper who needed to heal the rifts between his own supporters at court and those who had supported his brothers. His Confucian moralist mentors were Wei Cheng, who had served a rival rebel regime and had later been an adviser to Li Chien-ch'eng, and who took on the role as T'ai-tsung's public conscience, and Hsiao Yü, a descendant of an ancient Southern ruling family. The practical architects of his policies were Tu Ju-hui and Fang Hsüan-ling, who had served him since 618, and his much younger brother-in-law, Chang-sun Wu-chi, whose sister was

T'ai-tsung's empress and who was T'ai-tsung's closest friend and adviser. All these men enjoyed very long tenure and gave much of the special character to T'ai-tsung's reign.

Whatever T'ai-tsung's style, most of the dynasty's basic policies and institutions had been put in place by his father, Kao-tsu. The structure of government and the detailed law code, which were to provide models for all of East Asia, were already completed. T'ai-tsung's task was to get these institutions working effectively.

The main problem was reestablishing local government after years of rebellion and civil war. It took most of T'ai-tsung's reign to restore normal civil administration and to create a unified civil service. Even so, by the end of his reign, his local administrations had succeeded in registering only about a third of those who had registered under the Sui. Although he was renowned for his comparatively frugal government, T'ai-tsung had little choice: his tax base was reduced by almost two thirds. The reduced tax base was further cut by a militia system that aimed to provide a large permanent pool of self-supporting military manpower; the soldiers were granted exemption from taxes and labour service.

T'ai-tsung also had to deal with the great clans of Shantung, who considered themselves the superiors of the royal house. This he did by producing a national compendium of genealogies, ranking the royal house highest. T'ai-tsung further developed the state schools established by Kao-tsu and set up a national academy directorate to oversee them. Prefectural schools, including medical schools, were established throughout the country, and a systematic effort was launched to edit the texts of the Confucian canon and to provide standard commentaries for examination candidates. Official histories were also compiled.

*Foreign affairs.* While developing a new order at his capital, T'ai-tsung was engaged against both the eastern and the western Turks. He also began to establish sovereignty over the rich and highly cultured oasis kingdoms in what is now Sinkiang, strung out along the Silk Road to the west. An invasion of the northern Korean state of Koguryŏ in 645 ended in disaster. Yet T'ai-tsung acquired immense international prestige for the T'ang.

*The succession.* Despite T'ai-tsung's original designation of his eldest son, Li Ch'eng-ch'ien, as heir apparent, that son's unacceptable behaviour eventually resulted in his banishment and death. T'ai-tsung was forced to give the succession to his ninth son, Li Chih (the future Kao-tsung), who was not his preferred heir.

In the latter half of his reign, T'ai-tsung became increasingly arbitrary, impatient of his ministers' criticisms, and more and more assertive. T'ai-tsung inherited from his father the basic laws, institutions, and structure of government. He continued to perfect them but made few innovations, apart from his reorganization of the military. His unique contribution was his style of government: a style that could only be effective under an emperor who could deal with his ministers as "first among equals," exert easy personal dominance and authority, and who could deal with outspoken criticism from advisers, couched in the language of Confucianism to which he and they were unquestionably committed.

(D.C.T./Ed.)

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**T'ai-tsung,** Pinyin TAIZONG (temple name, or *miao-hao*), personal name (*hsing-ming*) CHAO HUANG, CHAO KUEI, or CHAO K'UANG-I (b. 939, China—d. 997, China), second emperor of the Sung dynasty (960–1279) and brother of the first emperor, T'ai-tsu. He completed consolidation of the dynasty. When T'ai-tsu died in 976, the throne was passed to T'ai-tsung, rather than to the first emperor's infant son, presumably against the will of the first emperor. This speculation is reinforced in that, after becoming emperor, T'ai-tsung, formerly a very mild and forbearing man, treated his younger brother and his nephew with such cruelty that they committed suicide.

Three years after assuming the throne, T'ai-tsung took over the two remaining independent states in South China, thereby nearly completing the empire's unification. But in foreign affairs he was less successful. When he attempted to regain former North Chinese territory between Peking and the Great Wall, he suffered a disastrous defeat at the hands of the Khitan tribes that had occupied the area and assumed the dynastic name of Liao (947–1125). Fighting continued until 1004, when T'ai-tsung's successor agreed to give up claims to that region.

In civil administration T'ai-tsung paid particular attention to education, helping to develop the civil-service examination system and to further its use in determining entrance into the bureaucracy. He centralized control more thoroughly than ever before in Chinese history, concentrating great power in the emperor's hands. He followed the T'ang dynasty's prefectural system and divided China into 15 provinces, each of which was under a governor. By the end of T'ai-tsung's reign, Sung rule had become established, and the dynasty had begun its great cultural and economic achievements.

**T'ai-tung,** *hsien* (county), southeastern Taiwan. It is bordered by the *hsiens* of Hua-lien (north) and Kao-hsiung and P'ing-tung (southwest) and by the Philippine Sea (east). Thickly forested southeastern slopes of the Chung-yang Range extend over most of the area; Kuan Mountain, rising to 12,028 feet (3,666 m), is the highest peak on the northwestern border of the *hsien*. A hydroelectric plant, located 3 miles (5 km) northwest of T'ai-tung city on the Pei-nan River, provides electric power and irrigation facilities for the surrounding region. Agriculture is confined mostly to the narrow coastal plains; paddy rice, sweet potatoes, wheat, sugarcane, corn (maize), peanuts (groundnuts), bananas, and pineapples are grown. Cattle, pigs, and poultry are raised. Sugar milling, cotton ginning, and wood processing are the major industries. Gold, silver, copper, gypsum, nickel, and iron ore are mined. T'ai-tung, the administrative seat, has a teacher-training college. Area 1,357 square miles (3,515 square km). Pop. (1991 est.) 256,405.

**T'ai-tung,** formerly P'I-NAN, coastal *shih* (municipality) and seat, T'ai-tung *hsien* (county), southeastern Taiwan, on the southern bank of the Pei-nan River, 58 miles (94 km) northeast of Kao-hsiung.

The city was founded and developed during the reigns of Chia-ch'ing (1796–1820) and Hsien-feng (1851–61), both emperors of the Ch'ing dynasty. Situated on an alluvial plain, it is an important agricultural marketing centre; rice, sugarcane, and peanuts (groundnuts) are grown nearby. Sugar milling, cotton ginning, and timber and jute processing are the major industries. T'ai-tung city also has an experimental station for tropical agriculture. It is the southern terminus of the East Line railway from Hua-lien in the north and is connected by air to Taipei city, Kao-hsiung city, and Lan Island. Lack of a good harbour has retarded industrial development in T'ai-tung. Pop. (1990 est.) 108,127.

**Tai Tung-yüan:** *see* Tai Chen.

**T'ai-wan Hai-hsia** (China): *see* Taiwan Strait.

**Tai Wen-chin:** *see* Tai Chin.

**T'ai-yüan,** Pinyin TAIYUAN, city and capital of Shansi *sheng* (province), China. T'ai-yüan, one of the greatest industrial cities in China, lies on the Fen River in the north of its fertile upper basin. It commands the north-south route through Shansi, as well as important natural lines of communication through the mountains to Hopeh province in the east and—via Fen-yang—to northern Shensi province in the west.

The city was originally the site of Chin-yang, a strategic centre for the ancient state of Chao. After the Ch'in conquest of Chao in 221 BC, it became the seat of the commandery (district under the control of a commander) of T'ai-yüan, which continued during the Han dynasty (206 BC–AD 220) and after. In the Later Han period, it became capital of the province (*chou*) of Ping. In the 6th century it was for a time a secondary capital of the Eastern Wei and Northern Ch'i states, growing into a large city and also becoming a centre of Buddhism. From that time until the middle of the T'ang dynasty (618–907), the construction of the cave temples at T'ien-lung Mountain, southwest of the city, continued. The dynastic founder of the T'ang began his conquest of the empire with T'ai-yüan as a base and using the support of its local aristocracy. It was periodically designated as the T'ang's northern capital and grew into a heavily fortified military base.

The old city was at T'ai-yüan-chen, a few miles east of the modern city. After the Sung conquest in 960, a new city was set up on the banks of the Fen in 982. The city became a superior prefecture in 1059 and administrative capital of Ho-tung (northern Shansi) in 1107. It retained this function, with various changes in its name and status, down to the end of the Mongol period (1368). At the beginning of the Ming dynasty (1368–1644), it was renamed T'ai-yüan Fu (*fu* meaning "chief town") and retained this name until 1912. Under the Ming dynasty and in the Ch'ing period (1644–1911), it was capital of Shansi. Under the republic (established in 1911), its name was changed to Yang-ch'ü, a name it retained until 1947.

In 1907 the importance of T'ai-yüan was increased by the construction of a rail link to Shih-chia-chuang, in Hopeh, on the Peking to Wu-han trunk line. Soon thereafter T'ai-yüan suffered a serious economic crisis. In the 19th century the merchants and local banks of Shansi had been of national importance, but the rise of modern banks led to the rapid decline of this system—with disastrous effects upon Shansi and its capital.

After 1911 Shansi remained under a powerful warlord, Yen Hsi-shan, who retained control from 1913 to 1948. T'ai-yüan consequently flourished as the centre of his comparatively progressive province and experienced extensive industrial development. It was also linked by rail both to the far southwest of Shansi and to Ta-t'ung in the north.

After the Japanese invasion in 1937, T'ai-yüan's industries developed still further. In 1945 the Japanese army in Shansi surrendered to Yen Hsi-shan and continued to fight for him until 1948. Eventually, the Chinese Communist armies captured T'ai-yüan, but only after a destructive battle.

Since 1949 T'ai-yüan has developed a large industrial base with heavy industry (notably iron and steel) of prime importance; local coal

production is considerable. T'ai-yüan is also an engineering centre, produces cement, and has a large chemical-industrial complex. It is also a centre of education and research, particularly in technology and applied science. Pop. (2001 est.) 1,893,300.

**Taidu,** also spelled TA-TU, Mongol KHANBALIQ, the city of Peking (*q.v.*) under the Mongols.

**Taieri River,** river in southeastern South Island, New Zealand. It rises in the Lammerlaw Range and flows 179 miles (288 km) north and southeast in a great arc—across the Maniototo Plains, around the Rock and Pillar Range, and across the Taieri Plains—to the Pacific Ocean, 20 miles (32 km) southwest of Dunedin. Tributaries in the river's 720-square-mile (1,860-square-kilometre) basin include Serpentine Creek; Sowburn, Wether Burn, Kyeburn, and Nenthorn streams; and Waipori River. Gorges are found in both the upper and lower reaches of the Taieri, which has laid down the fertile Taieri Plains near its mouth. Launches may navigate the river as far as Henley. The river's name is possibly derived from the Maori word for "to smash," or "to pound up," and "shining river"; it may also refer to an unusual flow of the river's tides.

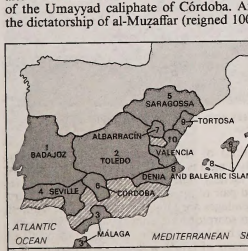
**Ṭa'if, aṭ-,** also spelled TAYIF, city, western Saudi Arabia. Lying at an elevation of 6,165 feet (1,879 m) on a tableland southeast of Mecca, it is the nation's principal summer resort. Once the seat of the pagan goddess Allat, it is revered now as the site of the tomb of 'Abd Allāh ibn 'Abbās, a cousin of the prophet Muḥammad, and for the graves of two infant sons of the Prophet. Aṭ-Ṭā'if is the site of the signing of the treaty of 1934, which demarcated a portion of the Saudi Arabia–Yemen boundary. The city, noted for its production of fruit and woven coats, is the site of a military hospital and the Akramah Dam for irrigation (completed 1956). A modern highway links the city to Mecca and Jidda. Pop. (1991 est.) 410,000.

**taifa** (Spanish), Arabic ṬĀ'IFA, plural ṬAWĀ'IF, a faction or party, as applied to the followers of any of the petty kings who appeared in Muslim Spain in a period of great political fragmentation early in the 11th century after the dissolution of the central authority of the Umayyad caliphate of Córdoba. After the dictatorship of al-Muẓaffar (reigned 1002–08), civil war reduced the caliphate to a puppet institution and allowed the various *taifas* to establish themselves in independent and short-lived kingdoms throughout the Iberian peninsula. There were at least 23 such states between 1009 and their final conquest by the Almoravids of North Africa in 1091. Thus, the Berbers counted in their party the Aftasids of Badajoz, the Dhū an-Nūnids of Toledo, and the Ḥammūdids of Málaga, who briefly helped the Córdoban caliphate. The Andalusians, or Hispano-Arabs, were represented by the 'Abbādids of Seville, the Jahwarids of Córdoba, and the Hūdids of Zaragoza. The Ṣaqālibah (Slav mercenaries) did not form dynasties but created such kingdoms as Tortosa, Denia, and Valencia.

Wars between the various states never ceased. The states had few scruples in asking for Christian support against rival Muslim kings or in turning to the North African kingdoms for aid against Christian princes. Such lack of unity and consistency made the kingdoms of the *taifas* fair targets for the growing forces of Christian reconquest; soon Badajoz, Toledo, Zaragoza, and even Seville were paying tribute to the Christian Alfonso VI of Leon and Castile.

Despite their political incompetence, however, the *taifa* kings fostered a period of brilliant Islāmic cultural revival. In the manner of the caliphal courts, they entertained poets; promoted the study of philosophy, natural science, and mathematics; and produced such noted figures as the poet-king al-Mu'tamid of Seville and his vizier Ibn 'Ammār, the poets Ibn Zaydūn and Wallādah of Córdoba, and Ibn Ḥazm, the poet-philosopher-scholar.

In 1085 Alfonso took Toledo. At the invitation of several party kings, the Almoravid Yūsuf ibn Tāshufīn entered Spain and defeated Alfonso at the Battle of Zallāqah, near Badajoz, in 1086. When Muslim fortunes in Spain did not improve, Yūsuf returned in 1088; he dissolved the party kingdoms (1090–91) and extended the Almoravid empire into Spain.




*Taifa* kings (*mulūk aṭ-ṭawā'if*) in Muslim Spain in 1050 (the kingdoms are named on the map; the "party kings" and the years of their rule are indicated on the numbered legend)

Adapted from Claudio Sanchez-Albornoz y Menduiña, *La España Musulmana*, vol. 2

*Consult the* INDEX *first*

**taiga,** also called BOREAL FOREST, open coniferous forest growing on swampy ground that is commonly covered with lichen. It is the characteristic vegetation of the subpolar region spanning northern Eurasia, between the colder tundra zone to the north and the warmer temperate zone to the south. *See* coniferous forest.

**T'aigo Wangsa** (b. 1301, Korea—d. 1382, Korea), Buddhist monk, founder of the T'aigo sect of Korean Buddhism.

T'aigo entered into Buddhism at the age of 13 and at 25 passed the national Buddhist service examination. He practiced at a temple in a mountain in the north of Seoul, which he built and named T'aigoam (whence his name was derived). In 1346 he went to China and received further training for two years under the guidance of Shih-wu, the 18th patriarch in the Lin-chi branch of the Ch'an sect in China. In an attempt to reform Korean Buddhism, T'aigo adopted the *Regulations of the Ch'an Sect* compiled by Pai Chang, and in 1356, with the approval of King Kongmin, he established a new Buddhist administration office called Wonyung-bu. Though he became head of the office, his reform attempt did not bear tangible fruit, and the T'aigo sect has remained relatively small.

**Taihape,** town, Manawatu-Wanganui local government region, south-central North Island, New Zealand. It lies along the Hautapu River, 7 miles (11 km) above the latter's confluence with the Rangitikei. It was founded in 1894 as a coaching station on a track leading east to Hastings and was known as Otaihape, a Maori word meaning the "abode of Tai the hunchback." It quickly developed as the centre of a lumber industry. Situated along a major highway and railway to Wellington (148 miles [238 km] southwest), Taihape now serves a dairy- and sheep-farming area. It has engineering works, iron and brass foundries, and furniture and concrete-products factories. Pop. (1996) 1,994.

**Taihō code** (AD 701), in Japan, administrative and penal code of the Taihō era early in the Nara period, modeled on the codes of the Chinese T'ang dynasty (618–907) and in force until the late 8th century. Although the first work on legal codes was begun in 662, the Taihō code was the most famous. It provided for the establishment of the central-government administrative organs; of provinces (*kuni*) ruled by governors (*kokushi*) who were appointed by the central government; districts (*gun, or kōri*) administered by district governors (*gunji*) selected locally from the gentry; and townships of 50 households, governed by headmen. Provisions included not only administrative laws (*ryō*) but also penal laws (*ritsu*), which concerned matters of arrest and imprisonment.

The original code is not extant, but its content has been largely preserved in the Yōrō code (718).

**Taika era reforms,** Japanese in full TAIKA NO KAISHIN ("Great Reformation of the Taika Era"), series of political innovations that followed the coup d'état of AD 645, led by Prince Nakano Ōe (later the emperor Tenji; *q.v.*) and Nakatomi Kamatari (later Fujiwara Kamatari; *q.v.*) against the powerful Soga clan. The reforms extended the direct dominion of the emperor's family over the whole of Japan with an orderly and fair system of government modeled on that of T'ang China. One of the adoptions from China was the naming of eras in an emperor's reign, and the newly enthroned emperor Kōtoku promptly took the era name Taika ("Great Change") for the first half of his reign.

Prior to the Taika era, Japan had been a patchwork of clans, and the imperial court had been dominated for 50 years by the Soga family, which worked its will by intrigue, manipulation, and murder. One victim of the arrogant Soga Iruka, scion of the family, was Prince Yamashiro Ōe, murdered in 643. Thereupon, Iruka styled his own mansion "Imperial Palace" and called his own sons princes.

In 645 Prince Nakano-Ōe and a cohort killed Iruka in the palace of Nakano's mother, the empress Kōgyoku. She then abdicated in favour of Nakano's uncle, who became the emperor Kōtoku, setting the stage for the Era of Great Change.

Nakano, scarcely 20 years old, had enormous influence in his uncle's regime and became the crown prince; his cohort, Nakatomi Kamatari, became minister of the interior. Nakano Ōe and Kamatari are regarded as the architects of the Taika reforms. Although the orderly government of the Chinese T'ang dynasty had been known for some time through Japanese emissaries and scholars, it was the crown prince's meticulous planning and Kamatari's execution of the reforms that brought Japan for the first time an effective, centralized, imperial government.

Although some of the reforms traditionally attributed to the Taika era probably occurred later, it is well-established that changes of immense consequence occurred during this era—a considerable number of them in the first year and even the first days of Kōtoku's

reign. An Imperial rescript at the beginning of 646 formally initiated the wave of reform. In four articles it abolished private ownership of land and people, proclaiming that they were owned by the public, (*i.e.*, the emperor); that new administrative and military organizations responsible to the emperor should be established both in the capital and the provinces; that a census would be introduced and with it fair distribution of land; and that a new and equitable tax system would be created.

In March Prince Nakano formally surrendered his estates and serfs to the state; other nobles followed his lead, and in August an edict reinforced the January decree and made such surrender mandatory and universal. The promised census was initiated, reporting not only population statistics but data concerning land use; it prepared the way for a peasant tax system based on population rather than land use, and it also facilitated land redistribution. A Chinese-style Imperial capital was designed and created at Omi, and a large-scale land distribution program was established in the capital area.

Laws were codified for the first time and then substantially reformed. Government departments emulating those of the T'ang rulers were established and staffed with trained officials, many of whom had been educated in China. Construction of a new nationwide network of roads was started.

Scholars of the Taika era are struck by the similarity of the scope of its reforms to that of the Meiji Restoration, 1,200 years later, but unlike the Meiji reforms, those of the *Taika no kaishin* were carefully planned and publicly proclaimed in advance of their execution.

**taiko,** any of various Japanese forms of barrel-shaped drums with lashed or tacked heads,



*Taiko,* Japanese barrel-shaped drum
K.B.S. Photo by Hisao Maejima

usually played with sticks (*bachi*). When the word combines with another for the name of a specific type of drum, the *t* euphonically changes to *d,* thus the large *o-daiko* of folk festivals and Kabuki drama and the *gaku-daiko* of the court orchestra (*gagaku*).

The *tsuri-daiko* is a hanging drum made of zelkova wood and suspended within an elaborate circular frame. Other prominent taiko are the *asobi-daiko* (a children's frame drum) and *den-den-daiko* (a fan-shaped frame drum).

**Taikō Josetsu** (fl. late 14th–early 15th century, Kyōto), priest and painter, regarded as the first of the long line of Japanese Zen Buddhist priests who painted in the Chinese-inspired *suiboku* (monochromatic ink painting) style.

Josetsu was associated with the Shōkoku-ji (in present Kyōto), where his pupil, the prominent painter Tenshō Shūbun (flourished early–mid-15th century) also resided. Josetsu's most important work is an ink landscape painting, "Catching a Catfish with a Gourd." It was commissioned by the founder of the temple, Ashikaga Yoshimitsu, military dictator of Japan from 1368 to 1394, and is one of the earliest *suiboku* paintings in Japan. The subject is Zen inspired; the soft ink-wash technique reflects the influence of Mu Ch'i Fa-ch'ang, a 13th-century Chinese Zen Buddhist painter whose style was widely emulated by the Japanese priest-painters. Josetsu is also believed to have done the boldly executed group portrait of Buddha, Lao-tzu, and Confucius, "The Three Teachers," located in the Ryōsoku-in monastery, Kyōto.

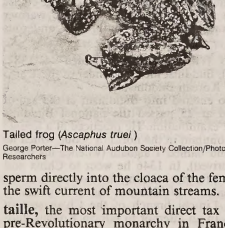
**Taiku** (South Korea): *see* Taegu.

**tail,** in zoology, prolongation of the backbone beyond the trunk of the body, or any slender projection resembling such a structure. The tail of a vertebrate is composed of flesh and bone but contains no viscera. In fishes and many larval amphibians, the tail is of major importance in locomotion. In most land-dwelling quadrupeds it is not an important locomotory device, although in animals such as crocodiles, otters, and whales, which are secondarily adapted to an aquatic environment, the tail, often flattened, again becomes important. Arboreal animals (*e.g.,* squirrel) use the tail for balance and as a rudder when leaping; in some (*e.g.*, spider monkey, chameleon) it is prehensile, a fifth limb for increased mobility and stability. Other adaptive uses of the tail are for defense (*e.g.*, porcupine), social signals (dog), warning signals (rattlesnake), and hunting (alligator). Most of the tail vertebrae of birds have been fused into the short pygostyle bone; this appendage holds the tail feathers, which aid in flight maneuverability.

**tailbone:** *see* coccyx.

**tailed frog** (*Ascaphus truei* ), the single species of the frog family Ascaphidae (order Anura). It is restricted to cold, clear forest streams of the American Pacific northwest.

The "tail" found on the male is actually an extension of the cloaca, an internal chamber that receives waste materials and reproductive products. This extension serves to transfer



Tailed frog (*Ascaphus truei* )
George Porter—The National Audubon Society Collection/Photo Researchers

sperm directly into the cloaca of the female in the swift current of mountain streams.

**taille,** the most important direct tax of the pre-Revolutionary monarchy in France. Its unequal distribution, with clergy and nobles exempt, made it one of the hated institutions of the ancien régime.

The taille originated in the early Middle Ages as an arbitrary exaction from peasants. Often commuted or renounced after 1150, it was revived in regulated forms in the later Middle Ages. During the Hundred Years' War (1337–1453), the king's seigneurial taille, raised from his domain, was extended throughout France to meet expenses, and it developed into the royal taille. Since the taille was a monetary equivalent for military service, the nobility who fought and the clergy who were exempt from fighting did not pay, so that the tax fell on nonprivileged persons and lands. Under Charles VII (ruled 1422–61) the collection of the taille was formally organized and made permanent and exclusively royal. The taille had become an indispensable source of royal revenue and continued to be collected by the French kings until the Revolution at an ever increasing rate.

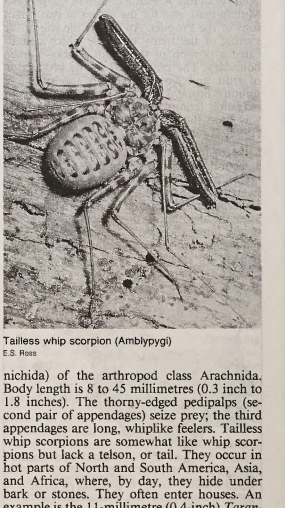
The taille was collected by two methods. In the districts of the taille *personnelle* (*i.e.,* northern France) it was levied on an individual basis; in the districts of the taille *réelle* (Languedoc, Provence, Guyenne, Dauphiné) it was levied on nonprivileged land.

By the 18th century the many exemptions to payment of the taille made it weigh more heavily on those who still were liable to pay it. Inhabitants of large towns, such as Paris and Lyon, did not have to pay, and an ever increasing number of judicial and financial offices carried with them the right of ennoblement, giving the holders the enviable social status of non-taillables.

The taille was abolished with the Revolution of 1789.

**Taille, Jean de la:** *see* La Taille, Jean de.

**tailless whip scorpion,** any of the 60 species of the order Amblypygi (sometimes Phry-



Tailless whip scorpion (Amblypygi)
E.S. Ross

nichida) of the arthropod class Arachnida. Body length is 8 to 45 millimetres (0.3 inch to 1.8 inches). The thorny-edged pedipalps (second pair of appendages) seize prey; the third appendages are long, whiplike feelers. Tailless whip scorpions are somewhat like whip scorpions but lack a telson, or tail. They occur in hot parts of North and South America, Asia, and Africa, where, by day, they hide under bark or stones. They often enter houses. An example is the 11-millimetre (0.4-inch) *Tarantula marginemaculata* of Florida.

**tailorbird,** any of the nine species of the genus *Orthotomus,* of the Old World warbler family Sylviidae, that sew together the edges of one or more leaves to contain the nest. A tailorbird makes a series of holes with its long slender bill and then draws plant fibre, insect silk, or even stolen household thread through the holes to form separate loops, which are knotted on the outer side.

The long-tailed tailorbird (*O. sutorius*) fre-



A Philippine tailorbird (*Orthotomus derbianus*)
Painting by H. Jon Janosik

quents gardens from India to southern China and Java; 13 centimetres (5 inches) long, with narrow tail carried cocked up, it is yellowish-green above and white below, with red-brown cap.

For other sylviids that sew, *see* cisticola; prinia; wren-warbler.

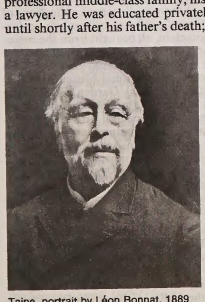
**Taimyr** (Russia): *see* Taymyr.

**Taimyr Peninsula:** *see* Taymyr Peninsula.

**Táin Bó Cuailnge** (epic): *see* Cattle Raid of Cooley, The.

**Taine, Hippolyte(-Adolphe)** (b. April 21, 1828, Vouziers, Ardennes, Fr.—d. March 5, 1893, Paris), French thinker, critic, and historian, one of the most esteemed exponents of 19th-century French Positivism. He attempted to apply the scientific method to the study of the humanities.

*Early life and career.* Taine was born into a professional middle-class family; his father was a lawyer. He was educated privately at home until shortly after his father's death; thereafter,



Taine, portrait by Léon Bonnat, 1889
Hachette—J.P. Ziolo

he went with his mother to live in Paris and became an outstanding pupil at the Collège Bourbon and then at the highly prestigious École Normale. He gained his *licenceès-lettres* (preliminary degree) in 1848 and began to study for his *agrégation* (advanced degree) in philosophy, one of his dominant interests. He already held unorthodox intellectual views. He had apparently lost his Christian faith by the age of 15, and his youthful rationalist attitude led him to admire the ideas of the Idéologue philosophers who held that all knowledge must be based on sense experience, on observation, and on controlled experiment; this overriding conviction guided his later career. He was also already attracted by the metaphysical ideas of Hegel and Spinoza, which inspired in him a desire to find a total explanation of the causal forces of life and the universe.

In contrast to these views, his new teachers of philosophy in Paris held the prevailing philosophical doctrine of eclecticism; consequently—and not without creating some scandal in academic circles—Taine's *agrégation* jury failed him in 1851. He then taught for brief periods at Nevers and Poitiers but in 1852 applied for leave of absence. Returning to Paris, he devoted himself to preparing his two dissertations for the doctorate in literature: *De Personis Platonicis* ("Concerning Plato's Characters") and his first well-known work, a study of La Fontaine (1853; revised and published in 1861 as *La Fontaine et ses fables* ["La Fontaine and His Fables"]).

He gained his doctoral degree in May 1853 and began an essay on Livy, *Essai sur Tite-Live* (1856), which, despite further criticism of his philosophical outlook, won a prize from the Académie Française. During this period he was also attending lectures in science and gathering the knowledge of physiology that he utilized later in his work on psychology. Reluctant to return to full-time teaching, he lived by private tutoring and as a man of letters. Even a holiday in 1854, necessitated by ill health, was turned to advantage: in 1855 he published a literary guidebook based on his travels, *Voyage aux eaux des Pyrénées* ("Voyage to the Waters of the Pyrenees").

*Attack on eclecticism.* More important for his own development, he contributed frequent literary and historical articles to such leading journals as the *Revue des Deux Mondes,* the *Revue de l'Instruction Publique,* and the *Journal des Débats,* articles that provided the basis for three books further enhancing the reputation he had gained by his works on La Fontaine and Livy. These were *Les Philosophes français du XIXe siècle* (1857; "The French Philosophers of the 19th Century"), a critical polemic against the prevailing eclectic philosophy of Victor Cousin and his group, which also provides in its later chapters a lucid exposition of his own Positivist theory of knowledge; a first collection of *Essais de critique et d'histoire* (1858; "Essays of Criticism and History"); and his notable *Histoire de la littérature anglaise,* 4 vols. (1863–64; *History of English Literature,* 1871).

The celebrated "Introduction" to the *Histoire* gives a succinct statement of Taine's approach to literary and cultural history and a basic text for the understanding of his scientific attitude to literary criticism. The same great causal factors underlie any cultural artifact of a given age and society, he claims. By studying the literary documents one may understand the psychology of their author, and this, complemented by scrutiny of the facts of his life and personality, illuminates the "*faculté maîtresse,*" the predominant characteristic that determines his work; this, in turn, can then be "explained" by reference to three great conditioning facts, "*la race,*" "*le milieu,*" and "*le moment*"; *i.e.,* the writer's inherited personality, his social, political, and geographical background, and the historical situation in which he writes. It is evident that Taine's interest here is less in literature itself than in historical causation and psychology, and his method may well be thought to have encouraged in his admirers an excessive preoccupation with biography and literary history at the expense of critical judgment, though Taine's own abilities as a critic were considerable.

Throughout the 1860s Taine continued indefatigably his researches and his writing. Even his travels (to England, Italy, Germany, and The Netherlands) were utilized to gather notes for future work—for example, his closely observed if simplifying *Notes sur l'Angleterre* (1872; *Notes on England,* 1872); and even his life in Paris led to his *Notes sur Paris: Vie et opinions de M. Frédéric-Thomas Graindorge* (1867; *Notes and Opinions of Mr. Frédérick-Graindorge,* 1875), perhaps the most personal and entertaining of his books.

In 1864, by a happy decision of Napoleon III, he was appointed to succeed Viollet-le-Duc, the architect, as professor of aesthetics and of the history of art at the École des Beaux-Arts in Paris, where he lectured for 20 years. The lecture courses, which he eventually published, include *Philosophie de l'art* (1865; *The Philosophy of Art,* 1865), *De l'idéal dans l'art* (1867; "On the Ideal in Art"), and those on the philosophy of art in Italy (1866), The Netherlands (1868), and Greece (1869).

This post also gave him a security that favoured his more protracted scientific studies and helped make the later 1860s a happy and fertile period in his life. He published, in addition to the works named, his second volume of essays, *Nouveaux essais de critique et d'histoire* (1865; "New Essays of Criticism and History"), including his perceptive articles on Racine, Balzac, and Stendhal (whose psychological acuity he was one of the first to admire). In 1868 he married Mlle Denuelle, the daughter of a well-known architect and artist, by whom he had a son and a daughter.

*Publication of De l'intelligence.* In 1870 he published the two volumes of *De l'intelligence* (*On Intelligence,* 1871), a major work in the discipline of psychology, which had interested him since his youth. His devotion to science is most fully illustrated here; he opposes the speculative and introspective approach of the eclectics and outlines a scientific methodology for the study of human personality that established Ribot, alongside thinkers such as Théodule Ribot and Pierre Janet, as a founder of empirical psychology. Though much of the work is now outdated, in its day it helped to modify methods of research by its emphasis on experiment, the search for causes, the study of pathological cases, and the physiological basis of personality. It also intensified opposition to his ideas, and he was angrily accused of holding a strictly determinist and materialist view of man—not altogether unfairly, even though he claimed to reject materialism and argued that moral responsibility was compatible with determinism as he conceived it.

The work also develops his long-standing attempt to fuse Positivism and Hegelian Idealism and to provide a method for a scientific metaphysics. Through such a metaphysics, he maintained, the final causes of life itself might be discovered; its insights inspired him to an exalted pantheistic trust in nature that is movingly expressed in essays on Marcus Aurelius (in *Nouveaux essais*) and Iphigeneia (in *Derniers essais*).

Germany's invasion and defeat of France in 1870–71 had a profound impact upon Taine (already prepared in his mind by a visit in 1869 that had disabused him of his earlier enthusiasm for German civilization). The French defeat, in his view, sprang from a deep national sickness, and he determined to devote his final years to examining its causes. A shift of interest toward politics is illustrated by a brochure of 1872 on the problems and effects of universal suffrage, but, above all, his approach was historical: to seek the sources of the political instability that he held responsible for his country's plight.

*Historical theories.* This major reorientation of concern led to his great historical work,

*Les Origines de la France contemporaine* ("The Origins of Contemporary France"), a monumental analysis, claiming scientific objectivity (although its factual and interpretative reliability have been challenged). It seeks to show that France's primary fault lay in excessive centralization, originating during the ancien régime, and intensified by the French Revolution, about which he shares and develops Edmund Burke's hostile view. Taine asserted that far from promoting liberty, as most of the French believe, the Revolution merely transferred absolute power to even more illiberal hands. A first volume, on *L'Ancien Régime* ("The Old Regime"), appeared in 1876, followed by three volumes on the Revolution (1878–85). In 1878 he was also elected to the Académie Française.

To have more time for his self-appointed task he withdrew increasingly from Paris and after 1883 even resigned his professorship. Only one volume of *Le Régime moderne* ("The Modern Regime"), however, was published in his lifetime (1891), the second volume coming out in November 1893. The entire work was reissued in 1899. There also appeared after his death his *Derniers essais de critique et d'histoire* (1894; "Last Essays of Criticism and History") and an unfinished autobiographical and psychological novel, written about 1861, *Étienne Mayran* (1910). He died in Paris in 1893 and was buried at Menthon-Saint-Bernard. (D.G.Ch.)

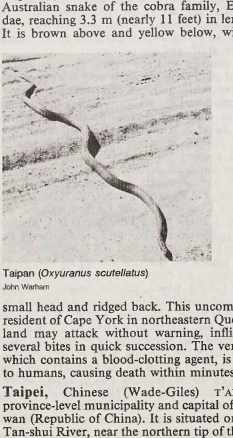
**Taino,** Arawakan Indians who once inhabited the Greater Antilles in the Caribbean Sea. The Taino may have numbered one or two million at the time of the Spanish conquest in the late 15th century. They were easily conquered by the Spaniards beginning in 1493; enslavement, starvation, and disease reduced them to near extinction by 1550, although groups of Taino survived in such places as Cuba, Puerto Rico, and Florida.

The Taino's staple foods were cassava and yams at the time they were first encountered by the Spanish. They also grew corn (maize), beans, squash, tobacco, peanuts (groundnuts), and peppers and ate birds, small animals, and seafood.

Taino settlements ranged from single families to groups of 3,000 people, and houses were built of logs and poles with thatched roofs. Men wore loincloths, and women wore aprons of cotton or palm fibres. Both sexes painted themselves on special occasions, and they wore earrings, nose rings, and necklaces. Other crafts were few; some pottery and baskets were made, and stone and wood were worked skillfully. A favourite form of recreation was a ball game played on rectangular courts. The Taino had an elaborate system of religious beliefs and rituals that involved the worship of spirits (*zemis*) by means of carved representations. They also had a complex social order. Government was by hereditary chiefs and subchiefs, and there were classes of nobles, commoners, and serfs (or slaves).

**Tainter, Charles Sumner** (b. Aug. 25, 1854, Watertown, Mass., U.S.—d. April 20, 1940, San Diego, Calif.), American inventor who, with Chichester A. Bell and Alexander Graham Bell (who were cousins), developed the graphophone. A direct competitor of Thomas A. Edison's phonograph, the graphophone utilized a wax-coated cardboard cylinder and a flexible recording stylus, both superior to the tinfoil surface and rigid stylus then used by Edison. They patented these improvements in 1886. Tainter had earlier helped Alexander Graham Bell develop the photophone (a device for transmitting sounds by modulated light waves), and he continued to work on sound transmission by light; all were important contributions to the development of sound for motion pictures. Tainter himself eventually received 25 patents, including one for a variable-speed motor that maintained a constant groove speed from the outer edge to the centre of a flat recording disc.

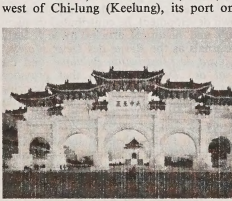
**taipan** (species *Oxyuranus scutellatus*), largest Australian snake of the cobra family, Elapidae, reaching 3.3 m (nearly 11 feet) in length. It is brown above and yellow below, with a



Taipan (*Oxyuranus scutellatus*)
John Warham

small head and ridged back. This uncommon resident of Cape York in northeastern Queensland may attack without warning, inflicting several bites in quick succession. The venom, which contains a blood-clotting agent, is fatal to humans, causing death within minutes.

**Taipei,** Chinese (Wade-Giles) T'AI-PEI, province-level municipality and capital of Taiwan (Republic of China). It is situated on the Tan-shui River, near the northern tip of the island of Taiwan, about 15 miles (25 km) southwest of Chi-lung (Keelung), its port on the



The main entrance gate to Chiang Kai-shek Memorial Hall (centre background), Taipei, Taiwan
Mitt and Jean Mann—Cameramann International

Pacific Ocean. The city of Tan-shui is about 12 miles (20 km) northwest at the river's mouth on the Taiwan Strait, the channel that separates Taiwan from mainland China.

Taipei lies in the relatively narrow, bowl-shaped valley of the Tan-shui and two of its main tributaries, the Chi-lung and Hsin-tien rivers. The climate is humid subtropical, with hot, muggy, rainy summers and cool, damp winters. Taiwan's largest city, it is also the political, economic, and cultural centre of the island. Area 105 square miles (272 square km). Pop. (2003 est.) 2,638,065.

*History.* Taipei was founded in the early 18th century by Chinese immigrants from Fukien province on the mainland. In the 19th century it became an important centre for overseas trade via its outports of Chi-lung and Tan-shui. Taipei was made an administrative entity of the Chinese government in 1875 and the provincial capital when Taiwan became a province of China in 1886. The Japanese acquired Taiwan in 1895 after the Sino-Japanese War and retained Taipei as the capital. During that time the city acquired the characteristics of an administrative centre, including many new public buildings and housing for civil servants. The island reverted to China in 1945, after Japan's defeat in World War II. The city became the capital of the Chinese Nationalist government in 1949 after the communists on the mainland had forced the Nationalists to reestablish themselves on Taiwan.

Taipei expanded greatly after 1949, and in 1967 it was declared a special municipality and given province-level status. The city's population expanded rapidly after 1967, exceeding two million by the mid-1970s. Although growth within the city itself gradually slowed thereafter, Taipei remained one of the world's most densely populated urban areas, and the population continued to increase in the surrounding region.

*The contemporary city.* Taipei and its environs has long been the foremost industrial area of Taiwan, although the region's preeminence has diminished somewhat. Most of the country's important factories producing textiles and wearing apparel are located there; other industries include the manufacture of electronic products and components, electrical machinery and equipment, printed materials, precision equipment, and foods and beverages. Services, including those related to commerce, transportation, and banking, have become increasingly important. Tourism is a small but significant part of the local economy.

Many older, low wooden buildings in Taipei have been replaced with high-rise apartment houses and office buildings. However, there has been a chronic housing shortage, and real-estate costs have remained high. Much new construction has occurred in the city centre, particularly in the area of the Presidential Building and the Nationalist Party headquarters. Among the more notable commercial projects was the Taipei 101 (Taipei Financial Center) building, which, when its framework was completed in 2003, became the world's tallest building, reaching 1,667 feet (508 m).

Railways and roads connect Taipei with all parts of the island. The city's first line of a rapid-transit system opened in 1996; other lines subsequently were added. Chiang Kai-shek International Airport, about 25 miles (40 km) west of Taipei, is Taiwan's major point of entry for overseas travelers. The city has a sophisticated telecommunications infrastructure.

Among the many educational institutions in Taipei are the National Taiwan University (1928), the National Taiwan Normal University (1946), and the National Chengchi University (1927). The National Palace Museum houses one of the world's largest collections of ancient Chinese artifacts, calligraphy, paintings, and porcelain, all brought from the mainland. Among the city's other cultural sites are the Chiang Kai-shek Memorial Hall, the Confucian Temple, the National Museum of History, and the Botanical Garden. The Snake Alley night market is a popular tourist attraction southeast of the central area near Lungshan Temple. Taipei maintains an extensive system of parks, green spaces, and nature preserves. One of the most popular nearby recreation areas is Mount Yang-ming, which is 6 miles (10 km) north of the central city. Both the mountain and the town of Pei-t'ou at its base are known for their hot springs.

**Taiping,** town, northwestern West Malaysia (Malaya). The town is situated on a coastal plain just west of the Bintang Range. It originated as a Chinese mining settlement in the Larut district, where large-scale tin mining developed in the 1840s. Although its importance as a mining centre has been supplanted by the Kinta Valley, tin remains one of the main products, along with paddy rice and rubber. Taiping is a neatly planned town with suburbs at Au Long and Simpang. Industrial development includes the Kamunting Industrial Estate (with more than 30 factories). The town lies along the main western peninsular road and rail lines and also has an airfield.

The State Museum includes collections of

Malay weapons and archaeological specimens, and its Lake Garden has a small zoo. Taiping is picturesquely situated at the foot of Bukit Maxwell (formerly Maxwells Hill; about 3,399 ft [1,036 m]), Malaysia's oldest hill station, accessible only to four-wheel drive vehicles and noted for its cabbages, tomatoes, and flora. Tourists often climb to Cottage, the resort's only accessible summit. Pop. (1991) 183,165.

**Taiping Rebellion** (1850–64), radical political and religious upheaval that was probably the most important event in China in the 19th century. It ravaged 17 provinces, took an estimated 20,000,000 lives, and irrevocably altered the Ch'ing dynasty (1644–1911/12).

The rebellion began under the leadership of Hung Hsiu-ch'üan (1814–64), a disappointed civil service examination candidate who, influenced by Christian teachings, had a series of visions and believed himself to be the son of God, the younger brother of Jesus Christ, sent to reform China. A friend of Hung's, Feng Yün-shan, utilized Hung's ideas to organize a new religious group, the God Worshippers' Society (Pai Shang-ti Hui), which he formed among the impoverished peasants of Kwangsi. In 1847 Hung joined Feng and the God Worshippers, and three years later he led them in rebellion. On Jan. 1, 1851, he proclaimed his new dynasty, the T'ai-p'ing T'ien-kuo (Heavenly Kingdom of Great Peace), and assumed the title of T'ien-wang, or Heavenly King.

Their slogan—to share property in common—attracted many famine-stricken peasants, workers, and miners, as did their propaganda against the foreign Manchu rulers of China. Taiping ranks swelled, and they increased from a ragged band of several thousand to more than 1,000,000 totally disciplined and fanatically zealous soldiers, organized into separate men's and women's divisions. Sweeping north through the fertile Yangtze River Valley, they reached the great central China city of Nanking. After capturing the city on March 10, 1853, the Taipings halted. They renamed the city T'ien-ching (Heavenly Capital) and dispatched a northern expedition to capture the Manchu capital at Peking. This failed, but another expedition into the Upper Yangtze Valley scored many victories.

Meanwhile, Yang Hsiu-ch'ing, the Taiping minister of state, attempted to usurp much of the T'ien-wang's power, and as a result Yang and thousands of his followers were slain. Wei Ch'ang-hui, the general who had slain Yang, then began to grow haughty, and Hung had him murdered as well. Another Taiping general, Shih Ta-k'ai, began to fear for his life, and he abandoned Hung, taking with him many of the Taiping followers.

In 1860 an attempt by the Taipings to regain their strength by taking Shanghai was stopped by the Western-trained "Ever-Victorious Army" commanded by the American adventurer Frederick Townsend Ward and later by the British officer "Chinese" Gordon. The gentry, who usually rallied to support a successful rebellion, had been alienated by the radical anti-Confucianism of the Taipings, and they organized under the leadership of Tseng Kuo-fan, a Chinese official of the Manchu government. By 1862 Tseng had managed to surround Nanking, and the city fell in July 1864. Hung, who had refused all requests to flee the city, committed suicide. Sporadic Taiping resistance continued in other parts of the country until 1868.

Taiping Christianity placed little emphasis on New Testament ideas of kindness, forgiveness, and redemption. Rather it emphasized the wrathful Old Testament God who demanded worship and obedience. Prostitution, foot-binding, and slavery were prohibited, as well as opium smoking, adultery, gambling, and use of tobacco and wine. Organization of the army was elaborate, with strict rules governing soldiers in camp and on the march. For those who followed these rules, an ultimate reward was promised. Tseng Kuo-fan was astonished when, after the capture of Nanking, almost 100,000 of the Taiping followers preferred death to capture.

Under the Taipings, the Chinese language was simplified, and equality between men and women was decreed. All property was to be held in common, and equal distribution of the land according to a primitive form of communism was planned. Some Western-educated Taiping leaders even proposed the development of industry and the building of a Taiping democracy. The Ch'ing dynasty was so weakened by the rebellion that it never again was able to establish an effective hold over the country. Both the Chinese Communists and the Chinese Nationalists trace their origin to the Taipings.

**taira** (mammal): *see* tayra.

**Taira** FAMILY, also called HEIKE, Japanese samurai (warrior) clan of great power and influence in the 12th century. The genealogy and history of the family have been traced in detail from 825, when the name Taira was given to Prince Takamune, grandson of Kammu (the 50th emperor of Japan). From about 1156 to 1185, the Taira monopolized high positions at the Imperial court; in the latter year the clan was destroyed in the sea battle of Dannoura.

*Origins and first period of power.* The clan had its origins in 825, at a time when government finances were at a low ebb and members of the Imperial line were numerous. In an attempt to eliminate some of the drain on the finances, collateral Imperial branches were given surnames (the Imperial family had none) and sent out into the provinces. The name of "Taira" was given to Prince Takamune, the son of Prince Kuzuhara and grandson of Kammu, the 50th emperor. His descendants were accordingly called Taira of Kammu. Takamochi, a nephew of Takamune, arrived in the Hitachi district (about 40 miles [60 kilometres] northwest of present-day Tokyo) as a local official and settled there. His descendants succeeded him in the post, and the family became powerful samurai in the district.

Taira Masakado (*q.v.*), a great-grandson, acquired great power and soon governed the whole Kantō district. In 939 he established a government in the southern part of Kantō, styling himself *shinnō* ("new emperor") in opposition to the Emperor in the capital at Kyōto, but was subdued in 940. In 1028, when Taira Tadatsune attempted to reestablish Taira domination over the Kantō, the court dispatched another warrior, Minamoto Yorinobu, to quell the rebellion, and three years later, Tadatsune surrendered. As a result the Taira family began to decline, and the Minamoto family, descendants of Seiwa, the 56th emperor, organized a big samurai group in Kantō, with the Taira under them.

*Second era of power.* In later years the Fujiwara family, who, sharing power with the emperor, had monopolized the highest posts in the court from the mid-10th to the mid-11th century, began to decline. In the latter half of the 11th century, the emperor Shirakawa abdicated the throne in favour of his son and then introduced a new political system called *insei*, by which the former emperor, who was now freed from the ceremonial requirements of the Imperial office (but could count on the loyalty of his son, the real emperor), was finally able to wrest the power of the throne away from the Fujiwara. So as to retain absolute power, the former emperor Shirakawa summoned Taira Masamori, a descendant of the Taira of Kantō with considerable local power in the Ise district (present-day Mie Prefecture), to suppress the Minamoto family, whose military strength had been helping to ensure the dominance of the Fujiwara at court. Masamori's success was so absolute that he stood high in the former emperor Shirakawa's favour and won speedy promotion as a court official.

Masamori's son Tadamori continued his father's successes. By eliminating the pirates along the Inland Sea in western Japan, he curried Imperial favour.

Taira Kiyomori (*q.v.*), the son of Tadamori and grandson of Masamori, continued to enlarge the family's holdings and to increase its influence at court, making a conflict between the Taira and Minamoto inevitable. Finally in 1156 a dispute over control of the court between two brothers, the former emperor Sutoku and the reigning emperor Go-Shirakawa, resulted in the Hōgen War between Kiyomori and the head of the Minamoto. Aided by the defection of a group of Minamoto warriors, Kiyomori emerged victorious. Three years later, in the Heiji War of 1159, Kiyomori brutally eliminated those Minamoto who had sided with him in the Hōgen War and thus became the most powerful figure in Japan.

The Taira family monopolized high positions as court officials, governing almost half of all the provinces and owning more than 500 manors. In 1179 the court nobles led by the former emperor Go-Shirakawa rebelled against him but were subdued, and Go-Shirakawa was imprisoned. As a result, Kiyomori's grip became positively dictatorial, the period being known as the "Rokuhara regime" since he lived at Rokuhara in Kyōto. In spite of his great powers, however, he failed to make any basic changes in the Imperial system. As a result, the Taira hold over the countryside weakened as the family became accustomed to the rich court life and lost touch with the provincial warrior groups.

*Rise of the Minamoto family.* In 1181, when Kiyomori died after an illness, movements were started against the tyrannical Taira clan all over the country. The strongest opposition was that of the Minamoto family, whose scion, Minamoto Yoritomo, living in Kantō, had been spared in the great conflicts of 1159 because of his extreme youth at the time. With the assistance of other samurai hostile to the Taira, he rose in arms. When the Minamoto army advanced on the capital, the Taira escaped from Kyōto and, taking the young emperor, Antoku, with them, attempted to establish themselves in their stronghold in western Japan. They were defeated in two successive battles, however—one at Ichinotani, west of the city of Kōbe in Settsu Province, and the other at Yashima Island, along the Inland Sea in Sanuki Province (present Kagawa Prefecture). Forced to flee further west, the Taira family was finally completely destroyed in 1185 in the great sea battle of Dannoura, which occurred off the eastern end of the strait that separates Kyushu from Honshu. In this battle the emperor Antoku drowned, taking with him the great sword that was one of the Imperial Treasures of Japan, the symbols of divine authority that had supposedly been brought to Japan when the first emperor descended from heaven. (K.Ho.)

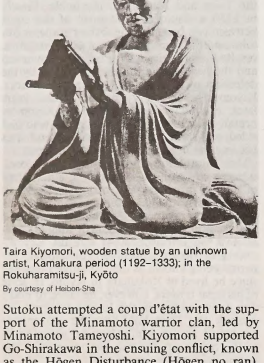
BIBLIOGRAPHY. For more information on the Taira family, see *The Heike Monogatari*, trans. by A.L. Sadler, *Transactions of the Asiatic Society of Japan*, vol. 46, pt. 2, and vol. 49, pt. 1 (1918–21); and Carl Spohr, *Gempei: The Civil Wars of Old Japan* (1967).

**Taira Kiyomori** (b. 1118, Japan—d. March 21, 1181, Kyōto), first of the Japanese soldier-dictators, whose victories in the Hōgen and Heiji disturbances marked the ascendancy of the provincial warrior class to positions of supreme power.

Kiyomori succeeded his father, Tadamori (died 1153), as head of the powerful Taira, a

warrior clan in the Inland Sea area of western Japan, where its members had become the major military support of the Imperial court.

In 1156 a conflict for power erupted between the retired emperor Sutoku and his younger brother, the reigning emperor Go-Shirakawa.



Taira Kiyomori, wooden statue by an unknown artist, Kamakura period (1192–1333); in the Rokuharamitsu-ji, Kyōto
By courtesy of Heibon Sha

Sutoku attempted a coup d'état with the support of the Minamoto warrior clan, led by Minamoto Tameyoshi. Kiyomori supported Go-Shirakawa in the ensuing conflict, known as the Hōgen Disturbance (Hōgen no ran), one of the bloodiest and bitterest in Japanese history, and emerged victorious, partly because of the defection of Tameyoshi's son, Yoshitomo. Kiyomori ruthlessly executed his enemies and ordered Yoshitomo to cut off his own father's head. Yoshitomo refused, but another Minamoto eventually carried out the order.

Dissatisfied with his share of the spoils, Yoshitomo took advantage of Kiyomori's absence from the capital during the winter of 1159–60 to seize power, an act that precipitated the Heiji Disturbance. Although taken by surprise, Kiyomori gathered what forces he could muster and advanced in a series of daring, cleverly executed maneuvers. Victorious, he returned to the capital and annihilated his enemies, allowing only Yoshitomo's two infant sons to live, a leniency he later regretted. The Heiji Disturbance became the subject of many stories and legends.

In 1167 Kiyomori was made *dajō-daijin,* or prime minister, which was the highest position of any court official. Preferring to exercise his authority in the traditional manner—by marrying his daughters into the Imperial family and having his relatives appointed to high positions—Kiyomori dominated the Emperor instead of ruling directly. He also managed to marry his wife's younger sister to the then retired Go-Shirakawa, whose son became the crown prince. In 1180 Kiyomori placed his two-year-old grandson on the throne as the emperor Antoku and moved the capital to his own city of Fukuhara (modern Kōbe), which provided ready access to the Inland Sea and the rich trade routes with China. In the same year one of Kiyomori's trusted chieftains issued a call to his followers throughout the country to revolt. The initial rebellion was crushed, but Minamoto Yoritomo, Yoshitomo's son who had been spared in his youth, seized the opportunity to raise a revolt, in which he gained the support of many warriors in the outlying provinces.

An army was dispatched from the capital to quell the rebellion, but the Taira forces, weakened by many years of luxurious living, were no match for the frontier troops and were immediately defeated. Turning over all government administration to his son, Kiyomori devoted himself to building a new army, but he died before the task could be accomplished. In 1185 Yoritomo annihilated the last of the Taira clan, including the emperor Antoku, and established Minamoto supremacy throughout Japan.

**Taira Masakado** (d. March 25, 940, Kitayama, Shimōsa Province, Japan), Japanese rebel leader descended from the emperor Kammu (reigned 781–806).

In 939 Masakado gained control of the Kantō region in central Japan and used the mystique of his Imperial blood to proclaim himself the New Emperor (Shinnō) and organize his own court, appointing governors for the eight northern provinces of Japan. In the struggle for power, Masakado eliminated many of his own blood relatives, including several uncles. He was finally brought under control by two local rivals in an incident known as the Tengyō no ran (War in the Tengyō era). The revolt was symptomatic of the deterioration of the central government's hold over the countryside and presaged the development of powerful warlord families in the provinces, of which the Taira clan eventually became one of the most powerful.

**Taira Masamori** (fl. early 12th century, Japan), warrior responsible for the rise to power of the Taira clan in Japan.

The leader of a powerful provincial warrior family, Masamori was hired by the court in 1108 to eliminate a troublesome member of the powerful Minamoto clan, who had occupied the area of western Japan along the Inland Sea. The Minamoto warriors were not accustomed to fighting in sea and coastal areas, and Masamori proved victorious. He was lavishly rewarded by the Emperor, who allowed the family to settle in western Japan, where trade with China was highly profitable. The Taira gradually increased their power until by 1159 they dominated all of Japan.

**Taira Tadamori** (b. 1096, Japan—d. Dec. 2, 1153, Japan), warrior whose military and diplomatic skills made the Taira clan the most powerful family in Japan and laid the groundwork for his son Kiyomori's assumption of virtual control over the country.

After the death of his father, Masamori, who had established the family along the Inland Sea in western Japan, Tadamori helped the Imperial court by subduing the pirates menacing navigation. In so doing, he gained many retainers for his clan and new titles and grants from the Imperial government, which was pleased that trade with China again flourished. Tadamori also shared in the lucrative China trade, and he further enhanced his position by consistently supporting the court against the challenges of rival clans, particularly the Minamotos.

Unlike his provincial rivals, who were bedazzled by the magnificence of the capital, Tadamori was highly cultivated and schooled in classical learning. As the Emperor's personal bodyguard and confidant, he was accepted as an equal by the court aristocracy. Thus, he elevated the influence of the Taira clan, giving its members a psychological advantage over their warrior rivals.

**tairō,** in Japanese history, office of senior minister or chief councillor, the highest administrative post in the shogunate during the Tokugawa period (1603–1867). The office of *tairō* stood above the other senior councillors (rōjū), and so resembled the position of prime minister. Its chief function was to advise on matters of high policy or to serve as shogunal regent. After 1648, however, the office was filled only in times of crisis for a specific purpose. The best known figure to hold the position was Ii Naosuke, appointed *tairō* in 1858. Ii was largely responsible for the decision to sign a commercial treaty with the United States in 1858, soon followed by treaties with England, France, Russia, and The Netherlands, and he also acted swiftly to decide a succession dispute when the shogun Iesada died in the same year leaving no heir.

*Where the same name may denote a person, place, or thing, the articles will be found in that order*

**Tairona,** Indians of the northern Colombian Sierra Nevada de Santa Marta, known only from occasional references in Spanish colonial writings and from archaeological study. The Tairona used stone to build houses, tombs, bridges, and terraced platforms. Their crafts are represented by ceramic ware; stone utensils such as metates (for grinding corn [maize]); bone and shell ornaments; and beads, buttons, and jewelry made of gold, copper, and gold-copper alloy (*tumbaga*). It is known that the Tairona were agriculturists because tools such as metates and hoes have been found; and, from the well-made stone buildings and artifacts of worked metals, it can be supposed that their culture was similar to those of the Chibcha or the Inca, although the Tairona were apparently unrelated to them.

**Tairov, Aleksandr Yakovlevich,** original name ALEKSANDR KORNBLIT (b. June 24, 1885, Romny, Russia—d. Sept. 25, 1950, Moscow), founder and producer-director (1914–49) of the Kamerny (Chamber) Theatre in Moscow, which, during the era of the Revolution, rivaled the Moscow Art Theatre in professional competence.

Tairov took up law briefly before settling on a theatrical career. He worked in several companies, including that of the Mobile Theatre of P.P. Gaydeburov. In 1913–14 he managed the shortlived Free Theatre Moscow prior to founding the Kamerny.

In the wake of the Bolshevik Revolution—at a time when the United States had broken off diplomatic relations with the Soviet Union—Tairov brought to Moscow audiences the work of the American playwright Eugene O'Neill, notably *The Hairy Ape, All God's Chillun Got Wings,* and *Desire Under the Elms.* Tairov's style was avant garde, particularly with respect to staging. He helped develop the functional "constructivist" setting, a bare, multilevel scaffolding devoid of traditional decorative scenery. His approach to theatre was stylized and antirealistic and was diametrically opposed to that of the followers of actor-director Konstantin Stanislavsky. He attached great importance to the actor's physical attributes; members of his company were rigorously trained in dancing, singing, acrobatics, and rhythmic precision of move-



Tairov
Tass—Sovfoto

ment. His 1934 production of Vsevolod Vishnevsky's *The Optimistic Tragedy* was regarded as a high point of Socialist Realist theatre. Under pressure from Stalinist authorities, however, Tairov was eventually compelled to work under the guidance of a state theatre committee. His wife, Alisa Koonen, starred in many of his productions.

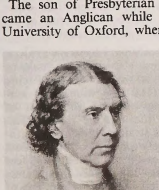
**Taishō,** in full TAISHŌ TENNŌ, personal name YOSHIHITO (b. Aug. 31, 1879, Tokyo, Japan—d. Dec. 25, 1926, Hayama), the 123rd ruling descendant of the Japanese imperial family, the emperor who reigned from 1912 to 1926 during a period in which Japan continued the modernization of its economy.

Yoshihito was proclaimed crown prince on Nov. 3, 1889, after his two elder brothers died. He ascended the throne on July 30, 1912. Unlike his predecessor, the Meiji emperor, the Taishō emperor was sickly as a child and played almost no political role. He became mentally deranged in his later years, and his son, Crown Prince Hirohito (later Emperor Hirohito), was appointed prince regent in 1921.

His reign, referred to as the Taishō ("Great Righteousness") period, was characterized in foreign affairs by policies congenial to Western powers, especially to Great Britain and the United States. In domestic affairs there was increasing use of parliamentary procedures and a broadening of the suffrage.

**Tait, Archibald Campbell** (b. Dec. 21, 1811, Edinburgh, Scot.—d. Dec. 3, 1882, Addington, Surrey, Eng.), archbishop of Canterbury, remembered primarily for his efforts to moderate tension in the Church of England at the height of the Oxford Movement.

The son of Presbyterian parents, Tait became an Anglican while a student at the University of Oxford, where in 1835 he became a tutor at Balliol College. A year later he was made a deacon, and for five years he was also a curate at two nearby village parishes. In March 1841 he joined others in a written protest against Tract 90 of the Tractarian (or Oxford) Movement, which was devoted to recovering the High Church ideals of the later 17th-century church. In 1842 Tait succeeded Thomas Arnold as headmaster of Rugby School, where he improved the prefect system. He became dean of Carlisle Cathedral in 1849, was active in 1850–52 in the royal commission that advised reform at Oxford, and in 1856 was made bishop of London. Stressing reconciliation, he avoided partisan issues and thus faced opposition from both evangelical and high churchmen, who, following the program of the Oxford Movement, often offended the evangelicals by introducing liturgical elaborations that appeared to be inspired by Roman Catholic practice.



Archibald Campbell Tait, chalk portrait by Lowes Cato Dickinson, 1867; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

As bishop of London, Tait strengthened the diocese by supporting efforts to construct new churches and by founding the Bishop of London's Fund to finance additional clergy.

Becoming archbishop of Canterbury in 1868, Tait faced at once the bill to disestablish the (Anglican) Church of Ireland; his statesmanship largely accounted for its smooth passage through Parliament. High Church opposition continued, notably to his support of the Burials Act (1880), which legalized non-Anglican burial services in Anglican churchyards, and to his dislike for the sternness of the Athanasian Creed's clauses regarding salvation.

Tait's major successes were in his work on the royal commissions on ritual (1867) and as spokesman for the Anglican church, a role in which he commanded esteem in the House of Lords. His numerous writings include *The Dangers and Safeguards of Modern Theology* (1861) and *Harmony of Revelation and the Sciences* (1864).

**Tait, Peter Guthrie** (b. April 28, 1831, Dalkeith, Midlothian, Scot.—d. July 4, 1901, Edinburgh), Scottish physicist and mathematician who helped develop quaternions, an advanced algebra that gave rise to vector analysis and was instrumental in the development of modern mathematical physics.

After serving from 1852 to 1854 as a fellow and lecturer of Peterhouse College, Cambridge, Tait took a professorship in mathematics at Queen's College, Belfast. There he joined the noted Irish chemist Thomas Andrews (1813–85) in researches on the density of ozone and the effect of electric discharges on oxygen and other gases. From 1860 he was professor of natural philosophy at the University of Edinburgh.

Tait made fundamental contributions to the theory of quaternions, as evidenced in *Elementary Treatise on Quaternions* (1867), which went through three editions. Later he wrote *Introduction to Quaternions* (1873). In collaboration with the English physicist Sir William Thomson (later Lord Kelvin), Tait produced *Treatise on Natural Philosophy* (1867), which traced the concept of conservation of energy to the work of Sir Isaac Newton. Their efforts were vital to the newly emerging concept of energy and its properties.

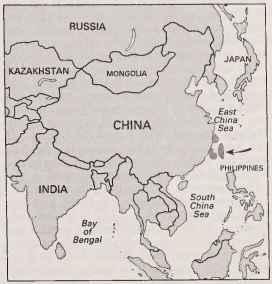
After Tait published *Treatise on Natural Philosophy,* he concentrated on studies of thermoelectricity and thermal conductivity (the capacity for heat flow). With the Scottish physicist Balfour Stewart he wrote *The Unseen Universe* (1867). Such was the public response that they released a sequel, *Paradoxical Philosophy* (1878).

**Taitai Series,** lowermost major division of Cretaceous rocks and time in New Zealand (144 to 66.4 million years ago). The Taitai Series underlies rocks of the Clarence Series.

The rocks of the Taitai Series consist largely of mudstones, conglomerates, and graywackes that were rapidly deposited in the East Coast Geosyncline (downward flexure of the Earth's crust) of New Zealand, a slowly subsiding trough that extended along the islands' northeastern region during the Cretaceous Period. The Taitai Series has been divided into two stages, smaller divisions of rocks and time: the earliest is the Mokoiwian, which consists largely of shales; overlying the Mokoiwian is Korangan, which consists of graywackes.

**Taiwan,** Chinese (Wade-Giles) T'AI-WAN, or (Pinyin) TAIWAN, Portuguese FORMOSA, island situated 100 miles (160 km) off the southeast coast of the China mainland. It is governed by the Republic of China, or National Chinese, who also claim jurisdiction over the whole of mainland China; the island, in their view, is Taiwan Area, or Taiwan District. The People's Republic of China, in turn, claims jurisdiction over Taiwan. Both governments agree that Taiwan is a *sheng* (province) of China.

The island lies astride the Tropic of Cancer in the Pacific Ocean. It extends about 245 miles (395 km) from south to northeast and about 90 miles (145 km) at its widest from west to east. Taiwan is bounded by the East China Sea (north), the Pacific Ocean (east), the Bashi Channel (south), and the Taiwan




Taiwan

(Formosa) Strait (west). Since 1949 Taipei has been designated by the Nationalists as the provisional capital of the Republic of China; the provincial capital is Chung-hsing Hsin-ts'un. Area 13,900 square miles (36,000 square km). Pop. (1991 est.) 20,489,000.

A brief treatment of Taiwan follows. For full treatment, *see* MACROPAEDIA: Taiwan.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*The land.* About two-thirds of Taiwan's total area is composed of mountains and hills. The five main physiographic regions from east to west are: the rugged and steep T'ai-tung Mountains; the long, narrow T'ai-tung rift valley; the Chung-yang (Central) Mountain Range, consisting of three parallel ranges (Chung-yang, Yü Mountains, and A-li Mountains); a wide belt of very hilly country; and finally the densely populated western coastal plains and basins (P'ing-tung basin in the south, T'ai-chung basin in the central west, T'ai-pei basin in the north, and I-lan basin in the northeast). Mount Yü, the highest peak in the country at 13,113 feet (3,997 m) above sea level, is located in the south-central part of the island. The country's major rivers are the Tan in the north and the Cho in the west. Both are used extensively for irrigation and hydroelectricity.

Taiwan's climate ranges from subtropical in the north to tropical in the south. The mean monthly winter (October–March) temperature is about 59° F (15° C); the corresponding figure for the summer (June–September) is 86° F (30° C). Mean annual precipitation is 102 inches (2,590 mm), ranging from 50 inches (1,270 mm) on the west coast to 250 inches (6,350 mm) and more on the mountain slopes. Tropical cyclones (typhoons), averaging three to four per year, are concentrated in the months from July to September.

Natural vegetation, covering about two-thirds of Taiwan's land area, consists of five altitudinal belts: mangrove forests are found in the tidal delta areas below 300 feet (90 m); tropical evergreen (mixed with bamboo and palm) forests grow at elevations of less than 2,000 feet (600 m); subtropical evergreen forests (camphor and laurel) abound between 2,000 and 6,000 feet (1,800 m); broadleaved evergreen forests (cedars, cypresses, junipers, rhododendrons, and maples) flourish between 6,000 and 8,000 feet (2,400 m); and above

8,000 feet coniferous forests are found. Animal life includes foxes, deer, wild boars, bears, monkeys, and goats.

*The people.* Han Chinese constitute 98 percent of the population; the rest are mostly of Malayo-Polynesian origin. Mandarin Chinese is the official language, but Taiwanese dialects of Chinese are also spoken, as are the Fukien and Hakka dialects. Buddhism, Taoism, and Confucianism are the main religions; only a small percentage of the population is Christian.

To deal with Taiwan's rapid population growth, the government has encouraged late marriages, female employment, and single-child families. Taiwan's population density, one of the highest in the world, is greatest along the western coast. With almost three-fourths of the population in urban areas, the government has tried to alleviate overcrowding by developing the small and intermediate cities.

*The economy.* Taiwan has a market economy based on manufacturing, trade, and services, and from 1946 to 1967 its growth was financed chiefly by foreign capital. Capital has subsequently come from domestic savings, and investments have shifted from light to heavy industries and then to high-technology industries.

Agriculture accounts for only a tiny fraction of the gross domestic product (GDP) and employs only a small portion of the workforce. Small family-owned farms predominate. Although cropland is highly productive, emigration from the countryside has depleted the rural workforce. Production of rice meets domestic demand; other grains must be imported.

Forests cover more than half of the land; most of the logs removed are used in industry. Fishery production is mostly for domestic consumption. Mineral industries are of little economic importance.

Manufacturing accounts for about one-fourth of GDP and employs about one-fourth of the workforce. Leading exports include electronic equipment, garments, and textiles.

All but one-tenth of Taiwan's roads are paved. Roads and ports are congested, and the government has initiated projects to improve the infrastructure. There are international airports at T'ao-yüan and Kao-hsiung.

The economy depends on imports of raw materials and consumer goods and on exports. Chief markets include the United States, which receives about one-fourth of Taiwan's exports, Japan, and Singapore. Japan, the United States, South Korea, and Germany are leading suppliers.

*Government and social conditions.* Taiwan combines cabinet and presidential systems, based on a constitution originally promulgated in 1947 for all of China. When the Nationalists fled the mainland to Taiwan in 1949–50, they imposed Nationalist rule on the native Taiwanese and declared martial law and a state of national emergency that lasted until 1987. The Nationalist Party was the island's only legal political party from 1949 until the late 1980s, during which time it dominated the country's political life.

The delegates to the National Assembly elect the president. A growing proportion of these delegates is chosen by the Taiwanese electorate, not by Nationalist Party members who hold lifetime seats in the Assembly. Elected to a six-year term, the president is the supreme executive authority. Under the president are five independent *yüan*s (councils): executive (functioning as the Cabinet), legislative, judicial, examination (fulfilling civil-service commission functions), and control (overseeing government administration). The executive *yüan* is responsible for policy and administration, while the legislative *yüan* is the main law-making body. The judicial *yüan* administers the nation's system of courts.

The Nationalist Party controlled the membership of most of these governmental bodies until the mid-1980s, when opposition parties first began to contest elections for nationwide offices. During the 1980s and '90s representation of native-born Taiwanese grew in the government, replacing Nationalists who had fled the mainland in 1949–50.

Taiwan's social-welfare programs, financed primarily through employer contributions, provide hospital care for old age, disability, sickness, maternity, and work injury. Health conditions have improved, as health facilities and sanitation services have been extended and diet has improved. The average life expectancy of about 74 years for men and 80 years for women is comparable to that of many developed countries. The housing shortage has been alleviated through government housing programs.

Virtually the entire population is literate. Education is compulsory and free in primary and junior high schools for children between the ages of 6 and 15. Enrollment in secondary, including vocational, schools grew significantly, beginning in the 1970s.

Press censorship, mainly of magazines and foreign newspapers, has been easing. Most of the radio and television broadcasting stations are commercially owned.

*Cultural life.* Chinese culture predominates in Taiwan. Traveling troupes perform Chinese and Taiwanese operas. Taiwan is a major producer of Chinese-language films. The National Palace Museum (art brought from the mainland in 1949), the National Museum of History (artifacts, documents, and decorative arts), and the Taiwan Provincial Museum (anthropology, zoology, and botany) display the island's natural history and 4,000 years of Chinese cultural achievements.

*History.* Although the Chinese were aware of the existence of Taiwan and its Malayo-Polynesian population as early as the 7th century AD, Chinese settlement of the island did not begin until the 17th century. The Portuguese first visited the island in 1590, naming it Ilha Formosa ("Beautiful Island"), but did not settle there. By 1626 the Dutch and the Spanish had established fortified commercial settlements along the island's western coast. In 1646 the Dutch seized the Spanish settlement, gaining control of the island. The Dutch in turn were ousted in 1661 by Chinese refugees (from the deposed Ming dynasty, 1368–1644), who arrived in large numbers, raising the island's population to about 200,000. In 1683 the Manchus (of the ruling Ch'ing dynasty, 1644–1911/12) took control of Taiwan, incorporating it into Fukien province.

The Manchus began settling the island's eastern shores in 1796. By 1842 the population had risen to about 2,500,000, and sugar and rice were being exported to China. In 1875 Taipei became the capital of northern Taiwan, in 1886 the island became a province of China, and in 1894 Taipei became the official capital of the province of Taiwan. The next year Taiwan was ceded to Japan following the Sino-Japanese War.

Taiwan became a major supplier of rice and sugar to Japan. In the 1930s Japan emphasized industrial development based on cheap hydroelectric power. By 1940 the island's population had increased to 5,870,000.

Following World War II Taiwan was ceded to China, then governed by the Nationalists (1945). Following the Communist victory on the mainland in 1949 the Nationalist government and its supporters, led by General Chiang Kai-shek, fled to Taiwan. The Nationalists established direct rule over the island, and Chiang Kai-shek became president. His government continued to maintain that it was the legitimate government of all China. In 1954 the Nationalist government and the United States signed a mutual defense treaty. Taiwan received military and economic support from the United States for almost three more decades. Taiwan used U.S. aid and free-market policies to develop its economy during this period.

For two decades, the United States and many other countries treated Taiwan as the representative of all China, but in 1971 the United Nations ousted Taiwan as the representative of China and replaced it with the People's Republic of China. U.S. President Richard Nixon visited mainland China, and many countries soon recognized the People's Republic of China and severed formal diplomatic relations with Taiwan. On Jan. 1, 1979, the United States recognized the People's Republic as the sole legal government of China, but Taiwan's diminished international stature did not prevent it from becoming one of the emerging industrial powers of the Pacific Rim by the late 20th century.

Chiang Kai-shek died in 1975. He was succeeded as president by his son, Chiang Ching-kuo, who laid the basis for the democratic political reforms of his successor, Lee Teng-hui, who in 1988 became Taiwan's first native-born president. Lee's government began informally to allow trade with and travel to mainland China in the late 1980s, and by the early '90s trade links had been established between the two countries. By then Taiwan had a two-party political system, a developed economy, and an increasingly close, though still informal, relationship with mainland China.

Taiwan continued its political democratization with the victory in the 2000 presidential election of Ch'en Shui-pian, the candidate of an opposition party advocating independence for Taiwan. Relations with the mainland government, already strained, became more complicated as a result of Ch'en's election. Taiwan's economy, less affected than other Asian countries by the economic crisis of the late 1990s, has made a strong recovery.

**Taiwan Strait,** also called FORMOSA STRAIT, Chinese (Wade-Giles) T'AI-WAN HAI-HSIA, or (Pinyin) TAIWAN HAIXIA, arm of the Pacific Ocean, 100 miles (160 km) wide at its narrowest point, lying between the coast of China's Fukien province and the island of Taiwan (Formosa). The strait extends from southwest to northeast between the South and East China seas. It reaches a depth of about 230 feet (70 m) and contains the Pescadores Islands (which are controlled by the government of Taiwan). The chief ports are Amoy in mainland China and Kao-hsiung on Taiwan. The area lies in a typhoon zone.

The strait was named Formosa ("Beautiful") by Portuguese navigators in the late 16th century; although it is still known in the West by its European name, the Chinese and now most Westerners use the name Taiwan Strait.

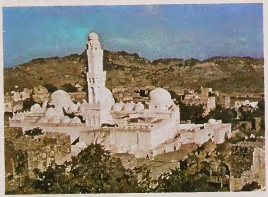
**Taíyetos Mountains,** Taíyetos also spelled TAYGHETUS, TAYGETUS, or TAIYETOS, Greek TAÍYETOS ÓROS, mountain range, southern Peloponnese, Greece. The maximum elevation is approximately 7,905 feet (2,371 m) in the range, which imposes a barrier between the regions of Laconia and Messina. Called the five-fingered mountain by the ancient epic poet Homer, the Taíyetos range, which is the highest mountain chain in the Peloponnese, consists of a narrow ridge of crystalline rock trending north-south for about 100 miles (160 km). The range's highest peak is Hagios Elias (Saint Elijah); at its summit is a chapel dedicated to the prophet, where an annual festival in his honour is held every August. In the region the chief economic activities are lumbering, especially of fir, black pine, chestnut, oak, and beech; and livestock farming. Grapes are cultivated, as well as such orchard crops as olives and citrus fruits.

**Taiyō** (Japanese: "The Sun"), Japanese magazine published from 1895 to 1928 and known for its literary criticism, Japanese literature, and translations of Western authors.

Although *Taiyō* treated practical, intellectual, and aesthetic subjects, its literary editors Takayama Chogyū (1871–1902) and Hasegawa Tenkei (1876–1940) were instrumental in popularizing the literature of late Romanticism and naturalism, both from abroad (in translations of such writers as Edgar Allan Poe, Gustave Flaubert, Guy de Maupassant, Mark Twain, Maurice Maeterlinck, and Leo Tolstoy) and at home (in such fiction writers as the naturalists Tokuda Shūsei, Tayama Katai, and Shimazaki Tōson). When naturalism faded, the magazine also faded in importance.

**Taizhou** (China): *see* T'ai-chou.

**Ta'izz,** also spelled TAIZ, city, southwestern Yemen, in the Yemen Highlands. It is one of the country's chief urban centres and a former national capital.



Al-Muẓaffarīyah Mosque, Ta'izz, Yemen
F. Balsen

The Ayyūbid dynasty under Tūrān Shāh, brother of Saladin, which conquered Yemen in 1173–74, made its capital first at Zabīd and then moved it to Ta'izz. The Ayyūbids were succeeded by the Rasūlids (1229–1454) and the Ṭāhirids (1454–1516), who moved the capital to Ṣan'ā'. In the latter year Ta'izz passed to Ottoman Turkish suzerainty, which lasted, with intervals, until 1918. The Zaydī imams (leaders) of Yemen frequently rebelled against Ottoman rule, however, and sporadically held the city. After the defeat of the Ottoman Empire in World War I (1918), Ta'izz and the surrounding area came into uncontested possession of the imam.

Picturesquely situated at about 4,500 feet (1,400 m) above sea level, the walled city is at the northern foot of Mount Ṣubr, 9,862 feet (3,006 m) high. It has many fine, elaborately decorated multistory houses. The Jāmi' (Al-Muẓaffarīyah) and Ash-Sharifīyah mosques are notable. Towering about 1,500 feet (450 m) above the city on a mountain spur is the old citadel and governor's residence. Ta'izz is the centre of the coffee-growing district of southwestern Yemen; kat (a mild narcotic) and vegetables are also grown in the area. The first city in the country to have a citywide purified water system (built by the United States in the 1960s), Ta'izz also has aluminum, biscuit, and soft-drink plants.

A Muslim madrasah (theological school) in Ta'izz is frequently referred to as an Islāmic university. A government experimental farm and agricultural school are located nearby. Ta'izz is the junction of two important all-weather highways, the east-west road from Mocha (Al-Mukhā) on the Red Sea coast, and the north-south route to the national capital of Ṣan'ā', via Ibb and Dhamār. Another road links Ta'izz with Aden.

Long an important administrative centre, the city was for a time under the monarchy the seat of Ta'izz (sometimes called South) *liwā'* (province), which was ruled as an emirate by a member of the princely Āl Wazīr house; the province came under the personal rule of the crown prince in 1944. From 1948 to 1962 (when the republic was established) Ta'izz was the residence of the imam and the administrative capital of the country. Places of interest in the vicinity include the former royal residence of 'Usayfirah and the ruins of ancient Thamad, a 12th-century mountain resort of the Ṣulayḥid princes. Pop. (1986) city, 178,430.

**taj,** brimless hat, usually conical or curved on top, worn by men and women in Muslim countries. The taj (from the Persian and Arabic words for crown) developed out of the ancient tiaras (*see* tiara) worn in the Mesopotamian valley. A hat of notability and prestige, the taj is often made of rich fabrics, brocaded, and bejeweled. Most, however, are made of felt or leather.

**Tāj Mahal,** also spelled TĀDJ MAḤALL, mausoleum complex in Āgra, northern India, on the southern bank of the Yamuna (Jumna) River. In its harmonious proportions and fluid incorporation of decorative elements, the Tāj Mahal is the finest example of Mughal architecture, blending Indian, Persian, and Islāmic styles. One of the most beautiful structures in the world, the Tāj was designated a UNESCO World Heritage site in 1983.

Built by the Mughal emperor Shāh Jahān (reigned 1628–58) to immortalize his favourite wife, Mumtāz Maḥal ("Chosen One of the Palace"), who died in childbirth in 1631 after having been the emperor's inseparable companion since their marriage in 1612, the Tāj Mahal derives its name from her title. The design of the complex has been attributed to various architects of the period, although the chief architect was probably Ustād Aḥmad Lāhawrī, an Indian of Persian descent. The five principal elements of the complex—main gateway, garden, mosque, *jawāb* (literally "answer"; a building mirroring the mosque), and mausoleum (including its four minarets)—were conceived as a unified entity according to the tenets of Mughal building practice, which allowed no subsequent alteration. Building commenced about 1632. More than 20,000 workers were employed from India, Persia, the Ottoman Empire, and Europe to complete the mausoleum itself by about 1638–39; the adjunct buildings were finished by 1643, and decoration work continued until at least 1647. Construction of the 42-acre (17-hectare) complex spanned 22 years at a cost of between four and five million rupees.

Resting in the middle of a wide plinth 23 feet (7 m) high, the mausoleum proper is of white marble that reflects various hues according to the intensity of sunlight or moonlight. It has four nearly identical facades, each with a wide central arch rising to 108 feet and chamfered (slanted) corners incorporating smaller arches. The majestic central dome, which reaches a height of 240 feet (73 m) at the tip of its finial, is surrounded by four lesser domes. The acoustics inside the main dome cause the single note of a flute to reverberate five times. The interior of the mausoleum is organized around an octagonal marble chamber ornamented with low-relief carvings and *pietra dura* (hard stone); therein are the cenotaphs of Mumtāz Muḥal and Shāh Jahān. These false tombs are enclosed by a finely wrought filigree marble screen. Beneath the tombs, at garden level, lie the true sarcophagi. Standing apart from the central building, at each of the four corners of the square plinth, are elegant minarets.

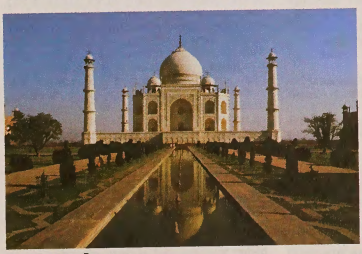
Flanking the mausoleum near the northwestern and northeastern edges of the garden, respectively, are two symmetrically identical buildings—the mosque, which faces east, and its *jawāb,* which faces west and provides aesthetic balance. Built of red Sikri sandstone with marble-necked domes and architraves, they contrast in both colour and texture with the mausoleum's white marble.

The garden is set out along classical Mughal lines—a square quartered by long water courses (pools)—with walking paths, fountains, and ornamental trees. Enclosed by the walls and structures of the complex, it provides a striking approach to the mausoleum, which can be seen reflected in the garden's central pools.

The southern end of the complex is graced by a wide red sandstone gateway with a recessed central arch two stories high. White marble paneling around the arch is inlaid with black Qu'rānic lettering and floral designs. The main arch is framed on either side by two pairs of smaller arches. Crowning the northern and southern facades of the gateway are matching rows of white cupola-like *chattris* (*chhattris*), 11 to each side, accompanied by thin ornamental minarets that rise to some 98 feet (30 m). At the four corners of the structure are octagonal towers capped with larger *chattris*.

Two notable decorative features are repeated throughout the complex: *pietra dura* and Arabic calligraphy. As embodied in the Mughal craft, *pietra dura* incorporates the inlay of semiprecious stones of various colours, such as lapis lazuli, jade, crystal, turquoise, and amethyst, in highly formalized and intertwining geometric and floral designs. The colours serve to moderate the dazzling expanse of the white Mākrana marble. Under the direction of Amānat Khān al-Shīrāzī, Qu'rānic verses were inscribed across numerous sections of the Tāj Mahal in calligraphy, the centre of Islāmic artistic tradition. One of the inscriptions in the sandstone gateway is known as Daybreak (89:28–30) and invites the faithful to enter paradise. Calligraphy also encircles the soaring arched entrances to the mausoleum proper. To ensure its uniform appearance from the vantage point of the terrace, the lettering increases in size according to its relative height and distance from the viewer.

A tradition relates that Shāh Jahān had originally intended to build another mausoleum across the river to house his own remains, the two structures to be connected by a bridge. He was deposed by his son Aurangzeb, however, and imprisoned for the rest of his life in Āgra



The Tāj Mahal, Āgra, India
Tom Nebbia—Aspect Picture Library

Fort, on the right bank of the Yamuna River 1 mile (1.6 km) west of the Tāj Mahal.

Over the centuries the Tāj Mahal has been subject to neglect and decay. A major restoration was carried out at the beginning of the 20th century under the direction of Lord Curzon, then the British viceroy of India. More recently, air pollution caused by emissions from foundries and other nearby factories and exhaust from motor vehicles has damaged the mausoleum, notably its marble facade. A number of steps have been taken to reduce the threat to the monument, among them the closing of some foundries and the installation of pollution-control equipment at others, the creation of a parkland buffer zone around the complex, and the banning of nearby vehicular traffic. A restoration and research program for the Tāj Mahal was initiated in 1998.

The Tāj Mahal has come to be seen as an Indian cultural symbol. Some Hindu nationalist groups have attempted to diminish the importance of the Muslim influence in the origins and design of the Tāj Mahal.

**Tajik,** also spelled TADZHIK, the original Iranian population of Afghanistan and Turkistan. The Tajiks constitute almost two-thirds of the population of Tajikistan. In the early 21st century there were more than 3,600,000 Tajiks in Tajikistan, almost two-thirds of its population; about 3,700,000 in Afghanistan, about one-fourth of its population; more than 1,000,000 in Uzbekistan; and 40,000 in the Sinkiang Uighur Autonomous Region in China.

The name Tajik refers to the traditionally sedentary Caucasoid people who speak a form of Persian called Tajik in Tajikistan and Uzbekistan and who speak the modern Persian language in Afghanistan.

The Tajiks belong to the Central Asian sedentary culture that diffused in prehistoric times from the Iranian plateau into an area extending roughly from the Caspian Sea to the borders of China. They built villages of flat-roofed mud or stone houses and cultivated irrigated fields of wheat, barley, and millet. Their gardens contained melons and a variety of fruits. Their crafts were highly developed, and their towns along the caravan routes linking Persia, China, and India were centres of trade. Turks subsequently migrated westward into the area inhabited by the Tajiks, who became Turkicized in their culture, though many retained their Iranian language.

Most Tajiks are Sunnite Muslims, but a few in mountain areas are Shī'ite Muslims.

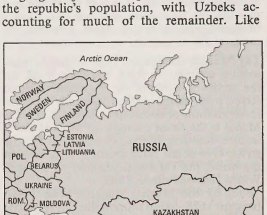
**Tajikistan,** officially REPUBLIC OF TAJIKISTAN, Tajikistan also spelled TADZHIKISTAN, Tajik TOJIKISTON, or JUMHURII TOJIKISTON, country of Central Asia that gained independence from the Soviet Union in 1991. Tajikistan is bounded by China to the east, Afghanistan to the south, Kyrgyzstan to the north, and Uzbekistan to the north and west. The autonomous region of Gorno-Badakhshan is located in the eastern half of the country. The capital is Dushanbe. Area 55,300 square miles (143,100 square km). Pop. (2000 est.) 6,312,000.

A brief treatment of Tajikistan follows. For full treatment, *see* MACROPAEDIA: Central Asia.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*Physical and human geography.* Tajikistan is mountainous, and about half of its territory lies above 10,000 feet (3,000 m). The southwestern limit of the Tien Shan mountains reaches into northern Tajikistan, while the Pamir mountains occupy the eastern portion of the country. Valleys, the main areas of human settlement, make up less than 10 percent of the country's area. The republic is crossed by the upper courses of the rivers Amu Darya and Syr Darya. The climate is continental (subject to temperature extremes) and arid.

Tajikistan is named for its principal inhabitants, the Tajiks, who speak an Indo-Iranian language closely related to Persian. (*See* Tajik.) Culturally the Tajiks are closely related to their Muslim coreligionists and neighbours, the Uzbeks, though the latter speak a Turkic language. Tajiks make up almost two-thirds of the republic's population, with Uzbeks accounting for much of the remainder. Like



Tajikistan

other Central Asian republics, Tajikistan has a fast-growing population owing to low mortality and high birth rates. Most of the population lives in villages called *qishlaqs*.

Tajikistan is the least developed of the Central Asian republics. Cotton is its leading branch of agriculture, which would be severely limited without irrigation using the waters of the Amu Darya and Syr Darya. After World War II a canal network started in the 1930s was expanded, making possible cattle raising, horticulture, and sericulture as well as cotton growing. Fruits, vegetables, and grain are grown in the valleys. The use of chemical fertilizers and pesticides in growing cotton has caused environmental pollution and health problems among the population, however.

Tajikistan is rich in mineral deposits, and coal mining and petroleum and natural-gas extraction are important heavy industries; these are supplemented by metalworking, including the manufacture of looms, power equipment, and cables, and by a chemical industry producing nitrogen fertilizer. Aluminium is produced from imported raw materials. The country's light industry is based on cotton milling, silk manufacture, and the production of knitted goods, footwear, and clothing. Food processing, carpet manufacture, and the production of geranium oil (used in perfumes) are other light industries.

Under Soviet rule, de facto power was held by the Communist Party of Tajikistan (CPT), with ultimate power residing in the Communist Party of the Soviet Union. The CPT-dominated governing structure collapsed after Tajikistan gained independence in 1991, with communists and their noncommunist opponents struggling for control of the government. A new constitution that established a strong, unicameral elected legislature, a directly elected president, and a judiciary including several high courts was adopted in 1994. In 1999 a bicameral legislature was created; elections for the two chambers were held in 2000.

The educational level of the Tajiks rose greatly in the 20th century as a result of Soviet efforts to introduce secular education and build schools. Education is now free and compulsory between the ages of 7 and 17. There are specialized secondary schools and institutions of higher learning, and Muslim education is also widely available.

*History.* The Tajiks are descended from the Persian-speaking Iranian peoples that once predominated in Central Asia. They were part of the empires of the Persians and of Alexander the Great and his successors, and in the 7th–8th century AD they were conquered by the Arabs and were Islāmicized. Successive Turkic migrations into the region over the centuries also influenced Tajik culture. The Tajiks were ruled by the Uzbek khanate of Bukhara from the 15th to the mid-18th century, at which time the Afghans conquered those Tajiks living south of the Amu Darya.

Russia took over much of Tajikistan in the 1860s. After the Russian Revolution of 1917, portions of Tajikistan were included in the Turkistan Autonomous Soviet Socialist Republic and in the Bukharan People's Soviet Republic. In 1924, however, these two portions of Tajikistan were consolidated into a newly formed Tajik Autonomous Soviet Socialist Republic, which was administratively a part of the Uzbek S.S.R. until the Tajik A.S.S.R. gained full-fledged republic status in 1929. The Tajik S.S.R. gained independence from the collapsing Soviet Union in 1991 and adopted the name Tajikistan. From 1991 Tajikistan experienced sporadic conflict as the communist-dominated government struggled to combat an insurgency by Islāmic and democratic opposition forces.

**Tajimi,** city, Gifu *ken* (prefecture), central Honshu, Japan. It lies along the Toki River, northeast of Nagoya.

Tajimi has long been known for its ceramics. In the 16th century, kilns were built at the foot of Mount Takatori, where captured Korean potters produced a white glazed pottery called Takatori ware (but now better known as Mino ware, for Mino province, which was part of what now is Gifu prefecture). In 1930 a native of Tajimi, Arakawa Toyozō, rediscovered some Mino kiln sites nearby and helped to revive the old processes. (In 1955 the Japanese government honoured Arakawa by naming him one of the nation's Living National Treasures.) Modern Tajimi is a major producer of ceramic tile and dinnerware. Tajimi contains the Prefectural Ceramic Art Institute and the Showroom of Ancient Pottery. Pop. (1995) 100,270.

**Tajmyr** (Russia): *see* Taymyr.

**Tajmyr Peninsula** (Russia): *see* Taymyr Peninsula.

**Tajumulco Volcano,** Spanish VOLCÁN TAJUMULCO, mountain peak in southwestern Guatemala. The highest peak in Central America, Tajumulco rises from sea level to an elevation of 13,845 feet (4,220 m) and is part of the Sierra Madre de Chiapas, a mountain range that extends into Guatemala from Chiapas state, southern Mexico. Tajumulco is thought to sit atop the remains of an older volcano and has two peaks. The extinct volcano can be climbed from the city of San Marcos, situated 9 miles (14 km) to the southeast.

**Takahama Kyoshi** (b. Feb. 22, 1874, Matsuyama, Japan—d. April 8, 1959, Kamakura), haiku poet, a major figure in the development of haiku literature in modern Japan.

Through his friend Kawahigashi Hekigotō, he became acquainted with the renowned poet Masaoka Shiki and began to write haiku poems. In 1898 Takahama became the editor of *Hototogisu,* a magazine of haiku that was started by Shiki. He and Kawahigashi, the two outstanding disciples of Shiki, became pitted against each other after Shiki's death.

Kawahigashi became the leader of a new style of haiku, one that disregarded the traditional pattern. For a time Takahama was preoccupied with writing novels in a realistic, sketchlike style, but he eventually returned to haiku. Writing in *Hototogisu,* he opposed Kawahigashi's new movement and advocated

realism in haiku, stressing that haiku poets should contemplate nature as it is. He published these beliefs in *Susumu beki haiku no michi* (1918; "The Proper Direction for Haiku"). His numerous collections of poetry have been compiled into the two-volume anthology *Takahama Kyoshi zenhaiku shū* (1980; "The Complete Haiku Poems of Takahama Kyoshi"). Takahama also wrote several novels, including *Haikaishi* (1909; "Haiku Poet").

**takahe** (species *Notornis mantelli*), rare flightless bird of New Zealand that was thought to have become extinct in the late 1800s but that was rediscovered in 1948 in several remote valleys on South Island. Related to the gallinules (family Rallidae), it is a colourful species with brilliant blue and coppery-green plumage and a large red bill, surmounted



Takahe (*Notornis mantelli*)
G.R. Roberts

by a red frontal shield that protrudes from the forehead. The takahe feeds by stripping seeds from grasses. The nest is placed on the ground, and two eggs, cream-coloured with brown blotches, are laid. The young are black and downy.

**Takakazu** (Japanese mathematician): *see* Seki Kōwa.

**Takakkaw Falls,** also spelled TAKKAKAW FALLS, cataract on the Yoho River, and a major feature in the northern part of Yoho National Park in southeastern British Columbia, Canada. The Takakkaw (Cree Indian for "wonderful") Falls is formed by meltwater from the Daly Glacier in the Waputik Mountains and consists of three distinct, nearly vertical drops. The Takakkaw was long thought to be the highest waterfall in Canada, but in 1985 a new survey showed its main drop to be 833 feet (254 m) in height rather than 1,260 feet (384 m) as was previously thought. The total height of the falls was thus accepted as 1,223 feet (373 m) rather than as 1,650 feet (503 m), making the Takakkaw considerably shorter than Della Falls, on Vancouver Island, B.C.

**Takamatsu,** city and capital of Kagawa *ken* (prefecture), Shikoku, Japan, facing the Inland



Ritsurin Garden, Takamatsu, Japan
Camera Tokyo Service

Sea. It was a castle town of the Tokugawa family from 1642 to 1868. A railway ferry was opened in 1910 between Takamatsu and Uno, in Okayama prefecture, thereby linking the city to the island of Honshu. The subsequent extension of railway lines and concentration of traffic in Takamatsu made the city the administrative, economic, and cultural centre of Shikoku. The city's industries include machinery, tools, pulp, paper, food, and furniture production.

Takamatsu is a popular tourist centre. Tamamo Park, near the harbour, contains the ruins of the 16th-century castle. Ritsurin Park, renowned for its landscaping, occupies 185 acres (75 hectares) and contains much of interest, including a natural pine forest, a zoo, an art gallery, and a museum. The tiny offshore island of Megi is associated with an ancient Japanese children's story, while the headland of Ya Island was the site of a major battle in the 12th century. Takamatsu is also the base for pilgrimages to the Kotohira Shrine, 19 miles (30 km) southwest. Pop. (1990) 329,695.

**Takamine, Jokichi** (b. Nov. 3, 1854, Takaoka, Japan—d. July 22, 1922, New York, N.Y., U.S.), biochemist and industrial leader whose most important achievement was the isolation of the chemical adrenalin (now called epinephrine) from the suprarenal gland (1901). This was the first pure hormone to be isolated from natural sources.

The son of a physician, Takamine graduated (1879) as a chemical engineer from the College of Science and Engineering of the Imperial University of Tokyo. The Japanese government sent him to Glasgow for postgraduate study at the university and at Anderson's College. During vacations he visited industrial plants, observing the manufacture of soda and fertilizers. After his return to Japan, Takamine entered the Imperial Department of Agriculture and Commerce; he rose rapidly, becoming head of the department's chemistry division. His first visit to the United States was in 1884 as a commissioner to the Cotton Centennial Exposition in New Orleans. In 1887 Takamine left government service in order to establish his own factory, the Tokyo Artificial Fertilizer Co., which manufactured superphosphate fertilizers.

In his private laboratory, Takamine developed, from a fungus grown on rice, a starch-digesting enzyme similar to diastase; he named it Takadiastase. In 1890 he was called to the United States to devise a practical application of the enzyme for the distilling industry. At this time he took up permanent residence in the United States, establishing the laboratory at Clifton, N.J., where his pioneering research in the isolation of adrenalin was carried out. The production of Takadiastase for medicinal use was taken over by the Parke-Davis Co., with whom Takamine was associated for the remainder of his career. He maintained close ties with Japan, aiding its development of industrial dyes, aluminum fabrication, nitrogen fixation, the electric furnace, and the manufacture of Bakelite.

**Takamura Kōun,** given name NAKAJIMA KŌZŌ (b. March 19, 1852, Edo [now Tokyo], Japan—d. Oct. 10, 1934, Tokyo), Japanese sculptor who worked to preserve the art of wood carving.

Takamura studied Buddhist sculpture under Takamura Tōun, later succeeding to his master's art and name. He had to endure poverty in order to continue making wood sculpture, since ivory was the favoured medium of the 1870s and 1880s. In 1887, when the Tokyo Fine Arts School was opened, he was invited by two art historians, Ernest F. Fenollosa and Okakura Tenshin, to head its wood-carving department. Takamura worked to free wood carving from the Buddhist tradition by stressing a realistic approach to his models. On the whole, however, he remained within the limits of traditional wood sculpture. His representative works are "Aged Monkey" and the bronze



"Aged Monkey," wood sculpture by Takamura Kōun, 1893; in the Tokyo National Museum
By courtesy of the Tokyo National Museum

statues "Nankō dōzō" and "Saigō Takamori dōzō."

**Takao** (Taiwan): *see* Kao-hsiung.

**Takaoka,** city, Toyama *ken* (prefecture), Honshu, Japan, on the lower reaches of the Shō River. The city was founded with the construction of Takaoka Castle in 1609. It became a trade centre, known for its manufacture of metalware. Based on the Comprehensive National Development Plan, the Toyama-Takaoka industrial city was created in 1969. Construction began on a large port for heavy industries. An aluminum refinery that was built in 1973 transformed the city into an important centre of the Japanese aluminum industry. Takaoka's other industrial products include copper, chemicals, and paper. Fushiki, on Toyama Bay of the Sea of Japan, serves as the city's outport. Takaoka is also a railway hub.



Pavilion of Buddha's ashes, Takaoka, Japan
Shostal

Takaoka Park, on the castle site, and Sakurababa Park, which contains a museum, are connected by an avenue of ancient cherry trees. The Buddhist Zuiryu Temple contains numerous national treasures. Pop. (1990) 175,469.

**Takarazuka,** city, Hyōgo *ken* (prefecture), Honshu, Japan, on the northeastern slope of Mount Rokkō. The city is a hot-springs resort and is renowned for its female opera company. The opera house, which has been operated by the Railway Society since 1919, has a seating capacity of 4,000, making it one of the largest in the Orient. Takarazuka also has botanical

gardens, pools, golf courses, racetracks, a zoo, and educational facilities. The Muko River flows through the city, and the river's banks

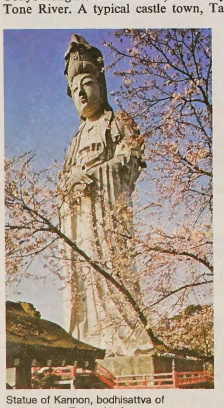


Entrance to the Takarazuka Women's Opera Theatre, Takarazuka, Japan
Imperial Press—FPG

are lined with hotels and restaurants. Pop. (1990) 201,863.

**Takasago,** city, Hyōgo *ken* (prefecture), Honshu, Japan, on the Inland Sea. It long served as a distribution centre for the rice that was produced in the hinterland of the Harima Sea, a portion of the Inland Sea. In the late 19th century Takasago's harbour and plentiful water supply were developed for industrial use (paper and cotton-spinning mills). Ceramics and heavy chemicals subsequently became the major industrial products, and Takasago, which at one time had been a quiet town graced with pine trees, began to be altered by pollution and noise. Pop. (1990) 93,267.

**Takasaki,** city, Gumma *ken* (prefecture), Honshu, Japan. It is situated northwest of Tokyo along the Karasu River, a tributary of the Tone River. A typical castle town, Takasaki



Statue of Kannon, bodhisattva of compassion, Takasaki, Japan
Tsuneo Iwata—Bon

became increasingly important as a commercial and transport centre with the expansion of the railway network after the Meiji era. Various traditional industries such as silk-reeling, woodworking, and brewing were supplemented after World War II by new ones, including the production of machines, metals, synthetic textiles, and chemicals. The statue of Kannon, the Japanese version of the bodhisattva Avalokiteśvara, 138 feet (42 m) high, stands atop Mount Kannon to the southwest. Pop. (1990) 236,463.

**Takashimaya Co., Ltd.,** Japanese TAKASHIMAYA KABUSHIKI-GAISHA, premier department-store company in Japan. The company traces its history back to a cotton-goods store founded in Kyōto in 1831; the modern limited-liability company was established in 1919. Today the company has department stores in Tokyo, Ōsaka, Kyōto, Rakusai, Sakai, Wakayama, and several other Japanese cities, as well as branches overseas in such cities as New York, Paris, London, Milan, Hong Kong, and Singapore. Headquarters are in Tokyo.

**Takasugi Shinsaku** (b. Sept. 27, 1839, Hagi, Nagato province, Japan—d. May 17, 1867, Shimonoseki), noted Japanese imperial loyalist whose restructuring of the military forces of the feudal fief of Chōshū enabled that domain to defeat the armies of the Tokugawa shogun, the hereditary military dictator of Japan. That victory led to the Meiji Restoration (1868), the overthrow of shogunal government and the restoration of power to the emperor.

Like most other imperial loyalists, Takasugi originally was strongly antiforeign, but he finally concluded that the expulsion of all Westerners from Japan was impossible, and he became an advocate of Western military techniques. His about-face almost resulted in his assassination, but he was vindicated in 1863, when attempts to expel foreigners from the Shimonoseki Strait resulted in the Shimonoseki Incident (1864)—the demolition of all Chōshū forts along the strait by warships from Britain, France, The Netherlands, and the United States. The loyalist faction in Chōshū then chose Takasugi to help construct a new Western-style army.

Takasugi's reforms completely transformed Japanese fighting techniques. Although commoners were theoretically forbidden to carry weapons, he formed a series of peasant militia units led by young extremist samurai and trained in Western-style military discipline. The most famous of these units, the Kiheitai ("Irregular Troop Unit"), remained under Takasugi's personal control.

Alarmed at the growing radical tendencies in Chōshū, the shogun in 1864 sent a punitive expedition to the fief. The Chōshū forces were defeated and a conservative government installed. As soon as the shogun's army left, however, Takasugi's irregular units attacked and defeated the conservative government's forces and reinstalled a radical group in power. In August 1865 the shogun sent another expedition, this one with orders to level the fief. By this time, however, Takasugi had brought his militia units, equipped with Western arms, under strict central control; the shogun's army was routed, and the balance of power in Japan was drastically altered. In January 1868, samurai from Chōshū and Satsuma fief overthrew the shogun and declared a new central government under the Meiji emperor.

One of the first acts of the new imperial government was to develop an army along the lines already begun by Takasugi, whose untimely death occurred before he could assume an important role in the new administration.

**Takatsuki,** city, Ōsaka *fu* (urban prefecture), Honshu, Japan. It lies along the Yodo River, midway between Ōsaka and Kyōto. During the late Muromachi period (1338–1573), Takatsuki became a castle town, and an army engineers' camp was established there in the late 19th century. The city's industrialization was rapid after World War II; products include electrical appliances and pharmaceuticals. Pop. (1990) 359,867.

**Takayama,** city, Gifu *ken* (prefecture), Honshu, Japan, on the Miya River. It contains many old buildings and temples, including the Kokubun Temple (1588), and it was a castle town during the Tokugawa period (1603–1867). Takayama is a centre of the Hida Mountains region. The city is also a tourist base



Old-style inn (*ryokan*), Takayama, Japan
Minoru Wanishina—Bon

for Chūbu-sangaku National Park to the east. Local industries produce lacquer ware and woodenware. Pop. (1990) 65,245.

**Takeda Shingen,** original name TAKEDA HARUNOBU (b. Dec. 1, 1521, Kai province, Japan—d. May 13, 1573, Komaba, Shinano province), one of the most famous of the military leaders who struggled for mastery of the strategic Kantō Plain in central Japan during the chaotic period of civil unrest in the 16th century. Takeda is especially well known for his series of battles with the noted warrior Uesugi Kenshin, not only famous in the annals of Japanese history but also much-celebrated in Japanese drama and folklore.

Born into the powerful Takeda clan, Shingen entered the priesthood in 1551. Taking priestly vows in no way hampered his participation in worldly affairs, however. After forcing his father to retire as head of the Takeda clan, he assumed that position and began his struggle with Uesugi for mastery of the Kantō. Although their battles were relatively indecisive, Takeda Shingen was recognized as one of the most powerful warriors in central Japan. As such, he posed a threat to the powerful feudal warrior Oda Nobunaga in his attempt to dominate the central government. Just as the conflict with Oda began, however, Takeda was wounded in battle and died.

**Takefu,** city, Fukui *ken* (prefecture), Honshu, Japan. It is situated on the alluvial fan of the Hino River. During the Tokugawa period (1603–1867), it was a castle town and a provincial capital. The city's traditional industry is the manufacture of cutlery. During the Meiji period (1868–1912), silk manufacture was introduced, and Takefu now produces silk, paper, fertilizers, petrochemicals, and electrical appliances. Pop. (1990) 70,188.

**Takeshita Noboru** (b. Feb. 26, 1924, Kakeya, Shimane prefecture, Japan—d. June 19, 2000, Tokyo), prime minister of Japan from November 1987 to June 1989, at

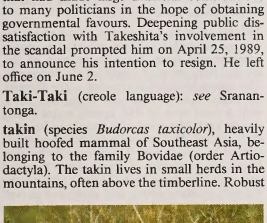
which time he resigned because of his involvement in an influence-peddling scandal.

Takeshita graduated from Waseda University, Tokyo, in 1947, after which he taught high school for four years. He served seven years on the Shimane prefectural council before being elected to the lower house of the Diet (parliament) in 1958; it was the first of 11 consecutive terms. His first ministerial post was as chief Cabinet secretary in 1971; he later became minister of construction and was minister of finance in 1979–80 and 1982–86. He was secretary-general of the Liberal-Democratic Party (LDP) in 1986–87. In November 1987 Takeshita was hand-picked for the post of president of the LDP by his predecessor, Prime Minister Nakasone Yasuhiro, and thereby became prime minister of Japan.

As prime minister, Takeshita obtained the passage of a new national sales tax. In April 1988 he publicly disclosed that he and several aides had been among those politicians who had received stocks, donations, and loans from Recruit, a Japanese telecommunications firm that had made large financial contributions to many politicians in the hope of obtaining governmental favours. Deepening public dissatisfaction with Takeshita's involvement in the scandal prompted him on April 25, 1989, to announce his intention to resign. He left office on June 2.

**Taki-Taki** (creole language): *see* Sranantonga.

**takin** (species *Budorcas taxicolor*), heavily built hoofed mammal of Southeast Asia, belonging to the family Bovidae (order Artiodactyla). The takin lives in small herds in the mountains, often above the timberline. Robust



Takin (*Budorcas taxicolor*)
George B. Schaller

and short-legged, it can move about quickly and easily over difficult slopes. It stands up to about 107 cm (3.5 feet) at the shoulder and has a shaggy yellowish to blackish brown coat. In profile, it has a convex nose; both sexes have heavy horns that turn outward from the centre of the forehead and then curve up and backward.

*To make the best use of the Britannica, consult the* INDEX *first*

**Takizawa Bakin** (b. July 4, 1767, Edo [Tokyo], Japan—d. Dec. 1, 1848, Edo), the dominant Japanese writer of the early 19th century, admired for his lengthy, serious historical novels that are highly moral in tone.

Bakin was the third son of a low-ranking samurai family. His father and mother died while he was still young, and, because of the famine and plague that struck Edo after 1780, he alone lived to continue his family name. After much drifting, he relinquished samurai status, married a merchant's widow, and devoted the next 50 years to writing.

With his more than 30 long novels—known as *yomihon*, "reading books"—Bakin created the historical romance in Japan. Court romances, military chronicles, nō plays, popular dramas, legends, and Chinese vernacular fiction all furnished him material. He freed the novel in Edo from subservience to actor, illustrator, and raconteur. Loyalty, filial piety, and the restoration of once-great families were his main themes. His special attention to Chinese civilization, Buddhist philosophy, and national history was tempered by a concern for language and style, compassion for his fellow man, and a belief in human dignity. Still, the samurai tradition and his own innate stubbornness led him to support the established order and gave a strong note of didacticism to his writing. Bakin's finest work is *Nansō Satomi hakkenden* (1814–42; "Satomi and the Eight Dogs"), on the theme of restoring a family's fortunes; it is acclaimed as a classic of Japanese literature.

**Takkakaw Falls** (Canada): *see* Takakkaw Falls.

**takkanah,** also spelled TAKKANA (Hebrew: "ordinance"), plural TAKKANOTH, or TAKKANOT, in Judaism, a regulation promulgated by rabbinic authority to promote the common good or to foster the spiritual development of those under its jurisdiction. Takkanoth, which are considered extensions of Torah Law (that is, the Law of Moses given in the first five books of the Bible), are of ancient origin and encompass such diverse subjects as liturgy, education of the young, and a bride's marriage contract (ketubah) to protect her financially in the case of divorce or her spouse's death. Among the most far-reaching ordinances of the European Middle Ages was a takkanah against polygamy issued in the 11th century by Rabbi Gershom ben Judah.

**Takla Makan Desert,** Chinese (Wade-Giles) T'A-K'O-LA-MA-KAN SHA-MO, or (Pinyin) TAKLIMAKAN SHAMO, great desert of Central Asia, and one of the world's largest sandy wastes, occupying an area of 105,000 square miles (272,000 square km) in the central Tarim Basin in China.

A brief treatment of the Takla Makan Desert follows. For full treatment, *see* MACROPAEDIA: Asia.

The Takla Makan Desert reaches elevations of 3,900 to 4,900 feet (1,200 to 1,500 m) in the west and south and 2,600 to 3,300 feet (800 to 1000 m) in the east and north. It is flanked by high mountain ranges including the Tien Shan to the north, the Kunlun Mountains to the south, and the Pamirs to the west; there is a gradual transition to the marshy Lop Nor basin in the east.

The surface of the Takla Makan is composed of friable alluvial deposits several hundred feet thick, with a wind-blown sand cover as much as 1,000 feet (300 m) thick. As a result of the desert's complex wind conditions, there is a variety of wind-formed topographic features, among them pyramidal dunes reaching 650 to 1,000 feet in height. Two small mountain chains composed of sandstones and clays, the arc-shaped Mazar Mountains and the Chiaolo (Chöl) Mountains, rise in the western Takla Makan.

The rivers draining the Kunlun Mountains penetrate from 60 to 120 miles (100 to 200 km) into the desert, gradually drying up in its sands. The climate is moderately warm and markedly continental in the Takla Makan. Precipitation is very low, ranging from 1.5 inches (38 mm) annually in the west to 0.4 inch (10 mm) in the east. Vegetation and animal life are very sparse, except in the few river valleys and the peripheral regions of the desert, and there is no fixed human population. The exploitation of vast petroleum reserves has been undertaken in both the northern and southern regions of the desert.

**Takoma Park,** city, Montgomery and Prince Georges counties, Maryland, U.S., on Sligo Brook Creek. It was founded in 1883 by Benjamin F. Gilbert along the Baltimore and Ohio Railroad track as a northern residential development for Washington, D.C. The Seventh-day Adventists arrived in the 1900s and



Weis Library, Columbia Union College, Takoma Park, Md.
Milt and Joan Mann from CameraMann

made Takoma Park their headquarters. They founded Washington Missionary College (now Columbia Union College), a sanitarium, and other institutions. The Takoma Park Campus of Montgomery College was opened in 1950. Inc. town, 1890; city, 1948. Pop. (1990) 16,700.

**Takoradi** (Ghana): *see* Sekondi-Takoradi.

**Taksin,** also called PHRAYA TAKSIN, or PHYA TAK (b. April 17, 1734, Ayutthaya [Thailand]—d. April 6, 1782, Thon Buri, Thailand), Thai general, conqueror, and later king (1767–82) who reunited Thailand, or Siam, after its defeat at the hands of the Myanmar (Burmese) in 1767.

Of Chinese-Thai parentage, Taksin became the protégé of a Thai nobleman who enrolled him in the royal service. In 1764 he gained the rank of *phraya* as the governor of the province of Tak, and to distinguish him from previous governors he was called Phraya Taksin. He and his provincial troops were among the forces besieged in Ayutthaya by the Myanmar in 1766–67, but before the city fell he fled the capital and made his way to the southeast of the kingdom. There he raised new troops, with which he regained the lower Chao Phraya River valley. Moving his capital to Thon Buri, opposite Bangkok, he repelled new Myanmar attacks and defeated other contenders for the throne by 1770. By 1776 he had driven the Myanmar from Chiang Mai and the north, and he soon extended his power into Laos, Cambodia, and the Malay states.

Taksin was a better conqueror than a politician. His rule grew arbitrary, and he convinced himself that he was well advanced toward buddhahood. His attempts to force the Buddhist monkhood and his subjects to accept his religious pretensions led to a rebellion organized by minor officials near the capital. After deposing and executing him, they invited the chief among his generals, then campaigning in Cambodia, to succeed him, as Rama I. Some historians believe that Taksin was secretly spirited away from Thon Buri in 1782 and lived in a mountain retreat in southern Thailand until 1825.

**Takulli** (people): *see* Carrier.

**Takuma Shōga,** original name TAKUMA TAMEMOTO (fl. mid- to late 12th century, Kyōto, Japan), member of a Japanese family of professional artists who specialized in Buddhist paintings (*butsuga*), creating a new style of religious painting that incorporated features of Chinese Southern Sung art.

A high-ranking priest of the Shingon sect of Buddhism, Shōga painted *butsuga* for the Tō and Jingō (or Takaosan) temples with which he was associated in Kyōto, as well as for in-

dividual court noblemen who used his paintings in their private religious observances. Of his *butsuga,* the most important was a group of the "Twelve Gods," painted on screens, in 1191, for the Tō Temple. The painting of the Moon deity, the only one of the 12 that is extant, exemplifies the style of iconography introduced by Shōga and continued by the Takuma family. It contrasts with earlier painting in its pale colours and limited patterns, and it reflects the Southern Sung influence most directly in the emphasis on brushwork. The deity, moreover, is now represented as a standing figure and in profile—a posture that displays to good advantage the graceful flowing lines of the robes.

**Takutarō** (sculptor): *see* Hiragushi Denchū.

**tāla,** in the music of India and Pakistan, a metric cycle with a specific number of beats—from 3 to 128—that recur in the same pattern throughout a musical performance. *Tāla* might generally be equated with rhythm or metre, although the *tāla* procedure has no precise counterpart in Western music. Within the pattern the beats are not necessarily grouped in identical subunits, as in common Western practice, but might occur in asymmetrical groups. Even in cases in which subunits are numerically identical, each such group is functionally different. The *tāla* known as *tīn-tāla,* for example, consists of 16 beats and might superficially resemble the Western $\frac{4}{4}$ metre, for it is divided into groups of four. Each four-beat group, however, has a different degree of emphasis, the strongest being the first group (the opening beat of which, the *sam,* is the most emphatic of the 16) and the weakest being the third (the first beat of which is called *khālī,* or "open beat"). Thus, each *tāla* has a character of its own, determined not only by the number of the beats but also by the subdivision of beats into small units with different points of stress.

Just as the scalar-melodic structure of the raga (*q.v.;* melodic framework) gives the performer a basis for melody, the *tāla* provides the undeviating framework for rhythmic improvisation. Generally, the *tāla* is given expression by an accompanying drummer; but the rhythmic cycles are maintained in the mind of the melodic soloist in any case and are ever present, whether or not audibly performed.

**Talaing** (people): *see* Mon.

**Talaing language:** *see* Mon language.

**Talak,** extensive sandy dune region of northwestern Niger, west of the Air massif. It covers about 40,000 square miles (100,000 square km) and is drained by a number of small, ephemeral watercourses, the longest of which, the Azaouak, eventually empties into the Niger River. Dinosaur fossils have been found at numerous sites in the region. Eastern Talak is crossed (north-south) by the trans-Saharan highway, which links Algiers on the Mediterranean with Kano, Nigeria.

**Talambo affair** (1862), attack by Peruvian workers on Spanish Basque immigrants on the hacienda (estate) of Talambo, in Peru; this incident led to the Spanish war against Peru (1864–66), the last attempt by Spain to reestablish hegemony over any of its former colonies in the Americas.

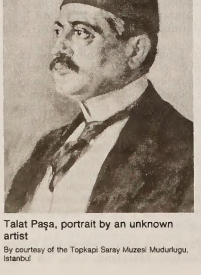
Following the attack at Talambo, the Spanish government sent an investigator, whom it called a viceroy (the title of the head of the former Spanish colonial government), to Peru; the Peruvian government resented the obvious denigration of its sovereignty and refused to deal with him. In April 1864 Spain dispatched a fleet that occupied Peru's guano-rich Chincha Islands, about 12 miles (19 km) off the Peruvian coast. The Peruvian president, General Juan Antonio Pezet, acceded to Spain's demands for an indemnity in return for the islands, but the ensuing furor among the islanders enabled General Mariano Ignacio Prado to oust him in 1865. Prado forged an alliance with Ecuador, Bolivia, and Chile and declared war against Spain in 1866; that year the South American allies defeated the Spanish fleet off Callao, Peru, thus effectively ending the Spanish intervention, although the treaty formally ending hostilities was not signed until 1879.

**Talara,** community, Piura *departmento,* northwestern Peru, on the Pacific Ocean. Rebuilt and developed by the International Petroleum Company (which provided workers' housing, hospitals, and schools), it is a refining and shipping port for Peru's main oil-producing region. To the southwest, near the foot of the La Brea Mountains, is the site of the pits (where Spaniards boiled tar to caulk their ships) and of Peru's first oil well, dug (not drilled) in 1850. Commercial production began after 1914. Pop. (2001 est.) 100,600.

**Talas,** *oblast* (province), northwestern Kyrgyzstan, centred on the Talas River valley that follows an essentially east-west axis through the northern portion of the *oblast.* Reconstituted in 1990, the *oblast* was formed in 1944 and remained in existence until 1956. It was reestablished in 1980–88 and once again reformed in 1990. The population of Talas includes a large concentration of non-Central Asian groups, among them ethnic Russians, Ukrainians, Germans, and Hui (Chinese Muslims, also called Dungan). In the uplands of Talas the major economic activity is pastoralism, in the lowlands, agriculture. Area 4,400 square miles (11,400 square km). Pop. (2001 est.) 208,000.

**Talat Paşa,** in full MEHMED TALAT PASA (b. 1874, Edirne, Ottoman Empire [now in Turkey]—d. March 15, 1921, Berlin, Ger.), leader of the Young Turks, Ottoman statesman, grand vizier (1917–18), and leading member of the Ottoman government from 1913 to 1918. A man of swift and penetrating intelligence, Talat was an idealist, forceful but never fanatical or vengeful.

The son of a minor Ottoman official, Talat joined the staff of the telegraph company in Edirne, but he was soon arrested (1893) for subversive political activity. Released two years later, he was appointed chief secretary of posts and telegraphs in Salonika (modern Thessaloníki, Greece) and rendered important services to the Young Turk cause. In 1908 he was dismissed for being a member of the Committee of Union and Progress (CUP), the conspiratorial nucleus of the Young Turk movement. After the Young Turk Revolution of 1908, however, he became deputy for Edirne in the Ottoman Parliament, and in 1909 he was appointed minister of the interior. He became minister of post and then the secretary-general of the CUP (1912).



Talat Paşa, portrait by an unknown artist

By courtesy of the Topkapi Saray Muzesi Mudurlugu, Istanbul

Before the outbreak of World War I, Talat sided with the Allied powers. In 1914, however, under the influence of Enver Paşa, minister of war and one of the triumvirate, the Ottoman Empire entered the war on the side of Germany. Talat, as minister of the interior, had to take responsibility for the deportation of the Armenians from the empire's eastern provinces, open to Russian influence, to Syria and Mesopotamia; some historians blame him for the barbarity of the operation, which resulted in the death of some 600,000 Armenians.

In 1917 he became the grand vizier; he resigned on Oct. 14, 1918, shortly before the Ottoman capitulation to the Allies. In November, together with Enver Paşa and Cemal Paşa, he fled to Germany, where he was killed by an Armenian three years later.

**Talaud Islands,** Indonesian KEPULAUAN TALAUD, also spelled TALAUR, or TALAUT, islands administered from Manado as part of Sulawesi Utara *provinsi* ("province"), Indonesia. The group includes Karakelong (the largest), Salebabu, Kaburuang, and numerous islets, with a total area of 495 square miles (1,281 square km). The coast of Karakelong Island is steep except on the southern shore, which is fringed by a wide reef. The seven tiny Nanusa Islands lie northeast of Karakelong. Forested and with hills rising to 2,231 feet (680 m), the Talauds produce ebony and ironwood as well as copra, sagō, and nutmeg. The inhabitants are mostly Christian; historically the islands were subject to the princes of Sangihe. The principal town and capital is Beo. Pop. (latest est.) 15,683.

**Talavera de la Reina,** town, Toledo *provincia,* in the *comunidad autónoma* ("autonomous community") of Castile-La Mancha, central Spain, on the northern bank of the Tagus River near its confluence with the Alberche. The town originated as the Roman Caesarobriga and was conquered by King Alfonso VI in 1082. Alfonso XI gave it to his queen, Maria of Portugal, whence its appellation *de la Reina* ("of the queen"). Historic monuments include the town walls, with 18 watchtowers, dating from the 12th and 13th centuries; the Gothic Church of Santa María la Mayor; the Mudéjar Church of Santiago; and a 15th-century bridge over the Tagus. In 1809 the French were defeated at Talavera in an important battle of the Peninsular War.

From the 16th century it was an important centre for woolen manufactures but was even more noted for its silk, pottery, and tiles. In the 18th century the ceramic industry declined, although it was revived to some extent in the 20th century. The royal silk factory, established in 1748, was closed in 1851. Economic recovery in the 20th century has been largely the result of the irrigation of land on the right bank of the Tagus, which has facilitated the cultivation of new crops such as cereals. Agriculture is the main occupation, with tobacco and cotton crops forming the basis of much local industry. Pop. (1998 est.) 72,200.

**talbīyah,** in Islām, the formulaic pronouncement *labbaykah allāhummah labbaykah* ("at your service, O Lord, at your service"), recited especially during a pilgrimage when pious Muslims perform the *jawāf—i.e.,* walk around the sacred shrine of the Ka'bah. The question whether the *talbīyah* is obligatory or merely a commendable tradition has been much discussed, but Muslim theologians have reached no consensus. All Muslim sects and theological schools within Islām thus continue to use

the *talbiyah* during pilgrimages and on other religious occasions. There are several longer versions of *talbtyah* that have been attributed to certain prominent Muslims, particularly to Muḥammad and the Companions, and even to such pious figures from the past as Adam and Noah.

**Talbot, Charles:** *see* Shrewsbury, Charles Talbot, duke and 12th earl of.

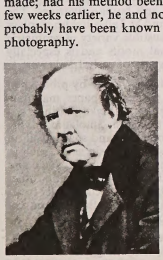
**Talbot, John:** *see* Shrewsbury, John Talbot, 1st earl of.

**Talbot, Mary Anne** (b. Feb. 2, 1778, London, Eng.—d. Feb. 4, 1808, Shropshire), British woman who served in the English army and navy disguised as a man. She was later known as the "British Amazon."

Talbot was seduced in 1792 by Captain Essex Bowen and accompanied him to Santo Domingo in the Caribbean, disguised as his footboy and using the name John Taylor. She then went to Flanders as a drummer. She was present at the capture of Valenciennes (July 1793), where Bowen was killed, and then deserted and joined a French lugger. She was captured by the British and then by the French. Talbot spent time in prison and voyaged to the United States before her true sex was discovered in London in 1796. She later became a servant of Robert Kirby, a London publisher, who published her story in *The Life and Surprising Adventures of Mary Anne Talbot* (1809).

**Talbot, Richard:** *see* Tyrconnell, Richard Talbot, earl of.

**Talbot, William Henry Fox** (b. Feb. 11, 1800, Melbury Abbas, Dorset, Eng.—d. Sept. 17, 1877, Lacock Abbey, near Chippenham, Wiltshire, Eng.), English chemist, linguist, archaeologist, and pioneer photographer. He is best known for his development of the calotype (*q.v.*), an early photographic process that was an improvement over the daguerreotype of the French inventor L.-J.-M. Daguerre. Talbot's calotypes involved the use of a photographic negative, from which multiple prints could be made; had his method been announced but a few weeks earlier, he and not Daguerre would probably have been known as the founder of photography.



William Henry Fox Talbot
The Mansell Collection

Talbot was educated at Harrow and at Trinity College, Cambridge, and published many articles in the fields of mathematics, astronomy, and physics. He briefly served in Parliament (1833–34) and in 1835 published his first article documenting a photographic discovery, that of the paper negative. These so-called photogenic drawings were basically contact prints on light-sensitive paper, which unfortunately produced dark and spotty images. In 1840 he modified and improved this process and called it the calotype (later the talbotype). Unlike the original process, it used a much shorter exposure time and a development process following exposure. Talbot patented the process in 1841 and was reluctant to share his knowledge with others, which lost him many friends and much information. In 1842 Talbot received a medal from the British Royal Society for his experiments with the calotype.

Talbot's *The Pencil of Nature* (1844–46), published in six installments, was the first book with photographic illustrations. Its 24 (of a proposed 50) plates document the beginnings of photography primarily through studies of art objects and architecture. In 1851 Talbot discovered a way of taking instantaneous photographs, and his "photolyphic engraving" (patented in 1852 and 1858), a method of using printable steel plates and muslin screens to achieve quality middle tones of photographs on printing plates, was the precursor to the development in the 1880s of the more successful halftone plates.

**talbotype** (photography): *see* calotype.

**talc,** common silicate mineral that is distinguished from almost all other minerals by its extreme softness (it has the lowest rating [1] on the Mohs scale of hardness). Its soapy or greasy feel accounts for the name soapstone given to compact aggregates of talc and other rock-forming minerals. Dense aggregates of high-purity talc are called steatite.

Since ancient times, soapstones have been employed for carvings, ornaments, and utensils; Assyrian cylinder seals, Egyptian scarabs, and Chinese statuary are notable examples. Soapstones are resistant to most reagents and to moderate heat; thus, they are especially suitable for sinks and countertops. Talc is also used in lubricants, leather dressings, toilet and dusting powders, and certain marking pencils. It is used as a filler in ceramics, paint, paper, roofing materials, plastic, and rubber; as a carrier in insecticides; and as a mild abrasive in the polishing of cereal grains such as rice and corn.

Talc is found as a metamorphic mineral in veins, in foliated masses, and in certain rocks. It is often associated with serpentine, tremolite, forsterite, and almost always with carbonates (calcite, dolomite, or magnesite) in the lower metamorphic facies. It also occurs as an alteration product, as from tremolite or forsterite.

One of the remarkable features of talc is its simple, almost constant composition; talc is a basic magnesium silicate, $Mg_3Si_4O_{10}(OH)_2$. Unlike other silicates, even closely related ones, talc appears to be unable to accept iron or aluminum into its structure to form chemical-replacement series, even though an iron analog of talc is known, and the structurally related chlorite forms at least a partial series between iron and magnesium endmembers. Talc is distinguishable from pyrophyllite chemically and optically. For detailed physical properties, *see* silicate mineral (table).

**Talca,** formerly SAN AGUSTÍN DE TALCA, capital of Talca *provincia* and Maule *región,* central Chile, in the Central Valley near the Maule River. Founded in 1692, it was destroyed by earthquakes in 1742 and 1928; completely rebuilt, it is now a major urban centre midway between Santiago, 160 miles (260 km) to the north-northeast, and Concepción. It lies in the nation's greatest wine-making zone and contains Chile's largest match industry, as well as shoe, biscuit, bed, chocolate, and noodle factories; paper and flour mills; distilleries; foundries; and a tannery. The University of Talca was founded in 1981. A transportation hub, Talca is on the Pan-American Highway and the main north-south railroad. Pop. (1995 est.) mun., 169,448.

**Talcahuano,** city, Concepción *provincia,* Bío-Bío *región,* south-central Chile, lying on a small peninsula that forms the southwestern shore of Concepción Bay, just north-northwest of the city of Concepción (*q.v.*), for which it became the outport after an earthquake in 1730. Talcahuano is now a major port and Chile's main naval station; it is also an important commercial, fishing, and manufacturing centre. Lumber, hides, wool, fur, and coal are the main exports; machinery is imported. Industries include fishing and fish canning, flour milling, and petroleum refining. Nearby is the large, modern steel plant at Huachipato, the San Vicente chemical complex and resort, and the Chilean Naval Academy. In Talcahuano harbour is moored the *Huáscar,* the Peruvian ironclad captured by Chile in 1879, during the War of the Pacific. Talcahuano is linked by both road and railroad to Concepción. Pop. (1995 est.) mun., 260,915.

**Taldy-Kurgan,** Kazak TALDYQORGHAN, city, southeastern Kazakstan. It is situated on the left bank of the Karatal River and in the western foothills of the Dzungarian Alatau Range. It grew up on the site of Gavrilovka village, founded in the second half of the 19th century, and it developed particularly after the construction of a branch line from the Turk-Sib Railway in 1949. Food products, construction materials, and diverse light industries predominate. The city has three parks, the largest of which half encircles the city; industrial and agricultural colleges; and a medical school. Pop. (1995 est.) 116,100.

**Tale of Genji, The,** Japanese GENJI MONOGATARI, masterpiece of Japanese literature by the Lady Murasaki Shikibu, written toward the start of the 11th century. It is considered the oldest full novel in the world and one of the finest. Most of the story is concerned with the loves of Prince Genji and the different women in his life, each of whom is exquisitely delineated. The work is supremely sensitive to human emotions and the beauties of nature; but the tone darkens as it proceeds, to reflect a Buddhist conviction of the vanity of this world. *The Tale of Genji,* translated by Arthur Waley, was published in 1935. A new translation by Edward G. Seidensticker was published in 1976.

**Talence,** town, Gironde *département,* Aquitaine *région,* southern suburb of Bordeaux, southwestern France. It is a centre for jet-aircraft production and has light industry and wine making. An extension of Bordeaux University (now Bordeaux University I), with housing for 30,000 students, was erected there in the 1960s and has since become a major educational and research centre. Pop. (1990) 36,172.

**Talensi** (people): *see* Tallensi.

**talent,** unit of weight used by the ancient Hebrews, Egyptians, Greeks, and Romans, among other ancient peoples. The weight of a talent and its relationship to its major subdivision, the mina (*q.v.*), varied considerably at different times and places in the ancient world. The most common ratio of the talent to the mina was probably 1:60.

The Hebrew talent, or *kikkor,* probably of Babylonian origin, was the basic unit of weight among the ancient Hebrews. In the sacred system of weights, the talent was equal to 50 sacred minas. The Talmudist talent was equal to 60 Talmudist minas.

The talent was also an important unit of weight among the Greeks, who undoubtedly borrowed it from eastern neighbours. The Attic talent, which equaled 60 Attic minas, is estimated as having weighed about 58 pounds (25.8 kg). It was certainly smaller than (perhaps half the size of ) the Hebrew talent.

**Talented Tenth** (1903), concept espoused by black educator and author W.E.B. Du Bois, emphasizing the necessity for higher education to develop the leadership capacity among the most able 10 percent of black Americans. Du Bois was one of a number of black intellectuals who feared that what they saw as the overemphasis on industrial training (as evidenced,

for example, by the plan proposed by Booker T. Washington in the 1895 Atlanta Compromise, *q.v.*) would confine blacks permanently to the ranks of second-class citizenship. In order to achieve political and civil equality, Du Bois stressed the importance of educating Negro teachers, professional men, ministers, and spokesmen, who would earn their special privileges by dedicating themselves to "leavening the lump" and "inspiring the masses."

**Taliban,** also spelled TALEBAN (Persian *Ṭālebān*, "Students"), ultraconservative political and religious faction that emerged in Afghanistan in the mid-1990s following the withdrawal of Soviet troops, the collapse of Afghanistan's communist regime, and the subsequent breakdown in civil order. The faction took its name from its membership, which consisted largely of students trained in fundamentalist *madrasahs* (Islāmic religious schools) for Afghan refugees in northern Pakistan.

The Taliban emerged as a force for social order in 1994 in the southern province of Kandahār and quickly subdued the local warlords who controlled the south of the country. By late 1996, popular support for the Taliban among Afghanistan's southern Pashtun ethnic group, as well as assistance from conservative Islāmic elements abroad, enabled the faction to seize the capital, Kabul, and gain effective control of the country. Resistance to the Taliban continued, however, particularly among non-Pashtun ethnic groups—namely the Tajik, Uzbek, and Hazāra—in the north, west, and central parts of the country, who saw the power of the predominantly Pashtun Taliban as a continuation of the traditional Pashtun hegemony. By 2001 the Taliban controlled all but a small section of northern Afghanistan. World opinion, however, largely disapproved of the Taliban's social policies—including the near-total exclusion of women from public life, the systematic destruction of artistic relics (as in the town of Bāmīān *(q.v.)*), and the implementation of harsh criminal punishments—and of its support for Islāmic militant groups. Following the September 11 attacks of that year, which were perpetrated by one such group, al-Qaeda *(q.v.)*, a combined force of Afghan and Western troops led by the United States drove the Taliban from power.

**Taliesin** (fl. 6th century AD), one of five poets renowned among the Welsh in the latter part of the 6th century, according to the *Historia Brittonum* attributed to Nennius (flourished *c.* 796). *The Book of Taliesin,* the oldest surviving copy of his works (written about 700 years after his time), contains a variety of poems, some on religious themes, some arcane religious verses that belong to Celtic mythological traditions and that are very difficult to decipher, and some that refer to known historical figures. Among the last, the poet praises Urien, king of the ancient Welsh territory of Rheged (the modern shires of Wigtown and Kirkcudbright in south Scotland), and laments the loss of Owain, son of Urien. A eulogy to Cynan Garwyn ap Brochfael, king of Powys, attributed to Taliesin, suggests that the poet may have been a native of Powys, Wales.

**Taliesin and Taliesin West,** the two homes, as well as architectural schools, of the architect Frank Lloyd Wright. Taliesin, which is located near Spring Green, Wis., was begun in 1911 and was rebuilt after fires in 1914 and 1925. Taliesin West, near Scottsdale, Ariz., was begun in 1938 as a winter home for Wright and his students. Both structures were continually renovated until Wright's death in 1959, after which they continued to be occupied by members of the Wright Foundation. Wright was of Welsh descent and named his homes for the Welsh bard Taliesin. In 1985, in accordance with the will of Wright's third wife, his remains were exhumed from their resting place in Spring Green and moved to Taliesin West. Damage from a storm at Taliesin in 1998 required extensive repairs.

**Tālikota, Battle of** (January 1565), confrontation between the forces of the Hindu raja of Vijayanagar and the Muslim sultans of Bijāpur, Bidar, Ahmadnagar, and Golconda in the Indian Deccan. It was decisive in breaking up the Vijayanagar Empire, a Telugu domination over the Tamil and Kannada South. It also began a final Muslim penetration lasting until the end of the 18th century.

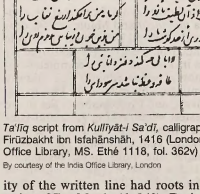
**talion,** Latin LEX TALIONIS, principle developed in early Babylonian law that criminals should receive as punishment precisely those injuries and damages they had inflicted upon their victims. Many early societies applied this "eye-for-an-eye" principle literally.

In early Palestine, injury and bodily mutilation as well as theft were considered private wrongs. It was not for the state to punish the offender; the matter was to be settled between the person who inflicted the injury and the one injured. The same attitude prevailed in early Rome. Talion was the ultimate satisfaction a plaintiff might demand, but it was not mandatory; the injured person could obtain satisfaction with money if he wished.

On the principle that two persons could not have exactly the same bodily members, the Palestinian sages enacted a law by which the injured party could not demand an eye from the person who caused the loss of his eye but could demand the value of his eye. This led to the abolition of talion in Palestine. In Rome by the 5th century BC, fines had begun to replace talion in many instances (*see* delict).

Until the end of the 18th century, talion provided the rationale for such corporal punishments as flogging, branding, mutilation, the stock, and the pillory. The principle still serves as a partial basis for the assessment of fines against minor offenders.

**ta'līq script,** in Arabic calligraphy, cursive style of lettering developed in Iran in the 10th century. It is thought to have been the creation of Ḥasan ibn Ḥusayn 'Alī of Fars, but, because Khawājah 'Abd al-Malik Buk made such vast improvements, the invention is often attributed to him. The rounded forms and exaggerated horizontal strokes that characterize the *ta'līq* letters were derived primarily from the *riqā'* script. The ornateness and sloping qual-



*Ta'līq* script from *Kulliyāt-i Sa'dī,* calligraphy by Firūzbakht ibn Isfahānshāh, 1416 (London, India Office Library, MS. Ethé 1118, fol. 362v)

By courtesy of the India Office Library, London

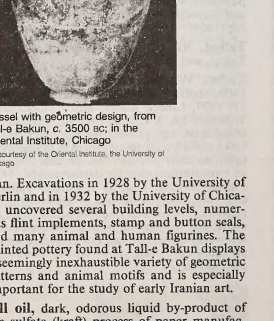
ity of the written line had roots in the *tawqī'* script of Ibn Muqla (d. 940). Designed specifically to meet the needs of the Persian language, *ta'līq* was used widely for royal as well as daily correspondence until the 14th century, when it was replaced by *nasta'līq. See* nasta'līq script.

**Talish Mountains,** Persian KŪHHĀ-YE ṬAVĀLESH, Russian TALYSHINSKIYE GORY, mountain chain, northwestern Iran, in the northwest section of the Elburz Mountains, extending southeastward from the Azerbaijan border to the lower part of the Safīd Rūd (Safid River). Few peaks rise above 10,000 ft (3,000 m). The humid subtropical coastal lowlands along the Caspian Sea lie to the east.

**talking drum,** any of various types of drums that, by imitating the rhythm and the rise and fall of words in languages, are used as communication devices. Such drums occur in East and West Africa, Melanesia, and Southeast Asia. Five varieties of *dùndún* pressure drums of the Yoruba and the *atumpani* and *fontomfron* of the Ashanti are especially notable. They send messages up to 20 miles (32 kilometres), where other drummers relay them.

**tall** (hill): *see* tell. For specific sites, *see under* substantive word (*e.g.,* Far'ah, Tall al-).

**Tall-e Bakun,** prehistoric Iranian site located near Persepolis in south-central Iran. The site, continuously inhabited from *c.* 4200 to *c.* 3000 BC, is the oldest yet discovered in that area of



Vessel with geometric design, from Tall-e Bakun, *c.* 3500 BC; in the Oriental Institute, Chicago

By courtesy of the Oriental Institute, the University of Chicago

Iran. Excavations in 1928 by the University of Berlin and in 1932 by the University of Chicago uncovered several building levels, numerous flint implements, stamp and button seals, and many animal and human figurines. The painted pottery found at Tall-e Bakun displays a seemingly inexhaustible variety of geometric patterns and animal motifs and is especially important for the study of early Iranian art.

**tall oil,** dark, odorous liquid by-product of the sulfate (kraft) process of paper manufacture, used after refining to make coatings, sizing for paper, paint, varnish, linoleum, drying oils, emulsions, lubricants, and soaps. Tall oil is principally a mixture of resin acids, such as abietic acid, and fatty acids, such as oleic and linoleic acids, with some sterols and other compounds. It is obtained by chemically treating the cooking liquor used in the operation of pulping wood for paper.

**tall tale,** narrative that depicts the wild adventures of extravagantly exaggerated folk heroes. The tall tale is essentially an oral form of entertainment; the audience appreciates the imaginative invention rather than the literal meaning of the tales. Associated with the lore of the American frontier, tall tales often explain the origins of lakes, mountains, and canyons; they are spun around such legendary heroes as Paul Bunyan, the giant lumberjack of the Pacific Northwest; Mike Fink, the rowdy Mississippi River keelboatman; and Davy Crockett, the backwoods Tennessee marksman. Other tall tales recount the superhuman exploits of western cowboy heroes such as William F. Cody and Annie Oakley. Native to the New England region are the tales of Captain Stormalong, whose ship was driven by a hurricane across the Isthmus of Panama, digging the Panama Canal, and Johnny Appleseed, who planted apple orchards from the east coast to the western frontier.

One of the few examples of the tall tale

not native to the United States is found in the German collection *Baron Munchausen's Narratives of His Marvelous Travels and Campaigns in Russia* (1785); it includes such humorous tales as one about the soldier who loaded his rifle with a cherry pit, fired it into the head of a stag, and later found a cherry tree rooted in its head.

**Tall Za'tar,** also called ZAʿATAR, former Palestinian refugee camp, Jabal Lubnān *muḥāfaẓah* (governorate), central Lebanon, north of Beirut, near Nabay. The camp was the last large Muslim outpost in the midst of the predominantly Christian inhabited area of north Lebanon and had a population estimated at 15,000 in the mid-1970s. During the Lebanese civil war (that began in the spring of 1975) between Muslims and Christians, the camp was decimated in August of 1976 after a 52 day siege by Christian militiamen aided by Syrian troops. About 1,600 people died during the siege, 4,000 were wounded, and 6,000 surrendered, the rest remaining in the camp, later to be placed in other settlements in Lebanon. The destruction of Tall Za'tar in the Lebanese civil war completed the partitioning of Lebanon between Muslims in the south and Christians in the north.

**Talladega,** city, seat of Talladega County, east central Alabama, U.S., in the foothills of the Appalachian Mountains. Founded in 1834 on the site of an Indian village on the edge of Creek land, its name was derived from the Indian words *talla* and *dega*, meaning "bordertown." In 1813 Andrew Jackson's Tennessee Volunteers defeated a large force of Creek Indians there. The city is in an agricultural region, with marble, limestone, and iron deposits, which form the basis for its industries. Talladega College was founded in 1867. A division of the Talladega National Forest is to the east. Inc. 1835. Pop. (2000) 15,143.

**Talladega Mountains,** low-lying segment of the Appalachian Mountains, along the border of Clay and Talladega counties in east central Alabama, U.S. Rising to Mt. Cheaha (2,407 ft [734 m]), the highest point in Alabama, the pine- and hardwood-covered mountains are mainly within the eastern division of the Talladega National Forest. In August 1540 the Spanish explorer Hernando de Soto led his expedition through the region, which in 1847 was briefly a focus for gold-mining activities.

**tallage,** in medieval Europe, a tax imposed by the lord of an estate upon his unfree tenants. In origin, both the amount and the frequency of levies was at the lord's discretion, but by the 13th century tallage on many estates had already become a fixed charge. In England, from the late 12th century, tallage had become established as the name of a royal tax levied on estates in the king's possession and on boroughs. The latter produced the major revenue from the tax, London's contribution alone often amounting to more than one-third of the whole. King John (reigned 1199–1216) levied tallages frequently, and the practice was attacked in the Magna Carta (1215). From the late 13th century, when borough representatives began to be summoned to Parliament, parliamentary taxation of boroughs and of the king's estates began to be preferred to tallage. The last royal tallage in England was taken in 1312.

**Tallahassee,** city, capital of Florida, U.S., seat (1824) of Leon County, in the northern part of the state. In 1539 Hernando de Soto discovered an Indian village in the area. Seven Franciscan missions were established, with their headquarters at Ft. San Luis (1633), which was destroyed by Gov. James Moore of South Carolina during Queen Anne's War (1702–13) to punish the Spanish for inciting Indian attacks against English settlers. In 1821, when Florida became an American territory, it had two capitals, St. Augustine and Pensacola. As a central location between the two, Tallahassee (derived from a Creek Indian word meaning "old town") became the capital in 1824. The porticoed capitol building, begun in 1839, acquired its dome in 1902 and its south wing in 1947; it now forms the frontage to a new skyscraper capitol (completed 1977). During the Civil War Tallahassee was far removed from the significant battle areas, although there was an engagement (March 6, 1865) at Natural Bridge, 9 mi (14 km) south (now a state historic site) to repulse a Union march on the city, which was the only capital of a Confederate state east of the Mississippi not captured by Union forces. Tallahassee is a key wholesaling and distribution point for the surrounding lumbering, cotton, and cattle-raising region. It is the seat of Florida Agricultural and Mechanical University (1887), Florida State University (1851), and Tallahassee Community College (1965). Prince Achille Murat, nephew of Napoleon I, and his wife, Catherine Willis, great-grandniece of George Washington, were early residents. Inc. 1825. Pop. (2000) city, 150,624; Tallahassee MSA, 284,539.

**Tallahatchie River,** river rising in Tippah County, Mississippi, U.S., and flowing 230 mi (370 km) in a southerly direction to join the Yalobusha River just north of Greenwood in Leflore County. The upper section of the river (above the influx of the Yocona and Coldwater rivers) is sometimes called the Little Tallahatchie. Immediately southeast of Sardis, Miss., is a dam, constructed in 1940 for flood control. Tallahatchie is probably derived from a Choctaw Indian word meaning "rock stream."

**Tallapoosa River,** river rising in the Piedmont area of western Georgia, U.S., west of Atlanta, and flowing southwest in an irregular, steplike course for about 268 mi (431 km), joining the larger Coosa River just north of Montgomery, Ala., to form the Alabama River. Its only large tributary is the Little Tallapoosa, which joins it about midway in its course. All but the lower part of the drainage basin of about 4,500 sq mi (11,700 sq km) lies in the Alabama–Georgia Piedmont. The falls at Tallassee, Ala., the chief city on the Tallapoosa, about 43 mi upstream from its mouth, and a steep gradient above the latter have prevented use of the river for navigation. Three private power dams (Martin, Yates, and Thurlow) above Tallassee have impounded the Tallapoosa to create reservoirs, including Lake Martin, for river control, power, and recreation.

The name Tallapoosa is of Creek origin, and many Indian villages were along the banks of the lower river before the 19th century. The Battle of Horseshoe Bend during the Creek War (1814) was fought near what is now the northern end of Lake Martin, north of Dadeville, Ala. This battle, in which Andrew Jackson defeated the Creeks, is commemorated by the Horseshoe Bend National Military Park (1956).

**tallboy** (furniture): *see* highboy.

**Tallchief, Maria** (b. Jan. 24, 1925, Fairfax, Okla., U.S.), ballet dancer of North American Indian descent noted for fine technique and considered one of the United States' greatest ballerinas.

After studying with Bronisława Nijinska, Tallchief joined the Ballet Russe de Monte Carlo in 1942 and soon became a leading dancer. In 1947 she was guest artist at the Paris Opéra, and in 1948, the year in which it gave its first public performance, she joined the New York City Ballet and was for a time its prima ballerina. In 1960 Tallchief joined the American Ballet Theatre, but she returned to the New York City Ballet three years later and remained with the company until 1965. She then served for a number of years as artistic director of the Lyric Opera Ballet in Chicago before founding the Chicago City Ballet in 1980. Tallchief particularly excelled in the roles created for her by George Balanchine (to whom she was married, 1946–52). Her performances in *The Firebird, Orpheus, The Nutcracker, Sylvia Pas de Deux, Scotch Symphony, Pas de Dix,* and *The Ground Symphony* are among Tallchief's most highly acclaimed.



Maria Tallchief in *Swan Lake*
Martha Swope

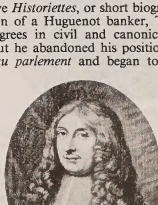
**Tallchief, Marjorie** (b. Oct. 19, 1927, Fairfax, Okla., U.S.), ballerina, dance teacher, and the first American ever to become the première danseuse étoile at the Paris Opéra.

She studied primarily with Bronisława Nijinska and David Lichine and performed with several dance companies: the American Ballet Theatre (1944–46), the original Ballet Russe de Monte Carlo (1946–47), the Grand Ballet du Marquis de Cuevas (1947–57), Ruth Page's Chicago Opera Ballet (guest artist, 1956–58), the Paris Opéra Ballet (1957–62), and the Harkness Ballet (1964–66).

Tallchief's most famous roles included those in *Annabel Lee* (1951), *Romeo and Juliet* (1955), *Camille* (1958), *Pastorale* (1961), and *Ariadne* (1965). She taught at the Dallas Civic Ballet Academy and helped her sister Maria Tallchief to found the Chicago City Ballet (1980).

**Tallemant des Réaux, Gédéon** (b. Oct. 2, 1619, La Rochelle, Fr.—d. Nov. 10, 1692, Paris), French writer of entertaining and informative *Historiettes,* or short biographies.

The son of a Huguenot banker, Tallemant took degrees in civil and canonical law at Paris, but he abandoned his position as *conseiller au parlement* and began to frequent



Tallemant des Réaux, engraving
By courtesy of the Bibliotheque Nationale, Paris

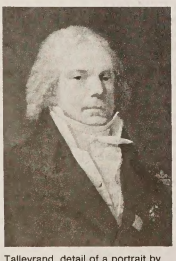
literary circles. In 1646 he married his cousin Élisabeth de Rambouillet, thus gaining entrée into the elegant society of the Hôtel de Rambouillet and the acquaintance of many of the leading literary figures whose lives are described in his work.

The *Historiettes*, completed in about 1659, were published in 1834–35. They contain a mass of information about leading men in Parisian society and French public life from the beginning of the 17th century. The Marquise de Rambouillet gratified his curiosity with stories of the reigns of Henry IV and Louis XIII that have real historical value. A good listener and an acute if somewhat malicious observer, he also sought out well-informed authorities (such as Boisrobert on Richelieu and Racan on Malherbe), with the aim of recording anything of interest that was not in printed histories. The new, sometimes disturbing information about prominent people was at first decried, but research has done much to establish its reliability. Much of Tallemant's material, recorded so near to the actual event, can be considered a firsthand source and has been useful as a corrective to later interpretations.

**Tallensi,** also spelled TALENSI, a people of northern Ghana who speak a language of the Gur branch of the Niger-Congo language family. They grow millet and sorghum as staples and raise cattle, sheep, and goats on a small scale. Their normal domestic unit is the polygamous joint family of a man and his sons (and sometimes grandsons) with their wives and unmarried daughters. Married daughters live with their husbands in other communities, commonly nearby.

**Talleyrand(-Périgord), Charles-Maurice de,** PRINCE DE BÉNÉVENT (b. Feb. 2, 1754, Paris—d. May 17, 1838, Paris), French statesman and diplomat noted for his capacity for political survival, who held high office during the French Revolution, under Napoleon, at the restoration of the Bourbon monarchy, and under King Louis-Philippe.

*Education and clerical career.* Talleyrand was the son of Charles-Daniel, comte de Talleyrand-Périgord, and Alexandrine de



Talleyrand, detail of a portrait by Pierre-Paul Prod'hon, 1809; in a private collection, Paris
Giraudon—Art Resource/EB Inc

Damas d'Antigny. His parents came from old, aristocratic families but were not rich. Charles-Maurice was sent to be nursed in a Paris suburb, where, when he was four years old, he is said to have fallen off a chest of drawers, dislocating his foot. It is possible, however, that his clubfoot was congenital, linked, perhaps, to a brain disorder. At any rate, Talleyrand's clubfoot was of cardinal importance in his choice of career.

As Talleyrand could not follow the family tradition by going into the army, his parents intended him for the church. From the age of eight he was a pupil at the Collège d'Harcourt in Paris, and at 15 he became an assistant to his uncle Alexandre, then coadjutor to the archbishop of Reims, in the hope that the luxurious life led by the princes of the church would awaken in him a taste for an ecclesiastical career. He liked what he saw, and in 1770 entered the seminary of Saint-Sulpice in Paris. There he certainly learned theology, but he also read, in the seminary's large library, the works of the Philosophes, the contemporary progressive thinkers. Thus he began his political education and acquired a skepticism regarding men and affairs that was never to leave him. In addition, while still a seminarian, he took his first mistress.

Expelled for his conduct (1775), he nevertheless received minor orders in April of that year and was, six months later, nominated by the King as abbot of Saint-Denis, at Reims. In March 1778 Talleyrand received his degree in theology from the Sorbonne. and in December 1779 he was ordained. The following day his uncle Alexandre, archbishop of Reims, appointed him his vicar general.

At that time Talleyrand appeared to be a typical court cleric, spending more time with the most fashionable wits and beauties of the day than with churchmen. Yet he did not devote all his time to pleasure; he believed in his future and desired above all to become a bishop. The surest way to his goal was appointment to the well-paid post of agent general of the clergy, who represented the French church in its dealings with the French government in the interval between meetings of the Assembly of the Clergy, which were held regularly every five years. Talleyrand was appointed agent general in 1780. There were, in fact, two agents general, but his colleague's reputation had been undermined, and Talleyrand was in practice the sole representative of the French church between 1780 and 1785. He seems to have taken his role very seriously; in any case, he showed great energy in defending the controversial privileges of the church. He fought vigorously for the right of the church to retain all its property. He also tenaciously defended ecclesiastical jurisdiction against the encroachments of royal justice, argued for the continued exemption of the clergy from ordinary taxes, and played a part in raising the standard of living of the lower clergy. His activities brought him into regular contact with various ministers of the crown. His participation in the meetings of the Assembly of the Clergy gave him an exceptional opportunity to acquire parliamentary experience. Finally, his activities won him the coveted bishopric: in November 1788 he was appointed bishop of Autun. When he took possession of his see on March 15, 1789, the Revolution was on the verge of breaking out.

*During the Revolution.* Talleyrand's first task was to prepare the elections to the States General, the National Assembly in which the Estates were separately represented. The assembly had not met in France since 1614 and was now summoned for May 5, 1789. Talleyrand, elected by his clergy as their deputy, like all delegates had prepared a list of grievances. His list contained demands for reforms in the status of the clergy as well as for a constitution that would provide a representative government guaranteeing equality for all citizens, especially fiscal equality, thus abolishing those financial privileges that he had defended four years earlier. This was the first of a series of reversals that were to be characteristic.

At the solemn opening of the States General at Versailles, Talleyrand attracted immediate attention and soon acquired great influence. During the earlier deliberations, the clergy and the nobility wanted to sit in separate chambers, as they had previously; Talleyrand, however, favoured uniting the three orders into one National Assembly, and his proposal was accepted. To the astonishment of his fellow bishops who remembered the zeal with which he had once defended church rights, Talleyrand urged the repeal of the tithe and the nationalization of French church property. The land thus appropriated was to be used to pay off the state's debts. When nationalization was voted on Nov. 2, 1789, Talleyrand emerged as one of the most revolutionary deputies, and when he celebrated mass at the Festival of the Federation on July 14, 1790, in commemoration of the taking of the Bastille the year before, he seemed the veritable "bishop of the Revolution." The same month, Talleyrand succeeded in having the Civil Constitution of the Clergy adopted, which, without papal approval, completely reorganized the French church on a democratic basis. The first bishop to take the oath of loyalty to this constitution, he also consecrated the first bishops elected according to the new procedure. The resulting excommunication by the Pope did not distress Talleyrand, who was already planning to leave the church. It no longer offered sufficient scope for his ambition, and, since, under the law expropriating the church he had been deprived of his property, a bishopric could no longer satisfy his monetary needs. Elected administrator of the *département* of Paris in January 1791, he resigned as bishop of Autun.

Talleyrand's skill as a clever negotiator was noted, and when at the close of 1791 the French government wanted to prevent England and Prussia from joining Austria in a coalition against France, the foreign minister sent Tafleyrand to London to persuade England to remain neutral. Arriving in London in January 1792, Talleyrand proposed to William Pitt, the prime minister, that both countries guarantee each other's territorial integrity. Returning to Paris in March without a definite answer from the British, Talleyrand persuaded the new foreign minister to appoint the young marquis de Chauvelin as ambassador to London and returned there as his assistant. The two men arrived in London on April 29, just after France had declared war on Austria, with whom Prussia then allied itself. Although Talleyrand secured a declaration of neutrality from the British government on May 25, the storming of the Tuileries palace by the Paris mob on June 20 made his position difficult, and he left London on July 5. The overthrow of the monarchy on August 10 and the massacre of royalist prisoners in September alienated what sympathy the London government had for France and, at the same time, made it advisable for Talleyrand to leave Paris. After drafting—as a pledge of loyalty to the Provisional Executive Council—a circular to all European governments attributing responsibility for the events of August 10 to Louis XVI, he obtained a passport to go to London in a private capacity. Arriving on September 18, he made every effort to avert war with Great Britain, but the invasion of Belgium by the French, followed by the execution of Louis XVI in January 1793, made war inevitable. Talleyrand, who had been denounced in the National Convention (the assembly elected after the overthrow of the monarchy), also became undesirable in England, where the most counterrevolutionary of the French émigrés were demanding his expulsion. Expelled in January 1794, he embarked for the United States in March. He remained there for two years, engaging in profitable financial speculations that enabled him to rebuild his fortune.

*During the Directory.* After the fall, in July 1794, of Maximilien Robespierre, the chief instigator of the Reign of Terror, Talleyrand petitioned the National Convention to remove his name from the list of émigrés, as he had

left France on an official passport. His request was granted and he reached Paris in September 1796, immediately taking the seat in the Institut National (a creation of the National Convention reestablishing, in a new form, the 18th-century academies, among them the Académie Française), to which he had been elected in his absence. The paper that he read there in July 1797, in which he concluded that France would be unable to reconquer its American colonies and should therefore attempt to establish colonies in Africa, showed that he again hoped to enter politics. A few days later, his paper, which raised him in public esteem, and his connections with a member of the ruling Directory gained him the post of foreign minister.

Talleyrand confirmed Napoleon's conclusion of the Treaty of Campo Formio (October 1797) following his great victories against Austria and negotiated the agreements annexed to the treaty, which are said to have brought him more than a million francs in bribes. Jointly with Napoleon he urged on the Directory his idea of a military expedition to Egypt, which ultimately ended in failure. Talleyrand alone, however, was responsible for a breach between France and the United States, following the indignant withdrawal of three U.S. envoys from whom Talleyrand had demanded enormous bribes. Acknowledging the failure of his policies, Talleyrand resigned, but after two years as foreign minister he had amassed an "immense fortune" that he deposited abroad.

*During the Consulate and the empire.* Five months after Talleyrand's resignation, Napoleon returned from Egypt, and, following his coup d'état of Nov. 9–10, 1799, established the Consulate, consisting of him as the actual ruler and two other consuls. Talleyrand supported him and returned to the foreign ministry on November 22. Talleyrand's principal aim was the pacification of Europe, and he began negotiation with the belligerent countries. His negotiations with Austria and England resulted in the treaties. For the first time in six years, Europe was at peace. Talleyrand contributed to the realization of Napoleon's ambitious plans to remodel Europe by helping him to establish French supremacy in Italy, Germany, and Switzerland. Much to his own profit, he supervised the allocaton of numerous secularized church lands. At home Talleyrand urged the signing of the concordat between Napoleon and Pope Pius VII (July 1801), which reestablished religious peace. Then, taking advantage of the concordat's provisions, he married his mistress, Catherine Grand, the divorced French wife of an English employee of the British East India Company.

Talleyrand's policy would have been completely successful had he been able to prevent the renewal of war between France and England in May 1803. This time, however, he did not resign. He had helped Napoleon establish himself as "consul for life" in 1802, and he continued to support him when Napoleon wanted to show that he would never come to terms with the Bourbons; Talleyrand therefore participated in one of the most dreadful crimes. When Talleyrand and Joseph Fouché, the minister of police, learned that a Bourbon prince, whom they believed to be the Duc d'Enghien, was planning the assassination of the First Consul, they advised his abduction. Although the Duke was living in neutral territory, Talleyrand promised that he would smooth over any protests to the violation of international law. And so the Duc d'Enghien was kidnapped, arrested, and transferred to Paris, where he was tried, condemned, and executed. Later, Talleyrand tried to remove from the archives documents proving his involvement. It was this crime that consolidated Napoleon's power, and when on May 18, 1804, he was proclaimed emperor, he appointed Talleyrand grand chamberlain, with an annual income of 500,000 francs.

Nevertheless, after 1805 Talleyrand's influence diminished, and his advice was not always beneficial. Alarmed by Napoleon's insatiable ambition, which, as he clearly saw, could lead only to disaster, he resigned his office in August 1807. It was not without pleasure that Napoleon accepted his resignation.

*Between empire and restoration.* Though no longer a minister, Talleyrand was still consulted by Napoleon, and in September 1808 he accompanied Napoleon to a congress of European sovereigns at Erfurt, Prussia. There Talleyrand had secret talks with Tsar Alexander I, urging him to oppose Napoleon, and thereafter conducted a clandestine correspondence with both Russia and Austria. This treasonable activity did not, in fact, involve Talleyrand in great risk, since it was approved by Fouché, the minister of police, who shared Talleyrand's opposition to Napoleon's policies.

After Napoleon had annulled his marriage to the empress Joséphine, Talleyrand played a part in arranging the Emperor's marriage with Marie-Louise of Austria, in the hope that this union would modify Napoleon's ambition. But nothing, apparently, could accomplish that. After the disastrous retreat from his invasion of Russia, Napoleon asked Talleyrand to return to the foreign ministry in order to negotiate with the allies, but Talleyrand, who was already planning to restore the Bourbons, refused, unmoved by the Emperor's anger. When the allies entered Paris, on March 31, 1814, the Tsar took up residence at Talleyrand's mansion and was eventually convinced by him that only the restoration of the Bourbons could guarantee peace in Europe. Talleyrand persuaded the Senate to establish a provisional government of five members, including himself, and to declare Napoleon deposed. The new government immediately recalled Louis XVIII, who on May 13, 1814, appointed Talleyrand his foreign minister.

*During the Restoration and the July Monarchy.* As France's representative at the Congress of Vienna (1814–15), Talleyrand exhibited his diplomatic skill to the full, but it is doubtful whether it benefitted France. He managed to divide the Allies, urging Austria and England to conclude secret agreements with France to prevent Russia from annexing the whole of Poland and Prussia from annexing the whole of Saxony. This new triple alliance succeeded in reducing the territorial claims of the other great powers and led to the agreement by which France retained the frontiers of 1792 (which were pushed back to those of 1790 after the Hundred Days, the period during which Napoleon reigned in Paris after his escape from Elba). In accepting the cession to Prussia of the greater part of the left bank of the Rhine, however, Talleyrand created a serious danger for France that became especially clear in 1870, 1914, and 1939.

Talleyrand remained in Vienna during the Hundred Days. On Louis XVIII's return to Paris, he was appointed president of the council, while retaining the office of foreign minister. The ultraroyalists now in power were violently opposed to a ministry dominated by two former revolutionaries, Fouché and Talleyrand, and Talleyrand was forced to resign. He then lived in retirement, writing his memoirs, until 1829, when his scheming political sense led him to ally himself with the Liberals in order to remove Charles X, the brother and successor of Louis XVIII. He established contact with Louis-Philippe and helped to make him king during the July Monarchy of 1830. As ambassador to London, from 1830 to 1834, he played a vital part in the negotiations between France and Great Britain that resulted in the creation of a neutral kingdom of Belgium. His diplomatic career was crowned by the signing of an alliance between France, Great Britain, Spain, and Portugal in April 1834.

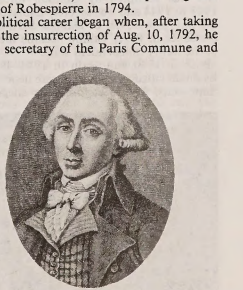
Talleyrand died in 1838 and received the last sacraments, having signed, a few hours before his death, a document in which he declared himself reconciled with the church. He was buried at his château of Valençay. He had separated from his wife in 1815 and left no legitimate descendants. (J.Go./Ed.)

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**Tallien, Jean-Lambert** (b. Jan. 23, 1767, Paris—d. Nov. 16, 1820, Paris), French Revolutionary who became a leader of the moderates (Thermidorians) after he helped engineer the fall of Robespierre in 1794.

His political career began when, after taking part in the insurrection of Aug. 10, 1792, he became secretary of the Paris Commune and



Tallien, engraving by F. Bonneville, late 18th century
H. Roger-Viollet

was elected to the National Convention, in which he sided with the more radical Montagnards against the Girondins. He voted for the execution of Louis XVI during the trial of the King (December 1792–January 1793). Later, as a member of the Committee of General Security, he was sent to organize army recruiting in southwestern France and to put down the rebels in Bordeaux.

Recalled to Paris in March 1794, Tallien

initially supported the Committee of Public Safety, but he opposed the committee after it ordered the arrest of a noblewoman known as Madame Cabarrus, whom the Committee accused of being his mistress. Denounced by Robespierre on June 12, 1794, Tallien conspired with Paul Barras, Joseph Fouché, and others to overthrow him, which they did on July 27 (9 Thermidor).

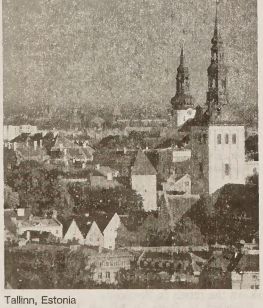
After Robespierre's fall, Tallien became a leader of the Thermidorian reaction, taking part in the suppression of members of the Revolutionary tribunals, the Jacobins, and some of his former colleagues whom he accused of being royalist sympathizers. As a member of the reconstructed Committee of Public Safety, he secured the release of Madame Cabarrus and married her on Dec. 26, 1794.

Under the Directory (1795–99), Tallien became a member of the Council of Five Hundred, but he had little influence because he was held suspect by all parties. He retained his seat until 1798, when he went to Egypt with Napoleon Bonaparte. Upon his return to Paris (April 1801), he divorced his wife, who had already deserted him.

Tallien supported the First Restoration (1814) and then the Hundred Days of Napoleon. Under the Second Restoration (1815), however, he was denied a pension and spent the rest of his life in poverty.

**Tallinn,** Russian TALLIN, German REVAL, formerly (until 1918) REVEL, city, capital of Estonia, on Tallinn Bay of the Gulf of Finland. A fortified settlement existed there from the late 1st millennium BC until the 10th–11th century AD, and there was a town on the site in the 12th century. In 1219 it was captured by the Danes, who built a new fortress on Toompea hill. Trade flourished, especially after Tallinn joined the Hanseatic League in 1285. In 1346 it was sold to the Teutonic Knights, and on the dissolution of the order in 1561 it passed to Sweden. Peter I the Great captured Tallinn in 1710, and it remained a Russian city until it became the capital of independent Estonia from 1918 to 1940. (Estonia was annexed to the U.S.S.R. from 1940 to 1991.) The city was occupied by German forces from 1941 to 1944 and was severely damaged. After the Supreme Soviet of Estonia declared independence in 1991, Tallinn became the capital of the newly independent state.

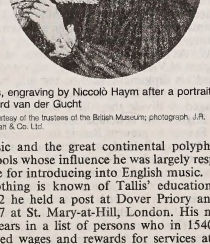
Both in 1940 and again in 1944–49, many Estonian citizens of Tallinn were deported and imprisoned by Soviet forces for alleged conspiracy, collaboration with the Germans, and opposition to collectivization. Of those exiled, a large proportion settled in Sweden or North America, and some maintained contacts with associates in Tallinn. Russians immigrated to the Estonian capital and comprise two-fifths of the population. Ethnic Estonians make up roughly half of the city's population.



Tallinn, Estonia
Chris Lisle—Corbis

Many relics of Tallinn's long history survive or have been restored, especially on Toompea hill and in the old, walled Lower Town. They include the 13th-century Toom Church, the Gothic Oleviste and Niguliste churches, the Great Guildhall of 1410, the 14th-century Rathus, and much of the old castle. Modern Tallinn is a major commercial and fishing port and industrial centre. Shipbuilding and machine building head a range of engineering industries, and many consumer goods are produced. The cultural centre of Estonia, Tallinn has an academy of sciences; polytechnic, fine-arts, and teacher-training institutes; a music conservatory; and several theatres and museums. Pop. (2001 est.) 399,850.

**Tallis, Thomas** (b. *c.* 1510—d. Nov. 23, 1585, Greenwich, London), one of the most important English composers of sacred music before William Byrd (1543–1623). His style encompassed the simple Reformation service



Tallis, engraving by Niccolò Haym after a portrait by Gerard van der Gucht

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

music and the great continental polyphonic schools whose influence he was largely responsible for introducing into English music.

Nothing is known of Tallis' education. In 1532 he held a post at Dover Priory and in 1537 at St. Mary-at-Hill, London. His name appears in a list of persons who in 1540 received wages and rewards for services at the dissolution of Waltham Abbey in Essex. From Waltham he appears to have gone briefly to Canterbury and then to the Chapel Royal. In a petition to Queen Elizabeth I, made jointly with William Byrd in 1577, he refers to having "served your Majestie and your Royall ancestors these fortie years," but his appointment as a gentleman of the Chapel Royal can hardly have been before 1542.

On Jan. 21, 1575, Queen Elizabeth granted Tallis and Byrd the monopoly for printing music and music paper in England. The first publication under their license was a collection of 34 motets, 16 by Tallis and 18 by Byrd, entitled *Cantiones sacrae,* printed by T. Vautrollier in 1575. These Latin pieces, together with five anthems to English texts printed by John Day in his *Certaine Notes* . . . (1560–65), comprise all of his music that Tallis saw in print during his lifetime.

Tallis' Latin works include a modest, unnamed 4-part mass; a 5-part mass, *Salve intemerata,* derived from his antiphon of the same name; a 7-part mass; and two settings of the Magnificat. He also made two settings of the Lamentations of Jeremiah, the first of which is among his most celebrated works. Finally, among his Latin pieces two in particular are often cited as demonstrations of Tallis' supreme mastery of the art of counterpoint: the 7-part *Miserere nostri,* an extraordinary feat of canonic writing, involving retrograde movement together with several degrees of augmentation; and the famous 40-part *Spem in alium,* considered a unique monument in British music.

Tallis was one of the first composers to provide settings of the English liturgy. He has left settings of the Preces and Responses, the Litany, and a complete Service "in the Dorian mode," which consists of the morning and evening canticles and the Communion Service. There are also three sets of psalms, and a number of anthems.

Tallis' keyboard music is regarded as substantial and significant. Of his 23 extant keyboard pieces, 18 occur in the mid-16th-century manuscript known as the Mulliner Book.

**ṭallit,** also spelled ṬALIT, TALLIS, or TALLITH, plural ṬALLITHIM, TALITHIM, or TALLISIM, prayer shawl worn by male Jews during the daily morning service (*shaḥarit*); it is also worn by the leader of the service during the afternoon service (*minḥa*). On Yom Kippur, males wear it for all five services and on Tisha be-Av only during the afternoon service.

Rectangular in shape, the wool (or sometimes silk) shawl has black or blue stripes with fringes (*tzitzit*) affixed to the four corners as the Bible prescribes (Numbers 15:38). Two fringes fall in front, two behind. Often an embroidered collar is added, inscribed with the blessing to be recited when the *ṭallit* is put on. A pious Jew is often buried in his *ṭallit* after one of the fringes has been removed.

**ṭallit qaṭan,** also spelled TALLITH KATAN (Judaism): *see* arba kanfot.

**tallow,** odourless, tasteless, waxy white fat, consisting of suet (the hard fat about the kidneys and loins of cattle, sheep, and horses) or similar vegetable substances. Tallow consists mainly of glyceryl esters of oleic, palmitic, and stearic acids. Tallow was used chiefly to make soap and candles until the development of synthetic surfactants made it available for animal feeds and as a base for chemicals and lubricants. Tallow is extracted by rendering, cutting, or chopping the fatty tissue into small pieces that are boiled in vats or cooked in steam digesters, then collecting the fat by skimming or by centrifuging.

**tallow tree** (*Sapium sebiferum*), small tree, of the spurge family (Euphorbiaceae), native to



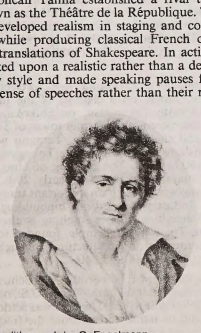
Tallow tree (*Sapium*)
Thase Daniel

China but much cultivated in the tropics for its tallow-producing seeds and elsewhere as an ornamental. The seeds are thickly coated with vegetable tallow from which candles and soap are made. It is a member of a 120-species genus of tropical trees, including *S. jenmanii,* of Guyana, which is a source of rubber, and *S. biloculare,* from northern Mexico, which is one of the small trees from which jumping beans come. The butter, or tallow, tree of Sierra Leone is *Pentadesma butyracea,* of the family Guttiferae (also called Clusiaceae).

**Talma, François-Joseph** (b. Jan. 16, 1763, Paris—d. Oct. 19, 1826, Paris), French actor and theatrical company manager whose reforms in acting styles, stage costuming, and scenery made him a leading precursor of 19th-century French Romanticism and Realism.

Although Talma's father, a dentist, wanted his son to become a dentist as well, young Talma spent his time instead in amateur theatricals and made his professional debut at the Comédie-Française on Nov. 21, 1787, as Seide in Voltaire's *Mahomet.* Influenced by his friend the painter David, he became one of the early advocates of historical costuming when he appeared in a Roman toga and headdress in the small role of Proculus in Voltaire's *Brutus.*

Until Nov. 4, 1789, Talma had taken only minor roles; on that day he took over the title role in Marie-Joseph-Blaise de Chenier's anti-monarchical *Charles IX* after it had been turned down by other actors, who feared political difficulties. As expected, the play caused demonstrations in the theatre and aroused such dissension in the company that the pro-republican Talma established a rival troupe known as the Théâtre de la République. There he developed realism in staging and costuming while producing classical French drama and translations of Shakespeare. In acting he insisted upon a realistic rather than a declamatory style and made speaking pauses follow the sense of speeches rather than their metre.



Talma, lithograph by G. Engelmann
By courtesy of the Victoria and Albert Museum, London

In 1799, when the two companies were reunited at Talma's theatre as the Comédie-Française, he emerged as the supreme tragedian of the era, winning the admiration and patronage of Napoleon. Talma wrote "Réflexions sur Lekain et l'art théâtral" as a preface to the memoirs of the French actor Lekain. His last appearance was in Delaville's *Charles VI* on June 3, 1826.

**Talmud** (Hebrew: Study, or Learning), in Judaism, scholarly interpretations and annotations on the Mishna—the first authoritative codification of Jewish oral laws, which was given its final form early in the 3rd century CE (Common Era) by Judah ha-Nasi—and on other collections of oral laws, including the Tosefta.

A brief treatment of the Talmud follows. For full treatment, *see* MACROPAEDIA: Judaism.

Each of two groups of Jewish scholars (*amoraim*), one in Palestine and the other in Babylonia, independently produced a Talmud. Although the two groups addressed the same Mishna and consulted with one another, their work resulted in two separate collections of law, lore, and commentary. The *amoraim* of Palestine laboured for about two centuries, completing their work *c.* 400 CE, approximately one century earlier than their counterparts in Babylonia. The Babylonian Talmud (Talmud Bavli) is consequently more extensive than the Palestinian Talmud (Talmud Yerushalmi) and, for that reason, more highly esteemed. Neither of the Talmuds covers every section of the Mishna; some commentaries were never written, and, presumably, others have been lost.

In early manuscripts and printings, the commentary on the Mishna was called Talmud, but in the Basel edition of 1578–81, the church censor changed the term Talmud to Gemara (Aramaic: Completion). This change was long the accepted terminology, with the term Talmud reserved for the entire work (Mishna and Gemara combined). In recent years, however, many Talmudic scholars have returned to the earlier usage.

The Talmud is, first and foremost, a legal compilation, although it treats of matters from all areas of human interest. Its material is presented in a unique dialectical style in which a piece of Talmudic text is focussed upon and all efforts to understand and interpret it are recorded. The religious beliefs of the Talmudic rabbis are clearly reflected in the decisions, ideas, and attitudes of the Talmud, which considers both ritual and social law to be of divine origin.

Following completion of the Talmud, efforts were made to codify its contents. The first known attempts were *Halakhot pesuqot* ("Decided Laws"), attributed to Yehudai Gaon in the 8th century, and *Halakhot gedolot* ("Great Laws") by Simeon Kiyyara in the 9th century. Although omitting the Talmud's dialectics, both preserved Talmudic order and language. Later codifications were written in monographic style (concentrating on one subject at a time). The most important of these are the *Mishne Torah* ("The Torah Reviewed") by Maimonides in the 12th century, the *Sefer ha-ṭurim* ("Book of Rows or Parts") by Jacob ben Asher in the 14th century, and the *Shulḥan ʿarukh* ("The Prepared Table") by Joseph Karo in the 16th century. The *Shulḥan ʿarukh,* which concentrates on the Sefardic tradition, was annotated by the Ashkenazic codifier Moses Isserles in the 16th century. In that form it became the standard code for all Jewry.

There is also a large body of interpretive literature on the Talmud. In the 11th century, an important commentary was produced in Europe by Rashi (Rabbi Shlomo Yitzḥaqi). His grandsons—Rabbis Isaac, Samuel, and Jacob—treated the Talmud as it had treated the Mishna and thereby established the interpretive method of *tosafot* that was adopted throughout Europe and that influenced the Sefardic commentaries of such writers as Ramban (Moses ben Naḥman) and Ran (Nissim ben Reuben Gerondi).

Another form of Talmudic literature arose in the 7th century, when written replies (*responsa*) were given by scholars to legal and religious questions. *Responsa* literature has continued to the present day; major authorities in the Middle Ages included Maimonides, Ramban, and Ran.

Because study in the ancient academies was conducted orally, it is not known when the Talmud was first written down. The Palestinian Talmud was first printed in Venice in 1523–24 and the Babylonian Talmud in Spain *c.* 1482. The standard version, first printed in Vilna in 1886, carries on each page a portion of the Mishna and its related Talmud, commentaries, and references.

The Talmud has continued to be of major importance to Orthodox Jews throughout the world. Since the establishment of the modern state of Israel in 1948, Conservative Jewry has increased its interest in Talmudic study, while some leaders of Reform Jewry have adopted Talmudic dialectic and the *responsa* form of interpretation. Modern Talmudic scholarship is centred in Israel and the United States.

**Talmud Bavli** (Jewish writ): *see* Babylonian Talmud.

**Talmud Torah** (Hebrew: Study of the Torah), since late medieval and early modern times, an elementary school under Jewish auspices that places special emphasis on religious education. Some Talmud Torahs concentrate on Talmudic studies as a preparation for entrance into a yeshiva (school of higher rabbinic learning), but others have broadened their curricula to provide a more general education in an atmosphere that is still predominantly religious.

**Talmud Yerushalmi** (Jewish writ): *see* Palestinian Talmud.

**talon:** *see* claw.

**Talon, Jean(-Baptiste),** COMTE (count) D'ORSAINVILLE (b. *c.* 1625, Châlons-sur-Marne, Fr.—d. Nov. 24, 1694, Paris), French statesman and the first intendant of New France (Canada), who tried unsuccessfully to develop its economy.

Talon entered the French military administrative services when he was 28 and, in 1653, became intendant in the army of the French military leader the Vicomte de Turenne. In 1655 he was appointed intendant of the Belgian province of Hainaut, and in 1665 he became intendant of New France, a position that made him responsible for all civil administration in the colony and for collaboration with military leaders. King Louis XIV and his minister Jean-Baptiste Colbert wanted Talon to achieve economic independence for the colony. To that end Talon encouraged immigration and population growth by attempting to clear the land for settlements and by diversifying the economy in hopes of introducing industrialization and a three-way trade system among Canada, the West Indies, and France. His efforts were thwarted, however, by insufficient time and by lack of aid from France.

Talon returned to France in 1668 but was persuaded to go back to Canada in 1670. There he became increasingly concerned with the colony's position in the world and the threat posed by the English. To counter that threat he encouraged exploration, hoping to reinforce French claims in North America and to make the St. Lawrence colony central to French colonizing activities. The church and business monopolies resisted his efforts, and much of his work was undone after he left in 1672. Back in France, he was made first valet of the king's wardrobe and secretary of the king's privy chamber. He received the title of comte d'Orsainville in 1675.

**Tālpur,** also spelled TĀLPURA, or TĀLPURI, Baluchi tribe that furnished a number of Muslim amirs in the Upper and Lower Sind, when the region was nominally a part of the Durrānī kingdom of Afghanistan. One of their leaders, Mīr Fatḥ ʿAlī Khān, set himself up as the *rais,* or viceroy, of Sind in 1783. He settled amicably with two Afghan expeditions for recovery of arrears of tribute, and by his death in 1802 Tālpur rule was firmly established in Sind. The Tālpur, native to Baluchistan, claimed no saintly descent and were not as popular as their predecessors, the Kalhōrā; but they did succeed in imposing peace in the area for 40 years and establishing a reasonably efficient administration.

The Tālpur consolidated and extended the Sind government at Hyderābād and recovered Karāchi. The British saw the Sind as the gateway to Afghanistan and, after years of increasing pressures, annexed the territory in 1843.

**Tam, Jacob ben Meir** (b. 1100, Ramerupt, France—d. June 9, 1171, Troyes). French Jew, an outstanding Talmudic authority of his time, who was responsible for a series of far-reaching decisions governing relationships between Christians and Jews in medieval Europe. He was also one of the most eminent of the French tosaphists (commentators on particular passages in the Talmud).

Tam was the grandson of Rashi, the renowned 11th-century Talmudic commentator. As a symbol of Jewry, he was attacked in 1147 by a band of crusaders, who wounded his head five times as revenge for the five wounds that the Jews allegedly inflicted on Christ. Saved from death by a passing knight, he fled to neighbouring Troyes. There he became a leading participant in the rabbinical synods that began about 1160.

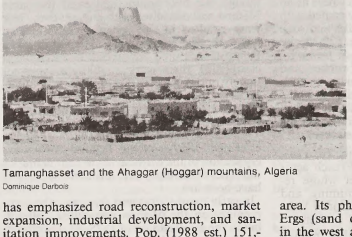
The synods developed rules to govern the relations between Christians and Jews, who were living on closer terms because of changing historical conditions. Tam was foremost in settling the terms from the Jewish side. The key ordinances of Rabbenu ("Our Teacher") Tam provided that (1) disputes between Jews were to be resolved by the Jewish authorities; (2) the law of Rabbenu Gershom (*c.* 960—*c.* 1028/40) abrogating polygamy was essentially reinforced; and (3) no Jew could lightly challenge the legality of a Jewish deed of divorce.

Tam's major legal work is *Sefer ha-yashar* (first published in 1811 in Vienna; "Book of the Righteous"). It contains explanations of 30 tractates of the Talmud, as well as responsa (authoritative answers to questions about Jewish law). He also wrote religious poetry, some of which was later incorporated into the Hebrew prayer book.

*Consult the* INDEX *first*

**tama,** formally MITAMA, in Japanese religion, a soul or a divine or semidivine spirit; also an aspect of a spirit. Several *mitama* are recognized in Shintō and folk religions. Among them are the *ara-mitama* (with the power of ruling), the *kushi-mitama* (with the power of transforming), the *nigi-mitama* (with the power of unifying, or harmonizing), and the *saki-mitama* (with the power of blessing). Some shrines pay homage to a particular *mitama* of a deity, such as the separate shrines dedicated to the *ara-mitama* and the *nigi-mitama* of the goddess Amaterasu.

**Tamale,** town, north-central Ghana. Surrounded by villages with high population densities, it lies 600 feet (183 m) above sea level on a plain 22 miles (35 km) east of the White Volta River. With its modern buildings and wide streets, Tamale serves as the administrative, financial, commercial, and transportation centre for northern Ghana. It is also an educational centre, having several teacher-training colleges, several secondary schools, and facilities for artisan training. The Vernacular Literature Bureau there also provides newspapers and literature for mass literacy campaigns. The town is a focus for agricultural trade and has cotton-milling and shea-nut enterprises. The main road northward from Kumasi passes through Tamale, and other roads reach it from east and west; there is also an airport. Since the mid-1970s, government aid has emphasized road reconstruction, market expansion, industrial development, and sanitation improvements. Pop. (1988 est.) 151,069.



Tamanghasset and the Ahaggar (Hoggar) mountains, Algeria
Dominique Darbois

**tamale,** Spanish TAMAL, plural TAMALES, in Mexican cuisine, small steamed cake of dough made from corn (maize). In the preparation of tamales, *masa harina,* fine-ground corn treated with unslaked lime, is made into a thick paste. For each tamale the *masa* dough is spread on a corn husk, a small amount of filling added, and the whole wrapped into a package and tied with a strip of husk. The tamales are steamed until cooked through.

There are dozens of local variations in the dough and filling for tamales. Banana leaves form the wrappers on the Gulf Coast and in the Yucatán. The *uchepos* of Morelia and *tamales dulces* of Jalisco employ fresh rather than dried corn. Fillings may contain meat, cheese, chilis, herbs, fish, and vegetables in savoury or sweet combinations; some tamales are even cooked "blind," with no filling.

Tamales were known from antiquity in Mexico. Several varieties were described by contemporary historians of the conquest of Mexico by Spain.

**Taman Negara National Park** (Malaysia): *see* Negara National Park.

**Tamāng,** also called MŪRMI, people of Nepal living in the mountains northwest, north, and east of the Kāthmāndu Valley. Their numbers were estimated to be about 690,000 in the late 20th century. The Tamāng speak a language of the Tibeto-Burman family. They are Buddhist in religion. Most of them draw their living from agriculture, but in some areas they work as day labourers and porters. Some have served, along with other Nepalese ethnic groups, as the Gurkha soldiers of the British and Indian armies.

They trace their descent along paternal lines and have patrilineal clans, some of which do not intermarry. Some Tamāng clans permit marriage with other neighbouring peoples, such as the Newār, Gurung, and Magar.

**Tamanghasset,** also called (after 1981) TAMENGHEST, formerly FORT LAPERRINE, town, southern Algeria. Located in the mountainous Ahaggar (Hoggar) region on the Wadi Tamanghasset, the town originated as a military outpost, guarding trans-Saharan trade routes. It has become an important way station on the north-south asphalt road called the Trans-Sahara Highway via northern Algeria, which reached Tamanghasset in 1980. Although the desert climate is mitigated by the town's elevation of 4,521 feet (1,378 m), some of the world's highest known shade temperatures (exceeding 100° F [38° C]) have been recorded there at the Jules Carde Observatory.

The town is a Tuareg Berber oasis settlement where citrus fruits, peaches, apricots, dates, almonds, figs, cereals, and corn (maize) are grown. Its red houses and magnificent, rugged scenery make Tamanghasset a tourist attraction during the cooler months.

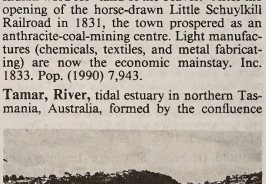
The surrounding region, located entirely within the Sahara, is a vast, extremely dry area. Its physiography includes the Grand Ergs (sand dunes) Occidental and Oriental in the west and northeast and the Tademait Plateau (a sandstone and limestone escarpment [hammada]) in the north. The Ahaggar is an arid mountainous plateau (more than 3,000 feet [900 m] above sea level) extending about 965 miles (1,550 km) north-south and 1,300 miles (2,092 km) east-west and culminating in Tahat, a peak 9,573 feet (2,918 m) in elevation. Eroded sandstone plateaus (*tassilis*) extend from the Ahaggar. The sparse population of this region is partly settled and partly nomadic. The nomads principally inhabit the valleys of Atakor (the highest areas of the Ahaggar) and graze camels and goats where the scant rainfall is enough to support a steppelike growth of grasses.

In 1905 Charles-Eugène Foucauld, the French explorer and ascetic, built his hermitage in the town of Tamanghasset, where he compiled a Tuareg language grammar and dictionary. A memorial column was erected near the spot where he was assassinated in 1916. The Museum of the Hoggar specializes in Tuareg exhibits. Pop. (1987 prelim.) 38,146.

**Tamano,** city, Okayama *ken* (prefecture), Honshu, Japan, on a channel of the Inland Sea, opposite Takamatsu, on Shikoku. The city is composed of the former towns of Tama, Hibi, and the port of Uno. Tamano was a small fishing village during the Tokugawa period (1603–1867). The opening of Uno port and a major railway in the early 20th century, however, made it an important transport centre. Industry is based on shipbuilding and related activities; copper smelting is also important. The Kibitsu Temple, founded in the 4th century, is an architectural highlight of the city. Pop. (1990) 73,240.

**Tamaqua,** town ("borough"), Schuylkill county, east-central Pennsylvania, U.S., on the Little Schuylkill River. The area was settled in 1799, and its name derives from the Iroquois Indian word for "land of the beaver." After the opening of the horse-drawn Little Schuylkill Railroad in 1831, the town prospered as an anthracite-coal-mining centre. Light manufactures (chemicals, textiles, and metal fabricating) are now the economic mainstay. Inc. 1833. Pop. (1990) 7,943.

**Tamar, River,** tidal estuary in northern Tasmania, Australia, formed by the confluence



The River Tamar at Launceston, Tasmania
Frederick Ayer—Photo Researchers

of the North and South Esk rivers. It extends 40 miles (65 km) northwest to enter Bass Strait at Port Dalrymple, the mouth of the estuary. The latter was named in 1798 by the explorers George Bass and Matthew Flinders and was the site in 1804 of George Town, the first settlement. About 2 miles (3 km) wide, the River Tamar is navigable over its entire length to the port of Launceston, but larger ships use wharves closer to the mouth at Bell Bay, Australia's largest aluminum-production complex, and at Beauty Point and Inspection Head. Fertile terraces, supporting orchards and sheep farms, line the river, which is paralleled by the East and West Tamar highways. The name Tamar was taken from a river flowing between Cornwall and Devon, Eng.

**Tamar, River,** river in southwestern England, rising within 4 miles (6 km) of the Bristol Channel and flowing south to the English Channel by Plymouth Sound. For most of its length of 61 miles (98 km), it forms the historic boundary between the counties of Devon and Cornwall. Its estuary, like those of its lower tributaries, Tavy, Lynher, and Tiddy, is a barrier to east-west communications, which are carried by ferry at Torpoint and the Tamar Road Bridge upstream of the railway bridge at Saltash. The sheltered, deep-water estuary known as the Hamoaze is the site of Plymouth Naval Base and Devonport dockyard, both notable British Royal Navy installations.

**tamarau,** also spelled TAMARAW (species *Anoa mindorensis*), small species of buffalo (*q.v.*).

**Tamaricales,** the tamarisk order of dicotyledonous flowering plants comprising three families (Tamaricaceae, Frankeniaceae, and Fouquieriaceae) of trees, shrubs, and herbs usually found in temperate and subtropical steppes, deserts, and salt deserts and along the margins of salt lakes and seacoasts.

The plants are characterized by radially symmetrical bisexual flowers with four to seven sepals, which persist in the mature fruit, and petals. The plant is also distinguished by a one-chambered ovary, which has several to many ovules that develop into seeds bearing a tuft of hairs at one end. The order is considered to be evolutionarily advanced and related to the willow order (Salicales), both of which are thought to have been derived from the violet order (Violales), probably from the family Flacourtiaceae of that order.

The tamarisk family (Tamaricaceae) contains four genera: *Tamarix,* 54 species; *Reaumuria,* 20 species; *Myricaria,* 10 species; and *Hololachna,* 2 species. All but *Reaumuria* are large shrubs or small trees with minute flowers borne in dense, feathery inflorescences (clusters). *Reaumuria* is a small shrub with relatively large solitary flowers. The leaves of all tamarisks are alternately produced on the twigs but are so small, scalelike, and closely appressed that the stems look bare. The flowers have 4 to 10 stamens (male pollen-producing structures), a 3- or 4-parted style (the upper part of the female structure, which bears the pollen-receptive surfaces, or stigmas), and slightly fused sepals. Of horticultural interest are the false tamarisk (species *Myricaria germanica*); the Athel tree, or salt tree (*Tamarix aphylla*); and the salt cedar, or French tamarisk (*T. gallica*).

The alkali-heath family (Frankeniaceae) has four or possibly five genera (*Frankenia,* 25 species; *Anthobryum,* 4 species; *Niederleinia,* 3 species; *Hypericopsis,* 1 species; and, questionably, *Petrusia,* 1 species). These are tropical and temperate, salt-tolerant herbs or softly woody shrubs with jointed stems, opposite leaves, and flowers having 4 to 10 stamens like those of the tamarisks but with only one style and free, unconnected sepals. The foliage is characteristic in that the leaves and twigs are in opposite pairs, each pair rotated at right angles on the stem relative to the pairs immediately above and below. Of horticultural interest are the alkali heath (*Frankenia grandifolia*) and several species of the same genus, which are cultivated as rock-garden novelties for their matlike growth forms, hairy, inrolled leaves, and small, pink or white flowers.

The candlewood family (Fouquieriaceae) contains two genera (*Fouquieria,* nine species; and *Idria,* one species) of thorny, small-leaved plants native to warm, dry regions of southwestern North America. The flowers differ technically from those of the other two families in having a tubular corolla (fused petals), 10 to 17 stamens with hairy filaments (basal parts), and three styles arising from a three-lobed ovary. The most notable plants of this family are the ocotillo, or coachwhip cactus (*Fouquieria splendens*), and the boojum tree (*Idria columnaris*).

**tamarin,** any of certain species of marmoset (*q.v.*).

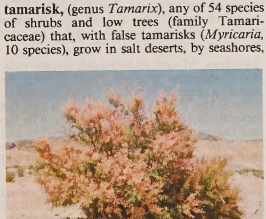
**tamarind** (species *Tamarindus indica*), evergreen tree, of the pea family (Fabaceae), native to tropical Africa. It is widely cultivated in other regions as an ornamental and for its



Tamarind (*Tamarindus indica*)
Walter Dawn

edible fruit. The tree grows to about 24 m (80 feet) tall and has alternate, pinnately compound (feather-formed) leaves; the leaflets are about 2 cm (0.75 inch) long. The yellow flowers, about 2.5 cm across, are borne in small clusters. The fruit is a plump pod 7.5–24 cm long that does not split open. It contains 1 to 12 large, flat seeds embedded in a soft, brownish pulp. This portion of the fruit is widely used in the Orient in foods, beverages, and medicines.

**tamarisk,** (genus *Tamarix*), any of 54 species of shrubs and low trees (family Tamaricaceae) that, with false tamarisks (*Myricaria,* 10 species), grow in salt deserts, by seashores,



Tamarisk (*Tamarix*)
F.M. Roberts—Ostman Agency

in mountainous areas, and in other semiarid localities from the Mediterranean region to central Asia and northern China. Many have been introduced into North America. They have deep-ranging roots and long, slender branches with numerous small, gray-green, scalelike leaves. Clusters of small pink flowers, hanging at the ends of branches or from the trunks, give the plants a feathery appearance. Each flower has 4 or 5 free sepals, 4 or 5 petals, and from 4 to 10 stamens. The petals and stamens arise from a fleshy disk. In *Tamarix* the stamens are separate; in *Myricaria* they are united. The fruit is a capsule with numerous seeds; each seed has a long tuft of hairs at one end.

Tamarisks are valued for their ability to withstand drought, soil salinity, and salt-water spray. The salt cedar, or French tamarisk (*T. gallica*), is planted on seacoasts for shelter; it is cultivated in the United States from South Carolina to California. The Athel tree (*T. aphylla*), which sometimes grows to about 18 m (60 feet), has jointed twigs and minute ensheathing leaves and is used as a windbreak in desert areas. *T. ramosissima* (or *T. pentandra*) and *T. chinensis,* with denser flower clusters, are frequently cultivated as ornamentals.

**tamāshā,** erotic form of Indian folk drama begun in the early 18th century in Mahārāshtra. In all other forms of Indian folk theatre, men are cast in the major roles. The leading female role in *tamāshā,* however, is played by a woman. *Tamāshā* plays, which are known to be bawdy, originated as entertainments for encamped armies. In the 20th century they became commercially successful.

**Tamatave** (Madagascar): *see* Toamasina.

**Tamaulipas,** *estado* ("state"), northeastern Mexico, on the Gulf of Mexico. It is bounded by the United States (north), the Gulf of Mexico (east), Veracruz and San Luis Potosí (south), and San Luis Potosí and Nuevo León (west). The central and southern portions of its 30,650-square-mile (79,384-square-kilometre) territory are mountainous, but there are extensive, fertile plains in the north. The sandy, lagoon-dotted coastal zone is sparsely inhabited.

With varied climates and vegetation, numerous crops (sorghum, soybeans, safflower, corn [maize], sugarcane, tobacco, cotton, coffee, and fruit) can be cultivated, and agriculture is the state's main industry. The Gulf of Mexico fisheries are an important resource. Large areas are irrigated. Livestock raising, preparation of istle (agave) fibre, and copper mining are additional sources of income. Tamaulipas produces a third of Mexico's natural gas and increasing quantities of petroleum. There are petrochemical plants in Ciudad Madero and Reynosa. Many miles of paved highway have been completed, bringing all of the towns within easy reach of each other, and the Monterrey-Tampico railway traverses the state, passing through Ciudad Victoria, the state capital. Other principal cities are Tampico, Ciudad Madero, Nuevo Laredo, Matamoros, and Reynosa. The larger cities all possess airports. Pop. (1990 prelim.) 2,244,208.

**tamaya,** in the Shintō religion of Japan, a memorial altar dedicated to the spirits of deceased ancestors. The *tamaya* is not found in all homes observing Shintō because Buddhist practices dominate Japanese funerary rites. But in priestly or strict Shintō households, the *tamaya* is placed on a lower level than the commonly found family altar, the *kamidana* ("god-shelf"). It contains a mirror or a tablet (*tamashiro*) listing the names of the deceased family members.

When a death occurs, before the body is removed for burial, the spirit of the deceased is asked to stay behind and to guard the

house. The name of the deceased is listed on a *tamashiro,* and offerings are made to the spirit daily for the first 50 days following death. The tablet is then placed in the *tamaya* for regular worship along with other family ancestors. *Compare* butsudan.

**Tamayo, Rufino** (b. Aug. 26, 1899?/1900?, Oaxaca, Mex.—d. June 24, 1991, Mexico City), painter who combined modern European painting styles with Mexican folk themes.

Tamayo attended the School of Fine Arts, Mexico City, but was dissatisfied with the



Rufino Tamayo, 1965
Cornell Capa—Magnum

traditional art program and thereafter studied independently. He then became head of the department of ethnographic drawing at the National Museum of Archaeology (1921–26) in Mexico City, where he became interested in pre-Columbian art. Tamayo reacted against the epic proportions and political rhetoric of the paintings of the Mexican muralists, who had dominated the country's art production since the Mexican Revolution. Instead, he chose to work on small canvases, using Cubist, Surrealist, and other European styles and fusing them with a basically Mexican subject matter involving figures, still lifes, and animals. By the 1930s he had become a well-known figure on the Mexican art scene. He exhibited his paintings at the Venice Biennale in 1950, and the success of his work there led to international recognition. He went on to design murals for the National Palace of Fine Arts in Mexico City ("Birth of Nationality" and "Mexico Today," 1952–53) and for the United Nations Educational, Scientific, and Cultural Organization in Paris ("Prometheus Bringing Fire to Man," 1958), among others.

The varied styles of Tamayo's easel paintings range from the stolid Cubist figures in "Women of Tehuantepec" (1939) to the expressive violence of the barking mongrels in "Animals" (1941). Tamayo generally used vibrant colours and solid compositions to depict natural subjects in a symbolic, stylized, or semiabstract mode.

**Tamayo y Baus, Manuel** (b. Sept. 15, 1829, Madrid, Spain—d. June 20, 1898, Madrid), Spanish dramatist who, with Adelardo López de Ayala y Herrera, dominated the Spanish stage in the mid-19th century. He was a key figure in the transition from Romanticism to Realism in Spanish literature.

Tamayo y Baus was the son of a well-known actor and actress. He began writing plays at a very early age, and one of his dramas received its first production when he was 11 years old. A prolific and versatile playwright who wrote in every style and genre, he had an extremely successful career in the theatre. In 1870, however, he stopped writing to become director of the National Library and secretary to the Spanish Academy.

His career falls into two phases: first, under the influence of the German dramatist Friedrich Schiller, he produced romantic historical dramas such as *La ricahembra* (1854; "The Lady") and *Locura de amor* (1855; "The Madness of Love"); in his second phase he wrote realistic thesis plays that denounced the evils of contemporary Spanish society—materialism (*Lo positivo,* 1862; "The Real"), dueling (*Lances de honor,* 1863; "Quarrels of Honour"), and tolerance of high-level corruption (*Los hombres de bien,* 1870; "Reputable Men"). Tamayo y Baus had an actor's knowledge of stagecraft and was able to make his satiric comedies come to life on the stage.

His masterpiece, which brought him international fame, is *Un drama nuevo* (1867; *A New Drama*), a skillful and moving tragedy.

**Tambacounda,** town, southeastern Senegal. It is situated about 250 miles (400 km) east-southeast of Dakar, the national capital. The town is in a tall-grass and acacia savanna area known for its varied agricultural potential. Crops grown include millet, sorghum, cotton, corn (maize), peanuts (groundnuts), and rice. Cattle are grazed by Fulani and Malinke (Mandingo) peoples, and there is a cotton mill in Tambacounda. The town has rail connections with Dakar to the northwest and with Mali to the northeast. Senegal's largest national park, the transitional savanna and woodlands Niokolo Koba National Park, is located about 45 miles (75 km) southeast. Pop. (1983 est.) 41,800.

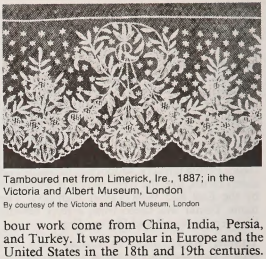
**Tambo, Oliver** (b. Oct. 27, 1917, Bizana, near Johannesburg, S.Afr.—d. April 24, 1993, Johannesburg), president of the South African black-nationalist African National Congress (ANC) from 1969. He spent more than 30 years in exile (1960–90).

Born in a Transkei village of subsistence farmers, Tambo attended Anglican and Methodist mission schools and the University of Fort Hare (B.S., 1941) and later studied law. In 1944 with Nelson Mandela and others, he cofounded the Youth League of the ANC and, after teaching school briefly, began engaging wholly in nationalist politics and legal cases, rising concurrently in the ranks of the ANC. Joining with Mandela in establishing South Africa's first black law practice in 1952, he was arrested on treason charges in 1956 but was released the following year. In 1958 he became ANC deputy president. Two days after the Sharpeville Massacre, the ANC was banned (March 23, 1960), and Tambo left South Africa to help set up the organization's foreign headquarters, eventually settling in Lusaka, Zambia. He assumed the presidency of the ANC in 1969, two years after the death of its old leader, Chief Albert Luthuli.

Tambo returned to South Africa from exile on Dec. 13, 1990, to attend the first full-scale conference of ANC members (including exiles and the formerly imprisoned) in more than 30 years. However, because of ill health owing to an earlier stroke, Tambo yielded ANC executive duties to his old colleague Mandela and took the largely honorary post of national chairman of the ANC in 1991.

**Tambora, Mount,** Indonesian GUNUNG TAMBORA, dormant volcanic mountain on the northern coast of Sumbawa island, Indonesia. Now 9,354 feet (2,851 m) high, it erupted violently in 1815, when it lost much of its top and caused the death of 50,000 islanders and destroyed the homes of 35,000 more. Before that eruption Mount Tambora was 13,000 feet (4,000 m) high.

**tambour,** embroidery worked on material that has been stretched taut on a tambour frame, which consists of two wooden hoops, one slightly larger than the other, fitting close together. The embroidery is worked with a needle or a tambour hook. When an expanse of material has to be covered that is too large for a fixed square frame, it is possible to do the work in stages on a tambour frame, stretching different portions of the material at a time. The frame is portable and suitable for carrying work around. Early examples of tam-



Tamboured net from Limerick, Ire., 1887; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

bour work come from China, India, Persia, and Turkey. It was popular in Europe and the United States in the 18th and 19th centuries.

**tamboura,** also spelled TAMBURA, long-necked, fretless lute that supplies a drone accompaniment in Indian music. Resembling the tanbur, the Middle Eastern lute from which it derives, it usually has four metal strings tuned (relative pitch) c–c′–c′–g or c–c′–c′–f. Precision tuning is achieved by inserting bits of wool or silk between the strings and lower bridge and by adjusting small beads attached to the strings. The tamboura is essential to provide a tonal framework within which a singer or instrumental soloist develops the raga, or melodic mode.

**tambourine,** small frame drum (one whose shell is too narrow to resonate the sound) having one or two skins nailed or glued to a shallow circular or polygonal frame. The tambourine is normally played with the bare hands and often has attached to it jingles, pellet bells,*or snares. European tambourines typically have one skin and jingling disks set into the sides of the frame. The designation tambourine refers specifically to the European frame drum; however, the term is often extended to include all related frame drums, such as those of the Arabic countries, and sometimes those probably unrelated, such as the shaman's drums of Central Asia, North America, and the Arctic.



Tambourine with snare and jingles, detail from an early 14th-century English manuscript (add. 42130, fol. 164); in the British Library, London
Reproduced by permission of the British Library, London

In ancient Sumer large frame drums were used in temple rituals. Small tambourines were played in Mesopotamia, Egypt, and Israel (the Hebrew *tof*) and in Greece and Rome (the *tympanon,* or *tympanum*) and were used in the cults of the mother goddesses Astarte, Isis, and Cybele. Today they are prominent in Middle Eastern folk music and are also used to accompany recitations of the Qur'ān. Varieties include the *duff* (also a generic word for such drums), *bandīr, ṭār,* and *dā'irah.* They are largely played by women.

Crusaders brought the instrument to Europe in the 13th century. Called timbrel or tabret, it continued to be played mainly by women and as accompaniment to song and dance.

The modern tambourine reentered Europe as part of the Turkish Janissary musical bands in vogue in the 18th century. It appeared occasionally in 18th-century opera scores (*e.g.*, by Christoph Gluck and André Grétry), and it came into general orchestral use in the 19th century with composers such as Hector Berlioz and Nikolay Rimsky-Korsakov.

**Tambov,** *oblast* (province), western Russia. It occupies an area of 13,250 square miles (34,300 square km) on the low, level plain of the Oka and Don rivers. The natural vegetation is forest-steppe on rich soils, but much of it has been cleared for agriculture; large areas of pine forest survive only on sandy soils along the Tsna and Vorona rivers. The climate is continental, with average temperatures of 12° F (−11° C) in January and 68° F (20° C) in July. The *oblast* is an important agricultural centre; its chief products are winter rye, spring wheat, corn (maize), oats, and millet. Sunflowers are the primary industrial crop, with some sugar beets, hemp, and tobacco; potatoes, melons, and other vegetables are widely grown. Beef and dairy cattle and poultry are kept in large numbers. Most of the cities, apart from the administrative centre, Tambov, with its engineering and chemical industries, are small and engaged in processing farm products. Pop. (1991 est.) 1,315,200.

**Tambov,** city and administrative centre of Tambov *oblast* (province), western Russia. It lies along the upper Tsna River. Founded in 1636 as a fortress on the Belgorod defensive line, in 1779 it became the centre of a province. Growth came slowly, chiefly in the late 19th century after construction of the Moscow–Saratov railway through the city. Tambov's chief industries are engineering, chemicals, and food processing. The city centre, laid out in a gridiron pattern, contains administrative and cultural institutions, with parks along the high Tsna bank; factories are concentrated to the north. Tambov has a teacher-training institute and a school of music, as well as a 17th-century cathedral. Pop. (1991 est.) 334,400.

**tambur** (musical instrument): *see* tanbur.

**tambura** (musical instrument): *see* tamboura.

**Tamburini, Antonio** (b. March 28, 1800, Faenza, Papal States [Italy]—d. Nov. 8, 1876, Nice, Fr.), Italian operatic baritone, particularly noted for his starring roles in the works of Gioacchino Rossini, Gaetano Donizetti, and Vincenzo Bellini.

As a youth he studied the horn with his bandmaster father and voice with Aldobrando Rossi and Bonifazio Asioli, making his operatic debut in Cento at 18 years of age in Pietro Generali's *La contessa di colle erbose.* He sang in Piacenza, Naples, Livorno, and Turin before appearing at La Scala, Milan, in 1822 in Rossini's *Matilde di Shabran,* Saverio Mercadante's *Adele e Emerico,* and the first performance of Donizetti's *Chiara e Serafin.*

From 1832 to 1843 Tamburini sang in Paris with Giulia Grisi, tenors Giovanni-Battista Rubini and Giovanni Mario, and baritone Luigi Lablache, the quartet (in which Mario eventually replaced Rubini) which premiered Donizetti's *Don Pasquale* and *Marino Faliero.* Tamburini appeared also in London in alternate years. He returned to Italy for a brief time, but in 1844 he moved to St. Petersburg, Russia, where he stayed until he retired a decade later. He was known for his musicianship and versatility. During a performance in Palermo he is supposed to have taken the costume and role of a young soprano too frightened to sing.

**Tamenghest** (Algeria): *see* Tamanrasset.

**Tamerlane,** also spelled TAMBURLAINE (Turkish leader): *see* Timur.

**Tameside,** district (borough) in the eastern part of the metropolitan area of Greater Manchester, England. It occupies 40 square miles (103 square km), and its eastern boundary is adjacent to the Peak District National Park. Its name is derived from the Tame River, which flows through the district to join the Mersey.

Coal mining, hatting, and cotton textiles were the traditional industries of the district. In Denton, hatting grew from a cottage industry in the 17th century into a major economic activity employing nearly half the town's population by the 1920s. Tameside's domestic textile industry gave way to factory production in the 18th century with the construction of water-powered mills along the River Tame. After 1830 steam power, fueled by local coal, replaced water power, and textile factories were built in the town centres. By the middle of the 19th century cotton spinning was the staple industry of the district. Metalworking and engineering were also important.

The traditional industries have contracted since World War I. Denton's hatting industry declined rapidly after the 1920s, and the last coal mine closed in 1959. Today the diversified industries of the district include food processing, plastics, and high-technology engineering. Pop. (1991 prelim.) 211,700.

**Tami style,** type of Oceanic carving originating on the Tami Islands, in Papua New Guinea. The style spread to the coastal areas along the Huon Gulf, to the islands of Umboi and Siassi, and to western New Britain.



Wooden female cult figure in the Tami style, bearing traces of paint, from Jerik, Umboi Island, Papua New Guinea; in the Museum für Völkerkunde und Schweizerisches Museum für Volkskunde Basel, Basel, Switz.
Holle Bildarchiv, Baden-Baden, Ger.

In representations of the human figure, the Tami style creates an impression of massiveness. The images, full-length and standing, are dominated by rectilinear lines, the head set directly on the torso and the arms and legs hanging straight down, though slightly bent. Three distinct horizontal axes cut across the statue—at the shoulder, at the hips, and at the feet. The monumental head supports a decorative headdress. The face is triangular with closely set, circular eyes placed directly under the lower edge of the forehead, which is connected to a thin, perpendicular nose. Unique to the sculpture of the Huon Gulf are triangular shapes painted or incised at the lateral extremities of the face with the apexes pointing toward the centre. The Tami style as manifested in figural sculpture has been extremely important in the art of Oceania; it has been suggested that few, if any, representations of the human figure have escaped its influence.

Decoration in the Tami style is also seen on ceremonial masks, in which articulation of the facial features closely resembles the style of carving found on the cult figures. The Tami style, as it is seen on secular objects, is characterized by depiction of a wide variety of animal figures (crocodile, turtle, lizard, fish, pig) in a highly stylized manner. The animal forms—commonly found on wooden bowls, suspension hooks, lime spatulas, headrests, canoe prows, and paddles—occasionally appear with representations of human beings.

**Tamiahua Lagoon,** long coastal lagoon in Veracruz *estado* ("state"), eastern Mexico. An inlet of the Gulf of Mexico, it extends approximately 65 miles (105 km) southward from Tampico. A long, narrow, sandy peninsula from which Cape Rojo projects eastward shelters the 12-mile- (19-kilometre-) wide lagoon from the Gulf. Numerous islands, the largest of which are Idolo and Juana Ramírez, lie within the lagoon, which is navigable for shallow-draft vessels. The town of Tamiahua, an agricultural centre (sugarcane and fruit), lies on the mainland at the lagoon's southwestern end, and San Jerónimo is on its western shore.

**Tamil,** people originally of southern India and speaking Tamil, one of the principal languages of the Dravidian family. Numbering about 57,000,000 in the late 20th century (including about 3,200,000 speakers in northern and eastern Sri Lanka), Tamil speakers make up the majority of the population of Tamil Nadu state and also inhabit parts of Kerala, Karnataka, and Andhra Pradesh states, all situated in the southernmost third of India. Emigrant Tamil may be found in some parts of the Malagasy Republic, the Malay Peninsula, Myanmar (Burma), Indochina, Thai-



Tamil woman picking tea, Sri Lanka
Shostal Assoc.

land, eastern Africa, South Africa, the Fiji and Mauritius islands, and the West Indies.

The Tamil area in India is a centre of traditional Hinduism. Tamil schools of personal religious devotion (bhakti) have long been important in Hinduism, being enshrined in a literature dating back to the 6th century AD. Buddhism and Jainism were widespread among the Tamil in the early Christian era, and these religions' literatures predate the early bhakti literature in the Tamil area. Although the present-day Tamil are mostly Hindus, there are Christians, Muslims, and Jains among them. In the recent past, the Tamil area was also the home of the Dravidian movement that calls for the desanskritization and debrahmanization of Tamil culture, language, and literature.

The Tamil have a long history of achievement; sea travel, city life, and commerce seem to have developed early among them. Tamil trade with the ancient Greeks and Romans is verified by literary, linguistic, and archaeological evidence. The Tamil have the oldest cultivated Dravidian language, and their rich literary tradition extends back to the early Christian era. The Chera, Chola, Pandya, and Pallava dynasties ruled over the Tamil area before the Vijayanagar empire extended its hegemony in the 14th century, and these earlier dynasties produced many great kingdoms. Under them the Tamil people built great temples, irrigation tanks, dams, and roads, and they played an important role in the transmission of Indian culture to Southeast Asia. The Chola, for example, were known for their naval power and brought the Malay kingdom of Sri Vijaya under their suzerainty in AD 1025. Though the Tamil area was integrated culturally with the rest of India for a long time, politically it was for most of the time a separate entity until the advent of British rule in India.

The Tamil in Sri Lanka today are of various groups and castes, though they are all Hindus. The so-called Ceylon Tamil, constituting approximately half of them, are concentrated in the northern part of the island. They are relatively well-educated, and many of them hold clerical and professional positions. The so-called Indian Tamil of Sri Lanka were brought there by the British in the 19th and 20th centuries as workers on the tea estates, and they have been regarded as foreigners by the other ethnic groups. The Ceylon and Indian Tamil are organized under different caste systems and have little social intercourse with each other.

In the 1980s, growing tensions between the Ceylon Tamil and the Sinhalese Buddhist majority in Sri Lanka prompted Tamil militants to undertake a guerrilla war against the central government in hopes of creating a separate Tamil state for themselves in the north and northeast. The Tamil rebels' organization, the Liberation Tigers of Tamil Eelam, continued their insurgency into the 1990s.

**Tamil language,** language of the Dravidian family, spoken in southern India; it is the official language of the state of Tamil Nadu (Madras). Other Tamil speakers live in Sri Lanka, Myanmar (Burma), Malaysia, Indonesia, Vietnam, eastern Africa, South Africa, Guyana, and islands in the Indian Ocean, the South Pacific, and the Caribbean. There are several regional dialects of Tamil, two social dialects (Brahman and non-Brahman), and a sharp dichotomy (diglossia) between literary and colloquial Tamil. Like the other Dravidian languages, Tamil is characterized by a series of retroflex consonants (*e.g., ṭ, ḍ, ṇ;* sounds pronounced with the tongue tip curled back against the roof of the mouth) and by its method of indicating such grammatical categories as tense, number, person, and case with suffixes.

Writing in Tamil can be traced back to inscriptions dating from the 3rd century BC that were written in an early dialect of Old Tamil with an alphabet adapted from the Brāhmī script, which is ancestral to all modern Indian alphabets. Modern Tamil has two types of script: Grantha, which is used in Tamil Nadu to write in Sanskrit; and Vaṭṭeḻuttu ("round script"), which is in common use.

**Tamil literature,** body of writings in Tamil, a Dravidian language of India and Sri Lanka. Apart from literature written in classical (Indo-Aryan) Sanskrit, Tamil is the oldest literature in India. Some inscriptions on stone have been dated to the 3rd century BC, but Tamil literature proper begins around the 1st century AD. Much early poetry was religious or epic; an exception was the secular court poetry written by members of the *caṅkam,* or literary academy (*see* caṅkam literature).

Notable works of the 4th–6th century include the twin epics *Cilappatikāram* ("The Lay of the Anklet") and *Maṇimēkalai* ("The Girdle of Gems," the only extant Tamil Buddhist work) and the *Tirukkuraḷ,* a collection of aphorisms on such matters as love, kingship, and ethics. The 6th–9th century saw the emergence of bhakti, the poetry and religion of personal devotion, which began in the Tamil region with the hymns of the Āḻvārs and the Nāyaṉārs (*qq.v.*) in honour of the Vaiṣṇava and Śaiva saints. From the 12th to the 16th century many philosophical treatises and anthologies of religious legends were composed, as well as the classic writings of the poet Kampan. From the 19th century, Tamil literature was increasingly influenced by Western forms and ideas. *See also* Indian literature.

**Tamil Nādu,** constituent state of India, located in the extreme southeastern part of the Indian peninsula. It is bounded by the Indian Ocean to the east and south; by the states of Kerala to the west, Karnātaka (Mysore) to the northwest, and Andhra Pradesh to the north. Its capital is Madras.

A brief treatment of Tamil Nādu follows. For full treatment, *see* MACROPAEDIA: India.

The history of Tamil Nādu began with the establishment of a trinity of Tamil powers in the area—the Cēra, Cōḷa, and Pāṇḍya kingdoms. Aryan influence increased after about AD 200 at a time when the area appears to have been engaged in considerable foreign trade. Various wars marked the period from the 6th to the 9th century, and from about 850 the area was dominated by Cōḷas. In the mid-14th century the Hindu kingdom of Vijayanagar—including Tamil Nādu—came into prominence and lasted for 200 years. The British established a trading post at the fishing village of Madraspatnam (now Madras) in 1639, and from the 17th century to 1946 the area was known as the Madras Presidency. By 1956 the presidency had been divided among the states of Andhra Pradesh, Kerala, Mysore (now Karnātaka), and Tamil Nādu within an independent Republic of India.

The state is divided naturally between the flat country along the eastern coast and the hilly regions of the north and west. The broadest part of the eastern plains is the fertile Cauvery River delta; farther south are the arid plains of Rāmanāthapuram and Madurai. The high Western Ghāts range runs all along the state's western border. The lower hills of the Eastern Ghāts run through the centre of the region. The most important rivers include the Cauvery, the Ponnaiyār, the Pālār, the Vaigai, and the Tāmbraparni. The Cauvery and its tributaries are Tamil Nādu's most important sources of water and power.

The climate is tropical. The temperature in summer occasionally exceeds 109° F (43° C) and in winter seldom falls below 64° F (18° C). The lowest temperatures are found during December and January, and the highest from April to June. The average annual rainfall, coming mainly between October and December, depends on the southwest and northeast monsoons and ranges between 25 and 75 inches (640 and 1,910 mm) each year.

Tamil Nādu's population characteristics have changed little over the centuries, and the Tamil people, who make up the bulk of the state's population, remain proud of their Dravidian language and culture. Most of the hill tribes are of Veddoid origin. Tamil is the official state language. Telugu, Kannada, Urdū, Malayalam, and English are minority languages. Nearly 90 percent of the population is Hindu; Christians account for about 5 percent. Although Tamil Nādu is one of the three most urbanized states of India, it is still a rural land.

Agriculture is the mainstay of life for about three-quarters of the rural population, and about one-half of the cultivated land is under irrigation. Multiple cropping, the use of new and better strains of rice, cotton, sugarcane, and millet, and the use of chemical fertilizers have done much to increase farm production. The state has been self-sufficient in food-grain production since 1967; and cotton, coffee, tea, and sugarcane—together with rice and peanuts (groundnuts)—are important cash crops.

Improved port facilities and the effective use of electric-power resources have helped Tamil Nādu's industrial development. It is one of the most industrialized of the Indian states. Cotton ginning, spinning, and weaving continue to be the major industries, followed by the manufacture of cars, motorcycles, electric motors, and transformers. The state also has petroleum refineries and fertilizer plants, as well as tire, aluminum, cement, chemical, and paper factories. The transport system of the southern Indian states converges on the city of Madras, and its artificial harbour handles seaborne traffic. There is an international airport at Meenāmbakkam near Madras; other airports are at Tiruchchirāppalli, Madurai, and Coimbatore. The state is served by a railway network and motorable roads.

In Tamil Nādu, Hinduism remains at the core of the culture, and there are more than 9,300 large temples in the state. The cycle of temple festivals attracts large congregations of devotees. Classical bharata natyam dancing and Carnatic music are widely practiced. Painting and sculpture are less developed, although there are schools for sculptors in stone and bronze. Since the 1940s the motion picture has become the most popular form of mass entertainment. There are both touring and permanent cinema theatres, and sentimental and spectacular films are produced by the state's film studios.

There are universities at Madras, Anamalai, Coimbatore, and Madurai, and the state has several medical colleges, engineering colleges, and polytechnic and industrial training institutes. Area 50,216 square miles (130,058 square km). Pop. (1991) 55,638,318.

**Tamilnād Plains,** eastern coastal lowlands of Tamil Nādu state, southern India. Bounded by the Bay of Bengal on the east, the Indian Ocean on the south, the Eastern Ghāts on the west, and the Andhra Plains on the north, the Tamilnād Plains consist of the Cauvery Delta and the deltas of the Vaigai and Pālār rivers, which have formed beaches of sand and shingles. Sand dunes (locally known as *theris*) rising 100 to 215 feet (30 to 65 m) and supporting Palmyra palm and thorny scrub are conspicuous features along the relatively straight coast. The flat plains are broken by numerous hills with a distinct north-northeast to south-southwest trend. Natural vegetation consists of littoral forests and plantations of casuarina and coconut, together with scattered trees, climbing vines, and grass. The Cauvery, Ponnaiyār, Pālār, Vaigai, Tāmbraparni,

Vellār, and Arni rivers flow east into the Bay of Bengal. The soils are red-loamy and sandy-loamy, both rich in iron. Agriculture is the mainstay of the economy of the region; crops include rice, pulse (legumes), oilseeds, tobacco, and sugarcane. The Cauvery delta has a large irrigation canal system. The early development of industry by the British has made the coast of the Tamilnād Plains one of the most industrialized areas in India; industries produce textiles, cement, chemicals, vegetable oil, fertilizers, automobiles, galvanized pipe, calculators, and teleprinters. The railway-coach factory at Perambur is one of the largest in Asia. Neyveli town has a large thermal power plant. Railways and roads connect Madras, Tiruchchirāppalli, Tirunelveli, Thanjāvūr, and Chingleput.

**Tamilnād Uplands,** hilly region in central Tamil Nādu state, southern India, extending over an area of about 15,200 sq mi (38,000 sq km) and bounded by the Eastern Ghāts on the west, the Sahyadris (Western Ghāts) on the south, the Tamilnād Plain on the east, and the Telangāna Plateau on the north. In the 4th century BC, the region was known as Tamilagam and was ruled successively by the Cēra, Cōla, and Pāṇḍya kingdoms. A number of temples constructed during the Middle Hindu Period (AD 800–1300) became the nuclei of towns such as Vellore, Krishnagiri, Dindigul, Coimbatore, and Erode. The Muslim rule extended from about 1650 to about 1800, when the region came under the domain of the British. The Cauvery, Pālār, Vaigai, Tāmbraparni, and Periyār rivers flow from west to east and drain into the Bay of Bengal. The Cauvery and its tributaries have diversified the terrain, by erosion, into the Tamil Nādu Hills, the Coimbatore–Madurai Uplands, and the Middle Cauvery Valley. The Tamilnād Uplands have an average elevation of 1,485 ft (450 m) in the west, decreasing to about 500 ft in the east. Cauvery Valley is approximately 1,000 ft above sea level. The soils are mostly loamy and clayey. Forests are almost nonexistent; scattered woodlands and scrub are found in the northern upland region. Agriculture is the principal occupation of most of the population; crops include rice, millet, oilseeds, pulse (legumes), cotton, and sugarcane. The region is one of the better developed industrial areas in India and produces textiles, machine tools, and chemicals. There are coffee, tea, cinchona, and cardamom plantations. Iron ore, magnesite, beryl, and zinc are mined. Roads and railways link Madurai, Coimbatore, Salem, Vellore, Dindigul, and Erode.

**Ta'mim, at-,** *muḥāfaẓah* (governorate), in northeastern Iraq, created from the northern part of Kirkūk *muḥāfaẓah*. It has an area of 3,729 sq mi (9,659 sq km) and encompasses the eastern part of the alluvial plain of the Tigris River and the foothills of the Zagros Mountains. Its economy is based on petroleum and dry-farm agriculture, which produces wheat, barley, and fruits; sheep are grazed. Its capital, Kirkūk, is one of the largest oil-producing centres in Iraq and has oil pipelines that connect it with Tripoli (Lebanon) and with Yumurtalik on the Turkish Mediterranean. Pop. (1987) 601,219.

**Tamiris, Helen,** original name HELEN BECKER (b. April 24, 1905, New York City—d. Aug. 4, 1966, New York City), American choreographer, modern dancer, and teacher, one of the first to make use of jazz, Negro spirituals, and social-protest themes in her work.

Tamiris began her dance studies with Irene Lewisohn in freestyle movement. Later, trained in ballet by Michel Fokine and at the Metropolitan Opera Ballet School, she danced for three seasons with the Metropolitan Opera Ballet Company, then toured South America with an Italian company. Dissatisfied with traditional ballet technique, she studied briefly



Helen Tamiris
By courtesy of the Dance Collection, New York Public Library, Astor, Lenox and Tilden Foundations

at the Isadora Duncan School in New York City but disliked its emphasis on purely personal expression and lyrical movement. She began to develop her own approach and in 1927 made her concert debut. She toured Europe in 1928 and in 1930 founded her own company and school, which she directed until 1945. She also organized the Dance Repertory Theatre (1930–32), which produced concerts jointly with such modern dance choreographers as Martha Graham, Doris Humphrey, and Charles Weidman. She encouraged the inclusion of dance in the WPA Federal Theatre Project and served as principal choreographer from 1937 to 1939. Tamiris, believing that each dance must create its own expressive means, did not develop an individual style or technique. Her works were often described, however, as vigorous and exuberant, and they frequently made use of American themes: *e.g., Bayou Ballads* and *Liberty Song*. Many of the approximately 135 dances she choreographed between 1930 and 1945 reflected her concern for social and political problems. Her best known concert piece, *How Long Brethren* (1937), depicted the despair of unemployed Southern blacks and was danced to Lawrence Gellert's "Negro Songs of Protest" sung by a black chorus.

As a choreographer for musical plays (1945–57), she excelled at creating clever characterizations and evoking the spirit of U.S. regions and periods. *Annie Get Your Gun* (1946), *Touch and Go* (1949), for which she won the Antoinette Perry Award for choreography, and *Plain and Fancy* (1955) were among the many musical plays for which Tamiris created the dances. She returned to concert modern dance with additional use of American themes, notably *Dance for Walt Whitman* (1958), and in 1960 formed the Tamiris-Nagrin Dance Company with her partner and husband, the dancer Daniel Nagrin.

**Tamiš River** (north-central Balkans): *see* Timiș River.

**Tamlūk,** ancient TĀMRALIPTĪ, also called TĀMRALIPTĀ, Pāli TAMALITTI, city, West Bengal state, northeastern India, just south of the Rūpnārāyan River. Archaeological excavations have revealed a sequence of occupation going back to a period in which stone axes and crude pottery were in use, with continuous settlement from about the 3rd century BC.

Jaina sources identify Tāmraliptī as the capital of the kingdom of Vaṅga. It was long known as a port. According to the *Mahāvaṃśa*, an epic history of Ceylon, it was the departure point of Prince Vijaya's expedition to colonize Ceylon (*c.* 500 BC) and for Aśoka's Buddhist missionary expedition to Ceylon 250 years later. Tāmraliptī was also the port for trade with Southeast Asia. The Chinese pilgrim Fa-hsien visited the city in the 5th century AD, and Hsüan-tsang visited it in the 7th century. Hsüan-tsang reported that there were 10 Buddhist monasteries and an Aśokan pillar there, and he referred to Tāmraliptī as a thriving port for export of indigo, silk, and copper (Sanskrit *tāmra*), from which it derived its name. In ancient times Tāmraliptī was near the sea. With the advance of the Ganges Delta, Tamlūk is now 60 mi (97 km) inland. A centre for boat traffic on the river, it is an agricultural distribution centre and has chemical factories and general engineering works. It has a surviving Buddhist temple, now dedicated to the Hindu goddess Kālī. It became a municipality in 1864. Pop. (1991 prelim.) 38,656.

**Tamm, Igor Yevgenyevich** (b. July 8 [June 26, old style], 1895, Vladivostok, Siberia—d. April 12, 1971, Moscow), Russian physicist who shared the 1958 Nobel Prize for Physics with Pavel A. Cherenkov and Ilya M. Frank for his efforts in interpreting the Cherenkov effect; *i.e.*, the emission of light waves by electrically charged atomic particles moving in a medium faster than the speed of light for that same medium.

A professor at Moscow University, he studied the quantum theory of diffused light in solid bodies before he worked with Frank in deriving the theory of Cherenkov radiation (1937). His technique of interpreting the interaction of elementary nuclear particles is known as



Tamm
Novosti Press Agency

the Tamm method. Interest in the peaceful uses of nuclear energy led him to work on methods for the control of thermonuclear reactions. He appeared on U.S. television (1963) in an appeal for international disarmament.

**Tammām ibn Ghālib abū Firās:** *see* Farazdaq, al-.

**Tammann, Gustav (Heinrich Johann Apollon)** (b. June 9 [May 28, old style] 1861, Jamburg, Russia—d. Dec. 17, 1938, Göttingen, Ger.), Russian chemist who helped to found the science of metallurgy and pioneered in the study of the internal structure and physical properties of metals and their alloys. In addition, his studies on heterogenous equilibria (*i.e.*, the behaviour of matter as a function of chemical composition, temperature, and pressure) played a major role in systematizing inorganic chemistry and contributed significantly to the development of physical chemistry as a discipline.

Relatively little was known about metallic compounds when Tammann began studying them in 1903. His research revealed that, in many cases, alloys behave as mixed crystals and that valence relationships do not hold for

crystals of such metal compounds. He developed a method known as thermic analysis for determining the chemical composition of a compound from its cooling curve, which enabled him to explain systems of mixed crystals. Tammann conducted much research on the mechanical properties of metals during cold-working and found that changes in such properties resulted from a rearrangement of their crystals. This finding, together with other related discoveries, influenced many techniques of modern metalworking. Noteworthy, too, was Tammann's analysis of tarnish on metallic surfaces, the results of which formed the basis of the theory of oxidation.

**Tammany Hall,** also called TAMMANY, the executive committee of the Democratic Party in New York City historically exercising political control through the typical boss-ist blend of charity and patronage. The name was derived from a pre-Revolutionary association named after Tammanend, a wise and benevolent Delaware Indian chief. When Tammany was organized in New York in 1789, it represented middle-class opposition to the power of the "aristocratic" Federalist Party. Incorporated in 1805 as a benevolent body, the Society of Tammany became identified with the Democratic Party by means of identical leadership within both organizations.

The makeup of the society was substantially altered in 1817 when Irish immigrants, protesting Tammany bigotry, forced their right to membership and benefits. Later Tammany championed the spread of the franchise to white propertyless males. Nevertheless, the society's appeal to particular ethnic and religious minorities, the doling out of gifts to the poor, and the bribing of rival political faction leaders, among them the notorious "Boss" William M. Tweed, made the name Tammany Hall synonymous with urban political corruption.

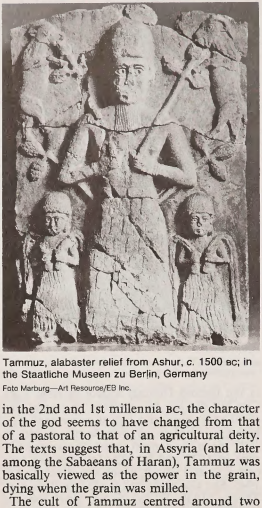
Tammany's power was formidable in the 19th and early 20th centuries, but its control over New York politics was diminished when Pres. Franklin D. Roosevelt reduced its status to a county organization after it failed to support him in 1932. It further declined in power during the reform administrations of mayors Fiorello H. La Guardia (1933–45) and John V. Lindsay (1966–73).

**Tammerfors** (Finland): *see* Tampere.

**Tammuz,** Akkadian DUMUZI, in Mesopotamian religion, god of fertility embodying the powers for new life in nature in the spring. The name Tammuz seems to have been derived from the Akkadian form Tammuzi, based on early Sumerian Damu-zid, The Flawless Young. The later standard Sumerian form, Dumu-zid, in turn became Dumuzi in Akkadian. The earliest known mention of Tammuz is in texts dating to the early part of the Early Dynastic III period (*c.* 2600–*c.* 2334 BC), but his cult probably was much older. Although the cult is attested for most of the major cities of Sumer in the 3rd and 2nd millennia BC, it centred in the cities around the central grasslands area (the *edin*), for example, at Badtibira (modern Madinah) where Tammuz was the city god.

As shown by his most common epithet Sipad (Shepherd), Tammuz was essentially a pastoral deity. His father Enki is rarely mentioned, and his mother, the goddess Duttur, was a personification of the ewe. His own name, Dumu-zid, and two variant designations for him, Ama-ga (Mother Milk) and U-lu-lu (Multiplier of Pasture), suggest that he actually was the power for everything that a shepherd might wish for: grass to come up in the desert, healthy lambs to be born, and milk to be plentiful in the mother animals.

When the cult of Tammuz spread to Assyria



Tammuz, alabaster relief from Ashur, *c.* 1500 BC; in the Staatliche Museen zu Berlin, Germany
Foto Marburg—Art Resource/EB Inc.

in the 2nd and 1st millennia BC, the character of the god seems to have changed from that of a pastoral to that of an agricultural deity. The texts suggest that, in Assyria (and later among the Sabaeans of Haran), Tammuz was basically viewed as the power in the grain, dying when the grain was milled.

The cult of Tammuz centred around two yearly festivals, one celebrating his marriage to the goddess Inanna, the other lamenting his death at the hands of demons from the netherworld. During the 3rd dynasty of Ur (*c.* 2112–*c.* 2004 BC) in the city of Umma (modern Tell Jokha), the marriage of the god was dramatically celebrated in February–March, Umma's Month of the Festival of Tammuz. During the Isin–Larsa period (*c.* 2004–*c.* 1792 BC), the texts relate that in the marriage rite the king actually took on the identity of the god and thus, by consummating the marriage with a priestess incarnating the goddess, magically fertilized and fecundated all of nature for the year.

The celebrations in March–April that marked the death of the god also seem to have been dramatically performed. Many of the laments for the occasion have as a setting a procession out into the desert to the fold of the slain god. In Assyria, however, in the 7th century BC, the ritual took place in June–July. In the major cities of the realm, a couch was set up for the god upon which he lay in state. His body appears to have been symbolized by an assemblage of vegetable matter, honey, and a variety of other foods.

Among the texts dealing with the god is "Dumuzi's Dream," a myth telling how Tammuz had a dream presaging his death and how the dream came true in spite of all his efforts to escape. A closely similar tale forms the second half of the Sumerian myth "The Descent of Inanna," in which Inanna (Akkadian Ishtar) sends Tammuz as her substitute to the netherworld. His sister, Geshtinanna, eventually finds him, and the myth ends with Inanna decreeing that Tammuz and his sister may alternate in the netherworld, each spending half of the year among the living.

Tammuz's courtship and wedding were a popular theme for love songs and anecdotal verse compositions that seem to have been used primarily for entertainment. A number of true cult texts, however, follow the rite step by step as if told by a close observer, and many laments were probably performed in the actual rites.

Eventually a variety of originally independent fertility gods seem to have become identified with Tammuz. Tammuz of the cattle herders, whose main distinction from Tammuz the Shepherd was that his mother was the goddess Ninsun, Lady Wild Cow, and that he himself was imagined as a cattle herder, may have been an original aspect of the god. The agricultural form of Tammuz in the north, where he was identified with the grain, may also have been an originally independent development of the god from his role as the power in the vegetation of spring. A clear fusion, though very early, was the merger of Tammuz in Uruk with Amaushumgalana, the One Great Source of the Date Clusters; *i.e.,* the power of fertility in the date palm (*see* Dumuzi-Amaushumgalana).

A later important fusion was the merger of Tammuz and Damu, a fertility god who probably represented the power in the sap to rise in trees and plants in spring. The relation of still other figures to Tammuz, such as Dumuzi-Abzu—a goddess who appears to have been the power in the waters underground (the Abzu) to bring new life to vegetation—is not entirely clear.

**Tammuz, Fast of,** a minor Jewish observance (on Tammuz 17) that inaugurates three weeks of mourning (*see* Three Weeks) that culminate in the 24-hour fast of Tisha be-Av. Though probably an adaptation of some pagan festival, the Jewish people have associated the fast with several unhappy historical events: the breaching of the walls of Jerusalem by the Babylonian king Nebuchadrezzar in 586 BC, the capture of Jerusalem by Titus in AD 70, the breaking of the tablets of the Law by Moses, the burning of the Torah, the suspension of whole offerings and the cessation of sacrifices, and the erection of an idol in the sanctuary by the Romans.

**Tampa,** city, seat (1846) of Hillsborough County, west central Florida, U.S., port of entry on Tampa Bay at the mouth of the Hillsborough River, connected to St. Petersburg and Clearwater (southwest and west) across the bay's western arm (Old Tampa Bay) by the Gandy and Howard Frankland bridges and the Courtney Campbell Causeway. Settlement of Tampa began with Ft. Brooke, established (1824) to oversee the removal of Seminole Indians. During the U.S. Civil War, the Confederates yielded the fort after bombardment by Union gunboats. Henry B. Plant's South Florida Railroad arrived in 1885 and stimulated new industry. Plant developed the port extensively and promoted tourism. Cigar manufacturing was introduced in 1886 by Vincente M. Ybor, and cigars are still made in Ybor City, Tampa's Latin quarter. Tampa was the embarkation point (1898) for Col. Theodore Roosevelt's Cuba-bound troops. In the 1920s the man-made Davis Islands were created offshore for real estate development. Citrus and phosphates (early economic factors) account for much of the port traffic. Tampa now has a wide range of industries and is a major distribution centre. The Gasparilla festival, a February event highlighted by a pirate invasion of the old port city, and Busch Gardens, including a zoo with an African setting, which features daily shows by rare tropical birds, are popular tourist attractions. It is also the home of a professional football team, the Tampa Bay Buccaneers.

The city is the seat of Hillsborough Community College (1968), the University of South Florida (1960), Tampa College (1890), and the University of Tampa (1931). The MacDill Air Force Base is nearby. Inc. 1855. Pop. (1990) city, 280,015; Tampa–St. Petersburg–Clearwater MSA, 2,067,959.

**Tampa Bay,** arm of the Gulf of Mexico, indenting western Florida, U.S., 25 mi (40 km) long, 7–12 mi wide, and partly sheltered on the west by the Pinellas Peninsula. Another,

smaller peninsula extends southward toward the middle of the bay, forming Old Tampa Bay to the west and Hillsborough Bay to the east. The bay serves the recreational and commercial activities of St. Petersburg (west) and Tampa (northeast). The conquistador Pánfilo de Narváez recorded entering the bay, which he called Espíritu Santo ("Holy Spirit"), in April 1528. Hernando de Soto, the Spanish explorer, began his travels through the southeastern part of the present United States when he reached Tampa Bay on May 25, 1539. Old Tampa Bay is spanned by two bridges and a causeway. Tampa Bay is spanned by the Sunshine Skyway Bridge, a single-span bridge (completed 1987) that was built to replace the old bridge damaged by a tanker in 1980.

**Tampere,** Swedish TAMMERFORS, city, Hämeen *lääni* (province), southwestern Finland, on an isthmus traversed by the Tammer Rapids between Lakes Näsi and Pyhä, northwest of Helsinki. Founded in 1779, it remained



The cathedral, Tampere, Fin.
By courtesy of the Embassy of Finland, Washington, D.C.

undeveloped until 1821, when Tsar Alexander I of Russia encouraged its growth by granting tax-free importation of raw materials and equipment. This privilege, enjoyed until 1905, resulted in the industrial expansion of the city. In 1918 an important victory in the Finnish War of Independence was won there. The Häme Museum of History (founded 1804) is in Tampere. The city is notable for many fine examples of modern Finnish architecture by Carl Ludwig Engel, Lars Sonck, Viljo Revell, Tovio Korhonen, and Jaako Ievaskoski. The cathedral was completed in 1907.

Tampere is Finland's second largest city and industrial centre and has the country's main textile and leather plants as well as lumber mills and machinery factories. It is a lake port and major rail junction. Its factories were built into the natural surroundings according to an industrial plan; they are primarily run by hydroelectric power, thereby reducing air pollution caused by coal dust and smoke. Pop. (2000 est.) mun., 193,174.

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**Tampico,** city and port, southeastern Tamaulipas *estado* ("state"), northeastern Mexico. It lies on the northern bank of the Pánuco River, 6 miles (10 km) from the Gulf of Mexico. Tampico is almost surrounded by swampy lands and lagoons.

The city grew around a monastery founded on the ruins of an Aztec village by a Franciscan friar about 1532. Destroyed by pirates in 1683, it was not reoccupied until 1823, when General Antonio López de Santa Anna ordered that the site be settled. In 1829 a Spanish force was defeated at Tampico by Santa Anna. It was occupied for a short time by U.S. forces during the Mexican War (1846–48) and also in 1862 by the French. The arrest of some U.S. sailors in Tampico on April 9, 1914, led to the bombardment and occupation of Veracruz on April 22, 1914, by the U.S. Navy.

Several of the most productive oil fields in Mexico (including the Ebano, Pánuco, Huasteca, and Túxpan) are situated within a 100-mile (160-kilometre) radius of the city. Until 1901 it was a second-rate port, the outlet for the fertile but relatively underdeveloped hinterland, with a reputation for unhealthful and insanitary conditions. The rapid exploitation of petroleum resources, however, resulted in a marked increase of population and in improved sanitary conditions, and for several years Tampico ranked as the greatest oil port in the world. Pipelines lead from the nearby fields, and fleets of barges transport oil from farther up the river. The Chijol Canal, which was begun in 1901, affords a waterway 6 feet (1.8 m) deep and 25 feet (7.6 m) wide for about 75 miles (120 km) southward through the oil fields to Tuxpan. Spacious, modern portworks, warehouses, a union railway station within easy reach of the waterfront, and excellent equipment for loading oil tankers make Tampico the most up-to-date harbour in Mexico.

Other industrial establishments include machine repair shops, shipyards, clothing factories, canneries, and sawmills. In addition to petroleum, exports include silver bullion, agave fibre, sugar, hides, live cattle, coffee, and copper ores. The city has excellent railway facilities, road connections with the Pan-American Highway, and air service to Mexico City and Veracruz, to Brownsville, Texas, and to other points as well. A branch campus of the Autonomous University of Tamaulipas is located there. Tampico is a tourist resort, and there are fine facilities for golfing and hunting and for swimming, fishing, and other water sports. The port city and suburb of Ciudad Madero was annexed to Tampico in the 1970s. Pop. (1995) 278,933.

**Tāmraliptā,** also called TĀMRALIPTĪ (India): *see* Tamlūk.

**Tamshui,** also spelled TAMSUI (Taiwan): *see* Tan-shui.

**Tamworth,** city, east-central New South Wales, Australia, on the Peel River, a tributary of the Namoi River. It was founded in 1848 in a valley (visited in 1818 by the explorer John Oxley) by a British land-development corporation and was named after Tamworth in Staffordshire, England, which was the parliamentary constituency of the British prime minister Sir Robert Peel.

Tamworth was made a town in 1850 and a municipality in 1876. During the 1860s, it was an important coaching station. In 1946 it was proclaimed a city. Now at the junction of the Oxley and New England highways and with air and rail links to Sydney (135 miles [217 km] southeast), Tamworth serves parts of the New England and Western Slopes districts that produce livestock, poultry, fruits, vegetables, wheat, tobacco, honey, and fodder crops. Its industries include egg and dairy processing, food freezing, and lumber and flour milling; other factories produce furniture, cable, aluminum products, truck and bus bodies, and starch. The city has several notable secondary schools and an art gallery. Pop. (1996) 31,865.

**Tamworth,** district (borough), county of Staffordshire, England, at the confluence of



The castle at Tamworth, Staffordshire
Christine Gascoigne—Robert Harding Associates

the Tame and Anker rivers, on the northeastern periphery of the metropolitan area centred on Birmingham. Offa, 8th-century king of Anglo-Saxon Mercia, built a palace on the site. The present castle, of Norman origin, was largely restored in the Jacobean period (1603–49). Tamworth itself, a borough since Saxon times, grew around its medieval market and was incorporated in 1560. The present Tamworth is the centre of an agricultural and coal-mining area, and its industries include agricultural engineering, textiles, asbestos, and aluminum ware. Its area is 12 square miles (31 square km). Pop. (1998 est.) 73,900.

**Tan, N.A.,** also called V.G. TAN: *see* Bogoraz, Vladimir Germanovich.

**Tan Cheng Lock,** also spelled TAN CHENG-LOCK (b. April 5, 1883, Malacca, Straits Settlements [now in Malaysia]—d. Dec. 8, 1960, Malacca, Malaya). Malaysian Chinese community leader, politician, and businessman.

Born into a wealthy Straits Chinese family with shipping and plantation interests, Tan Cheng Lock was an early beneficiary of the economic growth of Malaya under colonial rule. He invested especially in rubber and banking. He also acquired great familiarity with the classical European philosophers and in later life frequently used his knowledge to enliven his political discourse.

He first entered public life through the Straits Chinese British Association during World War I and in 1923 was appointed to the Legislative Council of the Straits Settlements, emerging there as the most outspoken of local Chinese leaders. Campaigning against the "pro-Malay" policy of the time, he argued for a united (and eventually self-governing) Malayan society in which all ethnic groups, immigrant as well as indigenous, would have equal rights. In 1933 he became the first Asian member of the Straits Settlements Executive Council, in part, perhaps, because of his support of the government's ban on the Kuomintang the previous year and his strongly expressed view that Malayan Chinese should be loyal only to Malaya.

During the Japanese occupation, which he spent in India, Tan Cheng Lock formed an Overseas Chinese Association designed to exert some influence on British post-war planning, though it seems probable that it was less concerned with political matters than with economic reparations. The Malayan Union scheme, with which the British returned to Malaya, proposed a unitary state with a com-

mon citizenship. The plan was similar to that sought by Tan Cheng Lock, and its rejection by the Malays drew him more directly into political activity for its support, sometimes with such strange bedfellows as the left-wing coalition known as the All-Malaya Council for Joint Action. When the outbreak of the Communist Emergency in mid-1948 interrupted all legitimate political activity, Tan Cheng Lock was among a small number of politically safe figures who from late 1948 took part in the British-sponsored Communities Liaison Committee, designed to lessen communal discord and work toward national unity. When the Malayan Chinese Association was formed in 1949, first as a welfare association and then as the first, full-fledged, centrist Malayan Chinese political party, Tan Cheng Lock was an almost inevitable choice to head it. He remained its president up to and beyond independence in 1957, though increasingly in a titular role.

**tan-e,** Japanese wood-block prints hand-coloured with an orange-red tone. *Tan-e* were produced in the Edo period from the late 17th century through the first quarter of the 18th century by Ukiyo-e (*q.v.*) artists.

**Tan Malaka, Ibrahim Datuk** (Headman) (b. 1894—d. April 16, 1949, Blitar, Java), Indonesian Communist leader who competed with Sukarno for control of the Indonesian nationalist movement.

Tan Malaka was a Minangkabau (a people of Sumatra) and a schoolteacher. When he returned in 1919 from Europe, where he was educated, he began to espouse Communist doctrines. The Communists had been working with the leading nationalist group, the Sarekat Islām (Islāmic Association) but in 1921 they split off and moved in the direction of revolutionary action, still trying to take with them local branches of Sarekat Islām. The following year Tan Malaka attempted to convert a strike of government pawnshop employees into a general strike, but the effort failed, and Dutch officials ordered him to leave the Dutch East Indies.

Tan Malaka represented Indonesia at the Fourth Congress of the Comintern (Communist International) in 1922, when he was appointed Comintern agent for Southeast Asia and Australia. He opposed as premature a Communist-backed rebellion in 1926 and was blamed by its proponents for the uprising's failure. The next year, however, he organized a group in Bangkok called the Indonesian Republic Party; its aim was to develop underground cadres to work in Indonesia. The party gained strength, but with little visible success in weakening colonial rule.

Tan Malaka returned to Java in 1944, during the Japanese occupation in World War II, and afterward competed for power against Indonesian president Sukarno. Sukarno, however, outmanoeuvred Tan Malaka by bringing Sutan Sjahrir to power as prime minister. Tan Malaka responded by creating a coalition, called the Persatuan Perdjuangan (United Struggle), to oppose any negotiated settlement with the Dutch, which Sjahrir favoured. When Sjahrir resigned in February 1946, Tan Malaka was asked to form a Cabinet. The members of the coalition failed to reach accord, however, and Sjahrir was recalled. Tan Malaka then either attempted a coup or was caught up in the plans of others and was arrested on July 6, 1946, and held for two years without trial. On his release he supported a new political party, the Partai Murba (Proletarian Party). At that time the Dutch and Indonesians were at war for control of the country, Sukarno and Mohammad Hatta were prisoners of the Dutch, and much of the Communist leadership had been killed. In December 1948 Tan Malaka made a bid for control of the Indonesian revolution. From the city of Kediri, Java, which remained in Indonesian hands, Tan Malaka proclaimed himself head of Indonesia. When the Dutch attacked Kediri, he escaped but within a few months was captured and executed by supporters of Sukarno.

Tan Malaka wrote several political works; the best known is the autobiographical *Dari Pendjara ke Pendjara* ("From Prison to Prison"). He was a powerful, moving force in the creation of Indonesia but, after 1966 and the massacre of Communists, his name went into eclipse.

**Tan-shui,** also spelled TAMSHUI, or TAMSUI, coastal *chen* (town) in T'ai-pei *hsien* (county), northern Taiwan, on the northern bank of the Tan-shui Ho (river), northwest of Taipei.

Tan-shui is the oldest of the port settlements in northern Taiwan. The area was occupied by the Spanish in the 1620s after they had seized Chi-lung (*q.v.*) farther east. In 1642 the Spanish were driven out by the Dutch, and in 1662 the Dutch in their turn were expelled by Koxinga (Cheng Ch'eng-kung), a man of mixed Chinese–Japanese parentage who ruled the island for a time; the port was restored to Chinese control in 1683.

In the early 18th century, trade began with the interior of the island, and strong links were built up with the merchant communities in Foochow and Ch'üan-chou in Fukien Province (*sheng*) on the Chinese mainland. In 1860 the port was opened to foreign trade as a treaty port. For the next few years Tan-shui became a centre of the growing Taiwan tea industry, founded by settlers from Fukien. This tea was shipped to Foochow and thence to Europe; by the end of the 19th century, Foochow was shipping more tea from Tan-shui than from Fukien itself.

Occupied by the French during the Sino-French War of 1883–85, Tan-shui was further developed in the late 1880s, when a shipping route was opened from Tan-shui to Shanghai, Hong Kong, and Singapore. Upon the completion of the railway line to the port of Chi-lung, however, and the increasingly serious silting of the Tan-shui Estuary, the port declined. It is now a seaside resort for the nearby capital city of Taipei. Pop. (1998 est.) township, 108,500.

*Consult the* INDEX *first*

**Tan-Tan,** town, provincial capital, and province, Sud region, southwestern Morocco. The town, about 16 mi (25 km) by road east of the Atlantic Ocean in the extreme northwestern reaches of the Sahara, is a military post and market centre for the Regeibat and Tekna nomads that live in the area. The annual *mūsim,* a commercial and religious fair, attracts traders and nomads from as far away as Senegal and Marrakech; camels and sheep are exchanged for grains, tea, sugar, and other necessities.

Tan-Tan province fronts the Atlantic Ocean (northwest), and is bounded by the provinces of Guelmim (east) and the Moroccan administered provinces of es-Semara (south) and Laâyoune (or El Aaiun; southwest) in the Western Sahara disputed (since 1976) territory. It embraces an area of 6,678 sq mi (17,295 sq km). The territory that now comprises Tan-Tan province became a part of the Spanish Protectorate of Morocco (the area defined as an integral part of Morocco by a Franco-Spanish convention in 1912) known variously as the Tekla zone, Tarfaya zone, or Spanish Southern Morocco. This region was returned to Morocco in 1958 and in 1976 Tan-Tan province was established in its northwest corner. Tan-Tan has been the site of warfare between Moroccan troops and the Western Saharan Polisario Front guerrillas; guerrillas raided Tan-Tan town twice in 1979.

The province is a relatively flat, stony plain with occasional intermittent stream beds, low-lying mountains, ridges, and saline depressions; sand dune beaches and high cliffs are found on the Atlantic coast. Ocean fog preserves limited scrub growth near the coast. Nomads are increasingly raising sheep rather than camels, and practicing transhumance. Pop. (1994) town, 45,800; province, 58,100.

**Tan-t'u** (China): *see* Chen-chiang.

**Tan-tung,** formerly (until 1965) AN-TUNG, Pinyin DANDONG, or ANDONG, city, southeastern Liaoning Province (*sheng*), China. A prefecture-level municipality (*shih*), its territory includes not only the municipal area but also several counties (*hsien*) occupying the entire North Korean border zone of Liaoning. It is situated some 22 mi (35 km) from the mouth of the Yalu River.

The city, known as An-tung until 1965, took its name from that of the protectorate general set up in southern Liaoning by the T'ang dynasty (618–907) in the mid-7th century. In the late 16th century the Ming dynasty (1368–1644) constructed a fort, Chen-chiang-pao, at what is now called Chiu-lien-ch'eng, some 2½ mi northeast of the modern city; during the late period of the Ming dynasty and early part of the Ch'ing dynasty (1644–1911/12), it held an important strategic position. The surrounding area was only sparsely peopled until the mid-19th century, but after it was opened for colonization in 1862–74, it was quickly settled, largely by immigrants from Shantung Province; in 1876 it was constituted a county town with a regular civil administration. As the town grew, it became the natural outlet for the Ch'ang-pai Shan (mountains) area and a centre of trade between Korea and Manchuria (now known as the Northeast). It became a collecting centre for agricultural produce, especially soybeans from the surrounding district, and was even more important as a timber exporting port. It developed a large junk fleet engaged in the coastal trade to Tientsin, Shanghai, and Shantung Province. It was opened to foreign trade as a treaty port in 1907.

Early in the 20th century its importance was enhanced by the construction of a railway joining it to Shen-yang (Mukden). Built by the Japanese Army during the Russo-Japanese War (1904–05), it passed under Japanese control according to the Treaty of Portsmouth; An-tung then became an important outlet for Manchurian goods. It was, however, a poor natural port, situated 22 mi from the sea on a river that rapidly silted up. During the Japanese occupation (1931–45), construction of a modern deepwater port at Tung-kou was begun at the mouth of the Yalu, but this was never completed. In 1933 An-tung was designated as one of the principal centres for industrial development. A large textile industry grew, and lumber processing and wood-pulp plants were installed.

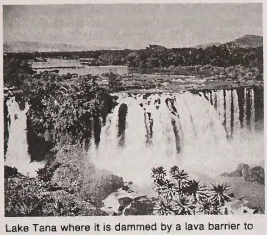
Since 1949 the city's industrial growth has continued. Its industry is highly diversified. The textile industry now includes cotton and silk weaving, silk reeling, and the making of synthetic fibres. There is a large paper and wood-pulp industry, and a diversified chemical industry producing pharmaceuticals and industrial chemicals; there is also a rubber industry and various engineering undertakings. Pop. (2001 est.) 528,000.

**tana** (Jewish scholar): *see* tanna.

**Tana** (Russian S.F.S.R.): *see* Azov.

**Tana** (Vanuatu): *see* Tanna.

**Tana, Lake,** largest lake of Ethiopia, in a depression of the northwest plateau, 6,000 ft (1,800 m) above sea level. It forms the main reservoir for the Blue Nile (Abbay) River, which drains its southern extremity near Bahir



Lake Tana where it is dammed by a lava barrier to form Tisisat Falls, Ethiopia

R.P. Livingston

Dar. The lake's surface covers 1,418 square miles (3,673 square km), with a surrounding drainage of 4,500 square miles (11,650 square km); its maximum depth is 45 feet (14 m). The reputed source of the Blue Nile is the Little Abbay, which rises south of the lake near Mount Amedamit; it is the longest (about 85 miles [135 km]) of the lake's 60 tributaries.

The lake was known to the ancient Greeks as Pseboa or Koloe. Coptic monasteries were built on Dak and Daga islands in the lake during the Middle Ages and were visited by Portuguese Jesuits in the 16th and 17th centuries. The Scotsman James Bruce, seeking the source of the Nile, reached the southern shores of Lake Tana in 1770.

The alluvial Dembea plains on the lake's northern shore and Fogera on the east indicate that the lake was at one time larger. Near Bahir Dar, the lake is dammed by a lava barrier over which the Blue Nile pours, dropping 138 feet (42 m) to form the spectacular Tisisat Falls (a section of which has been harnessed for hydroelectric power).

With abundant rainfall, the lake region produces grains, oilseeds, and coffee. Cattle raising is important, as is fishing, carried on from the ancient *tanqua* (papyrus reed boat).

**Tana River,** river, Kenya, flowing 440 miles (708 km) from its headwaters in the Aberdare Range and Mount Kenya to the Indian Ocean. Taking a northeasterly course at first, the river plunges over the Kitaru (Seven Forks) Falls (440 feet [134 m]) into a semidesert landscape that constitutes its middle course. Describing a wide arc, the Tana then veers south and opens into a wide valley, where it meanders through a floodplain subject to inundations. Kenya's longest river, it reaches the Indian Ocean at Formosa Bay, Kipini, but a former outlet lies 20 miles (32 km) southwest.

The river is navigable by small craft for about 150 miles (240 km) upstream, often with difficulty. In the upper catchment, Sasumua Dam provides water for Nairobi. Kindaruma, at Seven Forks, is the site of a hydroelectric project, and an irrigation project at Embu provides water for rice cultivation.

**Tanabe Hajime** (b. Feb. 3, 1885, Tokyo, Japan—d. April 29, 1962, Maebashi, Gumma prefecture), Japanese philosopher of science who attempted to synthesize Buddhism, Christianity, Marxism, and scientific thought. He taught the philosophy of science at Tōhoku Imperial University in Sendai from 1913 and later at Kyōto Imperial University, where he succeeded the foremost modern Japanese philosopher, Nishida Kitarō.

After studies at the universities of Berlin, Leipzig, and Freiburg (1922–24), Tanabe wrote his major early work, *Sūri tetsugaku kenkyū* (1925; "A Study of the Philosophy of Mathematics"), which made him the leading Japanese philosopher of science. In the late 1920s and into the 1930s, he developed "the logic of the species"—the "species" signified the nation as a historical mediating force between the individual and mankind. Tanabe departed from Nishida's "logic of field," which was thought to emphasize the individual to the detriment of the historical aspect of humanity. Tanabe's *Shu no ronri no benshōhō* (1947; "Dialectic of the Logic of the Species") was published in the midst of the post-World War II turmoil.

Works on Tanabe's syncretic approach to Christian love and Buddhistic "nothingness" include *Jitsuzon to ai to jissen* (1946; "Existence, Love, and Praxis") and *Kirisutokyō no benshōhō* (1948; "The Dialectic of Christianity"). In the postwar years, Tanabe developed his philosophy of metanoetics, which proposed that the only way to transcend noetics (speculative philosophy on the subjective aspect or content of experience) is to undergo a complete metanoia in the death-and-rebirth phenomenon of conversion.

**tanager,** any of numerous songbirds of New World forests and gardens, chiefly in the tropics, constituting most of the subfamily Thraupinae (formerly Tanagrinae), of the family Emberizidae. The subfamily includes 200 to 220 species, confined to the Americas.



Summer tanager (*Piranga rubra*)

Hal H. Harrison—The National Audubon Society Collection/Photo Researchers

Most tanagers are 10 to 20 cm (4 to 8 inches) long and have short necks, with bills of varying shape, slightly toothed and hooked. As a group tanagers are noted for the brilliancy of their plumage; reds, yellows, greens, blues, and black in solid colours are common and are sometimes arranged in striking patterns. The sexes may be similar in colour, or the female may be much duller than the male. Most tanager species are arboreal in habit, living in treetops, undergrowth, or shrubbery. Fruit is an important part of their diet, though some species eat insects. The birds' nesting behaviour is varied, and the clutch size varies from two to four eggs in number.

The three species of tanagers breeding in temperate North America are the scarlet tanager (*Piranga olivacea*), summer tanager (*P. rubra*), and western tanager (*P. ludoviciana*). A less showy bird, the hepatic tanager (*P. flava*), has a greater breeding range: from southern Arizona to central Argentina. The most striking tropical genus is *Tangara:* about 50 small species sometimes called callistes. An example is the paradise tanager (*T. chilensis*), called *siete colores* (Spanish) from its seven hues, including green, scarlet, and purple. The euphonias (*Tanagra* species) are found from Mexico southward; they should not be confused with *Tangara* species (above). Of the eight species of *Thraupis,* the blue, or blue-gray, tanager (*Th. episcopus,* sometimes *virens*) is common from Mexico to Peru and is introduced in Florida.

The thrush-tanager (*Rhodinocichla rosea*), found in lowlands from Mexico to Venezuela, may deserve family rank (Rhodinocichlidae). The swallow-tanager (*q.v.*) is of another subfamily entirely.

**Tanagra,** Modern Greek TANÁGRA, city of ancient Boeotia, Greece. It is situated in northern Attica on the left bank of the Asopós River near Thebes and Chalcis (Khalkis). The nearly circular hill of the ancient ruined city, just southeast of the present village, was first occupied by the Gephyreans, an Athenian clan. It rose subsequently to be the chief town of the eastern Boeotians, with lands extending to the Gulf of Euboea.

An early rival of Thebes, Tanagra probably assumed leadership of the Boeotian confederacy following the Greco-Persian Wars when it took over the clay-working industry of devastated Thebes. During the first Peloponnesian War in 457 BC, Athens and its allies lost a battle at Tanagra to Sparta and its allies, thus precipitating a decline from which Tanagra revived only in the Hellenistic period; in Roman times it was the cultural centre of Boeotia.

There is little left of ancient Tanagra save its ruined walls and gates, but the Tanagra site is known for the discovery in 1874 of a large cache of finely modeled, cast terracotta figurines. Bearing traces of their original blue-and-pink patina, the delicate pieces were widely imitated in their own time, with Tanagra work spanning the period from about 340 to 150 BC. The earliest figurines unearthed from the necropolis along the Asopós River focus on divinities; later pieces represent a variety of familial and domestic themes, particularly the female Graces. The finest examples, from the late 4th and 3rd centuries, compare favourably with the life-size work of the great masters of classical Greece, which they not infrequently imitated.

A large aircraft maintenance and repair industry was set up in 1979 not far from Tanagra. Pop. (1981) 1,097.

**Tanagra figurine,** any of the small terracotta figures dating primarily from the 3rd century BC, and named after the site in Boeotia, in east-central Greece, where they were found. Well-dressed young women in various positions, usually standing or sitting, are the main subject matter of the statuettes. On occasion the figures pull their garments around them closely, veiling the face, or they may wear a hat or hold a fan or mirror. The



Terra-cotta figurine from Tanagra, Greece, 4th century BC

By courtesy of the Metropolitan Museum of Art, New York City, Rogers Fund, 1906

Tanagra figurines were all manufactured with molds, but the use of separate molds in combination (different arms, heads) lent interesting variation. The figures were all originally covered with a white coating and then painted. The garments were generally bright shades—blue, red, pink, violet, yellow, and brown. The flesh was reddish or pinkish, the hair auburn, the lips red, and the eyes blue. Gilt and black were used for details. The authentic statuettes that survive are missing their white coating and bright paint. On their discovery in the 19th century they became enormously popular and were extensively and expertly forged, even with paint.

**tanaid,** any of more than 300 species of small, bottom-dwelling marine and brackish-water crustaceans constituting the order Tanaidacea (superorder Peracarida). Tanaids have a world-wide distribution; they are especially numerous in shallow marine habitats but also occur at considerable depths in the deep sea. The body of these invertebrates is typically elongate and slender and measures about 2 to 25 mm (0.08 to 1 inch) in length. The thorax has seven pairs of walking legs, the first of which has a large pincerlike claw (chela) for clasping and the second specialized for burrowing. The abdomen has five pairs of swimming limbs and a pair of posterior appendages. Tanaids live on or in soft sediments and feed on organic detritus and plankton. Several species inhabit delicate tubes, which they build with fibrous secretions from several of their thoracic limbs. Eggs and developing young are carried by the female in a ventral brood pouch.

**tanaim** (Jewish scholars): *see* tanna.

**Tanaina,** a North American Indian people, the only northern Athabascan-speaking Indians occupying extensive portions of the seacoast. They lived chiefly in the drainage areas of Cook Inlet and Clark Lake in southern Alaska. Tanaina, meaning "people," was their own name for themselves; they have also been called Knaiakhotana ("People of the Kenai Peninsula").

The Tanaina depended mainly on salmon and other fish (as well as shellfish) but also hunted bear, mountain sheep and goat, moose, caribou, and other game for both skins and food. Their dwellings consisted of semisubterranean log-and-sod houses for winter use and a variety of huts for summer use during the salmon runs; the huts also served as smokehouses for drying the fish catch. For transportation they used the skin-covered kayak and umiak, as well as snowshoes and sleds.

The Tanaina were divided into several tribes, or subgroups, each split into exogamous halves, or moieties, composed of clans. There were two social classes—nobles and commoners—and a village usually had a chief, who exercised a kind of fatherly guidance. Organized leadership, with real leaders and councils, usually developed only for warfare and raiding (their chief foes being the Eskimo). The Tanaina used the potlatch to increase their personal prestige through the ostentatious giving of gifts. In religion the Tanaina believed that all things in nature were animate and suffused with supernatural powers and that guardian spirits shadowed everyone. Taboos, tokens, and amulets were numerous. Shamans, the mediators with the spirit world, were very influential; some were chiefs.

**Tanaka Giichi,** BARON (Danshaku) (b. July 25, 1863/64, Yamaguchi prefecture, Japan—d. Sept. 29, 1929, Tokyo), prime minister (1927–29) and author of Japan's aggressive policy toward China in the 1920s.

Tanaka distinguished himself in the Russo-Japanese War and as a member of the Japanese army stationed in Manchuria in the early 1900s. Appointed minister of war in 1918, he was one of the most forceful advocates of Japanese involvement in a Siberian expedition against the new Soviet regime in Russia. The civilian leaders of the cabinet finally acquiesced when the United States and other Western countries also sent troops to Russia, but Tanaka, who had dreams of a Japanese empire in Siberia, conspired among his own military associates to send in many times the number of Japanese troops originally agreed upon and to keep them there long after other countries had withdrawn their forces.

Created a baron in 1920, Tanaka joined the dominant Friends of Constitutional Government (Rikken Seiyūkai) political party and was elected in 1925 to its presidency. As a result he became prime minister in 1927. Although his foreign policy seemed more belligerent than that of his predecessors, Tanaka continued to seek international cooperation, pursuing trade and economic interests in China but remaining adamant about retaining Japanese control in southern Manchuria. In 1927 he intervened against Chiang Kai-shek's Northern Expedition by blocking its progress in Shantung. Tanaka's aggressive tone toward China provoked an anti-Japanese reaction on the Chinese mainland. His efforts to deal with the 1927 economic crisis in Japan led to an inflationary spiral in the country and caused social unrest. When he moved to punish army officers involved in the assassination of the Manchurian leader Chang Tso-lin, the army refused to back him, and his cabinet fell. Tanaka died a short time later.

The "Tanaka Memorial," a document in which he supposedly advised the emperor to adopt an expansionist policy in China, has been shown to be a forgery.

**Tanaka Kakuei** (b. May 4, 1918, Kariwa, Niigata prefecture, Japan—d. Dec. 16, 1993, Tokyo), politician who was prime minister of Japan from 1972 to 1974 and who subsequently became the central figure in a major political scandal.

Tanaka was the only son of a bankrupt cattle dealer. He dropped out of school at the age of 15 and soon opened his own construction firm, the Tanaka Civil Engineering Company. His business prospered during World War II, largely because of military contracts, and he became one of the richest men in Japan. Entering politics, he was elected to a seat in the lower house of the Diet (parliament) in 1947 and rose rapidly through the ranks of the powerful Liberal-Democratic Party to become minister of postal services and communications in 1957. Resigning from that post in 1958, he then served as minister of finance from 1962 to 1964. He became one of his party's most powerful politicians and was made secretary-general of the party in 1965 and again in 1968.

After serving as minister of international trade and industry in the cabinet of Satō Eisaku, prime minister from 1964 to 1972, Tanaka succeeded the latter in a surprising upset victory over Satō's chosen successor, the former foreign minister Fukuda Takeo. Tanaka was a vigorous and popular prime minister; he pushed through many government projects and was responsible for economically revitalizing much of western Japan. He also established diplomatic relations with the People's Republic of China. Japan's economic growth slowed and inflation rose during his time in office, however, and in the elections of July 1974 his party made a poor showing. These problems, added to charges that he had profited illegally by means of his office, led to his resignation in December 1974.

Tanaka was arrested in July 1976 and indicted the following month on the charge of having accepted, while prime minister, about $2,000,000 in bribes from the Lockheed Aircraft Corporation in order to influence All Nippon Airways to buy that company's jet airliners. Despite the political cloud that enveloped him after the indictment, he continued to rule over the largest faction of the Liberal-Democratic Party; he thus had a major voice in the selection of three subsequent Japanese prime ministers. After a seven-year trial, Tanaka was convicted in 1983 of bribery and another charge and was sentenced to a fine of 500 million yen and four years in prison. He suffered a serious stroke in 1985, while his conviction was on appeal, and thereafter his power and influence waned.

**Tanaka Ōdō,** original name TANAKA KIICHI (b. 1867, Tomioka, Saitama prefecture, Japan—d. May 9, 1932, Tokyo), Japanese philosopher and critic who promoted within Japan the Western philosophy of pragmatism.

After learning English, Tanaka went to the United States in 1889 and studied first at the College of the Bible, a theological seminary in Kentucky, and later at the University of Chicago. He was profoundly influenced by such American philosophers as William James, George Santayana, and especially John Dewey at Chicago. After his return to Japan Tanaka taught at Waseda and Rikkyō universities and devoted himself to the study and promotion of pragmatism. In an effort to make pragmatism useful in Japanese society, Tanaka advocated combining functionalism with instrumentalism (*i.e.,* having ideas represent the instruments for actions). He made use of his philosophy to attack the naturalism that was popular in early 20th-century Japanese literature. He was, in addition, a strong proponent of democracy and believed that it should be based on individualism.

Tanaka wrote numerous books, including *Shosai yori gatō ni* (1911; "From the Study to the Street"), *Tetsujin shugi* (1912; "Philosophical Principles"), and *Shōchō shugi no bunka e* (1924; "On the Culture of Symbolism").

**Tanala,** also called ANTANALA, a Malagasy people living in southeastern Madagascar who are separated from the coast by the Antaimoro and other ethnic groups. They are divided into two subgroups: the Tanala Menabe in the mountainous north and the Tanala Ikongo dwelling in the more accessible southern part of the Tanala homeland. Tanala Menabe villages are isolated; they are built on mountain tops and are hidden in the dense forest. The Tanala speak Malagasy, the West Austronesian language common to all Malagasy peoples. At the time of the French conquest in 1895, the northern Tanala were under Merina domination while the southern Tenala still held many independent fiefdoms.

Tanala ("People of the Forest") are skilled woodsmen, food gatherers, and hunters. They trade beeswax, honey, and other forest products and engage in slash-and-burn agriculture, growing rice as a staple. The central government is encouraging the Tanala to use more modern agricultural methods in the cultivation of rice and coffee. The Tanala observe patrilineal descent and often live in large compounds consisting of a father and his sons or of a group of brothers.

**Tanana,** a small Athabascan-speaking tribe of North American Indians that lived along the headwaters of the Tanana River in central Alaska. They were nomadic hunters, relying chiefly on caribou, moose, and mountain sheep for both food and clothing, and lived in skin-covered domed lodges in winter and in bark or brush lean-tos or huts in summer.

In social organization they were divided into several loosely led clans that changed often in composition because of mergers, divisions, and migrations.

The potlatch was a means of ostentatiously distributing gifts and increasing personal prestige. Although the central person in Tanana religious life was the shaman, the re-

ligion was highly individualized; each person developed his own beliefs, practices, amulets, and taboos.

**Tanana River,** river, east central Alaska, U.S., an important tributary of the Yukon River. Arising from two headstreams, the Chisana and Nabesna rivers, and fed from glaciers high in the Wrangell Mountains of southeastern Alaska, the river flows 550 mi (885 km) from the head of the Chisana northwestward along the base of the Alaska Range to join the Yukon River near the village of Tanana. The Tanana was named from the Athabascan Indian term for river trail, and it was first explored by Russian traders in the mid-19th century. Its valley, an important gold-producing area made famous in 1904 by the gold rush, is also a lumbering district and one of Alaska's major farming regions, producing potatoes, truck crops, and small grains. Fairbanks, the terminus of the Alaska and Richardson highways (which follow the river west of the Yukon Territory, Canada) and of the Alaska Railroad (from the port of Seward), is the commercial and distributing centre of the Tanana Valley.

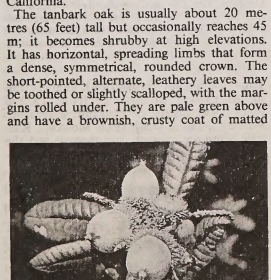
**Tananarive** (Madagascar): *see* Antananarivo.

**Tanaquil,** legendary Etruscan prophet, the wife of Tarquinius Priscus, traditionally the fifth king of Rome.

According to legend she married the low-born Lucumo (as Tarquinius was originally called) in the Etruscan city of Tarquinii; through her prophetic powers she saw that their fortunes and social status would improve if they settled in Rome. At Rome, Lucumo adopted the Latin name Lucius Tarquinius, and Tanaquil reportedly changed hers to Gaia Caecilia. Tarquinius is said to have ruled Rome from 616 until he was murdered in 578. Tanaquil then won the crown for her son-in-law, Servius Tullius. She earned renown for her skill at spinning and weaving. The Roman writer Pliny (1st–2nd century AD) reported that there was a statue to her as Gaia Caecilia in the temple of Semo Sancus, where her distaff and spindle were preserved as relics. Thus she became a model of virtue for Roman brides. Scholars have, however, concluded that Tanaquil and Gaia Caecilia were probably distinct characters.

**tanbark oak,** also called TANOAK (*Lithocarpus densiflorus*), oaklike ornamental evergreen tree with tannin-rich bark. It is a member of the beech family (Fagaceae) and is native to coastal areas of southern Oregon and northern California.

The tanbark oak is usually about 20 metres (65 feet) tall but occasionally reaches 45 m; it becomes shrubby at high elevations. It has horizontal, spreading limbs that form a dense, symmetrical, rounded crown. The short-pointed, alternate, leathery leaves may be toothed or slightly scalloped, with the margins rolled under. They are pale green above and have a brownish, crusty coat of matted hairs below; the undersides become bluish white as the hairs are shed during the summer.



Tanbark oak (*Lithocarpus densiflorus*)
Eugene Memmler

The flowers of the tanbark oak resemble those of the chestnut, but the fruit is oaklike in appearance. Most male flowers are borne in long, erect catkins; female flowers are usually in clusters at the base of male catkins. The fruit, a single nut, is held in a scaly, burrlike cup.

The tanbark oak is cultivated as an ornamental in cooler regions of the temperate zone. Its hard, light-brown, red-tinged wood is used for agricultural implements and furniture. The bark chips are used in tanning leather and as a mulch.

**tanbur,** also spelled TAMBUR, long-necked lute played under various names from the Balkans to northwestern Asia. Closely resembling the ancient Greek *pandoura* and the long lutes of ancient Egypt and Babylon, it has a deep, pear-shaped body; a fretted neck; and 2 to 10 double courses of metal strings fastened with front and side tuning pegs without a pegbox.

The tanbur has remained popular since medieval times. Its derivatives include the Greek *buzuki,* the Romanian *tamburitza,* and the Indian sitar and tambura.

**Tancred,** Italian TANCREDI (d. Feb. 20, 1194, Palermo), king of Sicily whose brief reign marked the end of the Norman rule there.

An illegitimate son of Duke Roger of Apulia and grandson of Roger II, king of Sicily, Tancred joined an insurrection in 1155 against his uncle William I of Sicily and was imprisoned for five years. Released, he participated in another abortive coup in 1161 and went into exile.

Thirteen years later, forgiven his disloyalty to William I, Tancred led William II's expedition against Alexandria and later commanded a Sicilian fleet. William II's death in 1189 without direct heirs found Tancred a serious contender for the throne. Opposed by the feudal barons but backed by the people and the papacy, he was crowned king in 1190. The first year of his reign was troubled by an anti-Muslim riot and by the stormy visit of Richard I the Lion-Heart of England and Philip Augustus of France on their way to the Third Crusade. Richard demanded a legacy promised him by William II and the restoration of the dowry of his sister Joan, William's widow. During the six months he spent in Sicily while negotiations continued, Richard provoked a riot in Messina, which he then put down by plundering, burning, and occupying the city. Tancred bought peace by yielding to Richard's financial demands, and in March 1191 Richard departed.

In 1191 the Holy Roman emperor Henry VI, who claimed the Sicilian throne through his wife, Constance I (daughter of Roger II), marched south to claim Constance's inheritance. He invaded Tancred's mainland territory and unsuccessfully besieged Naples. Constance remained in Salerno when he retreated and fell into Tancred's hands. Tancred gave in to pressure by the pope to release his valuable hostage to papal custody, but en route Constance managed to escape and return to Germany.

Three years later Henry made a fresh attempt on Sicily, his campaign partly financed by the ransom paid for Richard I the Lion-Heart, who had been made a prisoner in Germany. Before Henry reached Sicily, Tancred died suddenly, leaving only a young son, William III. The barons rallied to Henry, who was crowned king of Sicily on Christmas Day, 1194. Tancred's family was promised safe conduct but, under pretext of the discovery of a plot, was seized and sent in captivity to Germany, where William III died, probably murdered, ending the 125-year Norman rule of Sicily.

**Tancred** OF HAUTEVILLE, French TANCRÈDE DE HAUTEVILLE (d. Dec. 12, 1112, Antioch), regent of Antioch, one of the leaders of the First Crusade.

Tancred was a Norman lord of south Italy. He went on the crusade with his uncle, Bohemond (the future Bohemond I of Antioch), and first distinguished himself in Cilicia, where he captured Tarsus from the Turks and came into conflict with his fellow crusader, Baldwin of Boulogne. He played a prominent part in most of the major battles of the crusade, and after the capture of Jerusalem (1099) he received the title prince of Galilee. He served as regent of the principality of Antioch for Bohemond while the latter was a prisoner of the Turks (1101–03), and controlled Antioch permanently after Bohemond returned to Europe in 1104.

As regent of Antioch, and also of Edessa from 1104 to 1108, Tancred became the chief Latin magnate of northern Syria, and engaged in continual warfare with both the Turks and the Byzantines until his death. The portrayal of Tancred by Torquato Tasso in the Italian epic poem *Gerusalemme liberata* is largely imaginary.

**Tancredi** (Italian personal name): *see under* Tancred.

**Tandil,** city, southeastern Buenos Aires province, Argentina, within the Pampa at the northern end of the Sierra del Tandil. It was founded in 1823 by the colonial governor Martín Rodríguez, but after Indian attacks in 1856 the majority of settlers fled, not returning until some years later. Tandil was declared a city in 1895. Its clear air and hill scenery have made it both a health and a pleasure resort. Its outstanding Holy Week festivities, reminiscent of those held in Seville, Spain, draw large numbers of tourists. In 1961 a dam was built on the city outskirts to control seasonal flooding of the Fuerte and Blanco streams. The economy is based on agriculture; cattle raising is of some significance, and there is light industrial development. Pop. (1998 est.) 79,400.

**tandoori cookery,** an Indian method of cooking over a charcoal fire in a *tandoor,* a cylindrical clay oven. Shaped like a large urn, a *tandoor* is at least one metre in height and is often sunk up to its neck in the earth. *Tandoori* cooking is believed to have originated in Persia and is found in some form throughout Central Asia. A charcoal fire is built in the *tandoor* and allowed to burn for several hours to heat the oven. Meats cooked in the *tandoor* are marinated in yogurt and spices and threaded on long skewers that are placed vertically in the oven with one end resting in the ashes. The meats are coloured a bright orange-red by a natural dye, *tandoori rang,* added to the marinade. *Nan,* a leavened wheat bread, is formed into ovals and pressed against the inner neck of the *tandoor* to bake suspended over the fire. The most celebrated dish in *tandoori* cookery is *tandoori murgh,* skinless marinated whole chicken quickly grilled in the *tandoor.*

**Tandridge,** district, county of Surrey, England. It borders Greater London in the north, Kent in the east, and West Sussex in the south. It lies within easy commuting distance of central London and has excellent road and rail communications with the city. Urban expansion into the district has, nevertheless, been limited by the rugged terrain; the chalk heights of the North Downs cross Tandridge in the north, and in the south is a sandstone ridge. Much woodland remains on the slopes, and there is still some arable farming. The area of the district is 96 sq mi (250 sq km). Pop. (1998 est.) 79,400.

**Tandy, James Napper** (b. 1740, Dublin—d. Aug. 24, 1803, Bordeaux, Fr.), Irish politician, ineffectual revolutionary, and popular hero memorialized in the Irish ballad "The Wearing of the Green":

I met with Napper Tandy,
and he took me by the hand,
And he said "How's poor old Ireland,
and how does she stand?"

In the early 1780s Tandy was an artillery commander in the Irish Volunteers, and in 1791 he helped to form a Dublin branch of the radical Society of United Irishmen. Forced into exile in 1793, he made his way to Philadelphia in 1795 and to Paris in 1798, when the French government made him a general and sent him back to Ireland to raise an army against the British.



Tandy, engraving by James Heath, 1815, from an earlier drawing by James Petrie

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

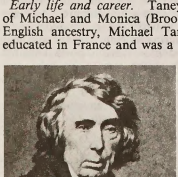
On Sept. 16, 1798, he landed at Rutland Island, off the Donegal coast, but abandoned the venture the same day. While returning circuitously to France, he was captured in Hamburg (November 1798), turned over to the British (September 1799), and, at a trial in Ireland, was sentenced to death (April 1800). He was released unconditionally, however, at the demand of Napoleon Bonaparte, and went (March 1802) to Bordeaux to live.

**Tandy, Jessica:** *see* Cronyn, Hume; and Tandy, Jessica.

**Taneev, Sergey (Ivanovich):** *see* Taneyev, Sergey (Ivanovich).

**Taney, Roger Brooke** (b. March 17, 1777, Calvert County, Md., U.S.—d. Oct. 12, 1864, Washington, D.C.), fifth chief justice of the Supreme Court of the United States, remembered principally for the Dred Scott decision (*q.v.*; 1857).

*Early life and career.* Taney was the son of Michael and Monica (Brooke) Taney. Of English ancestry, Michael Taney had been educated in France and was a prosperous tobacco grower in Calvert County, Md. After graduation from Dickinson College in Pennsylvania, in 1795, Taney studied law with Judge Jeremiah Chase, of the Maryland General Court. He was admitted to the bar in 1799 at Annapolis and served one year in the Maryland House of Delegates before settling down in Frederick, Md., to practice law. In 1806 he married Anne Key, whose brother, Francis Scott Key, later wrote "The Star-Spangled Banner."



Taney, photograph by Mathew Brady

By courtesy of the Library of Congress, Washington, D.C.

Taney was a member of the conservative, property-conscious Federalist Party until 1812, when the party opposed the war against England. He returned to the Maryland House of Delegates in 1816, when, as a political maverick, he was elected to the state senate. Two years after his term expired in 1821, he moved his family to Baltimore, where he was soon recognized as an excellent lawyer. Juries were impressed with his sense of fair play and his courtesy toward opposing attorneys. In 1827 he was appointed attorney general of Maryland. By this time he had aligned himself with Andrew Jackson, the leader of the Democratic Party, and when Jackson, elected president in 1828, reorganized his Cabinet in 1831, he appointed Taney attorney general of the United States.

*Fight against the Bank of the United States.* Throughout his tenure in Washington, Taney had been an outspoken leader in the Democrats' fight against the central bank, the Bank of the United States, which was widely regarded as a tool of Eastern financial interests. Taney believed it had abused its powers, and he strongly advised the President to veto the congressional bill that would renew the bank's charter and wrote much of the veto message; he also recommended that government funds be withdrawn from the bank and be deposited in a number of state banks.

As a result of his role in the fight over the Bank of the United States, Taney had become a national figure, and in 1833 President Jackson appointed him secretary of the treasury. But opposition to Taney and his financial program was so strong that the Senate rejected him in June 1834, marking the first time that Congress had refused to confirm a presidential nominee for a Cabinet post.

Taney returned to Baltimore to rebuild his law practice. A year later, Jackson nominated him to the Supreme Court of the United States as an associate justice. Taney's enemies stalled the nomination indefinitely. Then, on July 6, 1835, Chief Justice John Marshall died, and Taney was nominated to fill his place on the bench.

Despite powerful resistance, led by such prominent politicians as Henry Clay, John C. Calhoun, and Daniel Webster, Taney was sworn in as chief justice in March 1836. Although he had inherited the conservative tradition of the Southern aristocracy and had supported states' rights, the Taney court did not discard John Marshall's ideas of federal supremacy. Taney believed firmly in divided sovereignty, but he also believed it was the Supreme Court's role to decide which powers should be shared. Eventually, many of those who had opposed Taney's appointment came to respect him.

One of the most important decisions for which the Taney court is noted concerned rights granted by charters. The majority opinion in *Charles River Bridge* v. *Warren Bridge* (1837) declared that rights not specifically conferred could not be inferred from the language of a document. In this decision Taney rejected the claim of a bridge company that the subsequent grant by the state legislature of a charter to another bridge company impaired the legislature's charter to the first company.

*The Dred Scott case.* The majority opinion that Taney delivered on March 6, 1857, in *Dred Scott* v. *Sanford* is the one for which he is best known. In essence, the decision argued that Scott was a slave and as such was not a citizen and could not sue in a federal court. Taney's further opinion that Congress had no power to exclude slavery from the territories and that Negroes could not become citizens was bitterly attacked in the Northern press. The Dred Scott decision probably created more disagreement than any other legal opinion in U.S. history; it became a violently divisive issue in national politics and dangerously undermined the prestige of the Supreme Court.

Whenever state authorities threatened or interfered with the execution of federal power, however, Taney upheld federal supremacy. His opinion in *Ableman* v. *Booth* (1858), denying state power (in this case the courts of the state of Wisconsin) to obstruct the processes of the federal courts, remains a magnificent statement of constitutional federalism. Under Taney's leadership federal judicial power was expanded over corporations, the federal government was held to have paramount and exclusive authority over foreign relations, and congressional authority over U.S. property and territory was vigorously upheld. His conflict with President Lincoln over the president's suspension of a citizen's petition for a writ of habeas corpus in time of war made him an object of bitter criticism, although, eventually, many jurists came to agree with Taney's defense of an individual's constitutional rights.

Taney, a deeply religious Roman Catholic, considered slavery an evil. He had freed the slaves he had inherited before he came to the Supreme Court. It was his belief, however, that slavery was a problem to be resolved gradually and chiefly by the states in which it existed. As an adherent of the South, he could do nothing but watch the defeat of his cause. He died in Washington in October 1864. Even though his thinking ran counter to the dominant historical trends of his time, he had an enduring influence on the substance and evolution of U.S. constitutional law.

(A.J.Sc.)

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**Taneyev, Sergey (Ivanovich),** Taneyev also spelled TANEEV (b. Nov. 25 [Nov. 13, old style], 1856, district of Vladimir, Russia—d. June 19 [June 6, O.S.], 1915, Moscow), Russian composer, pianist, and theorist and the principal practitioner of counterpoint in 19th-century Russian music.



Taneyev

Hachette—J.P. Ziolo

Taneyev studied composition with Peter Ilich Tchaikovsky and piano with Nikolay Rubinstein. In 1878 he interrupted his career as a pianist to succeed Tchaikovsky at the Moscow Conservatory, where he was director (1885–89). In 1905 he resigned in protest at measures against the threatened revolution and resumed his career as pianist and composer. In 1909, after 20 years of work, he completed his two-volume study of counterpoint in the strict style. His works include the operatic trilogy *Oresteia* (1895), two trios, and a setting for chorus and orchestra of A.S. Khomyakov's "At the Reading of the Psalm" (1914).

Taneyev disliked all 19th-century music except that of Tchaikovsky, some of whose works he completed. He regarded counterpoint as a branch of mathematics and admired the Renaissance composers Jean d'Ockeghem and Josquin des Prez, Orlando di Lasso, and Palestrina, yet his finely wrought compositions show a romantic beauty. Taneyev was a great teacher, a popular eccentric, and a lifelong bachelor.

**Tanezrouft,** region of the Sahara lying in southern Algeria and northern Mali. Covering part of a plateau eastward toward the Ahaggar (Hoggar) uplands, it slopes to lower ground in the west, and farther southward lie swamps. The region lacks water, landmarks, and vegetation. It was formerly shunned by caravans but is now spanned by a trans-Saharan motor route going north-south from Béchar (Alg.) to Gao (Mali) and beyond. Poste Maurice Cortier is a fueling station on a north-south caravan route. Tanezrouft is inhabited only by a few Tuaregs. There is a vast water-bearing stratum a few thousand feet below the surface.

**T'ang ——:** for rulers of the T'ang dynasty, *see under* individual names.

**T'ang,** Pinyin TANG, also called (Wade-Giles romanization) CH'ENG-T'ANG, OR TA-I, or T'IEN-I (fl. *c.* 18th century BC), Chinese emperor who overthrew the Hsia dynasty and founded the Shang dynasty (traditionally dated 1766–1122 BC; some modern scholars believe it lasted from the mid-16th to the mid-11th century BC).

As a historical figure, T'ang was apparently a scion of a noble family. According to legend, he was a descendant of the mythical sage-king the Yellow Emperor (Huang Ti). T'ang is also said to have revolted against the evil last ruler of the Hsia dynasty after reading on the shell of a tortoise a prophecy that he would do so.

Revered as a humane and generous ruler, T'ang is said to have offered himself as a sacrifice to Heaven during a drought. Rain fell before the ceremony ended, however, and he was spared. He is usually represented as a nine-foot-tall, white-faced, whiskered man with a pointed head, six-jointed arms, and a body markedly larger on one side than on the other.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**tang,** songbird, a species of chat (*q.v.*).

**tang** (fish): *see* surgeonfish.

**T'ang** DYNASTY, Pinyin TANG (618–907), Chinese dynasty that succeeded the short-lived Sui dynasty and developed a successful form of government and administration on the Sui model and stimulated a cultural and artistic flowering that amounted to a golden age.

The first T'ang emperor, Li Yüan, known by his temple name Kao-tsu, began as a contender for the rule of the Sui dynasty, of which he had been an official. He overcame various rivals and rebels, and by 621 he controlled China's eastern plain; in 624 he added the North and South, although some rebels remained in the North throughout the dynasty. He directed many complex military operations in his tenure and established the basic institutions of the T'ang state. He emulated the first Sui emperor in establishing a highly competent bureaucracy, and he adopted the same pattern of local administration.

Because the state was bankrupt, the administration was kept small, simple, and cheap. The land-distribution system of the Sui was adopted to give every taxable male a plot and to minimize the number of large estates, and Li Yüan also took on the Sui system of taxation. He created mints and established a copper coinage that lasted throughout the dynasty. He recodified the laws with stated penalties for specific acts and provided for their review every 20 years.

The second emperor, Li Shih-min, known as T'ai-tsung, succeeded to the throne in 626 by murdering two brothers and forcing the abdication of his father, but he became one of the greatest emperors China has known. He adjusted the balance of the court aristocracy to equalize regional influences and expanded both the Sui use of examinations in literature and culture for hiring civil servants and the Sui system of high-quality schools at the capital. He further enshrined the classics and published a standard edition. He defeated his eastern Turkish enemies and spread disunity among those in the west, expanding China farther westward than ever before.

One of the most remarkable women in Chinese history, Wu-hou, intrigued her way into the role of empress during the reign of Kao-tsung (649–683). She took up residence in Lo-yang (the western capital) and ruthlessly aggrandized her role by inflating the bureaucracy during Kao-tsung's illness. Despite her excesses, she maintained a steady grip on the government until she was in her 80s, when she was forced to abdicate.

The dynasty reached the peak of its wealth and power during the early 8th century, which was a golden age for its arts. The aristocracy, scattered, murdered, and incarcerated under the empress Wu-hou, was restored and oversaw an era of reform. In the second half of the 8th century, however, rebellion broke out in the northeast and spread rapidly, forcing the emperor Hsüan-tsung to flee west to Szechwan. Although the rebellion was finally suppressed, in its wake came a period of provincial separation and later rebellion. By 818 the emperor Hsien-tsung had restored the authority of the empire throughout most of the country. In the second half of the 9th century, the government grew weaker, and rebellions recurred; the dynasty declined until 907, when it collapsed into a scattering of independent kingdoms that withstood unification for more than 50 years.

The years of the T'ang were brilliant times for the arts and culture. Major imperial ceremonies saw a revival and elaboration of the ancient orchestras and companies of courtly dancers. The musicians played on bells, stone chimes, flutes, zithers, and drums. China in this period was hospitable to foreign ideas, as Arabian and Persian seamen roved its ports and "western" music and dance found their way into China from Central Asia. In the taverns of the western capital at Ch'ang-an (Sian), western songs and dances were performed to the accompaniment of western musicians on strange instruments. Exotic troupes of dancing girls became the subject of paintings and reproduction in clay figurines. The Pear Garden at the palace was reserved for training musicians and dancers. Foreign music became a third category of music, in addition to court and common music. Before the end of the dynasty there were 10 musical categories, several of them foreign. Although no orchestral scores survive, the music for several solo pieces has been found. Late T'ang paintings show imperial entertainments with ensembles of strings, winds, and percussion, and choreographic plans for bands and dancers have also been preserved.

Poetry was the greatest glory of the period. All the verse forms of the past were used and refined, and new ones developed. Regulated verse (*lü shih*) and an abbreviated, truncated verse (*chüeh chü*) were introduced and became widely popular. Nearly 50,000 works by some 2,000 T'ang poets have been preserved. Prose stylists were concerned with lyrical expression and rhetorical devices for artistic effect.

Heroic sculpture of Buddhas was a feature of the middle T'ang; and, although no works of this size and period survive in China, several do in Japan, which was profoundly influenced by the administration, arts, culture, and religion of the T'ang dynasty.

Painting played a major role in the culture of the era, and painters were important court figures. One of the T'ang ministers of state, Yen Li-pen, is far better known as a painter than as a statesman. The greatest master of figure painting of the dynasty was Wu Tao-tzu, who did 300 wall paintings in temples at Lo-yang and Ch'ang-an. A painter of horses was a great favourite in an era when military steeds were a matter of life and death and when court ladies played a form of polo. Landscape painting was dominated by Wang Wei, who was also an official at the court in the western capital. A new freedom with brushwork developed to provide a wider range of effects of texture and tone. Ch'an, or Zen, Buddhist painters brought still further freedom with the brush to religious painting.

Pottery made huge strides after the sterility of the Six Dynasties period. Finishes in white porcelain, three-colour pottery and figurines, stoneware with a rich black glaze, and a type of celadon all were developed by T'ang potters; and, in keeping with the general interest in things foreign, their wares were often in foreign shapes and followed foreign motifs. Great volumes of tomb figurines were produced. Metalwork and jewelry of the period included much silver. Ritual objects included foreign shapes among the traditional Chinese forms. Silver and gold vessels were no longer cast but "raised" into bowl shape by hammering thin sheets; such vessels for drinking were double thicknesses soldered together with an insulating layer of air between them. Decorated bronze mirrors were also popular.

The T'ang dynasty—like most—rose in duplicity and murder, and it subsided into a kind of anarchy; but at its apex in the early 8th century, the splendour of its arts and its cultural milieu made it a model for the world.

**T'ang, Prince of:** *see* Chu Yü-chien.

**T'ang Jo-wang:** *see* Schall von Bell, Adam.

**T'ang-ku,** Pinyin TANGGU, town in eastern China, on the Hai River and the Gulf of Chihli. It lies on the Tientsin–Shen-yang (Mukden) railroad and is an important shipping point. T'ang-ku is also an outport for the city of Tientsin, 30 miles (48 km) westnorthwest.

The town has long been important for its salt field. During the Ming dynasty (1368–1644) production was supervised by specially appointed feudal officials. Between 1969 and 1974 the Chinese enlarged the fields; they straightened the sides and leveled the bottoms of 10,600 acres (4,300 ha) of channels, shallow ponds, and crystallizing pans and reclaimed a further 4,450 acres from the Gulf of Chihli. The field supplies a large proportion of the salt used in China's industry and food. Pop. (mid-1970s est.) 10,000–50,000.

**T'ang-ku-la Mountains,** Wade-Giles romanization T'ANG-KU-LA SHAN, Pinyin TANGGULA SHAN, mountain range in the Tibetan

Autonomous Region, China. On the southeastern high plateau south of the mountains, there are many large salt lakes. In its eastern part the range forms the boundary between Tibet and Tsinghai province. Although many peaks are higher than 19,000 feet (5,700 m), and the tallest, Basudan Ula, reaches 20,000 feet (6,096 m), the mountains do not appear to be particularly high, since the surrounding plateau averages little less than 16,500 feet (5,030 m) above sea level. The range is rather rounded in contour in the west; the most rugged and deeply incised section is in the east, where there are considerable areas of permanent snow.

The northern flank of the mountains is drained by various headwaters of the T'ungt'ien River, a tributary of the Yangtze River. The southeastern flank drains into the Nu River, the headwater of the Salween River; and the Mekong River rises at the eastern end of the range. The range is crossed by the important T'ang-ku-la Pass, which carries the main route from Lhasa (capital of Tibet) and the southern Tibetan region to the Tsaidam Basin and beyond, to Sinkiang province to the north and west. Mineral surveys have revealed deposits of iron ore, hard coal, graphite, and asbestos in the range.

**T'ang-shan,** Pinyin TANGSHAN, industrial city in eastern Hopeh *sheng* (province), China. Originally, T'ang-shan was a small hamlet dependent upon nearby K'ai-p'ing and located in an area where many small coal pits had been worked since the 16th century. In 1876 a Cantonese promoter of Western-style industrialization proposed to the governor-general of the former province of Chihli that a coal industry be established there. The first shaft of the mine at K'ai-p'ing (T'ang-shan) was begun in 1879. The coal was taken by horse tramway to Hsü-ko-chuang (now known as Feng-nan), 7 miles (11 km) away, whence it was carried by canal to Ning-ho (Lu-t'ai) on the Pei-yün River, and thence shipped to a depot near Tientsin.

In 1882, despite official opposition to railway development, the tramway was turned into China's first proper railway. In 1887 the railway was extended to Ning-ho, and then in 1888 to T'ang-ku, the outport of Tientsin. New collieries were opened at Lin-hsi, 15 miles (24 km) northeast of T'ang-shan, and these too were linked by rail to Tientsin. The K'ai-p'ing Mining Company then established its own shipping line, supplying coal to the northern ports, to the Chinese northern fleet, and to Shanghai. In 1891–94 Tientsin was connected by rail with Shan-hai-kuan, on the coast to the northeast of T'ang-shan; the company also developed its own port facilities after 1899, with a railway link to the ice-free harbour of Ch'in-huang-tao. The Boxer Rebellion of 1900, which led to the occupation of T'ang-shan by Russian troops, while Ch'in-huang-tao was occupied by an allied force, brought suspension of work on the port and rail link. The company, already in financial difficulties, then fell under British control. Production was resumed, and the new port and rail link were completed; by 1903 virtually all coal was exported via Ch'in-huang-tao.

Yüan Shih-k'ai, the new governor of Chihli, repeatedly but unsuccessfully attempted to gain control of the mining company. He then established a rival Chinese company, the Luan-chou Mining Company, which opened mines in the same district at Ma-chia-kou and Chao-ko-chuang. Although these mines were speedily brought into production, the company was soon involved in a price war with the K'ai-p'ing company and fell into financial trouble. The outbreak of the revolution of 1911 precipitated a financial crisis, and in 1912 the Anglo-Chinese Kailan Mining Administration was established to resolve the conflict and jointly to control the affairs of both companies. This organization continued to operate until 1934, when the Chinese Nationalist government recognized the formation of the Kailuan Mining Corporation, formally combining both companies. Under this arrangement British control over the whole mining operation was secured, and it was continued—even after the Japanese occupation in 1937—until the outbreak of war between Japan and the Western powers in 1941. The company reverted to British control in 1945, but in 1948 the area was taken by the Chinese Communists, who expelled the British in 1952. Under China's First Five-Year Plan (1953–57) the works were extensively modernized and extended, with some Soviet technical assistance. T'ang-shan was also the site of other industries, among them a large cement plant—the Chee-hsin Works, which began operation in T'ang-shan in 1907.

After 1949, T'ang-shan's electric generating plants were expanded, and the city was joined to Tientsin and Peking by a high-tension grid. Iron and steel production that had been developed during the Japanese occupation declined after 1945 and remained at a low level until the mid-1950s, when it was rapidly expanded. In 1964 T'ang-shan was designated the centre of an experimental economic region designed to integrate the commercial life of the area. By the beginning of 1976, T'ang-shan was producing large quantities of ingot steel, pig iron, and finished steel. Engineering and ceramics were also important.

On July 28, 1976, the city was devastated by a giant earthquake. Strong after-tremors continued for days. The quake leveled almost every building and flooded the mines. An estimated 700,000 to 1,500,000 people died from the several earthquakes that struck the city during the late 1970s and early 1980s. All new buildings were designed to be highly earthquake-resistant. Huge new apartment complexes housed 80,000 families by the end of 1980, and factories were rebuilt downwind to minimize pollution. Land along the fault lines was reserved for parks. Although many industries resumed operation within a year or two, it was not until the 1980s that total production regained its pre-1976 levels. Pop. (1999 est.) 1,210,842.

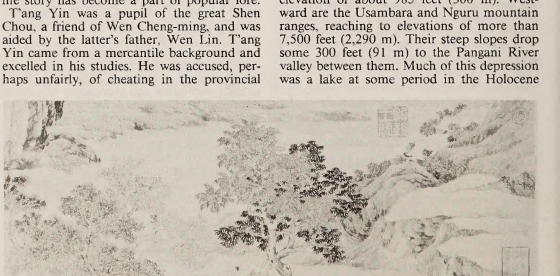
**T'ang Ti Yao** (Chinese mythology): *see* Yao.

**T'ang Yin** (b. 1470, Su-chou, Kiangsu province, China—d. 1523), Chinese scholar, painter, and poet of the Ming period whose life story has become a part of popular lore.

T'ang Yin was a pupil of the great Shen Chou, a friend of Wen Cheng-ming, and was aided by the latter's father, Wen Lin. T'ang Yin came from a mercantile background and excelled in his studies. He was accused, perhaps unfairly, of cheating in the provincial examinations that would have guaranteed him the security of a government sinecure and comfort for the cultivation of scholarly pursuits. Denied further official progress, he pursued a life of pleasure and earned a living by selling his paintings. That mode of living brought him into disrepute with a later generation of artist-critics (for example, Tung Ch'i-ch'ang) who felt that financial independence was vital to enable an artist to follow his own style and inspiration. While T'ang Yin is associated with paintings of feminine beauty, his paintings (especially landscapes) otherwise exhibit much the same variety and expression of his peers, which suggest a man of both artistic skill and profound insight.

**Tanga,** city and port, northeastern Tanzania, eastern Africa, located on the Pemba Channel of the Indian Ocean. The city itself was established on the coast by Persian traders in the 14th century, but early Iron Age sites in the nearby foothills of the Pare and Usambara mountains and in the Digo Hills are evidence of ancient occupation of the region. In the 16th and 17th centuries indigenous states formed in the region's interior were dominated by the Shamba peoples. Omani Arabs raided the coastal region in the early 18th century. During the 1840s, Arab and Swahili traders made their way into the region's interior for ivory, and later for slaves. The slave trade was abolished after Europeans arrived in the 19th century and established missions in the area. In the early 1880s the area came under German protection and then became a German colony. The city of Tanga experienced great development under German colonial rule in the 1890s. Tanga's port facilities were modernized, and the Tanga–Moshi railway stimulated agricultural development, making Tanga the territory's chief port for the export of sisal and coffee. German colonial rule ended during World War I when the British took over in 1917. After World War I the railway was connected to the central line, giving Tanga a direct rail link to the capital, Dar es-Salaam, and the central interior. In 1922 the Tanganyika Territory African Civil Services Association, the first known modern African political organization, was formed with Tanga city as headquarters. The region surrounding Tanga formed an intergral part of Tanganyika in 1961, when it gained independence, and of Tanzania in 1964, when Tanganyika merged with Zanzibar.

A few miles inland from the port's vantage point on the Indian Ocean begin a series of hills and ridges, and plateaus rising to an elevation of about 985 feet (300 m). Westward are the Usambara and Nguru mountain ranges, reaching to elevations of more than 7,500 feet (2,290 m). Their steep slopes drop some 300 feet (91 m) to the Pangani River valley between them. Much of this depression was a lake at some period in the Holocene



"Voyage to the South," detail of a handscroll by T'ang Yin, 1505; in the Freer Gallery of Art, Washington, D.C.

By courtesy of the Smithsonian Institution, Freer Gallery of Art, Washington, D.C.

(Recent) Epoch. Crops grown in the region include sisal, cotton, millet, oilseed, copra, corn (maize), bananas, and cassava. Many of the region's inhabitants engage in cattle raising and fishing. Local manufactures include textiles, plywood, furniture, fertilizers, paper products, and soap. Salt, mica, gypsum, and copper are mined nearby. Roads and railway link Tanga with Moshi, Morogoro, and Dar es-Salaam, and the city has an airport. With the improvement of Dar es-Salaam's harbour, Tanga's relative importance as a port has declined. Pop. (1988 prelim.) 187,634.

**Tangail,** city, north-central Bangladesh. It lies just east of the Jamuna (Brahmaputra) River. Tangail is an important handloom and cotton-weaving centre and serves as a trading centre for the rice, jute, and oilseeds that are grown in the surrounding agricultural area. The city is connected by road with Dhākā, Mymensingh, and Jamālpur. It has several colleges affiliated with the University of Dhākā. Pop. (1981) 77,518.

**Tanganyika, Lake,** second largest of the lakes of eastern Africa. It is the longest freshwater lake in the world (410 miles [660 km]) and the second deepest (4,710 feet [1,436 m]) after Lake Baikal in Russia. Comparatively narrow, varying in width from 10 to 45 miles (16 to 72 km), it covers about 12,700 square miles (32,900 square km) and forms the boundary between Tanzania and Zaire. It occupies the southern end of the western arm of the East African Rift Valley, and for most of its length the land rises steeply from its shores. Its waters tend to be brackish. Though fed by a number of rivers, the lake is not the centre of an extensive drainage area. The largest rivers discharging into the lake are the Malagarasi, the Ruzizi, and the Kalambo,



Lake Tanganyika near Bujumbura, Burundi
Kay Honkanen—Ostman Agency

which has one of the highest waterfalls in the world (704 feet [215 m]). Its outlet is the Lukuga River, which flows into the Lualaba River.

Lake Tanganyika is situated on the line dividing the floral regions of eastern and western Africa, and oil palms, which are characteristic of the flora of western Africa, grow along the lake's shores. Rice and subsistence crops are grown along the shores, and fishing is of some significance. Hippopotamuses and crocodiles abound, and the bird life is varied.

Many of the numerous peoples (predominantly Bantu-speaking) living on the lake's eastern borders trace their origins to areas in the Congo Basin. The lake was first visited by Europeans in 1858, when the British explorers Sir Richard Burton and John Hanning Speke reached Ujiji, on the lake's eastern shore, in their quest for the source of the Nile River. In 1871 Sir Henry Morton Stanley "found" David Livingstone at Ujiji. Important ports situated along Lake Tanganyika are Bujumbura (Burundi), Kalemi (Zaire), and Ujiji and Kigoma (Tanzania).

**Tange Kenzō** (b. Sept. 4, 1913, Imabari, Shikoku, Japan), one of the foremost Japanese architects in the decades following World War II.

He studied at the Tokyo Imperial University (1935–38), worked in the office of Maekawa Kunio, then returned to the university (1942–45), where in 1949 he was named professor and in 1974 professor emeritus. His first completed structure was a pavilion at the Kōbe Industry and Trade Fair of 1950. His best-known early work was the Peace Centre at Hiroshima (1946–56). In the years that followed he designed an outstanding series of public buildings, including the Tokyo City Hall (1952–57), the assembly hall at Shizuoka (1955–57), town halls at Kurayoshi (1955–57) and Kurashiki (1958–60), and the Kagawa prefectural offices, Takamatsu (1955–58), the latter being considered a particularly fine example of the blending of modern with Japanese architectural traditions. Most of these early structures were conventional rectangular forms using light steel frames.

Tange's work during the 1960s took more boldly dramatic forms with the use of reinforced concrete and innovative engineering. For the 1964 Olympic Games he designed the National Gymnasium, which was actually two buildings suspended together to create sweeping curved roofs and an asymmetrical but balanced arrangement that masterfully assimilates traditional techniques. During the same period Tange also designed Saint Mary's Cathedral in Tokyo, a bold cruciform design with stark, soaring roofs made of stainless steel.

Tange fulfilled many important overseas commissions during the 1960s and '70s, including embassies and university buildings in Taiwan, Saudi Arabia, Algeria, and Iran. During 1966–70 he designed the master plan for the Japan World Exposition (Expo 70), which was held in Ōsaka. In his later structures he built up combinations of smaller geometrical forms into an irregular but functionally attentive whole.

Tange has also been influential as a writer, teacher, and town planner. Some of his best-known publications translated into English are *A Plan for Tokyo* (1960), *Katsura: Tradition and Creation in Japanese Architecture* (1960), *Ise: Prototype of Japanese Architecture* (1962), and *Architecture and Urban Design* (1975).

**tangent,** in geometry, straight line (or smooth curve) that touches a given curve at one point; at that point the slope of the curve is equal to that of the tangent. A tangent line may be considered the limiting position of a secant line as the two points at which it crosses the curve approach one another. Tangent planes and other surfaces are defined analogously.

The trigonometric law of tangents is a relationship between two sides of a plane triangle and the tangents of the sum and difference of the angles opposite those sides. In any plane triangle $ABC$, if $a$, $b$, and $c$ are the sides opposite angles $A$, $B$, and $C$, respectively, then

$$\frac{a-b}{a+b}=\frac{\tan \tfrac{1}{2}(A-B)}{\tan \tfrac{1}{2}(A+B)},$$

$$\frac{c-a}{c+a}=\frac{\tan \tfrac{1}{2}(C-A)}{\tan \tfrac{1}{2}(C+A)},$$

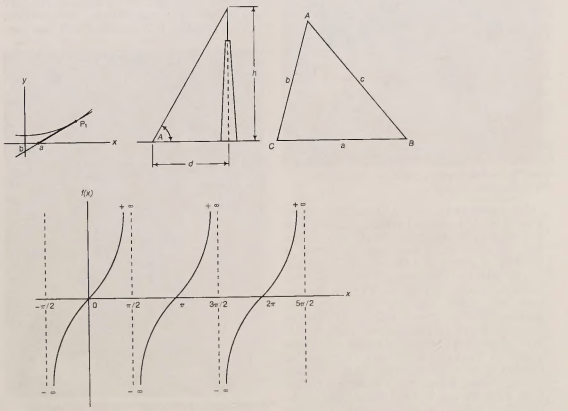
$$\frac{b-c}{b+c}=\frac{\tan \tfrac{1}{2}(B-C)}{\tan \tfrac{1}{2}(B+C)}.$$

The formula is especially useful in making calculations using logarithms.

In trigonometry of a right triangle, the tangent of an angle is the ratio of the side opposite the angle to the side adjacent. The value of the tangent (ratio) depends only on the size of the angle, not on the particular right triangle used to compute it.

*Consult the* INDEX *first*

**tangerine** (*Citrus reticulata deliciosa*), small, thin-skinned variety of orange belonging to the mandarin orange species of the family Rutaceae. Probably indigenous to Southeast Asia, tangerine culture spread westward along trade routes as far as the Mediterranean; in modern times, the fruit is cultivated in the subtropical regions of both the Old World and the New World, especially in southern Europe and the southern United States. Commercial crops are grown in Arizona, California, the Rio Grande Valley of Texas, and the Gulf states.




*Tangent relationships*
(Top left) Tangent to curve at $P_1$ is line $aP_1$; (top centre) height determination using tangent; (top right) law of tangents; (bottom) tangent function $f(x)$ for various values of $x$

The tangerine tree is smaller than other orange trees, with slender twigs and lance-shaped leaves. The fruit is slightly flattened at either end, with loose, deep, reddish-orange peel and easily separated segments. The



Tangerine (*Citrus reticulata deliciosa*)
Grant Heilman—EB Inc.

tender, juicy, richly flavoured pulp is abundant in vitamin C. Some varieties ship well. Those marketed commercially include Minneola, Orlando, Dancy, and Seminole. Oil extracted from the fragrant skin of the tangerine is a characteristic ingredient in several flavourings and liqueurs. Tangerines have been crossed with grapefruit to produce tangelos.

**Tanggu** (China): *see* T'ang-ku.

**Tanggula Shan** (mountain range, China): *see* T'ang-ku-la Mountains.

**Tangier,** French TANGER, Spanish TÁNGER, Arabic ṬANJAH, port and principal city of Tangier-Tétouan region, Morocco, on a bay of the Strait of Gibraltar 17 miles (27 km) from the southern tip of Spain.



Port and ramparts of the old town, Tangier, Mor.
M. Williams—Shostal Assoc./EB Inc.

First known as an ancient Phoenician trading post, it later became a Carthaginian and then a Roman settlement called Tingis. Becoming a free city in AD 42, it was made the capital of the Roman province of Mauretania Tingitana. Tingis, after five centuries of Roman rule, was captured successively by the Vandals, Byzantines, and Arabs. The city was occupied by Islāmic dynasties from *c.* 705 to 1471 and by the Spanish and Portuguese until 1662. In that year, as part of the dowry of Catherine of Braganza of Portugal upon her marriage to Charles II, it was transferred to the English crown, during whose rule extensive fortifications were erected. In 1684 it was returned to Morocco, and during the 19th century it was the diplomatic capital of that country, though British trade and political influence still predominated. When the rest of Morocco became a French protectorate in 1912, Tangier had special status; and in 1923 it officially became an international city, governed by a commission composed of representatives from Great Britain, France, Spain, Portugal, Italy, Belgium, The Netherlands, Sweden, and, later, the United States. Tangier remained an international zone (except for a period during World War II, when Spain took control) until it was integrated in 1956 with the independent Kingdom of Morocco.

The city is built on the slopes of a chalky limestone hill. The old town (medina), enclosed by 15th-century ramparts, is dominated by a Casbah, the sultan's palace (now a museum of Moroccan art), and the Great Mosque. European quarters (whose populations have declined considerably since integration with Morocco) stretch to the south and west. Tangier has been the site of the summer royal residence since 1962. The American University was established there in 1968 and the University of North Africa in 1971. An important port and trade centre, Tangier has excellent road and rail connections with Fès, Meknès, Rabat, and Casablanca, as well as regular shipping services to Europe and an international airport. Supplementing its role as a tourist centre are the building trades, fishing, and a textile industry (especially carpets). The port handles cereals and sugar imports.

Tangier and its suburbs dominate the Tangier-Tétouan region, which occupies the northernmost area of the country, situated on a peninsula immediately north of the Rharb Plain and adjacent to the Rif Mountains that lie to the southeast. The region is otherwise poor in resources. Vegetable growing and poultry breeding have traditionally been the main rural economic pursuits. Pop. (1994) city, 521,735; region, 2,036,032.

**tango,** ballroom dance that evolved about 1880 in lower-class districts of Buenos Aires, where the Spanish tango merged with the *milonga,* a fast, sensual, and disreputable Argentine dance; it shows possible influences from the Cuban habanera. In the early 1900s the tango became socially acceptable, and by 1915 it was a craze in fashionable European circles. The first tango music by known composers was published around 1910.

The early tangos were spirited and gay, but by 1920 the music and lyrics became intensely melancholy. The step likewise evolved from early exuberance to a smoother ballroom step.



Tango danced by Rudolph Valentino and partner from the motion picture *Four Horsemen of the Apocalypse,* 1921
By courtesy of Metro-Goldwyn-Mayer Inc., © 1921; photograph, from the Museum of Modern Art Film Stills Archive

The music is in $\frac{4}{4}$ time. The tango of Spain is a light-spirited variety of flamenco dance and music, possibly influenced by the Argentine dance.

**tangoreception** (physiology): *see* touch reception.

**Tanguay, Eva** (b. August 1878, Marbleton, Que., Can.—d. Jan. 11, 1947, Hollywood, Calif., U.S.), singing and dancing comedienne billed as the "Girl Who Made Vaudeville Famous."



Eva Tanguay as Salome
Brown Brothers

Tanguay went to the United States with her parents at an early age, obtained her first stage role at the age of eight, and later acted in variety, stock troupes, and musical comedy. At the beginning of the 20th century, she shocked audiences with her scanty costume and her risqué songs, such as "I Don't Care." As vaudeville's emphasis shifted from sentiment to sex in the early 1900s, Eva Tanguay became the highest-paid single performer in vaudeville, but she lost her fortune during the stock market crash of 1929. She spent the last two decades of her life a bedridden recluse.

**Tangub,** chartered city, Misamis Occidental province, northwestern Mindanao, Philippines. Located on the northern shore of Panguil Bay (an arm of Iligan Bay), it is just north of the narrow neck of land that connects Zamboanga del Sur province with the main part of Mindanao. The principal occupation in the city is fishing, mostly in Panguil Bay, for prawns and crabs. Coconuts (copra) are the main cash crop in the region. Tangub is connected by a coastal road with Ozamiz and Oroquieta to the north. Inc. city, 1967. Pop. (1995 est.) 46,000.

**Tangun,** mythological first king of the Koreans, the grandson of Hwanin, the creator, and the son of Hwanung, who fathered his child by breathing on a beautiful young woman. Tangun reportedly became king in 2333 BC.

Legends about Tangun differ in detail. According to one account, Hwanung left heaven to rule earth from atop Mt. T'aebaek (Daebaik). When a bear and a tiger expressed a wish to become human beings, he ordered the beasts into a cave for 100 days and gave orders that they were to eat only mugwort and garlic and avoid the sunlight. The tiger soon grew impatient and left the cave, but the bear remained and after three weeks was transformed into a beautiful woman. It was she who became the mother of Tangun. The myth is important inasmuch as it links the Korean people with a heavenly origin.

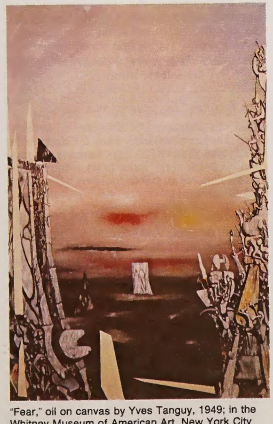
Tangun's legendary association with agriculture has led to speculation that the myth is based on a historical leader who learned the se-

crets of the soil in the city-states of the Huang Ho (river) valley. Buddhism and Taoism clothed themselves with a Korean mantle by crediting Tangun with starting a national religion of Heavenly Teaching and with originating the Korean maxim *Hongik-ingan* ("Love humanity"). An altar on Kanghwa Island, which is said to have been built by Tangun himself, is periodically refurbished. Tangun's birthday ("Opening of Heaven Day") on the 3rd day of the 10th month is a holiday for schoolchildren.

**Tanguy, Yves** (b. Jan. 5, 1900, Paris, France—d. Jan. 15, 1955, Waterbury, Conn., U.S.), French-born American painter who made a highly individual contribution to Surrealism.

After sailing with the merchant marine in his youth, Tanguy in 1922 returned to Paris, where he lived a Bohemian life and searched for a vocation. In 1923 a painting by Giorgio de Chirico that he saw in an art gallery made such a strong impression on him that he immediately took up painting. He joined the Surrealists in 1925, and he subsequently participated in all the Surrealists' major exhibitions. He visited the United States in 1939 and settled there, becoming a U.S. citizen in 1948.

Though he had no formal art training, Tanguy had found his own unique style of painting by 1927. His paintings depict groups of strange, unidentifiable objects that resemble marine invertebrates or sculpturesque rock formations. These ambiguous forms are painted with smooth, painstaking detail and are set in barren, brightly lit landscapes that have an infinite horizon and a timeless, dreamlike quality. After Tanguy resettled in the United



"Fear," oil on canvas by Yves Tanguy, 1949; in the Whitney Museum of American Art, New York City
Collection of the Whitney Museum of American Art, New York City

States, the objects in his paintings took on a more metallic appearance. Tanguy's eerie and illogical paintings made him the artist most faithful to Surrealist precepts.

**Tangyur** (Buddhist texts): *see* Bstan-'gyur.

**taṇhā** (Pāli), in the Buddhist chain of dependent origination, the thirst that leads to attachment. *See* pratitya-samutpāda.

**Tani Bunchō**, original name TANI MASAYASU, also called BUNGORŌ (b. 1763, Edo [now Tokyo], Japan—d. Jan. 6, 1840, Edo), Japanese painter who founded an eclectic



Landscape painting by Tani Bunchō; in the Tokyo National Museum
By courtesy of the Tokyo National Museum

school influenced by Chinese, Japanese, and Western styles.

The son of a poet, Tani studied first with a master of the Kanō school, stressing Chinese themes and techniques, and then with a painter of the Hoku-ga, or Northern school of Chinese art. He also came under the influence of Nan-ga (the Southern school of Chinese art, also known in Japanese as the Bunjin-ga, or "Literati Painting") as well as of Yamato-e (traditional Japanese paintings of scenes from daily life). He founded a new school of painting called Nanboku gōitsu, or the South and East school, and he introduced the use of Western perspective, a technique further refined by his most famous pupil, Watanabe Kazan. While his technique was outstanding and his knowledge of art considerable, his paintings frequently lack a spontaneous quality. Some of his mature works, especially portraits, are of striking realism. He also produced several art history books.

**Tanimbar Islands,** Indonesian KEPULAUAN TANIMBAR, group of about 30 islands in Maluku Tenggara *kabupaten* (regency), Maluku *provinsi* ("province"), eastern Indonesia. The islands lie between the Banda and Arafura seas.

The largest of the group is Yamdena Island, the principal town of which is Saumlaki, a port on the southern coast. This island has thickly wooded hills along its eastern coast, while its western coast is lower and often swampy. Surrounding islands include Larat to the north of Yamdena, with high cliffs, a rocky coast, and thick vegetation along the shore, and Selaru to the south of Yamdena, rather flat and with much grassland. The group, the total area of which is 2,179 square miles (5,625 square km), lies outside the zone of historic volcanic activity. Because there are few rivers, there is a lack of freshwater, but the soil supports corn (maize), rice, coconut and sago palms, yams, plantains, mangoes, and papayas.

The Tanimbar group was visited by the Dutch in 1629 and claimed by them in 1639 by right of discovery, but Dutch rule was not established on the islands until 1900. The people are basically Melanesians of the Papuan variety, but there has been much mixture with Mongoloid strains. There are many animists, a few Muslims, and some Christians. Houses of wood and palm leaf, generally on piles, are entered from underneath; their carved pillars show much artistry of construction. The men are skillful boatbuilders, search for trepang (sea cucumber) and turtle shell, keep pigs, and work in iron, copper, and gold. Pop. (latest est.) 55,405.

**Tanis,** biblical ZOAN, modern ṢĀN AL-ḤAJAR AL-QIBLIYAH, ancient city in the Nile River delta, capital of the 14th nome (province) of Lower Egypt and, at one time, of the whole country. The city was important as one of the nearest ports to the Asiatic seaboard. With the decline of Egypt's Asiatic empire in the late 20th dynasty, the capital was shifted from Per Ramessu, and about 1075 BC the 21st-dynasty pharaohs made Tanis their capital. A large temple of Amon was built, mainly with stone from the ruins of Per Ramessu. The Libyan pharaohs of the 22nd dynasty continued to reside at Tanis until the collapse of their shrinking domain before Shabaka, the Cushite founder of the 25th dynasty, in 712 BC. Tanis declined with Shabaka's shift of the royal capital to Memphis and with the rise of Pelusium 20 miles (32 km) to the east as the main eastern-frontier fortress and trade centre.

In 1939 several intact royal tombs of the 21st and 22nd dynasty were excavated in the main temple enclosure in Tanis. Silver coffins, gold masks, and jewelry in gold and silver recall the burial of Tutankhamen, though they are not as rich. Moreover, the tombs and even the sarcophagi were reused material from earlier periods. Pop. (latest est.) 6,328.

**Tanis, Table of** (ancient Egyptian inscription): *see* Canopus, Decree of.

**tanistry,** a custom among various Celtic tribes—notably in Scotland and Ireland—by which the king or chief of the clan was elected by family heads in full assembly. He held office for life and was required by custom to be of full age, in possession of all his faculties, and without any remarkable blemish of mind or body. At the same time and subject to the same conditions, a tanist, or next heir to the chieftaincy, was elected, who, if the king died or became disqualified, at once became king. Sometimes the king's son became tanist, but not because the system of primogeniture was in any way recognized; indeed, the only principle adopted was that the dignity of chieftainship should descend to the eldest and most worthy of the same blood, who well could be a brother, nephew, or cousin. This system of succession left the headship open to the ambitious and was a frequent source of strife both in families and between the clans. Tanistry in Scotland was abolished by a legal decision in the reign of James I (1406–37) and the English system of primogeniture substituted.

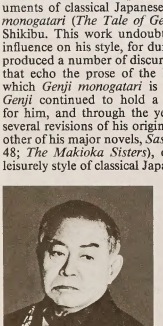
**Tanit,** also spelled TINITH, TINNIT, OR TINT, chief goddess of Carthage, equivalent of Astarte. Although she seems to have had some connection with the heavens, she was also a mother goddess, and fertility symbols often accompany representations of her. She was probably the consort of Baal Hammon (or Amon), the chief god of Carthage, and was often given the attribute "face of Baal." Although Tanit did not appear at Carthage before the 5th century BC, she soon eclipsed the more established cult of Baal Hammon and, in the Carthaginian area at least, was frequently listed before him on the monuments. In the worship of Tanit and Baal Hammon, children, probably firstborn, were sacrificed. Ample evidence of the practice has been found west of Carthage in the precinct of Tanit, where a *tofet* (a sanctuary for the sacrifice of children)

was discovered. Tanit was also worshiped on Malta, Sardinia, and in Spain.

**Tanite** DYNASTY, 21st dynasty of Egypt (1075–945 BC), whose name is derived from that of the city of Tanis in the Nile River delta, which Smendes (Nesubanebdet), the first king of the dynasty, made his capital. The seven Tanite kings usually exercised control over the strong priesthood of Thebes in Upper Egypt, but the district of Cush was probably independent. Egyptian hegemony over Palestine and Syria weakened under the Tanites, and thus small, thriving kingdoms developed in these areas.

**Tanizaki Jun'ichirō** (b. July 24, 1886, Tokyo, Japan—d. July 30, 1965, Yugawara), major modern Japanese novelist, whose writing is characterized by eroticism and ironic wit.

His earliest short stories, of which "Shisei" (1910; "The Tattooer") is an example, have affinities with Edgar Allan Poe and the French Decadents. After moving from Tokyo to the more conservative Ōsaka area in 1923, however, he seemed to turn toward the exploration of more traditional Japanese ideals of beauty. *Tade kuu mushi* (1929; *Some Prefer Nettles*), one of his finest novels, reflects the change in his own system of values; it tells of marital unhappiness that is in fact a conflict between the new and the old, with the implication that the old will win. Tanizaki began in 1932 to render into modern Japanese one of the monuments of classical Japanese literature, *Genji monogatari* (*The Tale of Genji*) of Murasaki Shikibu. This work undoubtedly had a deep influence on his style, for during the 1930s he produced a number of discursive lyrical works that echo the prose of the Heian period, in which *Genji monogatari* is set. *The Tale of Genji* continued to hold a deep fascination for him, and through the years he produced several revisions of his original rendition. Another of his major novels, *Sasame-yuki* (1943–48; *The Makioka Sisters*), describes—in the leisurely style of classical Japanese literature—



Tanizaki Jun'ichirō
By courtesy of Nippon Kindai Bungakukan, Tokyo

the harsh inroads of the modern world on aristocratic traditional society. His postwar writings, including *Kagi* (1956; *The Key*) and *Fūten rōjin nikki* (1961–62; *Diary of a Mad Old Man*), show an eroticism that suggests a return to his youth. His *Bunshō Tokuhon* (1934; "A Style Reader") is a minor masterpiece of criticism. Tanizaki's work has been characterized as a literary quest for "the eternal female."

**Tanjore** (India): *see* Thanjāvūr.

**Tanjungkarang-Telukbetung** (Indonesia): *see* Bandar Lampung.

**tank,** a heavily armed and armoured combat vehicle that moves on two endless metal chains called tracks. A tank is usually armed with a cannon mounted in a revolving turret and also has lighter automatic weapons. Tanks are the principal ground-assault weapon in modern mechanized warfare.

A brief treatment of tanks follows. For full treatment, *see* MACROPAEDIA: War, The Technology of.

Tanks were invented in World War I for use as armour-shielded assault vehicles that could cross the muddy, uneven terrain of the trench battle zone. Wheeled vehicles had proved insufficient in this regard. Several European nations worked on ways to adapt internal-combustion gas engines to tracked vehicles, and in 1915 the British Admiralty's "Landship Committee" became the first to adapt several tractors for military use. The first of these "tanks" were dispatched to France the following year and on Aug. 15, 1916, were assigned to combat at the first Battle of the Somme.

**Some notable tank models**

| designation and nationality | year introduced | weight (metric tons) | main armament (mm) | speed (km/hr) |
|---|---|---|---|---|
| Mark I (British) | 1916 | 30 | 57 mm | 6 |
| Schneider (French) | 1917 | 15 | 75 mm | 6 |
| Renault F.T. (French) | 1918 | 7½ | 37 mm | 10 |
| Panzerkampf-wagen III (German) | 1938 | 7–20 | 37 or 47 mm | 64 |
| T-34 (Soviet) | 1939 | 26–32 | 76 mm | 40 |
| M4 Sherman (U.S.) | 1942 | 33 | 75 mm | 39 |
| Panther (German) | 1943 | 45 | 75 mm | 46 |
| Tiger (German) | 1942–44 | 55–68 | 88 mm | 38 |
| Joseph Stalin (Soviet) | 1944 | 46 | 122 mm | 37 |
| Centurion (British) | 1945 | 52 | 76 mm | 34 |
| T-54, T-55 (Soviet) | 1948 | 36 | 100 mm | 51 |
| M47, M48 (U.S.) | 1951–53 | 44–48 | 90 mm | 40–48 |
| M60 (U.S.) | 1959 | 48 | 105 mm | 48 |
| T-62 (Soviet) | 1963 | 36½ | 115 mm | 50 |
| Chieftain (British) | 1963 | 52 | 120 mm | 40 |
| Leopard 1 (W.Ger.) | 1965 | 40 | 105 mm | 65 |
| AMX-30 (French) | 1966 | 36 | 105 mm | 65 |
| T-64 (Soviet) | 1975 | 40 | 125 mm | 60–70 |
| Merkava Mk. 1 (Israeli) | 1979 | 60 | 105 mm | 46 |
| Leopard 2 (W.Ger.) | 1979 | 55 | 120 mm | 72 |
| T-80 (Soviet) | 1982 | 42 | 125 mm | 75 |
| Challenger 1/2 (British) | 1983/94 | 62 | 120 mm | 56 |
| M1A1/A2 (U.S.) | 1985/92 | 57 | 120 mm | 67 |
| Merkava Mk. 3 (Israeli) | 1990 | 61 | 120 mm | 55 |
| Leclerc (French) | 1992 | 55 | 120 mm | 71 |

These early tanks were lightly armed and had machine guns and small-calibre guns. Tanks first played a decisive role in World War I in the Battle of Cambrai (Nov. 20, 1917), when 474 British tanks broke through the German lines, and they were henceforth used in increasing numbers by the Allies in that war.

After World War I France and Great Britain built lightweight tanks for cavalry-like actions and slower, heavier tanks for close infantry support. By the 1930s, however, light tanks carrying only heavy machine guns were seen to be extremely vulnerable to heavier tanks armed with 37- to 47-mm guns firing high-explosive shells. In response, the Germans and the Soviets in the mid-1930s began developing heavier tanks with thicker armour plating and guns up to 76 mm in diameter.

Germany's tank force in World War II, though not the largest in Europe, was at first the most effective because it was the only one organized into rapid-moving massed formations that had great striking power in an offensive. During the first two years of battle, 1939–41, German tank units suffered no major setbacks. German and Soviet tank research and development set the standard during the course of the war. In 1943 the German Panther tank was introduced to battle, armed with a 75-mm gun with more than twice the muzzle velocity of its predecessor, giving it great armour-piercing capability. Germany also brought out the Tiger tank, among the heaviest to be deployed in the war, armed with an 88-mm gun. The Soviets were the only ones to respond in kind, bringing out the Joseph Stalin tank in 1944 armed with a low-velocity 122-mm gun.

After World War II, all tanks were made capable of fighting other tanks as a matter of first priority. To this end they were equipped with guns of larger bore and increasing accuracy, armour of greater strength and weight, and engines of growing power. Most modern main battle tanks weigh more than 50 tons, yet, propelled by diesel or gas-turbine engines of up to 1,500 horsepower, they are capable of road speeds of 50–70 km/h (30–40 mph). Traditional steel armour has been supplemented by steel-ceramic composites or by reactive armour, which contains outward-directed explosives that counteract the effects of incoming projectiles. The standard main armament is a 120-millimetre smoothbore or rifled gun, which fires armour-piercing projectiles made of depleted uranium or carrying a shaped-charge explosive. Gun control is made extremely precise through the aid of laser range-finders, infrared imaging devices, and automatic stabilization of the turret while the tank is in motion. The tank's position and course can be plotted electronically through the use of global-positioning systems. Most tanks carry a crew of four—a gunner, a gun loader, a driver, and a commander—though some designs reduce the crew requirement to three by employing an automatic loading device. *See also* armoured vehicle.

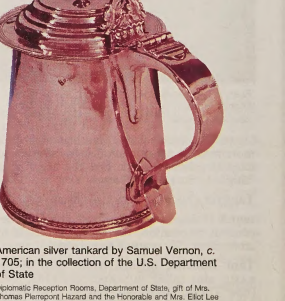
*To make the best use of the Britannica, consult the* INDEX *first*

**tank farming:** *see* hydroponics.

**tanka,** in literature, a five-line, 31-syllable poem that has historically been the basic form of Japanese poetry. The term tanka is synonymous with the term waka (*q.v.*), which more broadly denotes all traditional Japanese poetry in classical forms.

**tanka** (in Tibetan Buddhism): *see* thang-ka.

**tankard,** drinking vessel for ale or beer, widely used in northern Europe (especially Scandinavia, Germany, and the British Isles) and in



American silver tankard by Samuel Vernon, *c.* 1705; in the collection of the U.S. Department of State
Diplomatic Reception Rooms, Department of State, gift of Mrs. Thomas Plempont Hazard and the Honorable and Mrs. Elliot Lee Richardson; photograph, Helga Studio

colonial America from the second half of the 16th century until the end of the 18th century. The body is usually cylindrical, and it has a hinged lid (with or without finial), generally a thumbpiece, and a handle that is often in a scroll shape. On the handles of many 17th- and 18th-century tankards are whistles that were used for summoning waiters. Though they were sometimes made of horn, carved ivory, pottery, and porcelain (all with metal mounts), tankards most often were made from precious metals, especially silver, and pewter. In the late 17th century certain large tankards appeared, commissioned by corporate bodies or guilds for presentation or ceremonial use. Reproductions of traditional tankard styles have been made since the 19th century.

**tanker,** ship designed to carry liquid cargo in bulk. Its cargo is usually a petroleum product, either crude oil being carried from oil fields to



The supertanker *Lima* (318,000 tons deadweight)
© FotoFlite

refineries or gasoline being carried from refineries to distribution centres. The liquid is piped into the cargo space of the ship and transported without the use of barrels or other containers. Special tankers carry other liquids such as molasses, asphalt, wine, or liquefied natural gas. Tankers differ from general cargo ships in that they normally carry a full load in one direction and return without cargo.

Tankers vary in size from small coastal vessels about 60 m (200 feet) long, carrying from 1,500 to 2,000 tons deadweight, up to huge vessels that are more than 500,000 tons deadweight, reach lengths of more than 400 m (1,300 feet), and are the largest ships afloat. Experience with these supertankers has shown that the direct cost of transporting oil goes down as the size of the tanker increases, apparently without limit; an obstacle to building larger tankers is the lack of suitable shore facilities for them. Objection to these huge vessels has been raised by conservationists; when tankers suffer damage at sea, large oil spillages may result that can cause great damage to fish and other wildlife and to nearby coasts.

**tanna,** also spelled TANA (Aramaic: "teacher"), plural TANNAIM, or TANAIM, any of several hundred Jewish scholars who, over a period of some 200 years, compiled oral traditions related to religious law. Most *tannaim* lived and worked in Palestine. Their work was given final form early in the 3rd century AD by Judah ha-Nasi, whose codification of oral laws became known as the Mishna (*q.v.*). Some scholars believe the Mishna was committed to writing at this time, while others believe it was preserved solely by memory for another three or four centuries.

The *tannaim* were succeeded by other scholars, called *amoraim* ("interpreters" or "reciters") who, in Palestine and Babylonia, wrote extensive commentaries (Gemara) on the Mishna. The Palestinian and Babylonian Talmuds thus have the same Mishnaic content but significantly different Gemara.

**Tanna,** also spelled TANA, island of Vanuatu, in the southwestern Pacific Ocean. Volcanic in origin, it is 25 miles (40 km) long and 12 miles (19 km) wide and occupies an area of 212 square miles (549 square km). It rises to 3,556 feet (1,084 m) at Mount Tukosméra. Well-watered, wooded, and with a tropical climate, Tanna is the most fertile island in the republic and produces copra and cattle for export. On the southeast coast, 3 miles (5 km) from Port Resolution, is Mount Yasur, an active volcano. The former French administrative headquarters are at Lénakel, which lies on the southwest coast and is the site of an airfield, and the former British headquarters are at Whitesands on the east coast. The island is the centre of the Jon Frum cargo cult.

**Tannenberg, Battle of,** also called BATTLE OF GRÜNFELDE, OF GRUNWALD (July 15, 1410), battle fought at Tannenberg (Polish: Stębark) in northeastern Poland (formerly East Prussia) that was a major Polish-Lithuanian victory over the Knights of the Teutonic Order. The battle marked the end of the order's expansion along the southeastern coast of the Baltic Sea and the beginning of the decline of its power.

Polish and Lithuanian forces proceeding toward the order's stronghold, Marienburg, met its army between the villages of Grünfelde (Polish: Grunwald) and Tannenberg. Though the order defeated the Lithuanian contingent, the ranks of the Poles remained unbroken. By the end of the 10-hour battle, the order's forces had been crushed and its grand master, most of its commanders, and 205 of its knights had been killed. Subsequently many Prussian castles controlled by the order surrendered to the Polish-Lithuanian force, though Marienburg, which was defended by Heinrich Reuss von Plauen, did not fall. By September 1410 the Polish-Lithuanian army withdrew.

**Tannenberg, Battle of** (Aug. 26–30, 1914), battle fought at Tannenberg (Polish: Stębark), in what is now northeastern Poland, that ended in a German victory over the Russians in the early days of World War I.

Two Russian armies, the 1st, which was under General P.K. Rennenkampf, and the 2nd, under A.V. Samsonov, invaded German East Prussia in August 1914. Rennenkampf fought a successful action at Gumbinnen on August 20 but failed to maintain contact with Samsonov. The German commanders Paul von Hindenburg and Erich Ludendorff, making use of a plan devised by Lieutenant Colonel Max Hoffmann, threw all their strength against Samsonov's isolated army near Uzdowo, just south of the historic site of Tannenberg (August 26). Samsonov fell back, losing about half of his army in the next few days, and the Germans took 92,000 prisoners. Samsonov shot himself in despair on August 29. The Russians lost another 30,000 killed or wounded, while the Germans sustained a total of 13,000 casualties.

Tannenberg was a crushing defeat for Russia, which lost almost an entire army, 400 cannons, and other war matériel. The Russians' premature invasion of East Prussia had, however, compelled the Germans to divert troops from their attack on France at a crucial moment of that campaign.

**Tanner, Henry Ossawa** (b. June 21, 1859, Pittsburgh, Pa., U.S.—d. May 25, 1937, Paris, France), American painter who gained international acclaim for his depiction of landscapes and biblical themes.

After a childhood spent largely in Philadelphia, in 1880 Tanner began two years of formal painting study under Thomas Eakins at Philadelphia's prestigious Pennsylvania Academy of the Fine Arts, where he was the only African American. After teaching at Clark University in Atlanta for a time, in 1891 Tanner traveled to Paris to enroll at the Académie Julian. During this period he established his palette, favouring blues and blue-greens, and began to manipulate light and shadow for a dramatic and inspirational effect.

Tanner briefly returned to the United States in 1893, in part to deliver a paper on African Americans and art at the World's Columbian Exposition in Chicago. By 1894 his paintings, often on biblical themes, were being exhibited at the annual Paris Salons. The painting *The Raising of Lazarus* (*c.* 1897) won a medal at the Paris Salon of 1897, a rare achievement for an American artist. Later that year the French government purchased the painting.

Tanner remained an expatriate in France, routinely exhibiting in Paris as well as the United States, and winning several awards. In 1923 the French government made Tanner a chevalier of the Legion of Honour, and in 1927 he became the first African American to be granted full membership in the American National Academy of Design.

After his death, Tanner's artistic stature declined until 1969, when the Smithsonian Institution in Washington, D.C., exhibited several of his works. This was the first major solo exhibition of a black artist in the United States. In 1991 the Philadelphia Museum of Art mounted a touring retrospective of his works.

**Tanner, Väinö,** in full VÄINÖ ALFRED TANNER (b. March 12, 1881, Helsinki, Fin., Russian Empire—d. April 19, 1966, Helsinki, Fin.), moderate political leader, statesman, and prime minister who was instrumental in rebuilding the Finnish Social Democratic Party after his country's civil war of 1918. Thereafter he consistently opposed Soviet demands for concessions and inroads on his country's independence.

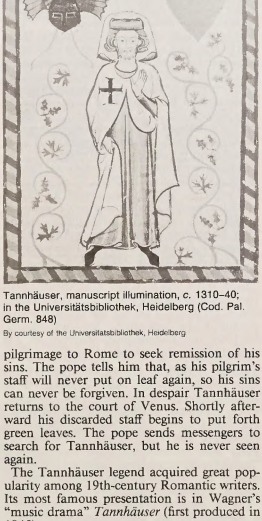
Tanner entered the Finnish Parliament as a member of the Social Democratic Party in 1907. In the 1918 civil war, he opposed the Social Democratic alliance with Communist forces, and, after their defeat, he helped reconstitute his party along democratic parliamentary lines. In addition to serving as prime minister in 1926–27, Tanner served as finance minister several times during the interwar period. At the outbreak of the Winter War of 1939–40, he became foreign minister and supported his government's hard line against Soviet demands. Holding cabinet posts throughout World War II, he largely consolidated the Finnish working class behind the war effort and suffered imprisonment thereafter on Soviet insistence. Released in 1949, Tanner returned to Parliament as a Social Democratic leader.

**Tannhäuser** (b. *c.* 1200—d. *c.* 1270), German lyric poet who became the hero of a popular legend.

As a professional minnesinger, he served a number of noble patrons, and from his references to them it can be concluded that his career spanned the period *c.* 1230–*c.* 1270. Not much is known of his life, except that he traveled widely and almost certainly took part in the Crusade of 1228–29. There are

six extant *Leiche* (lyric lays) by Tannhäuser, a few dance songs and love songs (the latter in a parodistic vein), and a group of *Sprüche* (gnomic poems).

The Tannhäuser legend is preserved in a popular ballad, *Danhauser*, traceable to 1515; the origins of the legend itself probably lie in the 13th century. Enticed to the court of Venus, Tannhäuser lives a life of earthly pleasure, but soon, torn by remorse, he makes a



Tannhäuser, manuscript illumination, *c.* 1310–40; in the Universitätsbibliothek, Heidelberg (Cod. Pal. Germ. 848)

By courtesy of the Universitatsbibliothek, Heidelberg

pilgrimage to Rome to seek remission of his sins. The pope tells him that, as his pilgrim's staff will never put on leaf again, so his sins can never be forgiven. In despair Tannhäuser returns to the court of Venus. Shortly afterward his discarded staff begins to put forth green leaves. The pope sends messengers to search for Tannhäuser, but he is never seen again.

The Tannhäuser legend acquired great popularity among 19th-century Romantic writers. Its most famous presentation is in Wagner's "music drama" *Tannhäuser* (first produced in 1845).

**tannin,** also called TANNIC ACID, any of a group of pale-yellow to light-brown amorphous substances in the form of powder, flakes, or a spongy mass, widely distributed in plants and used chiefly in tanning leather, dyeing fabric, making ink, and in various medical applications. Tannin solutions are acid and have an astringent taste. Tannin is responsible for the astringency, colour, and some of the flavour in tea. Tannins occur normally in the roots, wood, bark, leaves, and fruit of many plants, particularly in the bark of oak species and in sumac and myrobalan. They also occur in galls, pathological growths resulting from insect attacks.

In addition to their principal applications in leather manufacture and dyeing, tannins are used in the clarification of wine and beer, as a constituent to reduce viscosity of drilling mud for oil wells, and in boiler water to prevent scale formation. Because of its styptic and astringent properties, tannin has been used to treat tonsillitis, pharyngitis, hemorrhoids, and skin eruptions; it has been administered internally to check diarrhea and intestinal bleeding and as an antidote for metallic, alkaloidal, and glycosidic poisons, with which it forms insoluble precipitates. Soluble in water, tannins form dark blue or dark green solutions with iron salts, a property utilized in the manufacture of ink.

Tannins may be classified chemically into two main groups, hydrolyzable and condensed. Hydrolyzable tannins (decomposable in water, with which they react to form other substances), yield various water-soluble products, such as gallic acid and protocatechuic acid and sugars. Gallotannin, or common tannic acid, is the best known of the hydrolyzable tannins. It is produced by extraction with water or organic solvents from Turkish or Chinese nutgall. Tara, the pod from *Caesalpinia spinosa*, a plant indigenous to Peru, contains a gallotannin similar to that from galls and has become an important source for refined tannin and gallic acid. The European chestnut tree (principally *Castanea sativa*) and the American chestnut oak (*Quercus prinus*) yield hydrolyzable tannins important in leather manufacture. Condensed tannins, the larger group, form insoluble precipitates called tanner's reds, or phlobaphenes. Among the important condensed tannins are the extracts from the wood or bark of quebracho, mangrove, and wattle.

**tanning,** chemical treatment of raw animal hide or skin to convert it into leather. A tanning agent displaces water from the interstices between the protein fibres and cements these fibres together. The three most widely used tanning agents are vegetable tannin, mineral salts such as chromium sulfate, and fish or animal oil. *See also* leather.

The oldest system of tanning relies on the chemical action of vegetable material containing tannin, or tannic acid, on the protein constituents of skin. Vegetable tanning seems to have been practiced in prehistoric times. In historic times, the Hebrews tanned with oak bark, and the Egyptians, with babul pods. The Romans used bark, certain woods, and berries. The Arabs tanned with bark and roots, and in the Middle Ages they reintroduced the art into Europe via Spain. By the 18th century the value of materials such as oak bark, sumac, valonia, and hemlock was well established. The procedure, essentially unchanged in modern times, involves soaking hides in vats of increasingly strong liquors, or liquid extracts of vegetable tannin.

Tanning with chromium salts, introduced at the end of the 19th century, was probably the first change in the chemistry of leather production in at least 2,000 years. Two methods are used. In the double-bath method the hides are first bathed in a mild chromic acid solution. In the second bath, sodium thiosulfate and another acid react with the chromic acid to produce basic chromium salts, which are deposited on the fibres of the skins. In the more common single-bath method the hides are soaked in revolving drums filled with increasingly strong chromium sulfate solutions. Aluminum and zirconium salts are also used in tanning.

Oil tanning is an ancient method that is used for such soft, porous leathers as chamois and deerskin, which can be repeatedly wetted and dried without detrimental effects. Fish oil is sprinkled onto the hides and pounded in with mechanical hammers. The hides are then hung in ovens, and the oxidized oil adheres to the skin fibres.

The two main raw materials of tanning—animal hide and vegetable tannin—are available almost everywhere. As a result, tanning has spread throughout the world. It remains one of the first industries to be established in areas or nations undergoing industrialization.

**Tannu-Ola,** Mongolian TAGNĬN NURUU, mountain range of southern Tuva, extending eastward about 350 miles (560 km) from the Altai Mountains in Russia. The average elevation of its summits is 8,200–8,850 feet (2,500–2,700 m) above sea level, with a maximum elevation of 10,043 feet (3,061 m) at Sagly in the Western Tannu-Ola; the highest point in the Eastern Tannu-Ola is Despen (8,501 feet [2,591 m]). The range is drained northward by the northern Yenisey River and southward into the Hövsgol Lake. Tributaries of the Yenisey in the Western Tannu-Ola include the Anyyak-Chirgaky, Shemi, Chadana, and Torgalyg; in the Eastern Tannu-Ola, the Elegest, Ungesh, and Madzhegay are the chief tributaries. The northern slopes are covered by taiga woodland; steppe vegetation occurs on the southern slopes; and montane tundras are found at the higher elevations. The border between Russia and Mongolia is on or near the southern slopes.

**Tano River,** river, western Ghana, West Africa. It rises near Techiman and flows southward for 250 miles (400 km) to enter the Gulf of Guinea (Atlantic Ocean), at Aby Lagoon, Côte d'Ivoire (Ivory Coast). Its lower course forms the Ghana–Côte d'Ivoire boundary. It is navigable from its mouth for about 60 miles (95 km) to Tanoso, where further travel is blocked by the Sutre Falls. The Tano and the parallel Ankobra drain the western portion of a shallow basin lying southwest of the Kwahu Plateau, the main watershed of Ghana. The Ankobra–Tano Basin is important for mining (gold, bauxite), timber, copra, palm oil, and rubber.

**Tanoan languages** (North American Indian languages): *see* Azteco-Tanoan languages.

**Tanomura Chikuden,** original name TANOMURA KŌKEN (b. July 14, 1777, Bungo Province, Japan—d. Oct. 20, 1835, Ōsaka), Japanese painter noted for gentle, melancholic renderings of nature.

Early in life Tanomura planned to become a Confucian scholar, but he was also interested in painting, which he first studied under a lo-



Landscape, album leaf of ink and faint colour on paper from "Mata-mata Ichiraku-jyo," by Tanomura Chikuden, 1832; in the Nelraku Art Museum, Nara, Japan

By courtesy of the Neraku Art Museum, Nara, Japan

cal artist. Later he went to Edo (now Tokyo), where he became a pupil of the *bunjin-ga* painter Tani Bunchō. The *bunjin-ga* ("literati painting") style, also called Nan-ga, had originated in southern China and had a scholarly and literary base.

Tanomura returned for a while to his home district, where there had been a series of agrarian uprisings. After repeated futile attempts to persuade the local lord to make reforms, he decided to retire and concentrate on painting. He came to develop his own style, using gentle strokes and frequently achieving a somewhat melancholic effect. He painted mainly flowers, birds, and landscapes, and he also wrote numerous outstanding works on the Nanga school, of which *Sanchūjin jōzetsu* ("The Recluse's Tattle") is the best known.

**tanrec** (mammal): *see* tenrec.

**tansy** (*Tanacetum vulgare*, or *Chrysanthemum vulgare*), any of about 50 species of strong-smelling, poisonous herbs of the family Asteraceae, native to the North Temperate Zone. It has button-shaped yellow flower heads of disk flowers (no ray flowers) that are arranged in a flat-topped cluster; alternate, deeply cut leaves; and many stems.



Common tansy (*Tanacetum vulgare*)
Kitty Kohout from Root Resources

Tansy is sometimes cultivated in herb gardens and was formerly used in medicines and insecticides. Common tansy (*T. vulgare*) is sometimes known as golden-buttons.

**Ṭanṭā**, city and capital of al-Gharbiyah *muḥāfaẓah* (governorate), Lower Egypt, in the Nile Delta. It lies on an irrigation canal almost midway between the Rosetta (west) and Damietta (east) branches of the Nile on the Cairo–Alexandria superhighway. It is also a junction for railways leading to Alexandria and Damietta and serving the flat, alluvial *muḥāfaẓah*.

A centre of Arab learning and pilgrimage, Ṭanṭā's most revered possession is the mosque and tomb of Aḥmad al-Badawī, a 13th-century Islāmic marabout (holy man) born at Fès (Morocco). Three important annual feasts are celebrated in Ṭanṭā, including the birthday of the marabout. In addition to the Islāmic schools attached to al-Aḥmad Mosque, there is the Arabic college of al-Aḥmadi (renamed Ṭanṭā Institute), one of the oldest in Egypt. It was founded in 1276 and was reorganized in 1769 as an affiliate of al-Azhar University of Cairo. Ṭanṭā University opened in 1972, and another college opened in the early '80s. Ṭanṭā was one of two Coptic bishoprics created in 1895 under the Patriarch of Alexandria.

Industries include petroleum refining, cotton ginning, cottonseed oil extracting, wool spinning, flour milling, and the production of tobacco products and pasta (macaroni). The older Suez-Mediterranean oil pipeline runs through the city. Pop. (1986 prelim.) 334,505.

**tantalite,** tantalum-rich variety of the mineral columbite (*q.v.*). Tantalite is the principal ore of the metal tantalum.

**tantalum** (Ta), chemical element, very hard, silver-gray metal of Group Vb of the periodic table, characterized by its high density, extremely high melting point, and excellent resistance to all acids except hydrofluoric at ordinary temperatures. Closely associated with niobium in ores and in properties, tantalum was discovered (1802) by the Swedish chemist Anders Gustaf Ekeberg and named after the mythological character Tantalus because of the tantalizing problem of dissolving the oxide in acids. It was soon identified with niobium (then called columbium) until the German chemist Heinrich Rose demonstrated (1844) their distinct characters. Although some of the impure metal was isolated earlier, the Russian chemist Werner Bolton prepared (1903) the first ductile tantalum, which was used briefly as incandescent lamp-filament material.

Relatively rare, tantalum is about as abundant as uranium. It occurs, with niobium, in the columbite–tantalite and the pyrochlore–microlite series of minerals. Native tantalum metal with some niobium and traces of manganese and gold occurs sparingly in Russia in placers in the Ural and possibly the Altai mountains in Central Asia. For mineralogical properties, *see* native element (table).

Tantalum is separated from niobium compounds by solvent extraction and is then reduced to metallic tantalum powder. The massive metal is produced by powder metallurgy techniques. The most important uses for tantalum are in electrolytic capacitors and corrosion-resistant chemical equipment. Tantalum capacitors have the highest capacitance per unit volume of any capacitors and are used extensively in miniaturized electrical circuitry. Other uses include getters and components in electron tubes, rectifiers, and prosthetic devices.

Tantalum is chemically much like niobium because both have similar electronic configurations and because the radius of the tantalum ion is nearly the same as that of niobium as a result of the lanthanide contraction (*q.v.*). Tantalum is usually pentavalent; lower oxidation states, especially from +2 to +4, have been prepared. Tantalum compounds are relatively unimportant commercially, although the carbide TaC is used in cemented-carbide tools for machining hard metals. The only naturally occurring isotope, tantalum-181, is stable.

| | |
|---|---|
| atomic number | 73 |
| atomic weight | 180.948 |
| melting point | 2,996° C (5,425° F) |
| boiling point | 5,425° C (9,797° F) |
| specific gravity | 16.6 (20° C) |
| valence | 2, 3, 4, 5 |
| electronic config. | 2-8-18-32-11-2 or $(Xe)4f^{14}5d^{3}6s^{2}$ |

**Tantalus,** Greek TANTALOS, in Greek legend, son of Zeus or Tmolus (a ruler of Lydia) and Pluto (daughter of Cronus and Rhea) and the father of Niobe and Pelops (*qq.v.*). He was the king of Sipylus in Lydia (or of Phrygia) and was the intimate friend of the gods, to whose table he was admitted. The punishment of Tantalus in the underworld was occasioned by one of several crimes, according to various ancient authors: (1) He abused divine favour by revealing to mankind the secrets he had learned in heaven. (2) He offended the gods by killing his son Pelops and serving him to them, in order to test their power of observation. (3) He stole nectar and ambrosia, the food of the gods, from heaven and gave them to men.

In Hades Tantalus stood up to his neck in water, which flowed from him when he tried to drink it; over his head hung fruits that the wind wafted away whenever he tried to grasp them (hence the word tantalize). According to another story, a rock hung over his head ready to fall and crush him.

**Tantia Topi,** also spelled TATYA TOPE, original name RAMCHANDRA PANDURANGA (b. *c.* 1819—d. April 18, 1859), a leader of the Indian Mutiny of 1857. Though without formal military training, he was probably the best and most effective of the rebels' generals.

Tantia Topi was a Marāthā Brahman in the service of the former peshwa (ruler) of the Marāthā confederation, Bājī Rāo, and of his adopted son Nana Sahib, who was also prominent in the mutiny. He was present at Nana Sahib's massacre of the British colony in Cawnpore (Kānpur); in early November 1857 he had taken command of the rebel forces of the state of Gwalior and driven Gen. C.A. Windham into his entrenchments at Cawnpore on November 27–28. He was defeated by Sir Colin Campbell on December 6 but remained at Kālpi, the scene of his defeat. In March 1858 he moved to the relief of Jhānsi, whose rani (queen) was besieged by British forces. Again defeated, he welcomed the escaping rani at Kālpi and then made a successful dash to Gwalior on June 1. His forces were broken up on June 19, but he continued resistance as a guerrilla fighter in the jungle until his betrayal and execution.

**Tantra** (Sanskrit: Loom), any of numerous texts dealing with the esoteric practices of some Hindu, Buddhist, and Jaina sects. In the orthodox classification of Hindu religious literature, *Tantra* refers to a class of post-Vedic Sanskrit treatises similar to the *Purāṇas* (medieval encyclopaedic collections of myths, legends, and other topics). In this usage *Tantras* are, theoretically, considered to treat of theology, yoga, construction of temples and images, and religious practices; in reality, they tend to deal with such aspects of popular Hinduism as spells, rituals, and symbols. They are distinguished along Hindu sectarian lines between the Śaiva *Āgamas*, the Vaiṣṇava Saṃhitās, and the Śākta *Tantras*.

The lists of the Śākta *Tantras* differ considerably from one another but suggest that the earliest manuscripts date from about the 7th century. They emphasize the goddess Śakti (Shakti) as the female personification of the creative power or energy of the god. This view taken to its extreme holds that Śiva (Shiva) without his Śakti is like a corpse. In the *Tantras* that deal with yoga, Śakti is identified with the *kuṇḍalinī*, or the energy that lies coiled at the base of the spine until brought up through the body by yogic disciplines. The *Tantras* also stress the efficacy of *yantras* and *maṇḍalas* (ritual diagrams) and of *mantras* (mystic syllables or sacred formulas). Among the major Śākta *Tantras* are the *Kulārṇava*, which treats of "left-hand" practices, such as ritual copulation; the *Kulacūḍāmaṇi*, which discusses ritual; and the *Śaradātilaka*, which deals almost exclusively with magic.

The Buddhist *Tantras* are traced to the 7th century or earlier, the *Tathāgataguhyaka* being an early and extreme work. They were translated into Tibetan and Chinese from about the 9th century onward, and some texts have been preserved only in those languages, the Sanskrit originals having been lost. Among the Buddhist *Tantras* an important text is the *Kālacakra-tantra*.

**Tantric Buddhism:** *see* Vajrayāna.

**Tantric Hinduism,** system of esoteric practices used for both the attainment of spiritual experiences and the fulfillment of worldly desires. *Tantra* designates a particular group of post-Vedic Sanskrit treatises, heterogeneous in content, that deal with secret practices aiming at the purification of the body and the control of physiological and psychological processes. By such purification and control, it is believed, the body and the mind may be made perfect media for the realization of the highest truth, and also of all that concerns the worship of gods and goddesses, rites and rituals, and black magic. Tantrism also plays a significant part in Buddhism and, to a limited degree, in Jainism. It is practiced in India, Nepal, Bhutan, and especially, Tibet. (For Tantric Buddhism, *see* Vajrayāna.)

Tantric Hinduism is mostly concerned with practical methods and lays little stress on religious theories, which it accepts from the main

philosophical schools of Hinduism. Theologically it holds that the nondual Supreme Reality has two aspects, Śiva (male) and Śakti (female), the one representing pure consciousness and transcendent passivity, the other representing mental activity. This truth regarding Śiva-Śakti as well as the nonduality of the Absolute is to be realized within the human body, which is believed to be a microcosm, or epitome, of the universe. The spinal cord represents the fabulous Mount Meru; and the three main nerve connections (*iḍā, piṅgalā,* and *suṣumnā*) running along the left, the right, and the middle of the spine represent the three sacred rivers Ganges, Yamuna, and Sarasvatī; the breathing process represents the course of time. Śakti, the female force, also called *kuṇḍalinī,* lying serpentwise coiled and dormant in the lowest psychic centre, or *cakra,* of the body, has to be awakened and made to move upward through the five higher *cakras* along the spinal cord, so as to be united with Śiva, the male force, at the *sahasrāra cakra,* described as a thousand-petaled lotus at the top of the head. This union brings about the transcendently blissful realization of supreme nonduality.

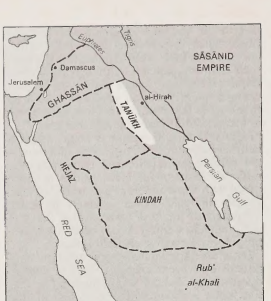
Tantrism, in an attempt to reach a supramental and depersonalized ecstasy, advocates the methodical use of sexual union without the pleasurable completion of the sex act, as a yogic process; this, it is believed, creates a state of heightened suspense leading to the complete arrest of all mental processes, in a mystic sense of oneness with the basic reality of the universe. In Tantrism, caste restrictions are reduced to a minimum; women are often revered as manifestations of Śakti, men being manifestations of Śiva. Tantrism also upholds the efficacy of *yantras* (ritual mystic diagrams) and of mantras (mystic syllables or formulas).

**Tanucci, Bernardo, Marchese** (b. Jan. 20, 1698, Stia, Italy—d. April 29, 1783, Naples [now in Italy]), foremost statesman of the Kingdom of Naples-Sicily in the 18th century.

Though a northerner, Tanucci came to the attention of the Spanish Bourbon prince Don Carlos, the future Charles III of Spain, who ruled Naples-Sicily in the middle decades of the century and who made Tanucci first secretary of state for justice and later foreign minister. Tanucci intelligently carried out Charles's policy of making the southern Italian kingdom genuinely independent, and in 1759, when Charles inherited the Spanish throne, Tanucci became one of the regents of the young king Ferdinand IV of Naples. In 1768 Ferdinand appointed him premier secretary of state, in effect prime minister, but he encountered opposition from the queen, Maria Carolina, around whom the nobility rallied. Tanucci was forced to resign in 1776 and spent his last years in retirement.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Tanūkh,** ancient group of various southern Arabian tribes and clans that first moved into central Arabia and then, at the beginning of the 2nd or 3rd century AD, moved into the fertile region west of the lower and middle Euphrates River. Although they were originally seminomadic, they later made a permanent settlement on the lower Euphrates, called al-Ḥīrah (from Syriac *ḥĕrtā,* "camp"). Most of the Tanūkh tribes were Christianized, but during the 7th century several of the tribes fought on the side of the advancing Muslim armies. During the last half of the 8th century some of the Tanūkh moved into northern Syria, and during the 9th century they continued into




The Tanūkh in the 2nd–7th century AD
From C. Brockelmann, *A History of the Islamic Peoples*

Lebanon. Many of the Tanūkh tribes in Lebanon readily accepted the politico-religious teachings of the Druze missionaries, whose sect accepts a mixture of Islāmic and Christian teachings.

**T'anŭm** (Korean artist): *see* Yi Chŏng.

**Tanuma Okitsugu** (b. 1719, Edo [now Tokyo], Japan—d. Aug. 25, 1788, Edo), renowned minister of Japan's Tokugawa shogunate (1603–1867); traditionally considered one of the corrupt geniuses of the period, he actually helped restore the financial footing of the government and greatly fostered trade.

Tanuma was the son of a minor Tokugawa official but rose to power in spite of the extremely restricted social mobility of the Tokugawa period. Beginning as a page in the apartments of Tokugawa Ieshige (reigned 1745–60), the ninth Tokugawa shogun, or military dictator of Japan, he rose to occupy the highest ministerial position in the administration of the 10th shogun, Tokugawa Ieharu (reigned 1760–86). At the same time he became the head of one of the important feudal fiefs into which Japan was then divided.

Able to dominate the central government completely, Tanuma made a vigorous effort to spur the development of trade and commerce. In his attempt to increase government revenues, he not only instituted the usual land reclamation and irrigation promotion policies to stimulate agricultural productivity but he also took steps to encourage foreign trade, especially with Russia. To this end he fostered the colonization and development of the northernmost Japanese islands of Hokkaido and Sakhalin, which bordered the Russian sailing routes.

Tanuma tightened the existing government monopolies in gold, silver, and copper trading, and he added new government monopolies in such important commodities as alum, camphor, ginseng, iron, brass, lime, and even lamp oil. He also made an attempt to increase mining production. Finally, he licensed many merchant guilds and established government moneylending institutions, thus finding important new sources of official revenue. To further increase government profits, he attempted to debase the currency.

Tanuma was criticized, however, for his policy of encouraging the giving of presents to superiors in the government bureaucracy. Many felt that he was wrong to encourage mercantile expansion; they also thought the government should take punitive action against the increasingly luxurious way of life of the merchant and noble classes and attempt to reinstate the martial vigour and feudal virtues of the past. Tanuma was thus blamed for much of the corruption that flourished during his regime and was considered responsible for the prevalence of famines, peasant rebellions, and worker discontent.

Thus, Tanuma became one of the most unpopular officials in Japanese history. In 1784 his son, a junior official, was assassinated in an attempt to destroy the family. Two years later, when Tokugawa Ieharu died, his successor stripped Tanuma of all his offices and severely reduced the size of his fief. In 1787 Tanuma's holdings were reduced even further, and he was ordered into confinement.

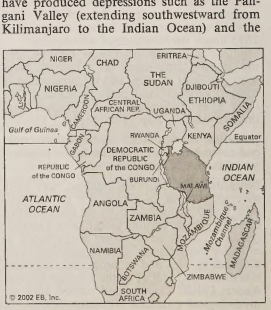
**Tanwŏn** (Korean painter): *see* Kim Hong-do.

**Tanzania,** officially UNITED REPUBLIC OF TANZANIA, Swahili JAMHURI YA MWUNGANO WA TANZANIA, East African country lying immediately south of the Equator. Dar es Salaam is the largest city and the seat of government, pending the transfer of official functions to the new capital at Dodoma. Facing the Indian Ocean on the east, Tanzania is bordered by Malawi and Mozambique in the south; Zambia, Congo (Kinshasa), Burundi, and Rwanda in the west; and Uganda and Kenya in the north. The outlying territories comprise the islands of Zanzibar (641 square miles), Pemba (380 square miles), and Mafia (200 square miles). Area 364,901 square miles (945,090 square km). Pop. (2000 est.) 35,306,000.

A brief treatment of Tanzania follows. For full treatment, *see* MACROPAEDIA: Eastern Africa.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*The land.* Although most of Tanzania consists of plain and plateau, it has some spectacular relief features. The coastal area is low and narrow. The mountain system sprawls in a twisting pattern from north to southwest, formed by the Ufipa Plateau, the Mbeya Range, and Rungwe Mountains. Near the coast are the Usambara and Pare mountains. The highland complex culminates in the snow-clad peak of Kilimanjaro, the highest peak in Africa, rising to 19,341 feet (5,895 m). The Uluguru Mountains stand about 120 miles (190 km) west of Dar es Salaam; overlooking Lake Nyasa in the south are the Kipengere and Livingstone mountains. Lake Tanganyika, the second deepest lake in the world (4,710 feet deep), forms part of the world's greatest continental rift system. To the north of Lake Nyasa the rift system divides into a western rift and an eastern rift. Mount Lengai, west of Kilimanjaro, is the only active volcano. The rifts have produced depressions such as the Pangani Valley (extending southwestward from Kilimanjaro to the Indian Ocean) and the




Tanzania

Malagarasi Swamp. On the borders are three lakes, including Lake Victoria (26,828 square miles [69,485 square km]), the world's second largest freshwater lake (following Lake Superior). Although three great rivers—the Nile, the Congo, and the Zambezi—have their origins in Tanzania, the country has few permanent rivers. The country's largest river basin, the Rufiji, covers an area of 61,000 square miles (157,900 square km) in southern Tanzania. The soils in many areas of the country are clayey and of limited fertility.

Tanzania experiences an equatorial type of climate, generally modified by elevation. The coastal area and immediate hinterland experience temperatures averaging 80° F (27° C) with high humidity and an annual rainfall varying from 30 inches (760 mm) inland to more than 60 inches (1,500 mm) along the coast. The central plateau, which is hot and dry, has from 20 to 30 inches of rainfall. In the Lake Victoria area rainfall ranges between 30 and 90 inches. Forests grow in the highland areas that receive high rainfall. The western and southern plateaus are primarily miombo woodland, which consists of an open cover of trees (notably *Brachystegia* and *Isoberlinia*), while in areas of less rainfall, bushland and thickets are found. Thinly wooded grasslands cover areas where the original forest cover has been burnt off for human use. The famous Serengeti Plain, by contrast, owes its grasslands to a calcium-rich hardpan deposited close to the soil surface by evaporated rainwater. Reed and grass swamps of the central plateau contrast with the thick mangrove forests of the coastal creeks. National parks and game reserves occupy one-seventh of the country and include the Serengeti National Park, famous for its vast plains-animal migrations. Tanzania's wildlife includes wildebeest, elephant, rhinoceros, buffalo, lion, leopard, zebra, giraffe, eland, kudu, and dik-dik.

Only about 4 percent of the land area is considered arable, though the total irrigated area has increased substantially since the 1960s. Nearly 40 percent of the land is pasture or rangeland. Tanzania has important deposits of gold and base metals. It also has energy reserves of coal and natural gas.

*The people.* Tanzania has about 120 identifiable ethnic groups, but none of them is large enough to be dominant. The largest, the Sukuma, constitutes about one-fifth of the population, and none of the others account for more than a small percentage. Non-Africans, including Europeans, Asians (Indians, Pakistanis, and Goans), and Arabs, constitute about 1 percent of the population. The main language groups are Bantu, Nilotic, and Cushitic. A majority speak Bantu languages, mostly Swahili, which is one of the country's two official languages (English is the other). Arabic is widely spoken on the coast. In religious terms, the number of people professing traditional animist beliefs is gradually declining. Muslims make up one-third of Tanzania's population and are most widespread in the coastal areas. Another one-third of the people are Christians.

Almost half of Tanzania's population is less than 15 years old, because of the very high birth rate. Patterns of human settlement are influenced principally by the incidence of rainfall and the presence of the tsetse fly. The tsetse, which thrives on wild game in miombo woodlands, makes human settlement hazardous in areas of moderate rainfall, so that areas of low or unreliable rainfall are more densely populated than would otherwise be the case. The insect does not pose a threat to areas of high rainfall and high population density. Most of the densely populated areas of Tanzania are thus located on the periphery of the country—around the shores of Lake Victoria, in the highlands around Kilimanjaro, and in the urban area of Dar es Salaam on the coast. Tanzania remains one of the least urbanized African countries; urban population is only one-third of the total. On the Tanzanian island of Zanzibar, however, two-fifths of the population is urban. Dar es Salaam accounts for nearly one-fifth of the total urban population.

*The economy.* Tanzania has a developing, centrally planned economy based largely on agriculture. The gross national product (GNP) is not growing as rapidly as the population, and the GNP per capita is among the lowest in the world.

The economy is overwhelmingly agrarian. Although cultivated land is extremely limited in Tanzania, the agricultural sector accounts for almost one-half of the gross domestic product (GDP) and employs more than four-fifths of the workforce. Production fluctuates considerably, with serious shortfalls occurring largely as a result of drought and shortages of fuels and machinery. Government policy encourages the growing of food crops (corn [maize], cassava, sorghum, millet, rice, and plantains) at the expense of cash crops (coffee, cloves [on Zanzibar], cotton, sisal, cashew, tea, and tobacco), but food shortages persist. Export cash crops continue to provide the country's main source of foreign exchange.

Diamond production has declined sharply. Tanzania also exploits gold, salt, gemstones, gypsum, iron ore, tin, and koalin. Coal is mined in the southwest. Natural gas has been discovered offshore of Kilwa, south of Dar es Salaam.

Industry accounts for only a tiny portion of the GDP and employs a comparable fraction of the workforce. Manufacturing is largely based on the processing of local commodities and is dominated by state corporations. The biggest industries, after food processing, are textiles, brewing, and cigarettes. Some 70 percent of the country's electricity is generated by water power. Services account for roughly one-third of the GDP and employ about one-seventh of the workforce.

Tanzania's total imports (including machinery and transport equipment, basic manufactures, fuel, and chemicals) amount to more than twice the value of its total exports (coffee, cotton, sisal, and cloves), and the country suffers from a serious lack of foreign exchange. Tanzania's chief trading partners include the United Kingdom, Germany, Japan, Italy, and The Netherlands. More than two-thirds of the republic's development is sponsored by a wide range of bilateral donors.

*Government and social conditions.* The United Republic of Tanzania's 1977 constitution vested political authority in the only legally permitted political party in the land, the Revolutionary Party of Tanzania (Chama Cha Mapinduzi; CCM). The constitution was amended in 1992 to open the political process to other parties, but the CCM remained the country's dominant political organization. The constitution vests executive power in a president (who is also usually chairman of the CCM), assisted by a vice president and a prime minister. The National Assembly is the highest legislative body and includes appointed members as well as members directly elected concurrently with the president every five years. Zanzibar elects its own administration for local affairs, consisting of an elected president, a prime minister appointed by him, and a House of Representatives. The president of Zanzibar and members of the legislature are directly elected.

The Tanzanian government operates a countrywide network of medical services including hospitals and dispensaries. Emphasis is placed mainly on preventive medicine, and significant improvements in health have resulted from implementation of control measures. The main environmental diseases are malaria, sleeping sickness, schistosomiasis, and onchocerciasis. Deficient nutrition is also a major problem.

The education system has three levels—primary school, secondary school, and university. Primary education is free and compulsory for seven years, and vocational training is encouraged by the government since only a small proportion of students advance to secondary school. There are also professional, vocational, and religious schools. A number of daily newspapers are published both in Swahili and in English: *Uhuru*, the CCM party newspaper. The other major newspaper, the *Daily News*, is government controlled, as is Radio Tanzania, which broadcasts in Swahili and English, with special programs for schools and farmers. There is television service only on Zanzibar.

*Cultural life.* The variety of its ethnic groups and their traditions, languages, and customs give Tanzania a remarkable cultural milieu. Among the plastic arts practiced are traditional abstract Makondo wood carving and the fabrication of weaponry by the Masai. Every tribe has its dances and folklore. Swahili poetry and prose writing flourish, and Julius Nyerere, the country's first president, was himself a literary figure of note, known especially for his translations of Shakespearean plays into Swahili.

*History.* In the 1st millennium BC Caucasoid peoples, probably southern Cushites from Ethiopia, inhabited northern Tanzania, spreading eventually to the southern regions. At some time during the first half of the 1st millennium AD small groups of iron-using and Bantu-speaking peoples settled in Tanzania from western Africa. By the end of the 1st century AD trading contacts existed between Arabia, the East African coast, and possibly India. The coastal trading centres were mainly Arab settlements. After the arrival of the Portuguese in the late 15th century, the position of the Arabs on the coast was gradually undermined, but the Portuguese made little attempt to penetrate the interior, and they lost their holdings north of the Ruvuma River early in the 18th century. In constant search for slaves, Arab traders penetrated farther into the interior, particularly in the southeast toward Lake Nyasa. About 1825, Arab merchants followed tribal trade routes to Nyamwezi, where ivory was as great an attraction as slaves. From Nyamwezi the Arabs pressed on to Lake Tanganyika in the early 1840s and established trading centres there.

In the late 1840s the Germans Johann Ludwig Krapf and Johannes Rebmann, who came to the area as representatives of the British Church Missionary Society, sighted Mount Kilimanjaro, which stimulated German interest in the area. By 1885 German colonists had penetrated the area, and they obtained full control by 1907. During World War I Britain occupied the German holdings, and after the war it came under British rule by a League of Nations mandate. Britain retained control of the region after World War II when it became a United Nations trust territory.

In 1961 Tanganyika gained independence and was admitted to the United Nations. A year later Tanganyika became a republic with Julius Nyerere as president but remained in the Commonwealth of Nations. In 1964 Tanganyika merged with Zanzibar to form Tanzania. By 1977 Tanzania had a new constitution limiting political activity to the Revolutionary Party and guaranteeing Zanzibar's autonomy. With the Arusha Declaration of 1967, Nyerere set Tanzania on a course of socialist economic development, to be based on a spirit of voluntary cooperation and self-reliance called *ujaama* ("familyhood"). This idealistic experiment, despite financial and technical aid from sympathetic countries, collapsed after a decade of inefficiency, corruption, resistance from peasants, and huge rises in the price of imported petroleum and in

Tanzania's debt to foreign lenders. Beginning in the mid-1980s, the privatization of industry met with modest success. In May 1992 the constitution was amended to provide for a multi-party political system, and in 1995 the first national elections under this system were held.

**tanzanite,** blue gem variety of zoisite (*q.v.*).

**Tanzimat** (Turkish: "Reorganization"), series of reforms promulgated in the Ottoman Empire between 1839 and 1876 under the reigns of the sultans Abdülmecid I and Abdülaziz. These reforms, heavily influenced by European ideas, were intended to effectuate a fundamental change of the empire from the old system based on theocratic principles to that of a modern state.

Many of the key provisions of the Tanzimat reforms were set forth in the Hatt-ı Şerif of Gülhane (1839; "Noble Edict of the Rose Chamber"). This document called for the establishment of new institutions that would guarantee security of life, property, and honour to all subjects of the empire regardless of their religion or race. It also authorized the development of a standardized system of taxation to eliminate abuses and established fairer methods of military conscription and training. The promises of equality for non-Muslims (mainly Christians and Jews) living in the empire were not always carried out, but the balance of the changes provided for in the Noble Edict, along with other reform measures, were implemented principally under the leadership of Mustafa Reşid Paşa, who served six terms as grand vizier. The reforms included the development of a new secular school system, the reorganization of the army based on the Prussian conscript system, the creation of provincial representative assemblies, and the introduction of new codes of commercial and criminal law, which were largely modeled after those of France. These laws, moreover, were administered by newly established state courts independent of the ʿulamāʾ, the Islāmic religious class.

The Tanzimat reform movement came to a halt by the mid-1870s during the last years of Abdülaziz's reign. Under the Tanzimat effort to centralize administration, all legal authority became concentrated in the hands of the sultan. As a result, little could be done when Abdülaziz began abusing his power and adopted revisionary policies. This fact notwithstanding, the Tanzimat reforms succeeded in laying the groundwork for the gradual modernization of the Ottoman state. *See also* Abdülaziz.

**tao,** Pinyin DAO (Chinese: "road," or "way"), in Chinese philosophy, a fundamental concept signifying "the correct way," or "Heaven's way." In the Confucian tradition, tao signifies a morally correct path of human conduct and is thus limited to behaviour. In the rival school of Taoism (the name of which derives from tao), the concept takes on a metaphysical sense transcending the human realm. The *Tao-te Ching,* a Taoist classic of contested authorship and date (sometime between the 8th and 3rd century BC), opens with these words: "The tao that can be spoken about is not the Absolute Tao." The Absolute Tao thus defies verbal definition, but language can make suggestions that may lead to an intuitive or mystical understanding of this fundamental reality.

One aspect of the tao, however, can be perceived by man, namely, the visible process of nature by which all things change. From an observation of the visible manifestation of the Absolute Tao, it is possible to intuit the existence of an ultimate substratum that is the source of all things. Awareness of this process then leads toward an understanding of the Absolute Tao.

Taoists view life and death as simply different stages, or manifestations, of the Absolute Tao and consequently advocate a life in accord with nature. The serenity of such a life stands in sharp contrast to the life of public service advocated by Confucius.

**T'ao-an** (China): *see* Pai-ch'eng.

**Tao-chi** (Chinese painter): *see* Shih-t'ao.

**T'ao Ch'ien,** Pinyin TAO QIAN, also called (Wade-Giles) T'AO YÜAN-MING (b. 365, Hsin-yang district, now in Kiangsi province, China—d. 427, Kiangsi), one of China's greatest poets and a noted recluse.



T'ao Ch'ien, portrait by an unknown artist; in the National Palace Museum, Taipei

By courtesy of the Collection of the National Palace Museum, Taipei, Taiwan, Republic of China

Born into an impoverished gentry family, T'ao Ch'ien while in his 20s took a minor official post in order to support his aged parents. After about 10 years at that post and a brief term as county magistrate, he resigned from official life, repelled by its excessive formality and widespread corruption. With his wife and children he retired to a farming village south of the Yangtze River. Despite the hardships of the farmer's life and frequent food shortages, T'ao Ch'ien was contented, writing poetry, cultivating the chrysanthemums that became inseparably associated with his poetry, and drinking wine, also a common subject of his verse.

The taste of T'ao Ch'ien's contemporaries was for an elaborate and artificial style, while his poetry is simple and straightforward, with a minimum of artifice. Hence he was not fully appreciated until the T'ang dynasty (618–907). A master of the five-word line, T'ao Ch'ien has been described as the first great poet of *t'ien-yüan* ("fields and gardens"). Essentially a Taoist in his philosophical outlook on life and death, he also freely adopted the elements of Confucianism and Buddhism that most appealed to him.

**Tao Hongjing** (Taoist scholar): *see* T'ao Hung-ching.

**T'ao Hung-ching,** Pinyin TAO HONGJING (b. 451, Mo-ling, China—d. 536, Hua-yang), Chinese poet, calligrapher, physician, naturalist, and the most eminent Taoist of his time.

A precocious child, T'ao was a tutor to the Imperial court while still a youth. In 492 he retired to Mao Shan, a chain of hills southeast of Nanking, to devote himself to the life and study of Taoism. There he established a mountain retreat where whole families lived under his spiritual guidance. T'ao was an adviser and friend to the emperor Wu Ti, and his retreat survived the proscription of all other Taoist sects in 504.

The major work of T'ao Hung-ching was the editing and annotation of the religious writings of Yang Hsi, Hsü Mi, and Hsü Hui, composed at Mao Shan in the 4th century. This enormous body of work includes Taoist scriptures, lives, and visionary dictations (*dictées*) that are the highest literary achievement of the formative period of esoteric Taoism. T'ao produced two compendiums of the literature, the *Chen Kao* ("Declarations of the Perfected") and the *Teng-chen yin-chüeh* ("Secret Instructions for Ascent to Perfection").

At Mao Shan, T'ao attempted to recreate the daily practices of Taoism laid down in these works in their original setting. In the course of his research into proper eating and living practices, he produced the *T'u ching yen i pen ts'ao,* one of the major pharmacological works of China. T'ao also effected a working synthesis of the private and individual practices of the Mao Shan literature with the 4th-century public rites of the Ling Pao liturgies. His writings on the Ling Pao pantheon reveal his familiarity with Buddhist as well as Taoist literature.

**Tao-kuang,** Pinyin DAOGUANG (reign name, or *nien-hao*), personal name (Wade-Giles) MIN-NING, posthumous name (*shih*) CH'ENG-TI, temple name (*miao-hao*) (CH'ING) HSÜAN-TSUNG (b. Sept. 16, 1782, Peking, China—d. Feb. 25, 1850, Peking), sixth emperor of the Ch'ing dynasty of China, during whose reign (1820–50) attempts to prevent governmental decline met with little success.

The young monarch ascended the throne in 1820, assuming the reign name Tao-kuang. The Imperial treasury had been greatly depleted during previous reigns, and he tried to restore the nation's finances by personal austerity. The need to repair the dikes along the Yellow River to prevent flooding and further famine became urgent, as did repair of the Grand Canal, which brought rice from South China to the capital at Peking. Yet corrupt officials embezzled money for repairs, and the Tao-kuang emperor feared to reduce the size of the labour force lest repair problems increase. By 1849 the Grand Canal was impassable, and the rice shipments had to be made by sea, where they were endangered by pirates. The thousands of unemployed canal boatmen helped fan the flames of unrest.

Meanwhile, in 1838 the emperor's attempts to stop the opium trade carried on by Western merchants resulted in the first Opium War between Britain and China (1839–42). The cost of the war and the large indemnity paid under terms of the peace treaty further increased discontent. Tao-kuang died just as the great political-religious upheaval known as the Taiping Rebellion (1850–64) was beginning to sweep South China.

**Tao Qian** (Chinese poet): *see* T'ao Ch'ien.

**Tao Sheng,** Pinyin DAO SHENG, secular name CHU (b. *c.* 360, P'eng-ch'eng, China—d. 434), eminent Chinese Buddhist monk and scholar.

Tao Sheng studied in the capital city of Chien-k'ang (Nanking) under Chu Fa-t'ai, spent seven years with Hui Yüan in the monastery at Lu-shan, and then went north to Ch'ang-an where, in association with Kumārajīva, he became one of the most learned and eloquent of Buddhist scholars. He returned south in about 409 and lectured at Lu-shan and Chien-k'ang until he was expelled by conservative monks for his revolutionary teaching. He taught that spontaneous acts made without deliberate mental choice and effort leave behind no karmic entail; that Buddhahood may be achieved by sudden enlightenment; that all sentient beings, even those unreceptive to Buddhism (the *icchantikas*), possess the Buddha-nature or Universal Mind; and that there is no Buddha-world beyond the present. When a complete translation of the *Parinirvāṇa sūtra* appeared in Chinese, Tao Sheng was vindicated. Many of his teachings were developed and systematized by Ch'an (Zen) masters in the 6th and 7th centuries.

**Tao-te Ching** (Chinese: "Classic of the Way of Power"), classic of Chinese philosophical literature. The name was first used during the Han dynasty (206 BC—AD 220); it had previ-

ously been called *Lao-tzu* in the belief that it was written by Lao-tzu, identified by Ssu-ma Ch'ien, China's first great historian, as a 6th-century-BC curator of the Imperial Chinese archives. Lao-tzu, however, is better known as the reputed founder of Taoism, a way of life (Chinese Tao, Way) that, among many competing "Ways," alone became known as the Tao school, or Taoism. The long tradition that Lao-tzu was the author of the *Tao-te Ching* was so badly shaken in the 19th century that some scholars even questioned the historical existence of the sage. The problem of authorship is still unresolved. The *Tao-te Ching*, moreover, contains no references to other writings, persons, events, or places that might provide a clue for dating the composition. Scholarly opinions consequently range between the 8th and 3rd centuries BC.

The *Tao-te Ching* presented a way of life intended to restore harmony and tranquillity to a kingdom racked by widespread disorders. It was critical of the unbridled wantonness of self-seeking rulers and was disdainful of social activism based on the type of abstract moralism and mechanical propriety characteristic of Confucian ethics. The Tao of the *Tao-te Ching* has received a wide variety of interpretations because of its elusiveness and mystical overtones and has been a basic concept in both philosophy and religion. In essence it consists of "nonaction" (*wu-wei*), understood as no unnatural action, rather than complete passivity. It implies spontaneity, noninterference, letting things take their natural course: "Do nothing and everything is done." Chaos ceases, quarrels end, and self-righteous feuding disappears because the Tao is allowed to flow unchallenged and unchallenging. Everything that is comes from the inexhaustible, effortless, invisible, and inaudible Way, which existed before Heaven and Earth. By instilling in the populace the principle of Tao, the ruler precludes all cause for complaint and presides over a kingdom of great tranquillity.

The popularity of the *Tao-te Ching* is reflected in the vast number of commentaries that have been written; over 350 have been preserved in Chinese, about 250 in Japanese. Since 1900 more than 40 translations have appeared in English.

**t'ao-t'ieh,** Pinyin TAOTIE, awesome monster mask commonly found on Chinese ritual bronze vessels and implements of the Shang (18th–12th century BC) and early Chou (1111–*c.* 900 BC) dynasties. It characteristically consists of a zoomorphic mask in full face that simultaneously may be divided through the nose ridge of the centre to form profile views of two one-legged beasts (*k'uei* dragons) confronting each other. A ground pattern of squared spirals, the "thunder pattern" (*lei-wen*), often serves as a design filler between and around the larger features of the design.

Typical features of the mask include large, protuberant eyes; stylized depictions of eyebrows, horns, nose crest, ears, and two peripheral legs; and a line of a curled upper lip with exposed fangs and no lower jaw. Since it suggests an ever-devouring "glutton," it was probably this last feature that later (3rd century BC) inspired the name *t'ao-t'ieh* for the ancient monster motif. The function of the *t'ao-t'ieh* motif has been variously interpreted; it may be totemic, or protective, or an abstracted, symbolic representation of the forces of nature. After the early Chou period, the *t'ao-t'ieh* mask motif was supplanted by a monster that was similar but depicted more literally and with diminished power.

**Tao Tsang** (Chinese: Canon of the Way), also called TAOIST CANON, a large, imperially sponsored collection of Taoist writings, very few of which have been translated into English. The original canon, printed by the Taoist emperors of the Sung dynasty (AD 960–1279), comprised almost 5,000 volumes, but many of these were destroyed by imperial decree during the Yüan, or Mongol, dynasty (1279–1368). The present *Tao Tsang*, numbering well over 1,000 volumes, contains a variety of texts including speculative philosophical writings and esoteric works on Taoist meditation, alchemy, and divine revelation.

**T'ao-yüan,** *hsien* (county), northern Taiwan, with an area of 471 sq mi (1,221 sq km). It is bordered by the *hsien*s of T'ai-pei (north), I-lan (east), and Hsin-chu (south) and by the Formosa Strait (west). Ranges of the Hsüeh-shan Shan-mo (mountain range) extend over most of the southeastern part of the county and gradually merge with the fertile alluvial coastal plains to the northwest where paddy rice, sweet potatoes, tea, and citrus fruits are grown. The Shih-men Shui-k'u (reservoir), on the Tan-shui Ho (Tamsui River), provides irrigation and hydroelectricity to nearby textile, cement, and small machinery industries. The T'ai-pei oil and gas fields are in the northeast; coal, iron ore, and nickel are mined. A network of north–south running railways and roads connect T'ao-yüan city, the administrative seat, with Hsin-chu (southwest), I-lan (southeast), and Chi-lung (Keelung; northeast). The Chiang Kai-shek International Airport (opened 1979) is located at T'ao-yüan city. Hsin-wu, a coastal village noted for historical architecture, and the Chung-cheng Sports Park, at Kui-shan, are the major tourist attractions. The mountainous region in the south is inhabited chiefly by Atayal aborigines. Pop. (1983 est.) 1,129,576.

**T'ao-yüan,** *shih* (municipality) and seat of T'ao-yüan *hsien* (county), northern Taiwan, situated 13 mi (21 km) southwest of Taipei city, in the northern part of the western coastal plain. Developed during the early 18th century, the city grew as an agricultural market centre for the surrounding fertile plain that raises rice and tea. Major industries produce textiles and cement; clay and iron ore are extracted nearby. The proximity to Taipei city, Taiwan's capital, has been instrumental in T'ao-yüan's economic development, including its status as a tourist and recreational centre. Near the city is one of the largest camping areas on Taiwan. The beach resort of Chu-wei is 9 mi northeast. The North-South freeway and the West Line railway link T'ao-yüan city with Chi-lung (Keelung) and Hsin-chu. The Chiang Kai-shek International Airport opened at T'ao-yüan in 1979. Pop. (1982 est.) 185,257.

**Ta'o Yüan-ming** (poet): *see* T'ao Ch'ien.

**Taoism,** a religio-philosophical tradition that has, along with Confucianism, shaped Chinese life for more than 2,000 years. The Taoist heritage, with its emphasis on individual freedom and spontaneity, laissez-faire government and social primitivism, mystical experience, and techniques of self-transformation, represents in many ways the antithesis to Confucian concern with individual moral duties, community standards, and governmental responsibilities.

A brief treatment of Taoism follows. For full treatment, *see* MACROPAEDIA: Taoism.

Taoism encompasses both a Taoist philosophical tradition (*Tao-chia*) associated with the *Tao-te Ching* (*Lao-tzu*), *Chuang-tzu*, *Lieh-tzu*, and other texts, and a Taoist religious tradition (*Tao-chiao*) with organized doctrine, formalized cultic activity, and institutional leadership. These two forms of Taoist expression are clearly interrelated, though at many points in tension. Aspects of both philosophical and religious Taoism were appropriated in East Asian cultures influenced by China, especially Korea, Japan, and Vietnam.

*Philosophical Taoism.* The text central to all expressions of the Taoist spirit is the *Tao-te Ching* ("Classic of the Way and Its Power"), previously known as *Lao-tzu* after the name of the mysterious master traditionally said to have been its author. The cardinal concept is that of the *Tao*, the ineffable, eternal, creative reality which is the source and end of all things. *Tao* is the Absolute, the "Uncarved Block" experienced only in mystical ecstasy. *Te* is the manifestation of the *Tao* within all things. Thus, to possess the fullness of *te* means to be in perfect harmony with one's original nature. According to Chuang-tzu (fl. 4th century BC), an individual in harmony with the *Tao* comprehends the course of Nature's constant change and fears not the rhythm of life and death.

As is accomplished at death, so in life must the individual return to the original purity and simplicity of the *Tao*. In contrast to the Confucian program of social reform through moral principle, ritual, and government regulation, the true way of restoration for the Taoists consisted in the banishment of learned sageliness and the discarding of wisdom. "Manifest the simple," urged Lao-tzu, "embrace the primitive, reduce selfishness, have few desires."

As the *Tao* operates impartially in the universe, so should mankind disavow assertive, purposive action. The Taoist life is not, however, a life of total inactivity. It is rather a life of nonpurposive action (*wu-wei*). Stated positively, it is a life expressing the essence of spontaneity (*tzu-jan*, "self-so"). While the *Chuang-tzu* and *Lieh-tzu* are guides directing all persons in the realization of total freedom, the *Tao-te Ching* is addressed in particular to rulers. Great rulers, taught Lao-tzu, simply follow Nature and the people only know of their existence.

*Religious Taoism.* The themes and texts of philosophical Taoism became established during the Warring States period (481–221 BC). Religious or esoteric Taoism as a movement of organized religious communities developed only in the 2nd century AD, appropriating a variety of themes and spiritual techniques associated with the common objective of immortality. While in fundamental ways such a goal was incompatible with the aims of philosophical Taoism, there were hints in the texts of the philosophical tradition to the extension of life and the protection from harm possible for those in harmony with the *Tao*. The lives of such perfected ones, or *hsien* (Immortals) as they came to be called, became the central paradigms of religious Taoism. Lao-tzu became deified as a revealer of sacred texts and a saviour, and techniques of spiritual attainment became fully elaborated.

Techniques for achieving immortality included dietary regimens, breath control and meditation, sexual disciplines, alchemy, the use of magical talismans, and the search for the fabled Isle of Bliss. Dietary concerns focussed on necessary nourishment while abstaining from foods which benefitted the "three worms" in the body (which caused disease, old age, and death). In meditation, the Taoist adept visualized the thousands of gods that inhabited the human body (microcosm) as they inhabited the universe (macrocosm). Through breath control and the movement of breath throughout the fields of the body, the individual both approached immortality in this life and achieved it finally through the nourishment within of a mysterious "embryonic body," which became the immortal self after death. By avoiding ejaculation during the sexual act, it was believed that semen could be mixed with breath to further nourish the embryonic body or be forced back through the spinal passage to repair the brain. In its search for an elixir of immortality, Taoist alchemy developed both chemical experimentation (*wai-tan*) and a theoretical internal alchemy (*nei-tan*). *Nei-tan* sought to invert the normal aging processes by an energizing marriage of the cosmic *Yin* and *Yang* forces within the body.

Talismans (*fu*) were used for healing, protection from demons, and communication with Taoist immortals.

*Historical development.* Of the two early organized Taoist communities, the religio-political movement known as the "Way of the Great Peace" was destroyed as a threat to the Han dynasty in AD 184. A more important and enduring tradition was that of the "Way of the Celestial Masters," founded by Chang Tao-ling in AD 142. Two late 4th-century movements were also very important: (1) the Shang-ch'ing (Supreme Purity) Mao Shan sect, and (2) the Ling Pao (Sacred Jewel) scriptural tradition. During the T'ang dynasty (618–907), Taoism received special favour at court and was characterized by doctrinal and liturgical syntheses. Despite attempts during the Ming dynasty (1368–1644) to curb a growing sectarianism, there remained in the late 20th century a polarization between classical orthodox tradition and heterodox traditions. On Taiwan, orders of the former tradition are referred to as "Blackheads" and those of the latter as "Redheads." While the future of Taoist practice on the mainland remains in question, there has been in recent decades some renewed interest in the religion on Taiwan. In addition, Western scholars have recently begun to investigate carefully the many contributions of Taoism to the development of Chinese culture.

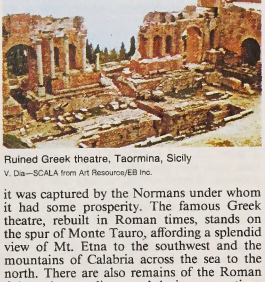
**Taoka Kazuo,** byname KUMA (Japanese: Bear) (b. March 28, 1912, Sanshōmura, Japan—d. July 30, 1981, Amagasaki), Japan's major crime boss (*oyabun*), who, after World War II, rose to head a giant crime organization, the Yamaguchi-gumi. Though centred in Kōbe, it had interests and affiliates nationwide and consisted of more than 10,000 members (known as *yakuza*) divided into more than 500 bands.

Taoka was born to a poor farm family in a village on the island of Shikoku; his father died before Taoka was born, and his mother died when he was four years old. Raised by relatives, he left school in his early teens and in 1929 began associating with *yakuza* gangs in Kōbe; in the early 1930s he became an apprentice and then a member of Yamaguchi-gumi. During World War II the organization fell apart; Taoka restored it in the postwar years and made it into a giant cartel, dealing in extortion, labour racketeering, gambling, prostitution, loansharking, smuggling, show business, and other enterprises both legal and illegal. Ideologically he was ultrarightist and ultranationalistic.

In 1963 the National Police Agency began to regulate the Yamaguchi-gumi, and in 1966 Taoka was indicted on five counts, including blackmail. After a long legal battle, he died of a heart attack just a month before he was to be sentenced by a Kōbe district court. Earlier, in July 1978, he had survived an assassination attempt when a member of a rival gang shot him in the neck in a Kyōto nightclub.

**Taolanaro** (Madagascar): *see* Faradofay.

**Taormina,** Latin TAUROMENIUM, town, Messina province, eastern Sicily, Italy, on a hill rising almost perpendicularly from the sea at the foot of Monte Tauro, between Messina and Catania. The ancient Tauromenium, which took its name from Monte Tauro, the site was originally occupied by the Siculi, an ancient Sicilian tribe, who were resettled there by Dionysius I the Elder of Syracuse *c.* 392 BC. After receiving a further colony of refugees from Naxos, just to the south, in 358, it flourished under the mild rule of Andromachus, father of the historian Timaeus. Passing to the Romans as an allied city *c.* 210 BC, it was made a colony by the emperor Augustus but declined under Roman, and later Byzantine, rule. Destroyed in AD 902 by the Arabs, it was rebuilt by the Christians of Val Demone, a valley in northern Sicily, before being taken again in 962 by the Arabs under the al-Mu'izz, who renamed the town Mu'izziyah. In 1078



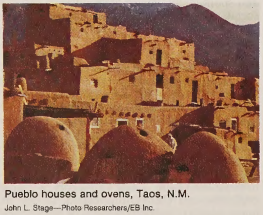
Ruined Greek theatre, Taormina, Sicily
V. Dia—SCALA from Art Resource/EB Inc.

it was captured by the Normans under whom it had some prosperity. The famous Greek theatre, rebuilt in Roman times, stands on the spur of Monte Tauro, affording a splendid view of Mt. Etna to the southwest and the mountains of Calabria across the sea to the north. There are also remains of the Roman Odeon theatre, discovered during excavations in 1892, and of the so-called Naumachia (a reservoir). The cathedral and the Corvaja, Santostefano, and Ciampoli palaces date from the medieval period.

Connected by road and rail with Messina and Catania, Taormina is one of the most popular winter resorts in Sicily. Pop. (2000 est.) mun., 10,669.

**Taormina, Carlo Filangieri, duca di** (duke of): *see* Filangieri, Carlo.

**Taos,** town, seat of Taos County, New Mexico, U.S., on a branch of the Rio Grande in the Sangre de Cristo Mountains, near Wheeler Peak (highest point in New Mexico), 55 mi (86 km) north-northeast of Santa Fe. An early Spanish settlement, it was the scene of a revolt (1680) of Taos and other Pueblo Indians against Spain. It became a trading centre on the Santa Fe Trail, and in 1847 Charles Brent, the U.S. civil governor, was killed there during an Indian uprising. The community is a service centre for nearby ranches and actually consists of three villages: Don Fernando de Taos (known as Taos), the pueblo of San Geronimo (Taos Pueblo), and the Ranchos de Taos. Taos, with its picturesque adobe atmosphere, was given impetus as a resort colony for writers and painters by the novelist D.H. Lawrence, who lived there during the 1920s.



Pueblo houses and ovens, Taos, N.M.
John L. Stage—Photo Researchers/EB Inc.

His ranch is maintained by the University of New Mexico. The grave of the frontiersman-scout Kit Carson is in a memorial state park, and the house he occupied (1853–68) is preserved. Taos is the headquarters of Carson National Forest, and Taos Ski Valley is 19 mi north-northwest. The area is well known for its Indian fiestas and ceremonial dances. Pop. (2000) 4,700.

**Taos, Marguerite:** *see* Amrouche, Marguerite Taos.

**Taounate,** town, provincial capital, and province (established 1978), Centre Nord region, northern Morocco. The town is a local market centre situated on the southern slopes of the Rif Mountains. It is located on a plateau overlooking the valley of the Oued Sra (Sra River), near the Gargara gorges.

Taounate province, with an area of 2,156 sq mi (5,585 sq km), is bounded by the provinces of Chaouen and al-Hoceima (north), Taza (east), Fès (south), and Kenitra (west). It is generally mountainous, and cereals (mostly wheat) and cattle are intensively raised at lower elevations. Fruits (including figs, olives, cherries, apples, and pears) are grown in the well-watered mountain valleys that receive about 30 in. (750 mm) of rainfall annually. Higher elevations are covered with commercially exploited cedars and cork oaks. Taounate province is inhabited mostly by Berbers; the more isolated groups speak only Riff, a Berber dialect, and the less isolated groups are generally bilingual, speaking both Riff and Arabic. The Idris I dam (completed 1973), one of Morocco's largest dams, is located in the southern part of the province and is part of an extensive irrigation project in the valley of the Oued (river) Sebou. Pop. (1994) town, 24,400; province, 1,719,800.

**tap dance,** style of theatrical dance characterized by precise, rhythmical patterns of



Jimmy Doyle and Harland Dixon, tap dancers known for their buck-and-wing
By courtesy of the Dance Collection, the New York Public Library at Lincoln Center, Astor, Lenox and Tilden Foundations

foot movement and stamping on the floor. The main historical sources of tap dancing appear in the traditional clog dance of northern England, in the jigs, reels, and flings of Ireland and Scotland, and in the rhythmic foot stamping of African dances. In 19th-century minstrel shows American blacks and their white imitators stylized and fused these elements into a popular style of dance and satire. Among noted minstrel performers were Ralph Keeler, Daniel Emmett, and the dance team of Lynch and Diamond.

In the late 19th century two distinct techniques emerged, buck-and-wing and soft-shoe. Buck-and-wing was active and fast and was danced in wooden-soled shoes; soft-shoe was relaxed, smooth, and danced in soft-soled shoes. In about 1900 George Primrose was famous for his soft-shoe dancing; Jimmy Doyle and Harland Dixon were known for their buck-and-wing.

By 1925 the two varieties had largely merged, and metal taps were attached to heels and toes to produce a more audible tap. The foot technique remained much the same; a great variety of leg movement was added to the footwork, and handclaps and body slapping were occasionally used. Dancers of this period included Pat Rooney, George M. Cohan, the Four Fords, Johnny Boyle, Tom Patriola, and the great Bill ("Bojangles") Robinson.

Tap dancing after 1940 developed even more complex footwork and incorporated many of the sophisticated elements of ballet and modern dance. Dancers who developed this form included Fred Astaire, Ray Bolger, Eleanor Powell, Paul Draper, and Gene Kelly.

**tapa:** *see* bark painting.

**Tapachula,** city, southeastern Chiapas *estado* ("state"), extreme southeastern Mexico. It is on the Coatán River, on the Pacific coastal plain, at 449 feet (137 m) above sea level, 9.5 miles (15 km) from the Guatemala border. Tapachula is the major manufacturing and commercial centre for the Soconusco region. Coffee, bananas, cacao, and sugarcane, the principal products of the region, are processed in and near Tapachula. Distilleries, saddleries, and silversmith's and goldsmith's shops are also located in the city. Tapachula is linked by highway to Ciudad Hidalgo (23 miles [37 km] to the southeast) and Talismán (11 miles [18 km] to the northeast) on the Guatemalan border and to other cities on the coastal plain. It is also on the Veracruz–Ciudad Hidalgo railroad and is served by domestic and international airlines. Pop. (1995) 163,253.

**tapaculo,** also spelled TAPACOLO, any of about 27 species of ground-dwelling birds of the family Rhinocryptidae (order Passeriformes) of Central and South America. When disturbed they scurry for cover with tail lifted. Tapaculos are wren- to thrush-sized, with short wings, longish legs, and strong feet for scratching in the earth. Most species are reddish brown or gray, with spots or bars (in both sexes); those of woodlands are darker than those of open scrub country. Tapaculos are detected by their loud ventriloquial calls, usually consisting of clucking, sucking, or gobbling notes. Nesting sites vary widely, from ground burrows to tree holes; some make a ball nest in a bush.



Rusty-belted tapaculo (*Liosceles thoracicus*)
Drawing by Murrell Butler

**Tapajós River,** Portuguese RIO TAPAJÓS, central Brazil, formed by the union of the Teles Pires and the Juruena rivers, in north-central Mato Grosso state. It winds northward through the Mato Grosso plateau and forms the state border between Mato Grosso and Amazonas and then between Pará and Amazonas states. It bends north-northeastward, traverses Pará, and empties into the Amazon River just above Santarém, after a course of about 400 miles (650 km). Its length, including its longest tributary, the Teles Pires, is 1,238 miles (1,992 km).

Although the Tapajós is interrupted by rapids, its entire length is navigable. It is even possible for rivercraft to ply the Tapajós and the Arinos, pass through a canal into the Cuiaba River, a tributary of the Paraguai River, and eventually reach Buenos Aires, Arg. Settlement along the Tapajós is sparse, and many of its tributaries are uncharted; but there are several important rubber plantations on its banks.

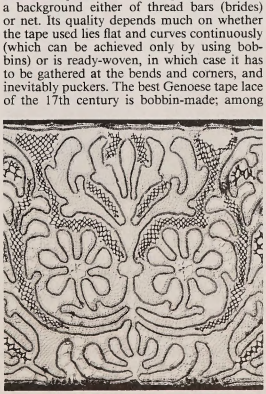
**tapas** (Sanskrit: "heat," or "ardour"), in Hinduism, ascetic practice voluntarily carried out to achieve spiritual power or purification. In the Vedas, *tapas* refers to the "inner heat" created by the practice of physical austerities and figured in the creation myths, as a means by which Prajāpati (the main creator god) brought the world into existence. In later Hinduism the practice of *tapas* was especially associated with yogic discipline as a way of purifying the body in preparation for the more exacting spiritual exercises leading to liberation (moksha). Among the austerities mentioned in the sacred literature are fasting, the holding of difficult and often painful bodily postures, vigils kept in the presence of fires or extreme cold, and breath control.

In the Jaina religion asceticism is seen as a way of preventing new karma (effect of good or bad action) from forming, as well as a way of getting rid of the old, and is thus one of the central means of breaking the cycle of rebirths. The Jainas distinguish between external *tapas,* such as fasting (including the most severe form, fasting unto death), restricting the intake of food, meditating, and living in seclusion, and internal *tapas,* such as contemplation, confession, and repentance of sins.

In early Buddhism the monastic life of chastity and poverty was regarded as the only path to enlightenment. Yet the Buddha renounced the extremes of self-mortification as strongly as he did self-indulgence, in his advocation of the "middle way."

**tape cassette** (electronics): *see* cassette.

**tape lace,** also called TAPE GUIPURE, lace in which the pattern is made up of tape set in a background either of thread bars (brides) or net. Its quality depends much on whether the tape used lies flat and curves continuously (which can be achieved only by using bobbins) or is ready-woven, in which case it has to be gathered at the bends and corners, and inevitably puckers. The best Genoese tape lace of the 17th century is bobbin-made; among the ready-wovens are the Belgian and French tape laces of the 1880s, such as so-called Renaissance lace.



Tape lace from Hungary, 19th century; in the Institut Royal du Patrimoine Artistique, Brussels
By courtesy of the Institut Royal du Patrimoine Artistique, Brussels; photograph, © A.C.L., Brussels

**tape recording,** method of magnetic sound recording using magnetic tape. *See* magnetic recording.

**tapestry,** woven decorative fabric, the design of which is built up in the course of weaving. Broadly, the name may be used for any heavy material used to cover furniture, walls, or floors or even to decorate garments, but its narrower, more precise meaning limits its use to heavy, handwoven textiles usually used for wall hangings or upholstery. William Morris, the English Arts and Crafts theorist of the 19th century, likened tapestry to a mosaic made up of coloured threads, and the 20th century French architect Le Corbusier referred to tapestries as nomadic murals, decorative but movable and interchangeable.

A brief treatment of tapestry follows. For full treatment, *see* MACROPAEDIA: Decorative Arts and Furnishings.

Tapestry has always been a luxury art, and its highest point of artistic achievement came under noble patronage in Flanders in the 15th century. Tapestries were frequently designed and woven in sets; it was not uncommon for a set to have six or more panels. The art of tapestry at its best is one in which weaver and designer work closely together. During the Middle Ages, when tapestry flourished, the weaver worked generally from the artist's design, or cartoon, frequently embellishing or refining it. Tapestry began to decline as an art from the Renaissance, when the goal of tapestry makers moved closer to that of painters, and designs became more and more illusionistic, with weavers attempting to create fine and intricate tapestries that imitated paintings on canvas. The art was revived toward the end of the 19th century and has flourished since then.

The most commonly used material for tapestry is wool, though silk has historically been used in China and Japan, and linen, cotton, and even gold and silver have been employed. Tapestry is woven by passing weft threads (those that run horizontally across a textile) over and under warp threads (the vertical framework of threads) so that the latter are completely covered by the coloured weft. Tapestry differs from other types of weaving in that only rarely are the weft threads carried across the complete width of the fabric. Specific colours are carried across only as far as necessary in a given row to create a particular section of the design. The work of weaving a tapestry, therefore, is skilled and detailed, and the final design is only apparent after much slow and meticulous work by the weaver. The fineness of the tapestry, and thus the level of pictorial detail it is capable of rendering, is determined by the number of threads to the inch. In Europe, weavers of the Renaissance achieved a level of fineness that has not been surpassed; silk tapestries of Asia are also particularly fine.

Tapestry cartoons were prepared and coloured by artists as guides to the weaver. Frequently more than one set was woven from a set of cartoons. Among the most famous cartoons in the history of art is the set made by Raphael in the 16th century depicting the "Acts of the Apostles" and the set made by Peter Paul Rubens in the 17th century called the "Triumph of the Eucharist." Both were reused, copied, and imitated many times.

The great period of European tapestry was the Middle Ages, from the 14th century when the art became firmly established and fashionable. The most famous medieval tapestry is the seven-piece "Angers Apocalypse" begun in 1377 in Paris. The other great centre of tapestry making at the time was in Flanders, especially the town of Arras, where the greatest tapestries of the early 15th century were made. Later in the century Tournai and Brussels became the centres. Flemish weavers set up workshops throughout Europe from the 16th century and took the art as far afield

as Spain, Italy, and England, the so-called Bayeux Tapestry of medieval England is actually a work of embroidery.

In the 17th century an important French tapestry industry was established with the aid of imported Flemish weavers. The two most famous factories were the Gobelins in Paris and the manufactory at Beauvais. The Gobelins produced furnishings for the royal palaces, notably Versailles, while the products of Beauvais served the nobility and the rich middle class.

A revival of medieval techniques and designs occurred in England in the 19th century, and in the 20th century tapestry attracted the interest of many of the leading artists—including Pablo Picasso, Henri Matisse, and Georges Braque. The French artist Jean Lurçat was particularly instrumental in reestablishing the close relationship that had existed in medieval times between craftsman and artist. One of the most ambitious tapesties of the century, "Christ in Glory," was designed in 1962 by the English painter Graham Southerland and woven at the Aubusson factory in France for the newly rebuilt St. Michael's Cathedral at Coventry, Warwickshire (now West Midlands).

**tapeworm,** also called CESTODE, any member of the invertebrate class Cestoda (phylum Platyhelminthes), a group of parasitic flatworms containing about 3,000 species. Tapeworms, which occur worldwide and range in size from about 1 mm (0.04 inch) to more than 15 m (50 feet), are internal parasites, affecting certain invertebrates and the liver or digestive tracts of all types of vertebrates—including humans, domestic animals, and other food animals, such as fish. Some attack a single host, others require one or two intermediate hosts as well as a final, or definitive, host during their life cycle. The disease caused by tapeworms is known as cestodiasis (*q.v.*).

Tapeworms are bilaterally symmetrical (*i.e.,* the right and left sides are similar). Some consist of one long segment; others have a definite head, followed by a series of identical segments called proglottids. The head, or scolex, bears suckers and often hooks, which are used for attachment to the host. The body covering is a tough cuticle, through which food is absorbed. There is neither a mouth nor a digestive tract.

Most tapeworms are hermaphroditic (*i.e.,* functional reproductive organs of both sexes occur in the same individual), and they are usually self-fertilizing. The life cycle is complex. The pork tapeworm (*Taenia solium,* or *Taeniarhynchus solium*), found wherever raw pork is eaten, lives in the human intestine in its adult stage. Each proglottid, following fertilization, may contain as many as 40,000 embryos encased in separate capsules. If the embryos, which pass out with the host's feces, are eaten by a mammal such as a dog, camel, pig, monkey, or human being, the larva emerges in the digestive tract. It bores through the intestinal wall into a blood vessel and is carried to muscle tissue in which it forms a protective capsule (encysts) and is called a cysticercus, or bladder worm. If the cysticercus is eaten alive in raw meat, it attaches itself to the host's intestine and develops directly into a mature adult.

The life cycle of the beef tapeworm (*Taenia saginata,* or *Taeniarhynchus saginatis*), which occurs worldwide where beef is eaten raw or improperly cooked, is much like that of the pork tapeworm. Man is the definitive host; cattle serve as the intermediate host.

The fish tapeworm (*Dibothriocephalus latus,* or *Diphyllobothrium latum*), most common in waters of the Northern Hemisphere, infests humans and other mammals that eat fish, particularly bears and dogs. Fertilized eggs pass from the host's body in the feces. In a water medium they develop into a hairlike larva and are eaten by tiny crustaceans, which, in turn, are eaten by a fish. In the fish, the tapeworm larva encysts in muscle tissue. When the fish is eaten by a mammal, the larva attaches to the mammalian intestine and develops into a mature adult. Fish hosts of this tapeworm include trout, salmon, pike, and perch.

**Tàpies, Antoni** (b. Dec. 13, 1923, Barcelona, Spain), Catalan artist who is credited with introducing contemporary abstract painting into Spain. Beginning as a Surrealist, he developed into an abstract artist under the influence of French painting and achieved an international reputation.

In 1943 Tàpies began studying for a law degree at the University of Barcelona, but he abandoned this career in 1946 to devote himself to painting. Largely self-taught as an artist, he helped to found (1948) in Barcelona the Dau al Set ("Seven-sided Die"), an organization of Surrealist artists and writers influenced especially by Paul Klee and Joan Miró, which published an artistic-literary review. In 1950 he saw the work of Jean Dubuffet, which turned him away from Surrealism toward abstraction. Discarding the Surrealist imagery of his Dau al Set period, he began in 1955 to work with a thick impasto. These "matter" paintings, similar in their power and individuality to American Abstract Expressionist paintings, secured his world reputation. In his later works Tàpies began incorporating real objects, such as buckets, mirrors, and silk stockings, in his paintings, and even larger objects as in his assemblage "Desk with Straw," in which an actual desk serves as the "canvas." His works of lithography were noted for their cryptic, spontaneous effects. He also collaborated with poet Joan Brossa on a number of illustrated books.



Tàpies, photograph by Arnold Newman, 1964
© Arnold Newman

In 1990 the Tàpies Foundation, which houses some 2,000 works by the artist, opened in Barcelona.

**Tapinocephalus,** extinct genus of therapsids, or mammallike reptiles, found as fossils in Permian rocks of South Africa (the Permian Period occurred from 286 to 245 million years ago). The genus *Tapinocephalus* is representative of the Tapinocephaloidea, characterized by many herbivorous specializations. A large and bulky animal, *Tapinocephalus* also is characteristic of a distinctive assemblage of lowland animals that are useful as a horizon marker for a part of the middle Permian in South Africa known as the *Tapinocephalus* zone.

**Tapio,** also called METSÄHINE, or HIISI, the Finnish god of the forest and ruler of the game therein. He was a personified form of the various forest spirits important to hunters dependent on the forest for their livelihood. Tapio, the personified forest, was sometimes depicted as being the size of a fir tree, fierce-looking, like a human being in the front, but like a gnarled old tree from behind. Often the forest deity was also female, occasionally an especially beautiful woman, who enticed hunters or woodcutters staying in the woods overnight; but she, too, turned out to be a rotten old stump upon closer scrutiny. The various forest deities and spirits were generally capricious in nature and had to be constantly placated by those who were dependent on their favours. Thus hunters made offerings to the deity and made sure they did not break any taboos in the forest, such as making excessive noise or shooting unusual birds that might be the forest spirit in disguise.

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**tapioca,** a preparation of cassava-root starch used as a food, in bread or as a thickening agent in liquid foods, notably puddings but also soups and juicy pies.

In processing, heat ruptures the starch grains, converting them to small, irregular masses that are further baked into flake tapioca. A pellet form, known as pearl tapioca, is made by forcing the moist starch through sieves. Granulated tapioca, marketed in various-sized grains and sometimes called "manioca," is produced by grinding flake tapioca. When cooked, tapioca swells into a pale, translucent jelly.

The cassava plant, or manioc, is native to the West Indies and to South America, where its roots are ground into meal and then baked into thin cakes. Tapioca became a common Asian food after the cassava was introduced into that part of the world during the 19th century. In Thailand, a pudding is made of tapioca and coconut, and tapioca paste is rolled into balls and dried to be eaten as cereal. The Vietnamese make a kind of thin pancake using tapioca starch.

**tapir** (species *Tapirus*), any of four species of hoofed mammals, the only extant members of the family Tapiridae (order Perissodactyla), found in tropical forests of Malaysia and the New World. Heavy-bodied and rather short-legged, tapirs are 1.8 to 2.5 m (about 6 to 8 feet) long and reach about 1 m at the shoulder. The eyes are small, the ears are short and rounded, and the snout extends into a short fleshy proboscis, or trunk, that hangs down over the upper lip. The feet have three functional toes, the first (inner) being absent, and the fifth reduced in front and absent in the hind foot. Body hair is short and usually sparse but fairly dense in the mountain tapir (*T. pinchaque,* formerly *T. roulini*). There is a short, bristly mane in the Central American,



Lowland tapir (*Tapirus terrestris*)
Warren Garst—Tom Stack & Associates

or Baird's, tapir (*T. bairdii*) and the South American lowland tapir (*T. terrestris*). This geographic distribution, with three species in Central and South America and one in Southeast Asia, is peculiar. Fossil remains from Europe, China, and North America show that tapirs were once widespread, but the extinction of intermediate forms has isolated the living species.

The three New World species are plain dark brown or gray, but the Malayan tapir (*T. indicus*) is strongly patterned, with black head, shoulders, and legs and white rump, back, and belly. The young of all tapirs are dark brown, streaked and spotted with yellowish white. A single young (rarely two) is produced after a gestation of about 400 days.

Tapirs are shy inhabitants of deep forest or swamps, traveling on well-worn trails, usually near water. When disturbed, they usually flee, crashing through undergrowth and often seeking refuge in water. Their main enemy wherever they are found is man; in South America the jaguar is a principal predator, and in Asia the tiger is another predator. Despite declining numbers caused largely by habitat destruction, tapirs are hunted for food and sport in many parts of their range.

**tap'o style,** Korean adaptation of a Chinese architectural style first introduced from China late in the Koryŏ period (935–1392). *Tap'o* means literally "multibracket," and its main feature is the adoption of intercolumnar brackets besides those on column heads. With the introduction of *tap'o* style, the brackets had more than three longitudinal spreaders to support eaves purlins, or timbers. Buildings in the *tap'o* style are much more decorative than those in the preceding *chusimp'o,* or columnhead bracketing, style because the intercolumnar brackets fill the otherwise empty spaces between columns.

The buildings also have coffered ceilings to conceal the girder beams and eaves purlins. The style is called *ama-gumi* in Japanese. Still a minor style in the final years of the Koryŏ period, *tap'o* became the prevailing style in the early Yi period (1392–1910) and had replaced the traditional *chusimp'o* style by the 17th century.

**Tappa Ḥiṣār,** also spelled TAPPEH ḤEṢĀR, or TEPE HISSAR, Iranian archaeological site located near Dāmghān in northern Iran. Excavations made in 1931–32 by the University of Pennsylvania and in 1956 by the University of Tokyo demonstrated that the site was continuously inhabited from about 3900 to about 1900 BC. The long habitation sequence provided valuable evidence for the development of prehistoric pottery and metallurgy in that part of Iran. To the southwest of the main mound, a large Sāsānian palace was also uncovered.

**Tappan, Arthur** (b. May 22, 1786, Northampton, Mass., U.S.—d. July 23, 1865, New Haven, Conn.), American philanthropist who used much of his energy and his fortune in the struggle to end slavery.

After a devoutly religious upbringing, Tappan moved to Boston at the age of 15 to enter the dry goods business. Six years later he launched his own firm in Portland, Maine, and then in 1809 moved the business to Montreal. Tappan struggled with the business both in Canada and, after the outbreak of the War of 1812, back in the United States. But in 1826 he started a new company in New York City. This business, a silk-importing firm, was successful, and Arthur and his brother Lewis became wealthy. The Panic of 1837 forced the Tappans to close their doors, but the brothers founded another lucrative enterprise when they opened the first commercial credit-rating service in the 1840s.

Arthur Tappan early and consistently used his wealth to support missionary societies, colleges, and theological seminaries. Conservative in his moral outlook, he founded the *New York Journal of Commerce* in 1827 to provide a newspaper free of "immoral advertisements." He also backed movements for temperance and stricter enforcement of the Sabbath and against the use of tobacco.

It was the Abolitionist crusade, however, to which Tappan devoted himself during the latter part of his life. He helped found several Abolitionist journals, and he was founder and first president (1833–40) of the American Anti-Slavery Society. Tappan at first backed the efforts of the Abolitionist William Lloyd Garrison but broke with him and the American Anti-Slavery Society when Garrison insisted upon linking abolition with other reforms.

Tappan then created a new organization, the American and Foreign Anti-Slavery Society. He advocated trying to achieve abolition through the political process and backed the Liberty Party in the 1840s. With the passage of the Fugitive Slave Law of 1850, however, both of the Tappan brothers became more radical. Arthur Tappan openly declared his determination to disobey the law, and he supported the Underground Railroad.

Old age limited Tappan's activities as the slavery controversy heated during the 1850s, but he did live to see the Emancipation Proclamation fulfill much of his life's work.

**Tāpti River,** also spelled TAPI, river in central India, rising in the Gāwīlgārh Hills of the central Deccan Plateau in south-central Madhya Pradesh state. It flows westward between two spurs of the Sātpura Range, across the Jālgaon Plateau in Mahārāshtra state, and through the plain of Surat in Gujarāt state to the Gulf of Cambay (an inlet of the Arabian Sea). It has a total length of about 435 miles (700 km) and drains an area of 25,200 square miles (65,300 square km). For the last 32 miles (51 km) it is tidal but is navigable by small vessels. The port of Swally, at the river's mouth, well known in Anglo-Portuguese colonial history, is now deserted, having become silted up. The Tāpti flows roughly parallel to the longer Narmada River to the north, from which it is separated by the main part of the Sātpura Range. The two river valleys and the intervening range form the natural barrier between northern and peninsular India. Its three major tributaries—the Pūrna, Girna, and Panjhra—flow from the south in Mahārāshtra.

**Ṭāq-e Bostān,** or ṬĀQ-I-BUSTĀN, village in western Iran, just northeast of Bakhtarān city. It is known for its rock carvings (bas-reliefs) of Sāsānid origin (3rd to 7th century AD). The carvings, some of the finest and best-preserved examples of Persian sculpture under the Sasānians, include representations of the investitures of Ardashir II (reigned AD 379–383) and of Shāpūr III (383–388), the latter in a man-made cave carved in the form of an iwan (three-sided, barrel-vaulted hall, open at one end).

**Taqī Khān,** MĪRZĀ, byname EMIR KABĪR (Great Prince) (b. *c.* 1807, Farhān, Qājār Iran—d. Jan. 9, 1852, Kāshān), prime minister of Iran in 1848–51, who initiated reforms that marked the effective beginning of the Westernization of his country.

At an early age Mīrzā Taqī learned to read and write despite his humble origins. He joined the provincial bureaucracy as a scribe and, by his abilities, rapidly advanced within the hierarchy of the administration. In 1829, as a junior member of an Iranian mission to St. Petersburg, he observed the power of Russia, Iran's great neighbour. He concluded that important and fundamental reforms were needed if Iran was to survive as a sovereign state. As a minister in Azerbaijan he witnessed the inadequacies of Iranian provincial administration, and during a tenure in Ottoman Turkey he studied the progress another Islāmic government had made toward modernization.

Upon his return to Iran in 1847, Mīrzā Taqī was appointed to the court of the crown prince, Nāṣer od-Dīn, in Azerbaijan. With the death of Moḥammad Shāh in 1848, Mīrzā Taqī was largely responsible for ensuring the crown prince's succession to the throne. Out of gratitude, the young monarch appointed him chief minister and gave him the hand of his own sister in marriage. At this time Mīrzā Taqī took the title of Emir Kabīr.

Iran was virtually bankrupt, its central government was weak, and its provinces were almost autonomous. During the next two and a half years the emir initiated important reforms in virtually all sectors of society. Government expenditure was slashed, and a distinction was made between the privy and public purses. The instruments of central administration were overhauled, and the emir assumed responsibility for all areas of the bureaucracy. Foreign interference in Iran's domestic affairs was curtailed, and foreign trade was encouraged. Public works such as the bazaar in Tehrān were undertaken. A new secular college, the Dār ol-Fonūn, was established for training a new cadre of administrators and acquainting them with Western techniques. The emir issued an edict banning ornate and excessively formal writing in government documents; the beginning of a modern Persian prose style dates from this time.

These reforms antagonized various notables who had been excluded from the government. They regarded the emir as a social upstart and a threat to their interests, and they formed a coalition against him, in which the queen mother was active. She convinced the young shah that the emir wanted to usurp the throne. In October 1851 the shah dismissed him and exiled him to Kāshān, where he was murdered on the shah's orders.

**taqiya,** also spelled TAQIYAH, Arabic TAQIYAH ("self-protection"), in Islām, the practice of concealing one's belief and foregoing ordinary religious duties when under threat of death or injury to oneself or one's fellow Muslims.

The Qur'ān allows Muslims to profess friendship with the unbelievers (3:28) and even outwardly to deny their faith (16:106), if doing so would save them from imminent danger, on the condition that their hearts contradict their tongues. Muḥammad himself was regarded to have set the first example for the application of taqiya when he chose to migrate to Medina rather than face his powerful enemies in Mecca.

Some rules have been laid down as to when a Muslim may or may not use taqiya. The threat of flogging or temporary imprisonment and other discomforts that remain within tolerable limits do not justify the use of taqiya. A person without responsibilities toward women or children may not use it under any circumstances short of direct and express threat to life. Oaths taken with mental reservation are justified on the basis that God accepts what is believed inwardly. Consideration of community rather than private welfare is stressed in most cases.

The Shī'ites, the minority branch of Islām, made taqiya a fundamental tenet because of their suffering from persecution and political defeats throughout their history. The Ibāḍiyah (a Muslim sect found in eastern Africa, southern Algeria, and Oman) called for prudent fear and avoidance of foolish and unnecessary martyrdom and regarded taqiya as a basic religious requirement. Many other sects went underground when they felt that open expression of their beliefs was harmful to their cause. Ultimately, it is left to the conscience of each individual to judge, when the situation arises,

whether taqiya is absolutely necessary and whether his private interests or those of the religion and the community are being served.

**taqlid,** Arabic TAQLID ("covering with authority"), in Islāmic law, the unquestioning acceptance of the legal decisions of another without knowing the basis of those decisions. There is a wide range of opinion about taqlid among different groups or schools of Muslims. Of the four Sunnite legal schools, the Shāfʿiyah, the Mālikiyah, and the Ḥanafiyah all embrace taqlid, while the Ḥanābilah reject it. Shīʿite Muslims hold to an affirmative but quite different understanding of the institution.

Those Sunnites who affirm taqlid believe that the legal scholars of the early period were uniquely qualified to derive authoritative legal opinions, binding upon the whole Muslim community, from the source materials of Islāmic law, the Qurʾān and the sunna of the Prophet. In the early period, a series of great legal scholars exercised independent interpretation (*ijtihād*) of the sources, carrying out their efforts through the use of such legal tools as analogical reasoning (*qiyās*). In the third Islāmic century (9th century AD) and subsequent centuries, with the emergence of legal schools formed around some of the most significant scholars, it came to be widely believed that all important questions of law had been dealt with and that the right of independent interpretation had been withdrawn for future generations. Henceforward, all were to accept the decisions of the early authorities—*i.e.*, to exercise taqlid toward them. This doctrine is usually expressed as "the closing of the gates of *ijtihād*" (*bāb al-ijtihād*).

By contrast, Ḥanābilite scholars and others who follow the teachings of the school (*e.g.*, the modern sect of the Wahhābīs) insist on the necessity of returning directly to the sources to make independent judgments of their meaning. In the 19th and 20th centuries, Muslim modernists engaged in bitter polemics against taqlid, which they held encourages stagnation of the law and Muslim backwardness.

In its use among the Shīʿites, taqlid refers to the necessity for a layman to accept and follow the opinions of an expert in Islāmic law (*mujtahid*). Every individual who does not himself have the qualifications to interpret the sources of the law must choose a member of the religious class (the *ʿulamāʾ*) whom he accepts as his *marjaʿ-i taqlid* ("source of authority") and whose teachings he observes. When his chosen *mujtahid* dies, he must select and obey another, because it is forbidden to follow a dead guide. In this sense taqlid is compulsory for Shīʿites.

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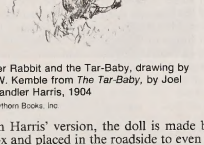
**taqsīm,** in Islāmic music, free-form melodic improvisation, performed by solo voice or on a solo instrument, often a lute; or by the principal instruments of an orchestra playing in succession. The *taqsīm* often forms the first movement of a suite (*nawbah*), a popular form in Arabic music; it may also be performed as an independent solo piece. It serves to establish the mood of the music to come, to accustom the listeners to the *maqām* ("melodic mode") to be used, and to verify the tuning of the instruments.

The rhythms of a *taqsīm* are simple and flexible, and the tempo can be varied freely. Although based on traditional melodic elements of the chosen *maqām*, the actual melodic motion is freely improvised by the performer.

**tar:** *see* wood tar; coal tar.

**tar** (Iranian: "string"), long-necked lute descended from the tanbur of Sāsānian Iran and known in a variety of forms throughout the Middle East and parts of Asia. Its name traditionally signified the number of strings employed—*e.g.*, *dutār* ("two-strings"), *setār* ("three-strings"), and *cartār* ("four-strings")—but this is no longer true, as the sitar of India has up to seven strings. The body of the tar is hollowed out of a single piece of wood and is usually rounded, although the Georgian version is octagonal, and the waisted tar of Turkey is so named because of its exaggerated hourglass figure. The instrument, which is played with a small metal pick, has a membrane belly, spike, movable frets, and lateral pegs for the metal strings that are rib-fastened.

**Tar-Baby,** sticky tar doll, the central figure in black American folktales popularized in written literature by the American author Joel Chandler Harris. Harris' "Tar-Baby" (1879), one of the animal tales told by the character Uncle Remus, is but one example of numerous African-derived tales featuring the use of a wax, gum, or rubber figure to trap a rascal.



Brer Rabbit and the Tar-Baby, drawing by E.W. Kemble from *The Tar-Baby,* by Joel Chandler Harris, 1904
Hawthorn Books, Inc

In Harris' version, the doll is made by Brer Fox and placed in the roadside to even a score with his archenemy Brer Rabbit. Brer Rabbit speaks to the Tar-Baby, gets angry when it does not answer him, strikes it, and gets stuck. The more he strikes and kicks the figure, the more hopelessly he becomes attached.

The sticky-figure motif is also common in American Indian tales.

**tar sand,** also called BITUMINOUS SAND, deposit of loose sand or partially consolidated sandstone that is saturated with highly viscous bitumen. Oil recovered from tar sands is commonly referred to as synthetic crude and is a potentially significant form of fossil fuel.

A brief treatment of tar sands follows. For full treatment, *see* MACROPAEDIA: Fuels, Fossil.

Deposits of bitumen, like those of other heavy hydrocarbons, are thought to be degraded remnants of accumulations of conventional (light-to-medium) oil. Degradation occurs when conventional oil migrates toward the surface and encounters, at temperatures below 93° C (200° F), descending rainwater containing oxygen and bacteria. This leads to the formation of a tarlike substance at the oil and water contact that eventually invades the entire oil pool. The lighter crude-oil fractions are removed by solution, while the paraffins are removed by the bacteria in the water.

Open-pit techniques can be used to mine thick deposits of tar sands when they occur near the surface. After the tar sand has been excavated, the bitumen has to be separated from the sand and then concentrated and cleaned. This crude bitumen is upgraded in a special coking unit, which produces a blend of lighter hydrocarbon fractions to yield synthetic crude, naphtha, kerosene, and gas oil.

The largest known deposits of tar sands occur in the Athabasca River valley of western Canada. The world's only commercial projects for synthetic oil production from tar sands are being carried out in the Athabasca region.

**Tārā,** Tibetan SGROL-MA, Buddhist saviour-goddess with numerous forms, widely popular in Nepal, Tibet, and Mongolia. She is the feminine counterpart of the bodhisattva ("Buddha-to-be") Avalokiteśvara. According to popular belief, she came into existence from a tear of Avalokiteśvara, which fell to the ground and formed a lake. Out of its waters rose up a lotus, which, on opening, revealed the goddess. Like Avalokiteśvara, she is a compassionate, succouring deity who helps men "cross to the other shore." She is the protectress of navigation and earthly travel, as well as of spiritual travel along the path to Enlightenment.

In Tibet she is believed to be incarnate in every pious woman, and the two wives—a Chinese princess and a Nepali princess—of the first Buddhist king of Tibet, Srong-brtsan-sgam-po, were identified with the two major forms of Tārā. The White Tārā (Sanskrit: Sitatārā; Tibetan: Sgrol-dkar) was incarnated as the Chinese princess. She symbolizes purity and is often represented standing at the right hand of her consort, Avalokiteśvara, or seated with legs crossed, holding a full-blown lotus. She is generally shown with a third eye. Tārā is also sometimes shown with eyes on the soles of her feet and the palms of her hands (then she is called "Tārā of the Seven Eyes," a form of the goddess popular in Mongolia).

The Green Tārā (Sanskrit: Syāmatārā; Tibetan: Sgrol-ljang) was believed to be incarnated as the Nepali princess. She is considered



White Tārā, gilt copper repoussé statue from Nepal, 18th century; in the Asian Art Museum of San Francisco, The Avery Brundage Collection
By courtesy of the Asian Art Museum of San Francisco, The Avery Brundage Collection; photograph, Martin Grayson

by some to be the original Tārā and is the female consort or sexual partner of Avalokiteśvara. She is generally shown seated on a lotus throne with right leg hanging down, wearing the ornaments of a bodhisattva and holding the closed blue lotus (*utpala*).

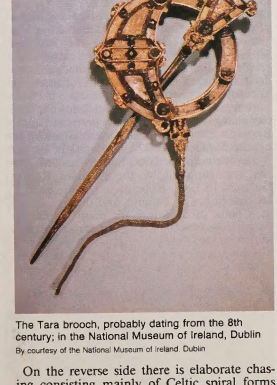
The white and green Tārās, with their contrasting symbols of the full-blown and closed lotus, are said to symbolize between them the unending compassion of the deity who labours both day and night to relieve suffering. Under the influence of Tibetan Lamaism the different forms of Tārā multiplied to a traditional 108. Tibetan temple banners frequently show 21 different Tārās, coloured white, red, and yellow, grouped around a central green Tārā. The figure of the "self-born" Buddha, Amitābha, is often shown in her headdress, as she, like Avalokiteśvara, is considered to be an emanation of Amitābha.

In her ferocious, blue form, invoked to destroy enemies, she is known as Ugra-Tārā, or Ekajaṭā; as a red goddess of love, Kurukullā; and as a protectress against snake bite, Jāṅguli. The yellow Bhṛkuṭī is an angry Tārā, with frowning brows.

**Tara** (Irish: "Place of Assembly"), low hill (about 507 feet [154 m]) in County Meath, Ireland, occupying an important place in Irish legend and history. The earliest local remains consist of a small passage grave (*c.* 2100 BC) known as Dumha na nGiall ("Mound of the Hostages"). Numerous Bronze Age burials were found in the earth mound, which lies just inside the perimeter of a vast oval enclosure called Ráth na Ríogh ("Fortress of the Kings"). Near the centre of this are two conjoined earthworks: Forradh ("Royal Seat") and Teach Cormaic ("Cormac's House"). On the latter is a pillar stone, often thought to be the inauguration stone of the kings of Tara. The other principal sites are a large ring fort, two circular enclosures, and a great rectangular earthwork 750 feet (230 m) long, which is usually identified as the banqueting hall. The Rath of the Synods is a ritual site that underwent four enlargements between the 1st and the 4th centuries.

The main earthworks on the hill probably date to the first five centuries of the Christian era, when Tara was the seat of a dynasty of Úi Néill kings, who appear to have abandoned it in the 6th century.

**Tara brooch,** fine example of a Celtic ring brooch, found on the seashore at Bettystown, south of Drogheda, and now preserved in the National Museum of Ireland, Dublin. The Tara brooch, probably dating from the 8th century, is of white bronze and consists of a large circle with about half of the centre empty and the other half filled in with sunken panels ornamented in extremely delicate filigree.



The Tara brooch, probably dating from the 8th century; in the National Museum of Ireland, Dublin
By courtesy of the National Museum of Ireland, Dublin

On the reverse side there is elaborate chasing consisting mainly of Celtic spiral forms and delicate interlaced patterns. A pin thrust through the brooch attached the whole to the garment; it is of exaggerated length with an elaborately decorated head. The brooch was probably worn on the shoulder with the pin pointing upward.

**Tara Singh,** also called MASTER TARA SINGH (b. June 24, 1885, Rāwalpindi, Punjab, India—d. Nov. 22, 1967, Chandigarh), Sikh leader known chiefly for his advocacy of an autonomous Punjabi-speaking Sikh nation in the Punjab. He was a champion of Sikh rights against the dominant Hindus, Muslims, and British.

Tara Singh was born a Hindu, but while a student in Rāwalpindi he became attracted to Sikhism and underwent the required initiation ceremony. Upon graduation from Khālsā College at Amritsar in 1907, he entered the Sikh school system in Lyallpur, becoming a high school teacher, or "master," a title associated with him thereafter.

A devout worker for the cause of Sikh religious and political integrity, Tara Singh often found himself in opposition to civil authority. He was jailed for civil disobedience 14 times between 1930 and 1966. In 1930 he became deeply involved with the civil-disobedience movement and was a leader of the Sikhs' Akālī Dal party and the Central Gurdwārā Management Committee. He was best known as an agitator for a Punjabi-speaking state in which Sikh religious and political traditions would remain intact.

In 1961 Tara Singh declared that he would fast until the Indian prime minister, Jawaharlal Nehru, ceded a portion of the Punjab as a Sikh state or until death claimed him. He began his fast in August at the Golden Temple at Amritsar, but Nehru responded that submission to Tara Singh's demands would be against India's secular constitution and unfair to the Hindus in the Punjab. After a personal letter from Nehru promising to investigate Sikh claims, Tara Singh broke his 48-day fast, incurring the wrath of the Sikh people. Tara Singh was brought to trial before a council of *pijaras* (Sikh religious leaders) and pleaded guilty. His failure to starve to death in defense of his ideals had discredited him as a leader, and Sant Fateh Singh was elected in his place. Tara Singh's dream of a Punjabi-speaking state was realized in 1966, when the present Indian state of Punjab was created.

**Taraba,** state, eastern Nigeria. It was created in 1991 from the southwestern half of former Gongola state. Taraba is bordered on the north and northeast by Bauchi and Adamawa states, on the west and southwest by Plateau and Benue states, and on the south and southeast by Cameroon.

Most of the northern part of the state is a wooded savanna region drained by the Benue River and its tributaries. Mountains in the state's southern portion rise to more than 3,300 feet (1,000 m). The state's population is engaged in farming and grows cassava, sorghum, millet, rice, yams, sugarcane, and corn (maize). River fishing and the herding of cattle, goats, and sheep are also economically important. In the southwestern part of the state, rubber trees and oil palms have been introduced, and in the extreme south, the Mambilla Mountain region of the Adamawa Plateau provides a tsetse-free grassy highland area that is highly suitable for cattle raising. Taraba state is inhabited mainly by the Jukum (Jukun) and Mambilla peoples, among whom there are considerable numbers of Christians.

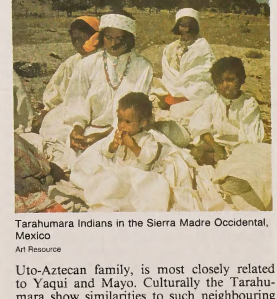
Cottage industries in the state produce leather goods, pottery, metalwork, and dyed cloth. The annual fishing festival at Ibi is a tourist attraction. The state is served by roads running north to Yola, west to Bauchi town, and south to Makurdi town, while the Benue River allows for river transport. Jalingo is the state capital. Gashaka/Gumti National Park, formerly a game reserve, was developed in the 1980s. Pop. (1991) 1,480,590.

**Ṭarafah,** in full ṬARAFAH ʿAMR IBN AL-ʿABD IBN SUFYĀN IBN MĀLIK IBN ḌUBAYʿAH AL-BAKRĪ IBN WĀʾIL (fl. 6th century), Arab poet, author of the longest of the seven odes in the celebrated collection of pre-Islāmic poetry *al-Muʿallaqāt* (*see* Muʿallaqāt, al-). Some critics judge him to be the greatest of the pre-Islāmic poets, if not the greatest Arab poet.

Little is known with any certainty of Ṭarafah's life. He is traditionally acknowledged to have been an extraordinarily precocious poet, writing verses as a boy. After a wild youth spent in Bahrain, and after fighting in the war between his tribe of Bakr and the Taghlib, he went with his uncle Mutalammis, who was also a poet, to the court of ʿAmr ibn Hind, the Lakhmid king of al-Ḥīrah, and there became companion to the king's brother; Ṭarafah's association with the court of al-Ḥīrah (554–568) is the only certainly known fact of his life. Having ridiculed the king in some verses, tradition relates, he was sent with a letter to the ruler of Bahrain and, in accordance with the instructions contained in the letter, was buried alive.

Ṭarafah is one of the few pre-Islāmic poets whose works—collected poems and the *Muʿallaqāt* ode—are still extant. His poetry is passionate and eloquent, defending sensual pleasure and the pursuit of glory as the only proper goals of life.

**Tarahumara,** also called RARÁMURI, Middle American Indians of southwestern Chihuahua state in northern Mexico. Their language, which belongs to the Sonoran division of the



Tarahumara Indians in the Sierra Madre Occidental, Mexico
Art Resource

Uto-Aztecan family, is most closely related to Yaqui and Mayo. Culturally the Tarahumara show similarities to such neighbouring Uto-Aztecan peoples as the Cora, Huichol, Tepehuan, and Pima-Papago. The land inhabited by the Tarahumara is high, broken plateau, cut by deep gorges and canyons; the climate is reasonably cool, but conditions are not particularly suited for agriculture. The Tarahumara are nonetheless small-scale farmers, growing corn (maize), beans, squash, and potatoes. They also keep goats and cattle, but pigs and chickens are uncommon. Crops are grown in small pockets of suitable soil, and a household's crops may be separated from one another by several miles. Settlements are scattered, usually loose clusters of households called *rancherías.* Each home consists of a one-room log or stone house and several storage huts. Settlements are not particularly stable, and a certain amount of seasonal mobility is usual. Pottery, blanket weaving, and basketry are the chief crafts practiced.

Nominally Roman Catholic, the Tarahumara celebrate fiestas for local patron saints; in the *rancherías,* however, pre-Christian rituals are usual, and native fiestas are held. Their mythology blends pagan and Christian elements.

**Tarai,** also spelled TERAI, region of northern India and southern Nepal running parallel to the lower Himalayan ranges. A strip of undulating former marshland, it stretches from

the Yamuna River (west) to the Brahmaputra River (east). At its northern edge are numerous springs forming several streams, including the important Ghāghara River, that intersect the Tarai (meaning "moist land") and are responsible for its marshy character. Interspersed with the Tarai is the Bhābar, which is a region of coarse gravel and shingle deposits supporting sal (*Shorea robusta*) forests. Drainage and cultivation of the area, once extremely malarial, have diminished the marshlands. The eastern part of the Tarai is known in West Bengal state and in Bangladesh as the Duārs.

**Taraïn, Battles of** (1191): *see* Taraori, Battles of.

**Tarakan Island,** Indonesian PULAU TARAKAN, island in Kalimantan Timur *provinsi* ("province"), Indonesia. It is situated in the eastern Celebes Sea, off the northeastern coast of Borneo. The island occupies an area of 117 square miles (303 square km) and has a length of approximately 10 miles (16 km). Its coastal area is low and swampy, and there are oil fields on the southwestern coast. During World War II the island was captured (January 1942) by the Japanese and was retaken by the Australians in May 1945. The town of Tarakan lies on the western side of the island. Pop. (latest est.) 31,118.

**Tarakanova, Yelizaveta Alekseyevna,** bynames KNYAGINYA VLADIMIRSKAYA (Princess of Vladimir), FRÄULEIN FRANK, or MADAME TRÉMOUILLE (b. *c.* 1745—d. Dec. 4 [Dec. 15, New Style], 1775, St. Petersburg, Russia), adventuress and pretender to the Russian throne who claimed to be the daughter of the unmarried empress Elizabeth (reigned 1741–62) and Count Aleksey G. Razumovsky.

She claimed to have been reared in St. Petersburg, but she was probably not Russian, and her origins and real name are unknown. She appeared in various cities of western Europe in the early 1770s and attracted several noble suitors. In 1774 she was convinced by émigré Polish rebels to pretend to the Russian throne. She thereupon claimed that she was Elizabeth's daughter and also that she was the sister of Y.I. Pugachov (who was then leading a rebellion in southeastern Russia), much to the disquiet of the reigning Russian empress, Catherine II the Great.

Catherine's erstwhile supporter, Aleksey Grigoryevich Orlov, discovered Tarakanova in Livorno, seduced her, and lured her aboard his ship in the harbour on the promise of marriage. Once aboard Tarakanova was arrested and sent to St. Petersburg, where she was imprisoned by Catherine in the Peter and Paul Fortress. She died there without revealing the secret of her past.

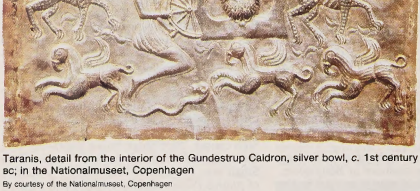
**Taranaki,** local government region, west North Island, New Zealand. It is centred on the Taranaki Peninsula and extends north to the Mokau River and south and east to include the Waitotara River. Its topography is marked by numerous stream valleys, including those of the Patea and Waitara rivers.

Taranaki's first European settlement was New Plymouth (1841), the name used when the area was made a province in 1853. Before the province was abolished in 1876, it had been the scene of the Taranaki War (1860–61) fought between the Maoris and Europeans over the Waitara land purchase. Taranaki is the Maori name (officially recognized) for Mount Egmont, a large volcano that dominates the local scenery. Taranaki is an important dairying area, concentrating on the fertile "ring plain" circling Mount Egmont. The region's principal towns include New Plymouth, Hawera, Stratford, Inglewood, Waitara, Eltham, and Patea.

The peninsula, extending into the Tasman Sea, is bounded by the Taranaki bights, which meet at Egmont Cape. The North Taranaki Bight is lined by coastal cliffs rising to several hundred feet in the north. The bight's good natural harbours are blocked by drifting sand, and the only adequate port is artificial (at New Plymouth). South Taranaki Bight, similarly handicapped by drifting sand, is bordered by an alluvial plain. Area 3,040 square miles (7,876 square km). Pop. (1991) 107,222.

**Taranaki, Mount:** *see* Egmont, Mount.

**Taranis** (Celtic: "Thunderer"), powerful Celtic deity that was one of three mentioned by the Roman poet Lucan in the 1st century AD; the other two were Esus ("Lord") and Teutates ("God of the People"). According to later commentators, Taranis' sacrificial victims, either human or animal, were placed in great wickerwork images, which were then burned. Taranis was symbolically represented by the wheel and the lightning flash. He was sometimes shown riding down a great serpent-footed monster, which represented a divinity or gigantic power of some unknown significance.



Taranis, detail from the interior of the Gundestrup Caldron, silver bowl, *c.* 1st century BC; in the Nationalmuseet, Copenhagen

By courtesy of the Nationalmuseet, Copenhagen

**tarantella,** couple folk dance of Italy characterized by light, quick steps and teasing, flirtatious behaviour between partners; women dancers frequently carry tambourines. The music is in lively $\frac{6}{8}$ time. Tarantellas for two couples are also danced. The tarantella's origin is connected with tarantism, a disease or form of hysteria that appeared in Italy in the 15th to the 17th century and that was obscurely associated with the bite of the tarantula spider; victims seemingly were cured by frenzied dancing. All three words ultimately derive from the name of the town of Taranto, Italy. Tarantellas were written for the piano by Frédéric Chopin, Franz Liszt, and Carl Maria von Weber.



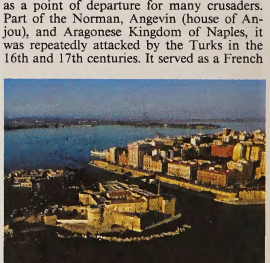
The tarantella from *Napoli,* choreographed by August Bournonville, 1842; performed by members of the New York City Ballet

© 1985 Martha Swope

**Taranto,** Greek TARAS, Latin TARENTUM, city, capital of Taranto *provincia,* Puglia (Apulia) *regione,* southeastern Italy. The city lies at the base of the Salentine Peninsula on the northern inlet (Mare Grande) of the Gulf of Taranto. The old part of the city occupies a small island that lies between the Mare Grande and the inner harbour (Mare Piccolo). Newer city sections are situated on the adjacent mainland.

In the 8th century BC (the traditional date is 706, but it may have been earlier), Greek settlers from Sparta and Laconia conquered the Messapian village of Taras on the river of the same name (modern Tara) and founded a new Taras on the peninsula (cut in 1480 by a canal) between the Mare Piccolo and the Mare Grande. Taras soon became one of the leading cities of Magna Graecia (Greek colonies in southern Italy), and its inhabitants founded several other coastal cities. Taras reached its zenith of military power and prosperity in the 4th century BC under the great philosopher and scientist Archytas, but after his death the city suffered in a series of wars, culminating in its submission to Rome in 272 BC. During the Second Punic War, it fell into the hands of the Carthaginian general Hannibal but was recaptured and plundered by the Romans (209). Although it later recovered many of its privileges, the Roman Tarentum declined under the Roman Empire, in spite of attempts to repopulate it.

From the 6th to the 10th century, the city changed hands repeatedly between Goths, Byzantines, Lombards, and Arabs. Destroyed by the Saracens in 927 and rebuilt by the Byzantine emperor Nicephorus II in 967, the city was captured by the Norman Robert Guiscard in 1063. Robert's son, Bohemond I, became prince of Taranto, and the city served as a point of departure for many crusaders. Part of the Norman, Angevin (house of Anjou), and Aragonese Kingdom of Naples, it was repeatedly attacked by the Turks in the 16th and 17th centuries. It served as a French



Taranto, Italy, the old city (Città Vecchia) with the Aragonese castle on an island (left) between the inner and outer harbours

Gianni Tortoli

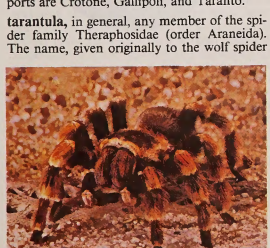
naval base during the Napoleonic Wars but was returned to the Kingdom of the Two Sicilies from 1815 until its union with Italy in 1860. An important stronghold of the Italian Navy in World Wars I and II, Taranto was heavily and effectively bombed by carrier-borne British planes in 1940 and was occupied by British forces on Sept. 9, 1943.

Considering the size of the Greek city-state of Taras, relatively few structural remains have been found. Numerous Greek tombs have yielded a rich collection of imported Greek and local vases, and a deposit of hundreds of statuettes of Apollo, presumably from the temple of that god, was found. There are also numerous ancient reliefs by local craftsmen. Most of these relics are housed in Taranto's National Museum. Taranto's better known Roman remains include ruins of large public baths and of an amphitheatre, mosaic floors, a house, and many cremation and burial tombs. The old city (Città Vecchia), on the site of the Acropolis of Taras on the island between the inner and outer harbours, contains the Aragonese castle (1480; later enlarged), the 11th-century Romanesque cathedral of S. Cataldo (with a Baroque facade), and the church of S. Domenico Maggiore (1302), with an imposing portal and a rose window. The Città Nuova (southeast) contains the Arsenal (1803), the government offices, the Meteorological and Geophysical Observatory (1905), the National Museum, and the State Institute of Marine Biology (1931). Borgo (northwest) is the industrial section.

An important naval base with the Arsenal and shipyards, Taranto is also the site of a large iron- and steelworks of the European Coal and Steel Community. Other industries include canning and processing of products from the fertile surrounding plain and the manufacture of chemicals, textiles, and cement. There is oyster and mussel farming in the Mare Piccolo and fishing with the ebb of the tide. A commercial centre, Taranto is linked by rail with Brindisi, Metaponto, and Bari. Pop. (1983 est.) mun., 242,831.

**Taranto, Gulf of,** Latin SINUS TARENTINUS, Italian GOLFO DI TARANTO, arm, about 85 mi (140 km) long and wide, of the Ionian Sea in southern Italy. Lying between the Capes Santa Maria di Leuca (northeast) and Colonne (southwest), it forms the hollow in front of the heel of the Italian "boot." Feeder streams include the Sinni, Agri, Basento, and Bradano. Main economic activities are the oyster and mussel industries and the exporting of wine, olive oil, fruits, and vegetables. The gulf's chief ports are Crotone, Gallipoli, and Taranto.

**tarantula,** in general, any member of the spider family Theraphosidae (order Araneida). The name, given originally to the wolf spider



American tarantula (*Aphonopelma*)
Lynam—Tom Stack & Associates

(*Lycosa tarentula*, family Lycosidae) of southern Europe, is derived from that of the town of Taranto, Italy.

The bite of *L. tarentula* was once thought to cause a disease known as tarantism, in which the victim wept and skipped about before going into a wild dance. It has been shown, however, that the bite of *L. tarentula* is not dangerous to humans and that no ill effects can be attributed to it. The body of *L. tarentula* is about 2.5 centimetres (1 inch) long. Like other wolf spiders, it spins no web but catches its prey by pursuit.

Members of the family Theraphosidae occur in the southwestern United States, Mexico, and tropical America. Many theraphosids make burrows in soil. They feed mainly at night on insects and occasionally eat small frogs, toads, and mice. In the southwestern United States, tarantulas of the genus *Aphonopelma* may attain a body length up to 5 cm (2 in.) and a leg spread up to 12.5 cm (almost 5 in.). The spiders, dark in colour and sluggish in movement, have hairy body and legs. Theraphosids are harmless to humans and can be trained as pets, although they can inflict painful bites if provoked.

The most common North American tarantula is *Eurypelma californicum*, found in California, Texas, and Arizona. A 30-year life span has been recorded for one individual of this species. Certain South American tarantulas, which have a body length of up to 7.5 cm (almost 3 in.), build large webs and eat small birds.

**Tarantula Nebula:** *see* 30 Doradus.

**Taraori, Battles of** (1191), Taraori also spelled TARAIN, series of engagements that opened all of North India to Muslim control. The battles were fought between Mu'izz-ud-Din Muhammad of Ghur and Prthviraja III, the Cauhan (Cahamana), Rajput ruler of Ajmer and Delhi. The battlefield lay between Karnal, 70 miles north of Delhi, and Thanesar, in the Karnal district of the modern state of Haryana in India.

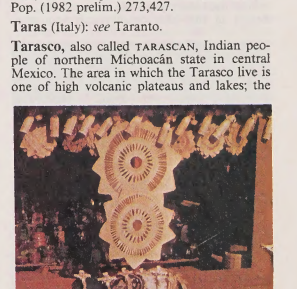
Muhammad had taken Lahore from the last of the Ghaznavids in 1186 and now wished to invade Hindu India. In 1191 he was defeated by confederate Rajput host, led by Prthviraja and supported by Jai Chand of Kanauj and Banaras (Varanasi). In 1192 he returned and defeated and killed Prthviraja, then unsupported by Jai Chand, on the same field. The Ghurid cavalry tactics baffled the Rajputs until Muhammad was able to crush the centre with his main force. This battle was decisive. Delhi was occupied in 1192–93, and the whole of North India fell into Muslim hands within 20 years.

**Tarapacá,** northernmost region, Chile, bordering Peru and Bolivia on the north and east and fronting the Pacific Ocean on the west. Tarapacá was ceded to Chile by Peru after the War of the Pacific (1879–83) and was organized as a province (area 22,820 sq mi [59,104 sq km]) in 1884, and as a region in 1974. It is divided into the provinces of Arica and Iquique. Part of the Atacama Desert, it is without water except at the base of the Andes, where streams flow down into the sands and are lost. In some places, however, there are oases with vegetation and water enough to support small settlements.

Tarapacá was sparsely populated until the 19th-century desert nitrate boom. Deposits are found on the Pampa de Tamarugal, a broad, desert plateau about 3,000 ft (910 m) above sea level between the coast range and the Andes. Since 1940, however, unfavourable world markets for nitrate have resulted in a decline in population. The regional economy is now based largely on fishing and fish processing and agriculture. New irrigation projects have opened lands for the cultivation of sugarcane, olives, citrus fruits, and alfalfa. There is an automobile assembly plant at Arica. The Pan-American Highway runs the length of the region, and "nitrate" railways run inland from the main ports of Arica (a free port for Bolivia) and the regional capital of Iquique (*q.v.*). Pop. (1982 prelim.) 273,427.

**Taras** (Italy): *see* Taranto.

**Tarasco,** also called TARASCAN, Indian people of northern Michoacán state in central Mexico. The area in which the Tarasco live is one of high volcanic plateaus and lakes; the



Handicrafts of the Tarasco Indians on display in Tzintzuntzan, Mex.
Emil Muench

climate is arid and cool. The Tarascan people are undergoing a slow process of assimilation into the mainstream *mestizo* culture of Mexico, but there are still people primarily monolingual in the Tarascan language and culturally conservative.

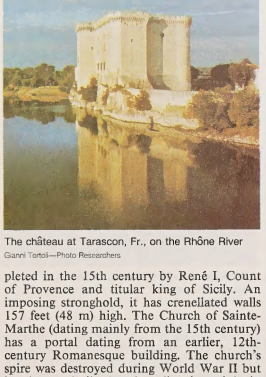
The Tarasco are basically agricultural, growing the Middle American staple crops—corn (maize), beans, and squash—and raising livestock—primarily sheep, hogs, and chickens. Field cultivation is by means of the plow or digging stick. A number of nonstaple crops are also grown for livestock food, for cash, and for variety in the diet. Fishing, hunting, trading, and wage labour are other activities of economic significance. Settlements are generally villages with farmlands surrounding them. Houses are of wood, stone, or adobe, with tile or shingle roofs. Among crafts practiced by the Tarasco are woodworking, weaving, pottery, mat making, net weaving, embroidering, and sewing. Craft specialization by village is the general rule. Traditional dress is disappearing among the Tarasco; most men wear denim work clothes and may have dark trousers, wool jackets, and felt hats for special occasions. Many women wear cotton housedresses, and even the traditional costume is much modified from the pre-Columbian skirt and *huipil* (overblouse, or tunic).

An important social institution is the *compadrazgo*, an institution of ritual kinship based on godparenthood, common in Middle America; in an elaborate form, it is widely seen among the Tarasco. The Tarasco are Roman Catholics, and although they practice the standard folk Catholicism of Middle America, emphasizing patron saints and fiestas, their Christianity is remarkably little influenced by pre-Columbian indigenous religion; they do not believe in gods, demons, or witches.

The Tarascan language is not known to be related to any other.

**Tarascon,** town, Bouches-du-Rhône *département*, Provence-Alpes-Côte-d'Azur region, southeastern France, east of Nîmes. Situated on the left bank of the Rhône opposite Beaucaire, the town is associated with a legendary monster, La Tarasque, which was said to have ravaged the region until it was tamed by St. Marthe. Since the late 19th century it has also been associated with the mock-heroic character Tartarin de Tarascon, created by the

French writer Alphonse Daudet. The château, which rises sharply on the Rhône bank, was begun in the 12th century and was completed in the 15th century by René I, Count of Provence and titular king of Sicily. An imposing stronghold, it has crenellated walls 157 feet (48 m) high. The Church of Sainte-Marthe (dating mainly from the 15th century) has a portal dating from an earlier, 12th-century Romanesque building. The church's spire was destroyed during World War II but has been rebuilt. Local trading is mainly in vegetables, fruit, and Provençal printed cloth. Pop. (1999) 16,884.



The château at Tarascon, Fr., on the Rhône River
Gianni Tortoli—Photo Researchers

**Tarasova, Alla Konstantinovna** (b. Jan. 25, 1898, Kiev, Ukraine, Russian Empire—d. April 5, 1973, Moscow, Russia, Soviet Union), outstanding actress of the Moscow Art Theatre, noted for her lifelike, naturalistic portrayals.

By the age of 14 Tarasova had become a member of the Second Studio of the Moscow Art Theatre. She rose quickly to become a supporting actress, and by the time the company toured England and the United States (1922–24) she was playing such roles as Anya in *The Cherry Orchard,* Sonia in *Uncle Vanya,* Irina in *The Three Sisters,* and Grushenka in *The Brothers Karamazov.* She continued to develop her talents through such portrayals as that of Negina in Aleksandr N. Ostrovsky's *Talents and Admirers* and Varvana in Maksim Gorky's *The Summer People.*

Her abilities reached full flower in the 1930s. She enjoyed outstanding success on the stage with her distinguished portrayals of the title role in *Anna Karenina* (1937) and of Masha in *The Three Sisters* (1939), while her film appearances as Katerina in *The Thunderstorm* (1934) and Ekaterina in *Peter the Great* (1937–39) earned equivalent accolades.

**Tarawa,** coral atoll of the Gilbert Islands and capital of Kiribati. It lies in the west-central Pacific Ocean, 2,800 miles (4,500 km) northeast of Australia and is the most populous atoll in the Gilberts. Tarawa consists of 15 islets, with a total land area of 12 square miles (31 square km) on a reef 22 miles (35 km) long. The atoll is a commercial and educational centre with port facilities on the islets of Betio, Bairiki, and Bikenibeu; an airport on Bonriki; and national government headquarters on Bairiki. There is also an extension centre of the University of the South Pacific on Bairiki. Copra and mother-of-pearl are exported. The atoll was the scene of fierce fighting during World War II (1943), when U.S. Marines retook it from Japanese occupation forces. Pop. (1999 est.) 32,000.

**Tarbela Dam,** giant rock-fill dam on the Indus River, Pakistan. Built between 1968 and 1976, it has a volume of 138,600,000 cubic yards (106,000,000 cubic m). With a reservoir capacity of 11,098,000 acre-feet (13,690,000,000 cubic m), the dam is 469 feet (143 m) high and 8,997 feet (2,743 m) wide at its crest. Tarbela Dam is one of two main structures (the other is Mangla Dam on the Jhelum River) in the Indus Basin project, which resulted from the Indus Waters Agreement between India and Pakistan. Together with their subsidiary dams, Tarbela and Mangla were built to control seasonal fluctuations on the Indus River.

**Tarbell, Ida M.,** in full IDA MINERVA TARBELL (b. Nov. 5, 1857, Erie county, Pa., U.S.—d. Jan. 6, 1944, Bridgeport, Conn.), investigative journalist, lecturer, and chronicler of American industry, best known for her classic *The History of the Standard Oil Company* (1904). Tarbell was one of the journalists characterized by President Theodore Roosevelt as a muckraker.

Tarbell was educated at Allegheny College (Meadville, Pa.) and taught briefly before becoming an editor for the Chautauqua Literary and Scientific Circle (1883–91). In 1891 she took her savings and went to Paris, where she enrolled in the Sorbonne and supported herself by writing articles for American magazines. S.S. McClure, founder of *McClure's Magazine,* hired her in 1894. *The History of the Standard Oil Company,* originally a serial in *McClure's,* is one of the most thorough accounts of the rise of a business monopoly and its use of unfair practices. Tarbell's association with *McClure's* lasted until 1906. She wrote for *American Magazine,* which she also co-owned and coedited, from 1906 to 1915. The year the magazine was sold. She lectured for a time on the Chautauqua circuit and wrote several popular biographies, including eight books on Abraham Lincoln. Later she served as a member of various government conferences and committees concerned with defense, industry, unemployment, and other issues. Her autobiography, *All in the Day's Work,* was published in 1939.

**Tarbes,** town, capital of Hautes-Pyrénées *département,* Midi-Pyrénées *région,* southwestern France. It lies on the left bank of the Adour River, which descends from the Pyrenees into a fertile plain.

After the Roman occupation, when it was a city of considerable importance, Tarbes was seized for a time by the Arabs. In the 10th century it became the capital of the ancient countship of Bigorre, and it was captured by the English during the Hundred Years' War (1337–1453). It suffered greatly in the Wars of Religion in the late 16th century. In 1814 the duke of Wellington, in command of British forces, won a battle against the French near the city. Tarbes' industries, which developed after the coming of the railways, include an arsenal and electrical, mechanical, and aircraft works. Tarbes is reputed for its stud farm breeding of Anglo-Arabian horses.

A small 14th-century Gothic cloister has been transferred from the ruined Abbey of Saint-Severand-de-Rustan and rebuilt in the Jardin Massey, a park. Marshal Ferdinand Foch and the poet Théophile Gautier were natives of Tarbes. Pop. (1999) 46,275.

**tarboosh,** also spelled TARBUSH, close-fitting, flat-topped, brimless hat shaped like a truncated cone. It is made of felt or cloth with a silk tassel and is worn especially by Muslim men throughout the eastern Mediterranean region either as a separate headgear or as the inner part of the turban. The tarboosh worn by women is made of rich materials and adorned with ornaments.

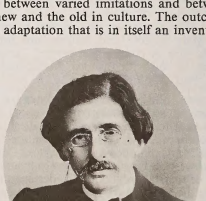
The tarboosh, which is of ancient Greek origin, is similar to the modern fez. As Muslim countries in the 20th century generally abolished national dress, the tarboosh was being abandoned.



Man wearing a tarboosh, portrait of Mehmed V, oil painting by an unknown artist, c. 1918; in the Topkapı Museum, Istanbul
By courtesy of Topkapı Museum, Istanbul; photograph, Sonia Halliday

**Tarde, Gabriel,** in full JEAN-GABRIEL DE TARDE (b. March 12, 1843, Sarlat, Dordogne, France—d. May 13, 1904, Paris), French sociologist and criminologist who was one of the most versatile social scientists of his time.

Tarde served as a magistrate in the Dordogne and, from 1894, as director of the criminal statistics bureau at the Ministry of Justice, Paris. From 1900 he was professor of modern philosophy at the Collège de France. By 1875 he had developed his basic social philosophy. Holding that invention is the source of all progress, Tarde believed that perhaps one person in 100 is inventive. Innovations are imitated, but the imitations themselves differ in degree and kind. Opposition arises both between varied imitations and between the new and the old in culture. The outcome is an adaptation that is in itself an invention.



Tarde, c. 1899
G. Streit—J.P. Zolo

Tarde saw this sequence as an unending cycle constituting the process of social history (*Les Lois sociales,* 1898; *Social Laws*). He treated the repetition phase in his best-known work, *Les Lois de l'imitation* (1890; *The Laws of Imitation*).

In *La Criminalité comparée* (1886; "Comparative Criminality") and other works, Tarde attacked the extreme biological-causation theories of Cesare Lombroso and his school, pointing out the importance of environment in criminal behaviour. His *Psychologie économique,* 2 vol. (1902), stimulated the institutional economics of John Hobson in Great Britain and Thorstein Veblen in the United States.

**Tardieu, André,** in full ANDRÉ-PIERRE-GABRIEL-AMÉDÉE TARDIEU (b. Sept. 22, 1876, Paris, France—d. Sept. 15, 1945, Menton), statesman who was three times premier of France and who attempted to carry on the policies of Georges Clemenceau in the aftermath of World War I.

A member of an upper middle-class family, Tardieu studied at the École Normale Supérieure. After a period in the diplomatic service, he made his reputation as foreign editor of *Le Temps*. Elected to the Chamber of Deputies in 1914, he served with distinction in the light infantry during World War I until 1916. At the Conference of Paris he had a considerable part in drafting the Treaty of Versailles.

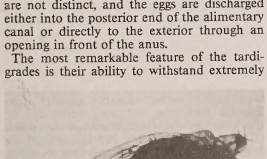
Tardieu was minister for the Liberated Areas (Alsace-Lorraine) in Clemenceau's government from November 1919 to January 1920. After Clemenceau's retirement he steadfastly refused to enter any government until 1926. Both in the Chamber of Deputies and in the press, Tardieu waged an uncompromising campaign against the relaxation of the Treaty of Versailles' punitive provisions against Germany. Then, to Clemenceau's chagrin, he accepted the Ministry of Public Works and later the Ministry of the Interior under Raymond Poincaré. As the leader of the right-centre in the Chamber, he was premier from Nov. 2, 1929, to Feb. 17, 1930, and again from March 2 to Dec. 5, 1930, advocating a policy of large national expenditure. He was minister of agriculture (1931–32) and of war (1932) in Pierre Laval's two Cabinets before becoming premier for the third time on Feb. 20, 1932. Defeated in the general elections, he resigned on May 10, 1932. Finally, disgusted with the condition of public affairs, he retired from active politics in 1936.

Tardieu wrote many books, including *La France et les alliances* (1908); *La Paix* (1921; *The Truth About the Treaty*); *Devant l'obstacle* (1927; *France and America*); and *La Révolution à refaire*, 2 vol. (1936–37), a denunciation of the French parliamentary system.

**tardigrade,** also called WATER BEAR, any of about 350 species of free-living, cosmopolitan invertebrates belonging to the phylum Tardigrada. In evolutionary development they are considered to lie between annelid worms and arthropods (*e.g.,* insects, crustaceans). Tardigrades are mostly about 1 mm or less in size. They live in varying habitats: in damp moss, on flowering plants, in sand, in freshwater, and in the sea. In adapting to this wide range of external conditions, a large number of genera and species have evolved.

Tardigrades have a well-developed head region and a short body composed of four fused segments, with each segment bearing a pair of short, stout, unjointed limbs generally terminated by several sharp claws. The animals have no known specialized organs of circulation or respiration, and the alimentary canal traverses the body from end to end. Most plant-eating tardigrades feed by piercing individual plant cells with their stylets (spearlike structures near the mouth) and then sucking out the cell contents. A few tardigrades are predacious carnivores. The sexes of tardigrades are not distinct, and the eggs are discharged either into the posterior end of the alimentary canal or directly to the exterior through an opening in front of the anus.

The most remarkable feature of the tardigrades is their ability to withstand extremely low temperatures and desiccation. Under unfavourable conditions, they go into a resistant state of suspended animation. Specimens kept for eight days in a vacuum, transferred for three days into helium gas at room temperature, and then exposed for several hours to a temperature of −272° C (−458° F) came to life again when they were brought to normal room temperature. Sixty percent of specimens kept for 21 months in liquid air at a temperature of −190° C (−310° F) also revived. Tardigrades are easily distributed by wind and water while in such resistant states.



Tardigrade (*Macrobiotus*)
Anthony F. Macorowski

**Tardiveau, René-Marie-Auguste:** *see* Boylesve, René.

**tare,** also called DARNEL, noxious weed of the ryegrass (*q.v.*) genus *Lolium.*

**Tarentum** (Italy): *see* Taranto.

**Tărgovište** (Bulgaria): *see* Tŭrgovishte.

**Târgoviște,** also spelled TÎRGOVIȘTE, city, capital of Dâmbovița *județ* (county), south-central Romania. It lies along the Ialomița River, in the southeastern Transylvanian Alps (Southern Carpathians), 50 miles (80 km) northwest of Bucharest. Târgoviște was the capital of feudal Walachia from the 14th to the 17th century. Its monuments include a 16th-century watchtower and a 17th-century church founded by Vasile Lupu. The city has become a centre of the oil industry, with oil-field-equipment works and many modern residential buildings. Târgoviște has a rare-books museum that was the former residence of Princess Safta; its exhibits trace the history of printing in Romania. An archaeological museum contains artifacts from the Stone and Iron Ages and from the Greek, Roman, and Dacian occupations. Railway connections and highways radiate from Târgoviște throughout the county. Pop. (1992 prelim.) 97,876.

**Târgu Jiu,** also spelled TÎRGU JIU, city, capital of Gorj *județ* (county), southwestern Romania, on the Jiu River. Formerly a Roman settlement, Târgu Jiu was the property of boyars until the 19th century. After World War II, the city developed rapidly from an agricultural market town into an industrial centre producing timber, clothing, cigarettes, and foodstuffs. It lies in the southern part of the Petroșani Depression, and there are open-cut coal-mining operations in the area and oil wells south of the city. The Jiu River valley was the scene of heavy fighting in World War I (especially in 1916) and World War II. The city park contains a monument to Romanian heroes of World War I by the sculptor Constantin Brâncuși, who was born in Hobița village. The city also has a museum of Brâncuși's artwork. Railway connections and highways extend through the city. Pop. (1992 prelim.) 98,267.

**Târgu Mureș,** also spelled TÎRGU MUREȘ, Hungarian MAROSVÁSÁRHELY, city, capital of Mureș *județ* (county), north-central Romania. It lies in the valley of the Mureș River, in the southeastern part of the Transylvanian Basin. First mentioned in the 14th century, it was a cattle and crop market town called Neumarkt by the Germans, Agropolis by Greek traders, and Marosvásárhely by the Magyars. In the 15th century it had 30 guilds. The 18th–19th-century mathematician Farkas Bolyai lived in Târgu Mureș.

Târgu Mureș is an important cultural centre in the heart of the Magyar and German minority area and was the administrative capital of the former Mureș Magyar Autonomous Region. There is a state theatre with Magyar and Romanian sections, a Szekler song and dance ensemble, a theatre institute, a technical university, and a university of medicine and pharmaceutics. The Teleki-Bolyai Library, founded at the end of the 18th century by Count Samuel Teleki, chancellor of Transylvania, contains a large collection of first editions and important manuscripts documenting Transylvanian history, as well as mathematical and scientific works. The Palace of Culture houses many activities; its stained-glass windows depict historical scenes.

The city's greatest growth has been in the 20th century. It has a sugar refinery, a nitrogenous fertilizer works using natural-gas by-products, and factories producing furniture, clothing, leather goods, and processed foods. New residential districts at Oancea and Merișani contrast with surviving old buildings. Pop. (1992 prelim.) 163,625.

**Targum** (Aramaic: "Translation," or "Interpretation"), any of several translations of the Hebrew Bible or portions of it into the Aramaic language. The word originally indicated a translation of the Old Testament in any language but later came to refer specifically to an Aramaic translation.

The earliest Targums date from the time after the Babylonian Exile when Aramaic had superseded Hebrew as the spoken language of the Jews in Palestine. It is impossible to give more than a rough estimate as to the period in which Hebrew was displaced by Aramaic as a spoken language. It is certain, however, that Aramaic was firmly established in Palestine by the 1st century AD, although Hebrew still remained the learned and sacred language. Thus the Targums were designed to meet the needs of unlearned Jews to whom the Hebrew of the Old Testament was unintelligible.

The status and influence of the Targums became assured after the Second Temple was destroyed in AD 70, when synagogues replaced the Temple as houses of worship. For it was in the synagogue that the practice of reading from the Old Testament became widely observed, along with the custom of providing these readings with a translation into Aramaic. When Scripture was read aloud in the synagogue, it was translated aloud by a *meturgeman,* or professional interpreter (hence the name Targum), for the benefit of the congregation. The translator tried to reproduce the original text as closely as possible, but since his object was to give an intelligible rendering of the biblical text, the Targums eventually took on the character of paraphrase and commentary, leaving literal translation behind. To prevent misconceptions, a *meturgeman* expanded and explained what was obscure, adjusted the incidents of the past to the ideas of later times, emphasized the moral lessons to be learned from the biblical narratives, and adapted the rules and regulations of the Scriptures to the conditions and requirements of the current age. The method by which the text was thus utilized as a vehicle for conveying homiletic discourses, traditional sayings, legends, and allegories is abundantly illustrated by the later Targums, as opposed to the more literal translations of the earlier Targums.

Though written Targums gradually came into being, it was the living tradition of oral translation and exposition that was recognized as authoritative throughout the Talmudic period of the early centuries of the Christian Era. The official recognition of a written Targum, and therefore the final fixing of its text, belongs to the post-Talmudic period of the 5th century AD. The best known, most literal, and possibly the earliest Targum is the Targum of Onkelos on the Pentateuch, which appeared in its final revision in the 3rd century AD. Other Targums include the Targum of Pseudo-Jonathan, the Samaritan Targum, and the Targum of Jonathan ben Uzziel.

**Tarhun,** also spelled TARU, TARHU, TARHUNT, TARHUNNA, or TARHUIS, ancient Anatolian weather god. His name appears in Hittite and Assyrian records (*c.* 1400–612 BC) and

later as an element in Hellenistic personal names, primarily from Cilicia. Tarhunt was the Luwian form and Tarhun (Tarhunna) probably the Hittite, from the common root *tarh-*, "to conquer." The weather god was one of the supreme deities of the Hittite pantheon and was regarded as the embodiment of the state in action. He played a prominent part in mythology, although his name is sometimes to be read either Taru or Teshub (the Hattian and Hurrian weather gods, respectively), as the myths are either of Hattian or of Hurrian origin. He was the consort of Arinnitti, the Hittite sun goddess and principal deity.

In art Tarhun's symbol was a three-pronged thunderbolt, which he usually carried in one hand while brandishing a club, ax, or other weapon with the other. He is rarely identified by name, and it is often uncertain whether Tarhun or the Hurrian Teshub was intended. His sacred animal was the bull, and in art this animal may stand as his symbol, or Tarhun may be depicted standing on it. Jupiter Dolichenus, the god on the bull worshiped by the Roman legions, was a development of Tarhun.

**tariff,** also called CUSTOMS DUTY, a tax levied on a commodity traded across the border of a country or that of a group of countries that have formed a customs union.

A brief treatment of tariffs follows. For full treatment, *see* MACROPAEDIA: International Trade.

A tariff may be assessed in a number of ways, including directly (*i.e.*, at the border) or indirectly (*i.e.*, by requiring a license to import given quantities of a good). In general, a tariff is imposed either for revenue collection, the protection of a local industry, or both. A tariff designed primarily to raise revenue might also exercise a strong protective influence, while a tariff levied primarily for protection can yield revenue.

Tariffs may be further classified into three groups: transit duties, export duties, and import duties. Transit duties are levied on products that originate in one country, pass through another, and are consigned to a third. Such duties are no longer important instruments of commercial policy, but, during the mercantilist period of the 17th and 18th centuries and even up to the middle of the 19th century in some countries, they played a role in directing trade and controlling certain of its routes.

Likewise, export duties are no longer used to a great extent, except to tax certain mineral, petroleum, and agricultural products. Several resource-rich countries do, however, depend upon export duties for much of their revenue. Export duties were far more common in the past and were significant elements of mercantilist trade policies. Their main function was to safeguard domestic supplies rather than to raise revenue.

Import duties are the most important and most common types of custom duties. As noted above, they may be levied either for revenue or protection or both, but tariffs are not a satisfactory means of raising revenue, because they tend to foster substitution and encourage economically inefficient domestic production of the dutied item.

Tariff reduction and international trade grew dramatically in the second half of the 20th century. By the year 2000, total world trade was 22 times greater than it had been in 1950. In the latter half of the 20th century, trade barriers, especially tariffs, were reduced or in some cases eliminated across the globe. A major impetus to the global growth of trade was the General Agreement on Tariffs and Trade (GATT), a series of trade agreements adopted in 1948 that focused on tariff reductions, especially for tangible goods such as agricultural products, processed foods, steel, and automobiles. A round of negotiations known as the Uruguay Round (1986–94) ultimately led to the creation of the World Trade Organization (WTO) in 1995.

Just as the approach to trade negotiation changed, the nature of products also changed. Advances in information technology beginning in the 1990s altered the focus of many trade agreements. In 1997, for example, the WTO's Information Technology Agreement (ITA) and its Basic Telecommunications Agreement (BTA) reduced the tariffs on computer and telecommunications products and some intangible goods considered to be drivers of the developing knowledge-based economy.

Since 1999, the WTO has been the focus of great criticism. Critics charge the WTO with infringing on national sovereignty, promoting the interests of large corporations, and ignoring environmental issues and the rights of domestic workers. Free-trade advocates, on the other hand, believe that WTO-sponsored agreements offer the best means of providing lower prices for consumers across a wide array of products while creating fairer competitive conditions for international suppliers. (*See* MACROPAEDIA: Globalization.)

**Tarija,** city, southern Bolivia, situated at 6,122 feet (1,866 m) above sea level in the Río Grande de Tarija (Guadalquivir) Valley. Founded in 1574 by the conquistador Luis de Fuentes as San Bernardo de la Frontera de Tarija, it is one of Bolivia's oldest settlements. The inhabitants are well known for their outdoor religious processions. Although the city is accessible by air and road, transport of the products of the rich surrounding agricultural region (which include corn [maize], vegetables, wheat, potatoes, grapes, and other crops) is difficult, and production is only for local consumption. The city is the seat of the "Juan Misael Saracho" Bolivian University (founded in 1946). Pop. (2001) 135,783.

**Tarikaikea** (Indonesia): *see* Mamberamo River.

**Tarim River,** Wade-Giles romanization T'A-LI-MU HO, Pinyin TARIM HE, chief river of the Sinkiang Uighur autonomous *ch'ü* (region), China, situated immediately north of the Tibetan Plateau. The river gives its name to the great basin between the Tien Shan and Kunlun mountain systems of central Asia. It flows for most of its length through the Taklamakan Desert. The word *tarim* means a bank of a river that flows into a lake or that is undifferentiable from the sands of a desert. This is a characteristic hydrographic feature of many rivers that traverse the sands of the Takla Makan Desert. Another characteristic of the rivers of the Tarim Basin, including the Tarim itself, is their active migration—*i.e.*, the shifting of their beds and banks.

The Tarim is formed by the confluence of the K'a-shih-ka-erh (Kyzylsu [Kashgar]) and Yarkand rivers in the far west; flowing northeastward from this confluence, the river is then joined some 230 miles (370 km) downstream by the rivers known as the A-k'o-su and the Ho-t'ien (Khotan). Only the A-k'o-su River flows for the entire year. It is the Tarim's most important tributary, supplying 70–80 percent of its water volume. The name Tarim is used below the Ho-t'ien River confluence. The total length of the Yarkand–Tarim river system is 1,261 miles (2,030 km), although, as the Tarim frequently changes its channel, the length tends to vary over the years. The Tarim's waters eventually drain into Lop Nor (lake) or into T'ai-t'e-ma Lake, which is located several hundred miles to the south of Lop Nor. The area of the Tarim River Basin, including the basins of T'ai-t'e-ma Lake and Lop Nor, is 367,400 square miles (951,500 square km). A considerable part of the Tarim's course is unformed, following no clearly defined riverbed. The lower course of the river diminishes in its water volume as a result of extensive evaporation. The Tarim's low-water period is from October through April. The spring and summer high waters begin in May and continue through September as the snows melt on the distant Tien Shan and Kunlun mountains.

The Lower Tarim Basin is an arid plain composed of alluvium and lake sediments and is bordered by massive mountain ranges. The basin is the driest region of Eurasia. The predominant part of the basin is occupied by the Takla Makan Desert, whose sand area exceeds 105,000 square miles (270,000 square km). In addition, there are several comparatively small sand massifs with areas of from 300 to 1,700 square miles (780 to 4,400 square km). Sand dunes are the predominating desert relief.

Precipitation in the Tarim Basin is extremely scanty, and in some years it is nonexistent. In the Takla Makan Desert and in the Lop Nor basin, the average annual total of precipitation is 0.4–0.5 inches (10–12 mm). In the foothills and in several other areas of the river's basin, the precipitation amounts to from 2 to 4 inches (51 to 102 mm) a year. In the Tien Shan it is much wetter, precipitation often exceeding 20 inches (510 mm). Maximum temperatures in the Tarim Basin are about 104° F (40° C). The Tarim River freezes over every year from December through March.

Vegetation in the Tarim Basin is mainly located along the river and its branches. Here, at the edge of the sands, shrublike vegetation and stunted trees, especially wormwood, is found. A thin forest of poplar grows in the Tarim Valley. Underbrush consists of willows, sea buckthorn, and dense growths of Indian hemp and Ural licorice.

The Tarim is rich with fish, and animal life on the Tarim and the surrounding desert is varied. The valley and lakes of the Tarim are used by many migratory birds as a temporary stopover.

Oasis agriculture remains the mainstay of the scattered settlements in the region. Grains, cotton, silk, fruits, and wool are the chief agricultural products, and Khotan jades are the only other important item. Little is exported from the basin, but local surpluses find a market among travelers passing through when conditions permit.

**Ṭāriq ibn Ziyād,** also spelled TARIK IBN ZEYAD (d. *c.* 720), general who led the Muslim conquest of Spain.

Mūsā ibn Nuṣayr, the Arab conqueror of Morocco, left his general Ṭāriq to govern Tangier in his place. Spain at this time was under Visigothic rule but was rent by civil war. The dispossessed sons of the recently deceased Visigothic king of Spain, Witiza, appealed to the Muslims for help in the civil war, and the Arabs quickly responded to this request in order to conquer Spain for themselves. In May 711 Ṭāriq landed on Gibraltar with an army of 7,000 men, mostly Berbers, Syrians, and Yemenis. Gibraltar henceforth became known as Jabal Ṭāriq (Mount Tarik), from which the Anglicized form of the name is adapted.

Ṭāriq soon advanced to the Spanish mainland itself, gaining valuable support from Spanish Jews who had been persecuted by the Visigoths and from Christian supporters of Witiza's sons. In July 711 he defeated the forces of the Visigothic usurper king Roderick at an undetermined location. He then immediately marched upon Toledo, the capital of Spain, and occupied that city against little resistance. He also conquered Córdoba. Mūsā himself arrived in Spain with about 18,000 more Arab troops in 712, and together the two generals occupied more than two-thirds of the Iberian peninsula in the next few years. In 714 Mūsā and Ṭāriq were summoned by the caliph back to Damascus, where they were

both accused of misappropriation of funds and died in obscurity.

**tariqa,** also spelled TARIQAH, Arabic TARIQAH ("road," "path," or "way"), the Muslim spiritual path toward direct knowledge (*ma'rifah*) of God or Reality (*ḥaqq*). In the 9th and 10th centuries tariqa meant the spiritual path of individual Ṣūfīs (mystics). After the 12th century, as communities of followers gathered around sheikhs (or *pīrs*, "teachers"), tariqa came to designate the sheikh's entire ritual system, which was followed by the community or mystic order. Eventually tariqa came to mean the order itself.

Each mystic order claimed a chain of spiritual descent (*silsilah*) from the Prophet Muḥammad, established procedures for initiation of members (murid, ikhwan, *darwīsh*, fakir), and prescribed disciplines. By following the path of a known "friend of God," or Ṣūfī saint, under the guidance of his sheikh, the Ṣūfī might himself achieve the mystical state (*ḥāl*) of the friends of God. Though sober teachers inveighed against excesses, the search for spiritual ecstasy sometimes led to such practices as drug taking and wild acrobatics, activities that earned for some of the orders the names whirling, howling, and dancing dervishes. Dervish orders frequently established monasteries (ribat, khankah, *zāwiyah*, tekke) in which laity as well as members were invited to stay.

First established in the 12th century, the orders numbered in the hundreds by the mid-20th century, with a membership in the millions. The greatest expansion of Ṣūfī tariqas has been in the central Islāmic countries, where they played a vital role in the religious life of the Muslim community. Orders also exist in west Africa, eastern Europe, India, and in Central and Far Eastern Asia.

**Tarkenton, Fran,** byname of FRANCIS ASBURY TARKENTON (b. Feb. 3, 1940, Richmond, Va., U.S.), American professional football quarterback who set National Football League (NFL) career records for most passes completed (3,686), most yards gained passing (47,003), and most touchdown passes (342).

Tarkenton began playing boys-club football at the age of 10 in Washington, D.C. At Athens (Ga.) High School he was all-state in his senior year; and, at the University of Georgia (Athens; 1958–61), he became an All-American quarterback, leading his team to victory with two touchdown passes in the 1960 Orange Bowl.

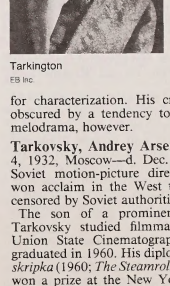
Tarkenton began his NFL career with the Minnesota Vikings in 1961 and became starting quarterback in his rookie year. He was traded to the New York Giants in 1967, who traded him back to the Vikings in 1972. A weak offensive line led to his becoming a successful scrambling quarterback when his pass protection broke down. He led the Vikings to the Super Bowl in the 1973, 1974, and 1976 seasons (defeated each time). By the time he retired in 1978, he had led the league in passing (1975–76, 1978) and had attempted more passes (6,467) than any other quarterback.

After he retired, he became a television football commentator and business consultant. He was inducted into the Pro Football Hall of Fame in 1986.

**Tarkington, (Newton) Booth** (b. July 29, 1869, Indianapolis, Ind., U.S.—d. May 19, 1946, Indianapolis), American novelist and dramatist, best-known for his satirical and sometimes romanticized pictures of American Midwesterners.

Tarkington studied at Purdue and Princeton universities but took no degree. A versatile and prolific writer, he won early recognition with the melodramatic novel *The Gentleman from Indiana* (1899), reflecting his disillusionment with the corruption in the lawmaking process he was to observe firsthand as a member of the Indiana legislature (1902–03). His immensely popular romance *Monsieur Beaucaire* (1900) he later adapted for the stage. His humorous portrayals of boyhood and adolescence, *Penrod* (1914), *Penrod and Sam* (1916), *Seventeen* (1917), and *Gentle Julia* (1922), became young-people's classics. He was equally successful with his portrayals of Midwestern life and character: *The Turmoil* (1915); *The Magnificent Ambersons* (1918; filmed 1941 by Orson Welles), and *The Midlander* (1924), the last two combined as *Growth* (1927); and *The Plutocrat* (1927). *Alice Adams* (1921), a searching character study, is perhaps his most finished novel. He continued his delineations of female character in *Claire Ambler* (1928), *Mirthful Haven* (1930), and *Presenting Lily Mars* (1933) and wrote several domestic novels in his later years. He also wrote many plays.

Tarkington was one of the most popular American novelists of the early 20th century: from *The Two Vanrevels* (1902) to *Mary's Neck* (1932) his novels appeared on annual best-seller lists nine times. Tarkington possessed an informal, charming style and a gift



Tarkington
EB Inc

for characterization. His critical vision was obscured by a tendency toward sentimental melodrama, however.

**Tarkovsky, Andrey Arsenyevich** (b. April 4, 1932, Moscow—d. Dec. 29, 1986, Paris), Soviet motion-picture director whose films won acclaim in the West though they were censored by Soviet authorities at home.

The son of a prominent Russian poet, Tarkovsky studied filmmaking at the All-Union State Cinematography Institute and graduated in 1960. His diploma work, *Katok i skripka* (1960; *The Steamroller and the Violin*), won a prize at the New York Film Festival, and his first full-length feature film, *Ivanovo detstvo* (1962; *Ivan's Childhood*), about the experiences of an orphaned boy on the Russian Front during World War II, established his international reputation. His next film, *Andrey Rublyov* (1965), the story of a medieval Russian icon painter, was acclaimed as a masterpiece for its vivid evocation of the Middle Ages. His subsequent films included *Solyaris* (1971; *Solaris*), *Zerkalo* (1975; *A Mirror*), and *Stalker* (1979).

Tarkovsky's films were notable for their striking visual images, their symbolic, visionary tone, and their paucity of conventional plot and dramatic structure. Several of his films were barred from domestic distribution by the Soviet authorities, and in 1984 Tarkovsky decided to remain in the West after having filmed *Nostalghia* (1983; *Nostalgia*) in Italy. His last motion picture, also made in western Europe, was *The Sacrifice* (1986).

**Tarku** (Egyptian king): *see* Taharqa.

**Tarkwa,** city, southwestern Ghana, western Africa. It is situated about 120 miles (190 km) west of Accra. Located in a predominantly agricultural and mining region, it is a marketing centre for rice, cassava, bananas, rubber, sugar, corn (maize), cocoa, copra, palm kernels, and kola nuts. The city's industries produce various building materials and consumer goods. Gold mining in the area dates back to the 10th century AD, and other minerals extracted include manganese, bauxite, diamonds, iron ore, asbestos, and chromite. Tarkwa is the headquarters of a sheep-breeding project, and a sheep and goat disease investigation centre is located there. Pop. (1984 est.) 22,000.

**Tarlton, Richard** (b. Condover, Shropshire, Eng.—d. Sept. 3, 1588, London), English actor, ballad writer, favourite jester of Queen Elizabeth I, and the most popular comedian of his age.

Tarlton takes his place in theatrical history as creator of the stage yokel; his performance in this role is thought to have influenced Shakespeare's creation of the character Bottom in *A Midsummer Night's Dream,* and Tarlton himself is said to have been the model for the court jester Yorick described in *Hamlet.* Tarlton's popularity and genius were undisputed. Thomas Nashe wrote that audiences began "exceedingly to laugh when he first peept out his head"; Edmund Spenser mourned him as "our pleasant Willy . . . with whom all joy and jolly merriment/Is also deaded"; and in 1643 Sir Richard Baker said that "for the . . . Clown's part he never had his match, never will have." Few of his actual roles as a comedian are known, however. Contemporary sketches show Tarlton in country homespun, holding a pipe and tabor and standing on one toe.

Tarlton is first mentioned in 1570 for his didactic ballad on the "late great floods." The Stationers' Register of 1576 credits him with "a newe booke in Englishe verse intituled Tarltons Toyes." By 1579 he was a well-known actor and Queen Elizabeth I's favourite jester, the only one able to "undumpish" her when she was out of humour and the only one allowed to tell her of her faults. In 1583 he became a leading comic actor of the Queen's Men and groom of Her Majesty's chamber. His plays, which were praised by contemporaries, are all lost. Of later jestbooks that were published as Tarlton's, such as *Tarltons Newes out of Purgatorie* (*c.* 1590) and *Tarlton's Jests* (1611), most are of dubious authenticity, but, like inn signboards that depicted him as late as 1798, they attested to how long his fame survived.

**Tarn,** *département,* Midi-Pyrénées *région,* southern France. It is separated from the Mediterranean Sea to the east by the *département* of Hérault. Created from a southwestern portion of the historic province of Languedoc, it has an area of 2,223 square miles (5,758 square km) and extends from the borders of the Massif Central to the Bassin d'Aquitaine in the centre and west.

The Tarn River, passing through Albi (*q.v.*), the capital of the *département,* and Gaillac, is joined on the western border by the Agout, which crosses the southern half of the *département* through Castres, flowing northwest. The Aveyron and its tributary, the Viaur, flow along the northern border.

The east and southeast sections include the high Sidobre Plateau; the Lacaune heights, rising at Montgrand to 4,157 feet (1,267 m); and the forested Montagne Noire, reaching 3,970 feet (1,210 m), just south of the border. The wooded plateau and heights in the centre rise to a little more than 1,000 feet (300 m). The terrain slopes westward toward the fertile plains of the Tarn-et-Garonne *département.*

The climate is harsh in the mountainous east, and there are sudden changes of temperature in the west. Winters are short and summers very warm. The high plateaus are used for pasture. The plains and valleys are

cultivated for cereals and fruit, and cattle are also raised. The Gaillac region is noted for its sparkling wine. The coal mines in the Albi-Carmaux area have closed, contributing to the decline of related industries such as metalworking. There has also been industrial restructuring in the traditional textile and hosiery industries located at Castres. Henri de Toulouse-Lautrec, the 19th-century painter, was born at Albi, which has a fine gallery of his works. At Castres the Musée Goya has a collection of Spanish art. The *département* has two *arrondissements:* Albi and Castres. It is in the educational division of Toulouse. Pop. (1999) 355,784.

**tarn,** a small mountain lake, especially one set in a glaciated steep-walled amphitheatre known as a cirque (*q.v.*).

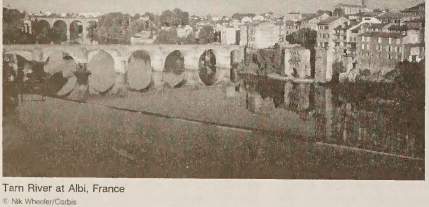
**Tarn, Pauline** (French poet): *see* Vivien, Renée.

**Tarn-et-Garonne,** *département,* in the Midi-Pyrénées *région,* southwestern France, occupying an area of 1,435 square miles (3,716 square km) to the north of Toulouse. It was created in 1808 by a reorganization of districts that, before the French Revolution, belonged historically to the regions of Guyenne and Gascony (Gascogne) and the addition of a small portion of Languedoc.

The Tarn River enters Tarn-et-Garonne *département* in the southeast, flowing northwest through Montauban, the capital, below which it is joined from the east by the Aveyron River. Flowing westward through Moissac, the Tarn empties into the Garonne River, which crosses the *département* from southeast to northwest. The climate is mild with warm summers.

The country is low-lying and has fertile soils on which wheat and corn (maize) are grown extensively. Cattle are also raised, and vineyards and orchards are widespread. The *département* has become increasingly specialized in the cultivation of fruits and vegetables. Generally there is little industry. Moissac produces white grapes of high quality for the table and is also renowned for its ancient abbey, dating from the 11th century, which has one of the finest cloisters in France. The *département* has two *arrondissements,* Montauban and Castelsarrasin. It is in the educational division of Toulouse. Pop. (1999) 213,178.

**Tarn River,** river, in southwestern France. It has its source south of Mont Lozère at an elevation of 5,167 feet (1,575 m) in the Massif Central. After a course of 233 miles (375 km) it joins the Garonne River below Moissac (Tarn-et-Garonne *département*). Its magnificent gorges—which extend for more than 30 miles through the limestone plateaus known as the Causse Méjean and the Causse de Sauveterre, between Florac (Lozère *département*) and Millau (Aveyron *département*)—are among the greatest tourist attractions in France. After entering the fertile lowlands of Aquitaine, passing through Albi, capital of Tarn *département,* the Tarn is joined below Montauban by an important tributary, the Aveyron. The Tarn drains a basin of about 4,600 square miles (12,000 square km).



Tarn River at Albi, France
© Nik Wheeler/Corbis

**Tarnobrzeg,** former (1975–98) *województwo* (province), southeastern Poland, now part of Świętokrzyskie, Podkarpackie, and Lubelskie (*qq.v.*) provinces.

**Tarnobrzeg,** city, Podkarpackie *województwo* (province), southwestern Poland. It received city rights in 1593. Located on the banks of the Vistula River on trade routes linking Warsaw to the cities of southeastern Poland, Tarnobrzeg has long been a leading centre of manufacturing and commerce. Its economy is based on food processing, the manufacture of machine tools, and paper and textile production. Since the early 1950s Tarnobrzeg has grown rapidly because of the discovery of sulfur deposits on the outskirts of the city; the deposits are among the richest in the world. Pop. (2002) 50,287.

**Tarnów,** former (1975–98) *województwo* (province), southeastern Poland, now part of Małopolskie and Podkarpackie (*qq.v.*) provinces.

**Tarnów,** city, Małopolskie *województwo* (province), southeastern Poland, near the confluence of the Biała and Dunajec (a tributary of the Vistula) rivers. It is an industrial city, producing mainly chemicals, building materials, processed foods, and electrical machinery, and a rail junction on the Kraków–Lviv (Ukraine) rail line.

A fortified town was founded on the site by the wealthy Tarnowski family in 1330. Completely destroyed by fire in the 15th century, it was rebuilt and became a cultural centre in the 16th century. It passed to Austria in 1772 and returned to Poland after World War II, in which all its industrial plants were destroyed. The Renaissance town hall and a 15th-century castle both contain museums. Pop. (2002) 119,913.

**Tarnowski, Jan** (b. 1488, Tarnów, Pol.—d. May 16, 1561, Tarnów), army commander and political activist notable in Polish affairs.

As a young army commander, Tarnowski defeated the army of the Moldavian prince Bogdan in southeastern Poland (1509) and took a leading part in victories over the Tatars at Wiśniowiec in 1512 and the Muscovites at Orsza in 1514. After traveling through western Europe and the Middle East (1517–19), he was entrusted with the command of a Portuguese army that he led to victory against the Moors (1520). Returning to Poland (1521), he led Polish forces in Prussia against the Teutonic Knights. Appointed commander in chief of the army (1527) by King Sigismund I the Old, he halted the Tatar raids into Poland, defeated the Moldavians at Obertyn in August 1531, and directed a campaign against the Muscovites in 1535. Appointed governor of Kraków province (1535) in recognition of his military services, he encouraged new settlements in southeastern Poland.

As a member of the Polish senate, Tarnowski supported Sigismund I during the "Poultry War," a revolt (1536) by the *szlachta* (gentry) against the king's attempt to increase his power. In 1547 he sided with King Sigismund II Augustus when the *szlachta* tried to force an annulment of the king's marriage to Barbara Radziwiłł, a member of a Lithuanian family whose power the *szlachta* feared. But in 1553, though a Catholic, Tarnowski supported the largely Calvinist *szlachta* against the restoration of independent Roman Catholic ecclesiastical courts. He wrote *De bello cum . . Turcis gerendo* (1552; "Concerning the Wars with the Turks"), about the emperor Charles V's projected war against the Turks, and *Consilium rationis bellicae* (1558; "Plans on Methods of War"), on traditional Polish methods of warfare.

**taro** (*Colocasia esculenta*), also called EDDO, or DASHEEN, herbaceous plant of the family Araceae. Probably native to southeastern Asia, whence it has spread to the Pacific islands,



Taro (*Colocasia esculenta*)
Donald P. Watson

it has become a staple crop cultivated for its large, starchy, spherical underground tubers, which are consumed as cooked vegetables, made into puddings and breads, and also made into the Polynesian poi, a thin, pasty, highly digestible mass of fermented taro starch. The large leaves of the taro are also eaten.

Taro is cultivated in rich, well-drained soil. The tubers are harvested seven months after planting. Taro leaves and tubers are poisonous if eaten raw; the acrid calcium oxalate they contain must first be destroyed by heating.

**tárogató,** single-reed wind instrument, widely played in the folk music of Romania and, especially, Hungary. It resembles a wooden soprano saxophone, but its conical bore is narrower.

The tárogató was originally a shawm (a loud double-reed instrument). At the end of the 19th century W. Joseph Schunda of Budapest

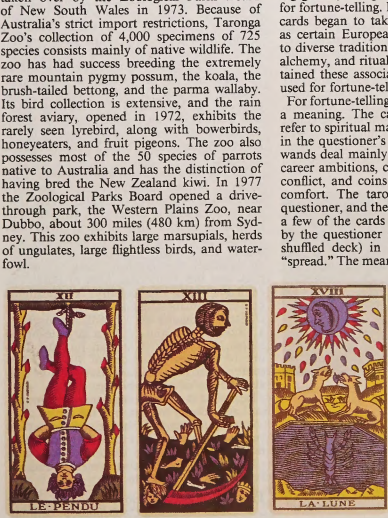


B♭ tárogató, made in Paris, 20th century; in the Horniman Museum, London

By courtesy of the Horniman Museum, London, A. Carse Collection (245)

gave it a saxophone mouthpiece (making it a single-reed instrument) and fitted it with a system of keys.

**Taronga Zoological Park,** zoo located in Taronga Park, Sydney, Australia, one of the outstanding zoos in Australia. It first opened in 1881 in Sydney as the Moore Park Zoo and was run by the Zoological Society of New South Wales. In 1916 the zoo reopened at a site in Taronga Park, overlooking Sydney Harbour, where the zoo now occupies 28 hectares (75 acres). The management of the zoo was taken over by the Zoological Parks Board of New South Wales in 1973. Because of Australia's strict import restrictions, Taronga Zoo's collection of 4,000 specimens of 725 species consists mainly of native wildlife. The zoo has had success breeding the extremely rare mountain pygmy possum, the koala, the brush-tailed bettong, and the parma wallaby. Its bird collection is extensive, and the rain forest aviary, opened in 1972, exhibits the rarely seen lyrebird, along with bowerbirds, honeyeaters, and fruit pigeons. The zoo also possesses most of the 50 species of parrots native to Australia and has the distinction of having bred the New Zealand kiwi. In 1977 the Zoological Parks Board opened a drive-through park, the Western Plains Zoo, near Dubbo, about 300 miles (480 km) from Sydney. This zoo exhibits large marsupials, herds of ungulates, large flightless birds, and waterfowl.




*Tarot cards of the Major Arcana*
(Left to right) Hanged Man, Death, Moon
Mary Evans Picture Library

**tarot,** any of a set of cards used in fortune-telling and in certain card games. Claims have been made for tarot cards' having originated in China, India, or Egypt, but their true origin remains obscure. Tarot cards approximating their present form first appeared in Italy and France in the late 14th century.

Early tarot decks were of several types, each varying in the number of cards. The standard modern tarot deck is based on the Venetian or Piedmontese tarot. It consists of 78 cards divided into two groups: the Major Arcana, which has 22 cards (also known as trumps), and the Minor Arcana, which has 56 cards. The cards of the Major Arcana have pictures representing various forces, characters, virtues, and vices. The 22 cards are numbered from I through XXI, with the Fool being unnumbered. The tarots of the Major Arcana are, in order: I Juggler, or Magician; II Papess, or Female Pope; III Empress; IV Emperor; V Pope; VI Lovers; VII Chariot; VIII Justice; IX Hermit; X Wheel of Fortune; XI Strength, or Fortitude; XII Hanged Man; XIII Death; XIV Temperance; XV Devil; XVI Lightning-Struck Tower; XVII Star; XVIII Moon; XIX Sun; XX Last Judgment; XXI World, or Universe; and the Fool.

The 56 cards of the Minor Arcana are divided into four suits of 14 cards each. The suits, which are comparable to those of modern playing cards, are as follows: wands, batons, or rods (clubs); cups (hearts); swords (spades); and coins, pentacles, or disks (diamonds). Each suit has four court cards (usually named king, queen, knight, and page) and 10 numbered cards. In ascending order, the value progression in each suit is ace to 10, then page (knave, or jack), knight, queen, and king (though the ace is sometimes assigned a high value as in modern playing cards). The standard deck of modern playing cards was historically derived from that of the Minor Arcana (with the elimination of the knight).

At first the tarot was probably used for playing games, though Gypsies may have used it for fortune-telling. From the 18th century, the cards began to take on esoteric associations, as certain European writers connected them to diverse traditions of mysticism, divination, alchemy, and ritual magic. The cards have retained these associations and are now widely used for fortune-telling.

For fortune-telling, each tarot card is ascribed a meaning. The cards of the Major Arcana refer to spiritual matters and important trends in the questioner's life. In the Minor Arcana, wands deal mainly with business matters and career ambitions, cups with love, swords with conflict, and coins with money and material comfort. The tarot deck is shuffled by the questioner, and then the fortune-teller lays out a few of the cards (either selected at random by the questioner or dealt off the top of the shuffled deck) in a special pattern called a "spread." The meaning of any card is modified according to whether or not it is upside down, its position in the spread, and the meaning of adjacent cards.

**tarpan,** European wild horse that survived in small herds in remote parts of central Europe during the Middle Ages but became extinct early in the 20th century. It is likely that late survivors crossed with domesticated horses. The Munich Zoo produced a tarpan-like horse by selective breeding of domestic horses known to have tarpan ancestry. These specimens are exhibited in zoos in the United States and Europe. They are small, dun-coloured horses with flowing manes and tails.

**Tarpeia,** in Roman mythology, daughter of the commander of the Capitol in Rome during the Sabine War. Traditionally, she offered to betray the citadel if the Sabines would give her what they wore on their left arms, *i.e.*, their bracelets; instead, keeping to their promise, they threw their shields on her and crushed her to death. The story may have been an attempt to account for the Tarpeian Rock, a cliff on the Capitoline Hill over which murderers and traitors were thrown.

**tarpon,** any of certain marine fish of the family Megalopidae (order Elopiformes), related to the bonefish and the ladyfish and identified by the elongated last dorsal fin ray and the bony throat plate between the sides of the protruding lower jaw. The scales are large, thick, and silvery.

The Atlantic tarpon (*Tarpon atlanticus,* alternate name *Megalops atlanticus*) is found



Young Atlantic tarpon (*Tarpon atlanticus*)
By courtesy of Miami Seaquarium

inshore in warm parts of the Atlantic, on the Pacific side of Central America, and sometimes in rivers. Also called silver king, grand écaille, and sabalo real, it habitually breaks water and gulps air. It regularly grows to 1.8 m (6 feet) and 45.4 kg (100 pounds) or larger and is a favourite game fish. The largest recorded catches weigh more than 136 kg. The Pacific tarpon, *M. cyprinoides,* is similar.

**Tarpon Springs,** city, Pinellas county, west-central Florida, U.S., on the Anclote River bayous between Lake Tarpon and the Gulf of Mexico, 27 miles (43 km) northwest of Tampa. Founded in 1882 by Anson P.K. Safford, a former governor of the Arizona Territory, it was named for the abundance of tarpon, a large, silvery game fish found in nearby ocean waters. In 1890 John K. Cheney, an early settler, founded the natural sponge industry in Tarpon Springs, which became one of the world's largest; a blight, however, in the sponge beds in the 1940s and the production of synthetic sponges considerably reduced the fleet, which in its heyday comprised more than 200 boats. The city's Universalist Church of the Good Shepherd contains paintings by the American landscape painter George Inness, Jr. Noell's Ark Chimpanzee Farm is nearby. Inc. city, 1887. Pop. (1990) 17,906.

**Tarquin,** Latin in full LUCIUS TARQUINIUS PRISCUS, original name LUCOMO (fl. late 7th and early 6th century BC), traditionally the fifth king of Rome, accepted by some scholars

as a historical figure and usually said to have reigned from 616 to 578.

His father was a Greek who went to live in Tarquinii, in Etruria, from which Lucumo moved to Rome on the advice of his wife, the prophet Tanaquil. Changing his name to Lucius Tarquinius, he was appointed guardian to the sons of King Ancus Marcius. Upon the king's death Tarquin assumed the throne. Eventually Ancus' sons had Tarquin murdered. Tanaquil then managed to put her son-in-law Servius Tullius in power.

The legends maintain that Tarquin increased the number of persons of senatorial and equestrian rank. He is thought to have instituted the Roman Games and to have begun the construction of a wall around the city.

**Tarquin,** Latin in full LUCIUS TARQUINIUS SUPERBUS (fl. 2nd half of the 6th century BC), traditionally the seventh and last king of Rome, accepted by some scholars as a historical figure. His reign is dated from 534 to 509.

Tarquinius Superbus was, in legend, the son or grandson of Tarquinius Priscus and son-in-law of Servius Tullius. Tarquin supposedly murdered Tullius and established an absolute despotism—hence his name Superbus, meaning "the proud." In the reign of terror that followed, many senators were put to death. Eventually a group of senators led by Lucius Junius Brutus raised a revolt, the immediate cause of which was the rape of a noblewoman, Lucretia, by Tarquin's son Sextus. The Tarquin family was expelled from Rome, and the monarchy at Rome was abolished (traditionally 509 BC).

The text of a treaty between a Tarquin—probably Tarquinius Superbus—and the city of Gabii, 12 miles (19 km) from Rome, did actually exist and was preserved in the Temple of Semo Sancus in Rome until the 1st century AD.

**Tarquinia,** Etruscan TÁRCHUNA, or TARCHNA, Latin TARQUINII, formerly CORNETO, town and episcopal see of Viterbo *provincia,* Lazio (Latium) *regione,* central Italy. It lies 4 miles (7 km) inland from the Tyrrhenian Sea, just north of Civitavecchia. The town developed out of the ancient Tárchuna (2 miles [3 km] northeast), which was one of the principal cities of the Etruscan confederation against Rome. Overcome by Rome in 311 BC, following wars in 394, 388, and 358–51, Tárchuna became the site of a Roman colony (Tarquinii) in 181 and received Roman citizenship in 90 BC. It declined during the late Roman Empire, and the old site was abandoned after the Lombard (6th century AD) and Saracen (8th century) invasions. Its inhabitants moved to a lower-lying site, known in medieval times as Corneto and from 1922 as Tarquinia.

The earliest archaeological remains at the original site of Tarquinia are 9th-century BC Villanovan (Iron Age) well tombs. The ancient city site was located on a hill by excavations carried out in 1934–38. Remains of an imposing circle of walls have been uncovered, as have the foundations of a great Etruscan temple known as the Ara della Regina, the decoration of which includes a terra-cotta group of winged horses in Hellenistic style that is considered a masterpiece of Etruscan art. The famous Etruscan necropolis of Tarquinii, situated on a ridge southwest of the ancient city, contains the most important painted tombs in Etruria (Etruscan Italy), mostly rock-cut chamber tombs dating from the 6th to the 4th century BC. The most famous is the Fowling and Fishing Tomb with its polychrome frescoes painted about 520 BC. The tombs of the Lionesses, of the Augurs, and of the Bacchantes (all 6th century BC) show dancing and banqueting scenes. The Tomb of the Triclinium is the most outstanding 5th-century painted tomb, and the Tomb of the Shields is a masterpiece of 4th-century painting. A distinctive 2nd-century painting tradition, rare in Etruria, is found in the paintings of the Tomb of the Cardinal. A serious conservation problem has arisen as many of the paintings have been attacked by moisture and fungus since the collection was opened to the public. A rich collection of articles from the necropolis is housed in the archaeological museum in the Palazzo Vitelleschi (1436–39) in modern Tarquinia, which also has many Romanesque buildings, notably the Church of Santa Maria de Castello, begun in 1121.



Medieval towers, Tarquinia, Italy
John Ross—Photo Researchers

Modern Tarquinia's economic activities include tourism, paper mills, and agricultural industries. Pop. (1990 est.) mun., 14,141.

**Tarquinius** (Roman kings): *see under* Tarquin.

**tarragon,** also called ESTRAGON (species *Artemisia dracunculus*), bushy aromatic herb of the family Asteraceae (Compositae), the dried leaves and flowering tops of which are used to add tang and piquancy to many culinary dishes, particularly fish, chicken, stews, sauces, omelets, cheeses, vegetables, tomatoes, and pickles. Tarragon is a common ingredient in seasoning blends, such as fines herbes. The fresh leaves are used in salads, and vinegar in which fresh tarragon has been steeped is a distinctive condiment.



Tarragon (*Artemisia dracunculus*)
G.R. Roberts

The plant is believed to be native to Siberia. The French variety is cultivated in Europe, particularly France and Spain, and in North America. Tarragon leaves are bright green in colour, have a warm odour, and taste reminiscent of anise. Tarragon contains 0.3 to 1.0 percent essential oil, the principal component of which is methyl chavicol.

**Tarragona,** *provincia,* in the *comunidad autónoma* of Catalonia, northeastern Spain. It borders the Mediterranean Sea. With Barcelona, Gerona, and Lérida provinces, Tarragona became one of the four component provinces of the newly created autonomous region of Catalonia in 1979. It comprises a coastal plain and the mountainous northwest and interior. Primarily agricultural, Tarragona is noted for its wines, hazelnuts, almonds, olives, wheat, tomatoes, fruits, and vegetables. Tourism, based on summer seaside resort facilities, centres upon Salou; fishing is practiced in many coastal villages. Aside from Tarragona city, the provincial capital, important towns are Vendrell, Valls, Reus, and Tortosa. A major nuclear-power plant was opened at Vandellós in 1972. Area 2,426 square miles (6,283 square km). Pop. (1988 est.) 536,713.

**Tarragona,** capital of Tarragona *provincia,* in the *comunidad autónoma* ("autonomous community") of Catalonia, northeastern Spain. It lies at the mouth of the Francolí River, on a hill (500 feet [150 m]) rising abruptly from the Mediterranean Sea.

Once the seat of an Iberian tribe, it was captured in 218 BC by the Roman generals Gnaeus and Publius Scipio, who improved its harbours and its walls, transforming it into the earliest Roman stronghold in Spain. It was known as Tarraco; Julius Caesar initiated its period of splendour and called it Colonia Julia Victrix Triumphalis to commemorate his victories. A temple was built in honour of the Roman emperor Augustus, who made Tarraco the capital of Hispania Tarraconensis; the so-called Castle of Pilate is supposed to have been his imperial palace. The emperors Hadrian and Trajan endowed Tarraco with power and cultural prestige, while its flax trade and other industries made it one of the richest seaports of the Roman Empire. Its fertile plain and sunny shores were praised by the Roman epigrammatist Martial and its famous wines extolled by the writer Pliny the Elder.

According to tradition, St. Paul, with the help of Thecla, founded the Christian church in Spain at Tarraco in AD 60. The city was razed by the Moors in 714 and remained unimportant until early in the 12th century, when it was recaptured by the Christians. After 1119, Tarragona resumed its new life as an important city of the Spanish kingdom of Aragon, and from it James I organized the conquest of Majorca (1229). Having inherited from Rome an imperial sense of unity, Tarragona has shown stubborn loyalty to the kings of Spain and has been a bulwark against invaders.

The old quarter, with many houses built partly of Roman masonry, is more than half surrounded by Roman walls and square towers from the time of the empire. Roman ruins include the theatre, amphitheatre, circus (now forming part of the city's Archaeological Museum), forum, and necropolis, and nearby, an aqueduct, the so-called Tomb of the Scipios, and the Triumphal Arch of Bará. The cathedral (12th–13th century) is transitional between Romanesque and Gothic, with a fine cloister. Tarragona has a pontifical university, a school of arts and crafts, a large technical school, and a paleo-Christian museum with one of the best collections of 4th- and 5th-century Christian documents in Spain. It is also the seat of an archbishop.

Tarragona is a flourishing seaport, an important agricultural market, and the centre of an active tourist trade. The city's industrial development is slight, but includes a petroleum refinery that, when it began production in 1976, was among the most modern in Europe. Pop. (1988 est.) 109,586.

**Tarrasa,** town, Barcelona *provincia,* in the *comunidad autónoma* ("autonomous community") of Catalonia, in northeastern Spain. Tarrasa lies along the coastal plain, just northwest of Barcelona city. The successor of

Egara, a Roman town, it became in AD 450 an important episcopal see with a cathedral, later destroyed. Existing historic churches include the 12th-century Romanesque Santa Maria and San Pedro, both of which have a 6th-century apse; Santa María contains 9th-century primitive paintings. The baptistery of San Miguel probably dates from the 6th century. In the Santo Espíritu church, begun in 1575, is an alabaster figure of Christ sculpted in 1544. The 12th-century castle has undergone reconstruction and houses the Soler y Palet Museum, famous for its medieval paintings and sculpture and for its collection of Catalan ceramics. Also in Tarrasa is the Biosca Museum of historic textiles and a school for textile engineers.

The town's main economic activity has for centuries been the manufacture of woolens; other products are nylon, cottons, carpets, mosaics, and glass. There are also mechanical and electrical concerns. Pop. (1981) 155,360.

**Tarrasch, Siegbert** (b. March 5, 1862, Breslau, Prussia [now Wrocław, Pol.]—d. Feb. 17, 1934, Munich, Ger.), German chess master and physician who was noted for his books on chess theories.

For most of his chess career, Tarrasch was not a strong winner, having had only one major victory, in 1898. After 1907 he participated in more than 20 international matches but never placed in the top three positions. Especially disappointing to him was his loss to Emanuel Lasker in 1908 for the world championship. Despite his failures, Tarrasch is best remembered for his books, especially *The Game of Chess* (1935), that developed and popularized Wilhelm Steinitz's theories, while differing with the master about what constituted a small advantage.

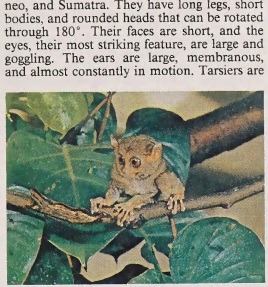
**Tarrytown,** village, northern suburb of New York City, in Greenburgh Town (township), Westchester county, southeastern New York, U.S., just west of White Plains, where the Hudson River widens to form the Tappan Zee (there bridged by the Dewey Thruway). With Irvington and North Tarrytown, it comprises the "Sleepy Hollow Country," made famous by the author Washington Irving, whose home "Sunnyside" is preserved as a shrine. The Washington Irving Memorial, of bronze and marble, created by Daniel Chester French, features reliefs of the legendary Rip Van Winkle and Boabdil, topped by a bust of the author.

The site, settled by the Dutch in the 17th century, was developed after the American Revolution as a river port. The Hudson River Railroad arrived in 1849, and the village was incorporated in 1870. The opening of the Tappan Zee Bridge (1956) stimulated commercial growth. Industry includes publishing, automobile assembly and the manufacture of machinery, chemicals, clothing, and aircraft instruments. Marymount College (1907; a Roman Catholic school for women), Lyndhurst (1838; a Gothic Revival mansion), and "Pocantico Hills" (the Rockefeller estate) are in Tarrytown. The graves of Irving, Andrew Carnegie, and William Rockefeller are in North Tarrytown's Sleepy Hollow Cemetery adjacent to the Dutch Reformed Church (1699; restored as a national historic site). Pop. (1990) 10,739.

**tarsal,** any of several short, angular bones that in humans make up the ankle and that—in animals that walk on their toes (*e.g.*, dogs, cats) or on hoofs—are contained in the hock, lifted off the ground. The tarsals correspond to the carpal bones of the upper limb. In humans the tarsals, in combination with the metatarsal bones, form a longitudinal arch in the foot—a shape well adapted for carrying and transferring weight in bipedal locomotion.

In the human ankle there are seven tarsal bones. The talus (astragalus) articulates above with the bones of the lower leg to form the ankle joint. The other six tarsals, tightly bound together by ligaments below the talus, function as a strong weight-bearing platform. The calcaneus, or heel bone, is the largest tarsal and forms the prominence at the back of the foot. The remaining tarsals include the navicular, cuboid, and three cuneiforms. The cuboid and cuneiforms adjoin the metatarsal bones in a firm, nearly immovable joint.

**tarsier** (genus *Tarsius*), any of three species of small primates, family Tarsiidae, intermediate in form between lemurs and monkeys. Tarsiers are found on several Southeast Asian islands including the Philippines, Celebes, Borneo, and Sumatra. They have long legs, short bodies, and rounded heads that can be rotated through 180°. Their faces are short, and the eyes, their most striking feature, are large and goggling. The ears are large, membranous, and almost constantly in motion. Tarsiers are



Tarsier (*Tarsius*)
Tierbilder Okapia, Frankfurt am Main

about 9–16 cm (3.5–6 inches) long, excluding the tail, which is about twice that length. Their fur is thick, silky, and coloured gray to dark brown.

Tarsiers cling vertically to trees and leap from trunk to trunk. They are well adapted to an arboreal life by the great elongation of their hindlimbs, by the expansion of the tips of the digits into disklike, adhesive pads, and by possession of the long, thin, tufted tail that serves as a balancer and prop. They are nocturnal animals and prey mainly on insects. A single young is produced in a fairly well-developed state, well furred and with eyes open; gestation may require about six months.

**Tarski, Alfred** (b. Jan. 14, 1902, Warsaw, Pol., Russian Empire—d. Oct. 26, 1983, Berkeley, Calif., U.S.), Polish-born American mathematician and logician who made important studies of general algebra, measure theory, mathematical logic, set theory, and metamathematics.

Tarski completed his education at the University of Warsaw (Ph.D., 1923). He taught in Warsaw until 1939, when he moved to the United States (becoming a naturalized citizen in 1945). He joined the staff of the University of California at Berkeley in 1942, was appointed professor of mathematics (1949), and was research professor of the Miller Institute of Basic Research in Science there (1958–60). In succeeding years he was responsible for influencing the careers of many mathematics students. He became emeritus in 1968. He wrote a number of works on algebra, geometry, and logic.

**Tarsus,** city, south-central Turkey, on the Tarsus River, about 12 miles (20 km) from the Mediterranean coast. It is an ancient city, on the alluvial plain of ancient Cilicia, the birthplace of St. Paul (Acts of the Apostles 22:3). Excavations by Hetty Goldman before and immediately after World War II at Gözlükule, on the southwestern periphery of the modern town, show that, with some interruptions, settlements had existed there from Neolithic to Islāmic times. Tarsus' prosperity between the 5th century BC and the Arab invasions in the 7th century AD was based primarily on its fertile soil, its commanding position at the southern end of the Cilician Gates (the only major pass in the Taurus Range), and the excellent harbour of Rhegma, which enabled Tarsus to establish strong connections with the Levant.

The first historical record of Tarsus is its rebuilding by the Assyrian king Sennacherib (705–681 BC). Thereafter, Achaemenid and Seleucid rule alternated with periods of autonomy. In 67 BC Tarsus was absorbed into the new Roman province of Cilicia. A university was established that became known for its flourishing school of Greek philosophy. The famous first meeting between Mark Antony and Cleopatra took place there in 41 BC.

During the Roman and early Byzantine periods, Tarsus was one of the leading cities of the Eastern Empire, with an economy based on agriculture and an important linen industry. Modern Tarsus continues to be a prosperous agricultural and cotton-milling centre. Pop. (1985) 146,502.

**Tartaglia, Niccolò Fontana,** Tartaglia also spelled TARTALEA (b. 1499, Brescia, republic of Venice [Italy]—d. Dec. 13, 1557, Venice), Italian mathematician who originated the science of ballistics.

During the French sack of Brescia (1512), his jaws and palate were cleft by a sabre. The resulting speech difficulty earned him the nickname Tartaglia ("Stammerer"), which he adopted. He settled in Venice in 1534 as a teacher of mathematics.

Tartaglia's *Nova Scientia* (1537; "A New Science"), a treatise on gunnery, is an important pioneering effort to establish the laws of falling bodies. Soon after the publication of this work, Tartaglia was asked by Girolamo Cardano, physician and lecturer in Milan, to publish his solution to the cubic equation. Tartaglia refused at first, but later, in the hope of becoming artillery adviser to the Spanish army, he confided in Cardano, who published the solution in his *Ars magna* ("Great Art"). Tartaglia's best-known work is *Trattato di numeri et misure,* 3 vol. (1556–60; "Treatise on Numbers and Measures"), an encyclopaedic treatment of elementary mathematics. He also published translations of Euclid and Archimedes.

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**tartan,** cross-checkered repeating pattern (or "sett") of different coloured bands, stripes, or lines of definite width and sequence, woven into woolen cloth (sometimes with silk added). Although such patterns have existed for centuries in many cultures, they have come to be regarded as peculiarly Scottish and a quasi-heraldic Scottish family or clan emblem. Most clans have had but one tartan. When it was bright, a second, muted pattern called a hunting sett (often gray-based) was used for everyday wear on the moors and in the mountains.

Great significance and antiquity were long claimed for many Scottish family or clan tartans, but the meagre references to "tartan" that can be gleaned from 15th- and 16th-century writings are somewhat dubious. Tartans are better dated from the 17th and 18th centuries. From the earliest known painted representation of the Highland dress, John Michael Wright's "Highland Chieftain" (Scottish National Portrait Gallery, Edinburgh), all that can be learned is that a small cross-check, or "tartan," pattern was adapted to use in kilt, plaid, and hose about 1660. The chieftain is believed to be a Campbell, but the pattern

that he wears bears no resemblance to that of any Campbell tartan (or any other established tartan) of today. The 18th century does provide a substantial number of portraits forming a reliable pictorial record of some tartans, but there is still little consistency; and portraits dating from the latter half of the 18th century show the Highland gentleman wearing such tartans as pleased him in colour and design, including different garments of unrelated tartans.

Highland dress and the tartan were proscribed after the Jacobite uprising of 1745 (*i.e.*, 1746–82). However, the Highland regiments of the late 18th century wore tartan; therefore, uniform military tartans came to be designed. The largely military revival of the tartan seems to have reached a peak during the state visit of George IV to Edinburgh in 1822. The following three decades saw undiminished interest and produced an imaginative and systematic recording of "clan tartans." Intermittent efforts to denigrate this systematization as mere myth-making have been futile: 200 years of the combined efforts of artists, writers, publishers, manufacturers, and tailors have created a tradition and firmly established the tartan as a Scottish badge.



Royal Stuart (Stewart) tartan
The Scottish Tartans Society/Museum

The Scottish Tartans Society (STS), founded in 1963, makes an intensive study of tartans; it maintains an indexed "Register of All Known Tartans" (which includes about 1,300 recorded tartans), offers an authentication service, issues accreditation certificates for established or new tartans, and operates a museum of tartans at its headquarters in Comrie, Perthshire, Scot. (The society's collections supplement those of Moy Hall in Inverness district and of the Highland Society of London.) The variety of tartans now established include the clan and family tartans; the district tartans of Scotland; the royal tartans; national tartans from communities with strong Celtic connections (Cornwall, Wales, Isle of Man); tartans from countries with Scottish connections (Australia, Bermuda, Northern Ireland); provincial tartans from Canada (Nova Scotia, Alberta); state tartans from the United States (Georgia); military tartans (Black Watch, Royal Canadian Air Force); corporate tartans (Encyclopædia Britannica, Scottish Tourist Board); and commemorative tartans (American Bicentennial).

**Tartar** (people): *see* Tatar.

**tartaric acid,** also called DIHYDROXYBUTANEDIOIC ACID, a dicarboxylic acid, one of the most widely distributed of plant acids, with a number of food and industrial uses. Along with several of its salts, cream of tartar (potassium hydrogen tartrate) and rochelle salt (potassium sodium tartrate), it is obtained from by-products of wine fermentation. In a partially purified form, tartar was known to the ancient Greeks and Romans; the free acid was first isolated in 1769 by C.W. Scheele. The lees, or sediments, and other waste products from fermentation are heated and neutralized with calcium hydroxide; the precipitated calcium tartrate is then treated with sulfuric acid to produce free tartaric acid. Rochelle salt is prepared from the crude crystalline potassium acid salt, called argol, by neutralization with sodium carbonate. Purified cream of tartar comes chiefly from the filtrates from production of the acid and rochelle salt. A third salt, tartar emetic (antimony potassium tartrate), is made from the potassium acid salt and antimony oxide.

Tartaric acid is widely used as an acidulant in carbonated drinks, effervescent tablets, gelatin desserts, and fruit jellies. It has many industrial applications—*e.g.*, in cleaning and polishing metals, in calico printing, in wool dyeing, and in certain photographic printing and development processes. Rochelle salt is used in silvering mirrors, in processing cheese, and in compounding baking powders. Cream of tartar is incorporated into baking powders, hard candies, and taffies; and it is employed in the cleaning of brass, the electrolytic tinning of iron and steel, and the coating of other metals with gold and silver. Tartar emetic is used as an insecticide and a dyeing mordant. Four stereoisomeric forms of tartaric acid exist: (1) the ordinary dextrorotatory tartaric acid found in grapes and several other fruits, (2) a chemically identical but levorotatory form obtained chiefly by resolution of (3), the racemic form, which can be obtained from the tartar mother liquors or prepared synthetically, and (4) a meso form also made synthetically but not resolvable into dextrorotatory and levorotatory isomers. Study of the crystallographic, chemical, and optical properties of the tartaric acids by Louis Pasteur laid the basis for modern ideas of stereoisomerism.

The various tartaric acids and the common tartrate salts are all colourless, crystalline solids readily soluble in water.

**Tartessus,** ancient region and town of the Guadalquivir River valley in southwestern Spain, probably identical with the Tarshish mentioned in the Bible. It prospered from trade with the Phoenicians and Carthaginians but was probably destroyed by the latter about 500 BC. The exact site of the town is not known, but archaeological evidence suggests it may have been near present-day Seville.

**Tartini, Giuseppe** (b. April 8, 1692, Pirano, Istria, republic of Venice [Italy]—d. Feb. 26, 1770, Padua, republic of Venice), Italian violinist, composer, and theorist who helped establish the modern style of violin bowing and formulated principles of musical ornamentation and harmony.

Tartini studied divinity and law at Padua and at the same time established a reputation as a fencer. Before the age of 20 he secretly married a protégée of the archbishop of Padua, resulting eventually in his arrest. Disguised as a monk, he fled from Padua and took refuge in a monastery at Assisi. There his violin playing attracted attention and ultimately influenced the archbishop to allow Tartini to return to his wife at Padua. In 1716 he went to Venice, later went to Ancona, and eventually returned to Padua, where he was appointed principal violinist at the Church of San Antonio in 1721. He directed the orchestra of the chancellor of Bohemia in Prague (1723–25), then returned once again to Padua, where he founded (1728) a school of violin playing and composition. He made a concert tour of Italy in 1740.

Tartini's playing was said to be remarkable for its combination of technical and poetic qualities, and his bowing became a model for later schools of violinists. His compositions include more than 100 violin concertos; numerous sonatas, including the *Trillo del Diavolo* (*Devil's Trill*), written after 1735; quartets; trios; symphonies; and religious works, including a five-part *Miserere* and a four-part *Salve Regina.*

He contributed to the science of acoustics by his discovery of the difference tone, also called the Tartini tone, a third note heard when two notes are played steadily and with intensity. He also devised a theory of harmony based on affinities with algebra and geometry, set forth in his *Trattato di musica* (1754; "Treatise on Music") and expanded into *Dissertazione dei principi dell'armonia musicale* (1767; "Dissertation on the Principles of Musical Harmony"). His theoretical works also include *Trattato delle appoggiature* ("Treatise on Ornamentation").

**Tartous** (Syria): *see* Ṭarṭūs.

**Tartu,** German and Swedish DORPAT, formerly (until 1893) DERPT and (1893–1918) YURYEV, old university city of Estonia, on the Emajõgi River. The original settlement of Tarbatu dates from the 5th century; in 1030 the Russians built a fort there called Yuryev. From the 13th to the 16th century, the town was a prosperous member of the Hanseatic League. Then held in turn by Poles (1582–1600, 1603–25) and Swedes (1600–03, 1625–1704), it was finally annexed to Russia by Peter I the Great in 1704. The city was devastated by fire in 1775 and was largely rebuilt in classical style. It suffered heavily again during World War II. Its university, founded in 1632 by Gustavus II Adolphus of Sweden, was evacuated to Parnu in 1699 and closed in 1710, but it was reopened in Tartu in 1802.

The university is noted for its observatory, art museum, botanical garden, and library. In 1951 an agricultural college was established. In addition to its academic role, modern Tartu is a city of factories producing instruments, agricultural machinery, footwear, foodstuffs, and other goods. The ruins of the 13th-century cathedral remain on Toomemjagi Hill. Pop. (1989) 114,000.

*To make the best use of the Britannica, consult the* INDEX *first*

**Ṭarṭūs,** also spelled TARTOUS, town, western Syria, situated on the Mediterranean coast opposite Arwād Island. It was founded in antiquity as Antaradus, a colony of Aradus (now Arwād Island). It was rebuilt in AD 346 by Emperor Constantine I and flourished during Roman and Byzantine times. Crusaders occupied Ṭarṭūs, then known as Tortosa, in the European Middle Ages, converting it into a fortress-town and successfully defending it against devastating attacks in the 12th century; they were driven out by the Arabs in 1291. From the beginning of the Ottoman conquest, the town declined in importance until its port was rejuvenated in the 20th century. The Cathedral of Our Lady of Tortosa, now the town's museum, is a perfect example of 13th-century crusader architecture. The Castle of the Templars (late 12th to early 13th century), now mostly in ruins, can be seen in the older part of Ṭarṭūs. Syria's second port (after Latakia), Ṭarṭūs is also a fishing port and the centre of a rich agricultural region. Pop. (1985 est.) 64,680.

**Taru** (Anatolian deity): *see* Tarhun.

**Taruc, Luis** (b. June 21, 1913, Santa Monica, Phil.), Philippine leader (1942–54) of the communist Huk (Hukbalahap) movement.

The son of poor peasants, Taruc studied at the University of Manila for two years (1932–34) and then became involved in the cause of the Philippines' landless peasants. Strongly drawn to Marxism, he joined the Socialist Party in 1935. In November of that year the socialists and communists merged to form a united antifascist front.

In 1942, following the Japanese invasion,

Taruc formed the Hukbalahap ("People's Anti-Japanese Army") in central Luzon and became its commander in chief. Although elected to the Philippine House of Representatives in 1946 as a member of the Democratic Alliance, he was barred from his seat when the Commission of Elections charged that he had won his election through terrorism. After unsuccessful attempts to negotiate with President Manuel Roxas, he went underground in late 1946. Between June and August 1948, Taruc's negotiations with the new president, Elpidio Quirino, also failed, and Taruc intensified his terrorist activities, helping in 1948 to create a new Huk movement called the Hukbong Magapayang Bayan ("People's Liberation Army"). By 1950 his guerrillas controlled most of central Luzon, the "rice basket" of the Philippines, including two provincial capitals, and were in a position to threaten the continued existence of the central government. Ramon Magsaysay, Quirino's minister of national defense, however, made considerable progress in countering Taruc's movement by gaining peasant support and reforming the army and constabulary. In 1954 the Huks had been so undermined that Taruc surrendered. Put on trial for revolt and terrorism, he was sentenced to 12 years' imprisonment. He was pardoned by President Ferdinand Marcos in September 1968 and once again became active in the land-reform movement. Taruc wrote *Born of the People* (1953) and *He Who Rides the Tiger* (1967).

**Tarudesert** (Kenya): *see* Nyiri Desert.

**Tarumanegara,** also called TARUMA, the oldest recorded kingdom in western Java. It was established about the 5th century AD, but little is recorded about the kingdom except for a sketchy account by a Chinese traveler and several rock inscriptions discovered near Bogor and in extreme western Java. These sources agree that the most powerful king of Tarumanegara was Purnavarman, who conquered neighbouring countries and built a canal to improve irrigation. The main product of the kingdom was indigo; its people practiced Buddhism. Chinese sources refer to the kingdom as To-lo-ma.

**tarweed,** any sticky, hairy plant of the genus *Madia* of the family Asteraceae, consisting of about 18 species. They are native for the most part to western South America.



Common tarweed (*Madia elegans*)
A to Z Botanical Collection

A few species are grown as garden plants for their yellow or brownish yellow flowers and strong odour. The madia oil plant (*M. sativa*) is raised in Chile for its oil content.

**Tarzan,** one of the best-known and most durable figures of popular fiction, the hero of jungle adventures in nearly 30 novels and dozens of motion pictures.

The creation of the American novelist Edgar Rice Burroughs (*q.v.*), Tarzan first appeared in a magazine story in 1912. His popularity led to the publication of a novel, *Tarzan of the Apes* (1914), and to a series of successful sequels reported to have sold more than 25,000,000 copies worldwide. Burroughs' novels relate in colourful, rather extravagant prose how Tarzan, the son of an English nobleman, is abandoned in the jungles of Africa, where he is adopted and raised by a tribe of great apes. In the course of a series of improbable but exciting adventures he learns English, meets and falls in love with Jane, the daughter of an American scientist, and recovers his title.

*Tarzan of the Apes* was made into a silent film in 1918, with lantern-jawed Elmo Lincoln as the first movie ape-man. More than a dozen actors have since swung through the trees as Tarzan, the most popular having been Johnny Weissmuller, a former Olympic swimming champion. Tarzan has also been the hero of a popular American comic strip and of numerous adventures on radio and television.

**Tasaday,** small group of people living in the highland rain forest of Mindanao, in the Philippines. Before their existence was first reported by anthropological investigators in 1971, the Tasaday, numbering about 25 individuals, apparently had been living a virtually isolated, primitive (incorrectly labeled "Stone Age") existence until they were discovered by nearby settled tribes in 1966. Visiting anthropologists found cave-dwelling food-gatherers whose subsistence was based on the wild yam; other foods included tadpoles, frogs, small fish, crabs, grubs, palm fruit, and wild bananas. The Tasaday were dressed only in loincloths and skirts made of orchid leaves, used only crude stone tools (axes and scrapers) and wooden implements (fire drills and digging sticks), and had no weapons for hunting or war.

The discovery of the Tasaday was hailed as one of the most intriguing anthropological finds of the century and received broad international media coverage. But questions about the authenticity of the Tasaday were raised in 1986, when they were revisited and found to be wearing Western clothing, using tools such as knives, mirrors, and other modern goods. It was asserted that their ethnic and cultural identity were really a hoax perpetrated by officials of the regime of former Philippine president Ferdinand Marcos in order to garner publicity and, eventually, to somehow profit from the management of Tasaday forestlands. According to these later reports, the Tasaday were actually members of the nearby, more culturally advanced Manubo-Blit or Tboli tribes who had acted the part of more primitive peoples at the prompting of Marcos' assistant on national minorities. Nevertheless, linguistic evidence obtained during the earlier anthropological study, however incomplete, seemed to indicate that the Tasaday were indeed isolated, though the Philippine government may have encouraged the people to feign a more primitive life-style than that which they actually lived.

In 1988, on the advice of a Congressional investigative committee, President Corazon Aquino pronounced the Tasaday an authentic minority group, but many scholars remained skeptical, and hope of any conclusive evidence on either side of the controversy was beginning to fade.

**Tashauz,** also spelled TAŠAUZ, city, northern Turkmenistan, in the western Khorezm oasis. The Shavat Canal, which gets its water from the nearby Amu Darya (river), divides the city into northern and southern sections. Originally a fort and the bazaar of western Khwārezm, it became a town in 1924. The old, typically Asiatic part of the city lies north of the canal, while the new part, with its wide tree-lined streets, occupies the southern bank. The city developed particularly after the construction of the railway in the 1950s. It has a cotton gin, food-processing plants, and vehicle-repair works and is a centre of carpet making. The city lies on the Chardzhou-Makat railway. Cotton, alfalfa, grains (sorghum, barley, rice, millet), and melons are produced in the surrounding area. Silk production is also practiced. Pop. (1991 est.) 117,000.

**tashbīh** (Arabic: "assimilating"), in Islām, anthropomorphism, comparing God to created things. Both *tashbīh* and its opposite, *ta'ṭīl* (divesting God of all attributes), are regarded as sins in Islāmic theology. The difficulty in dealing with the nature of God in Islām arises from the seemingly contradictory views contained in the Qur'an (Islāmic scripture). On the one hand God is described as unique and not similar to anything that the mind can imagine; on the other hand he is referred to in the language of anthropomorphism—having eyes, ears, hands, and face, and sitting on his throne and talking and listening.

Some Muslim theologians argued that the Qur'ān used such human concepts and idioms because there are no other means of delivering God's message to man and urged that they be interpreted allegorically rather than literally. Al-Ash'arī, a 10th-century Muslim theologian, asserted that the hands, eyes, and face of God and his sitting and talking must be recognized literally without asking how.

In the literature of the Ṣūfīs (Muslim mystics) God is spoken of in the language and style of ordinary love poetry, which the Ṣūfīs interpret allegorically. This is done on the grounds that man is created after God's own image. When Ibn al-'Arabī (Muslim mystic of the 12th century) published his collection of poems *Tarjumān al-ashwāq* ("The Interpreter of Desires"), the Muslim orthodox rejected his claim of alluding to divine realities and accused him of actually celebrating the charms of his mistress. He wrote a lengthy interpretation of the poetic text to avoid the accusation of *tashbīh*.

Both *tashbīh* and *ta'ṭīl* were avoided by many theologians who spoke rather of *tanzīh* (keeping God pure) and of *tathbīt* (confirming God's attributes). The major reason for the fear of *tashbīh* is that it can easily lead to paganism and idolatry, while *ta'ṭīl* leads to atheism.

**Tashkent,** Uzbek TOSHKENT, capital of Uzbekistan and the largest city in Central Asia. Tashkent lies in the northeastern part of Uzbekistan. It is situated at an elevation of 1,475–1,575 feet (450–480 m) in the Chirchik River valley west of the Chatkal Mountains and is intersected by a series of canals from the Chirchik River. The city probably dates from the 2nd or the 1st century BC and was variously known as Dzhadzh, Chachkent, Shashkent, and Binkent; the name Tashkent, which means "stone village" in Uzbek, was first mentioned in the 11th century.

An important centre of trade and handicrafts on the caravan routes to Europe and the Orient, the city was conquered by the Arabs at the beginning of the 8th century and later became part of the possessions of various Muslim ruling lines before falling to the Mongols in the early 13th century. It was subsequently ruled by the Timurids and Shaybānids and then led an independent existence before being annexed by the khanate of Kokand in 1809. When it was captured by the Russians in 1865, it was a walled city of some 70,000 inhabitants and already a leading centre of trade with Russia. In 1867 it was made the administrative centre of the new governorate-general of Turkistan, and a new European city grew

up beside the old native one. Soviet rule was established by Russian colonists in November 1917 after an armed uprising. Tashkent remained the capital of the new republic of Turkistan in the U.S.S.R., but when the latter was split in 1924, Samarkand became the first capital of the republic of Uzbekistan, U.S.S.R. The capital was transferred to Tashkent in 1930.



Market in the Uzbek quarter, Tashkent city, Uzbekistan
Stephanie Dinkins—Photo Researchers

Today Tashkent is the main economic and cultural centre of Central Asia. Cotton is the chief crop of the region in which it is situated. Wheat, rice, jute, vegetables, and melons are also grown, and silkworms are bred. The city lies in the most industrially developed part of Uzbekistan, and much of its industry is in some way connected with cotton—the manufacture of agricultural and textile machinery and of cotton textiles. It also has various food-processing industries. The city's numerous institutions of higher education and research establishments include the university, founded in 1920, and various institutes of the Uzbek Academy of Sciences, set up in 1943. Another notable institution is the Navoi Public Library. The city's numerous theatres, Uzbek and Russian, include the Navoi Theatre of Opera and Ballet. There are also a Palace of the Arts and several museums, parks, and stadiums. The city has been extensively rebuilt since an earthquake in 1966 left 300,000 people homeless. A few 15th- and 16th-century religious buildings and mausoleums survive, including the Barakkhan Madrasah (theological school). Uzbeks and Russians comprise nearly 80 percent of the population, with minorities of Tatars, Jews, and Ukrainians. Pop. (1998 est.) 2,124,000.

**Tashkent Agreement** (Jan. 10, 1966), accord signed by India's prime minister Lal Bahadur Shastri (who died the next day) and Pakistan's president Ayub Khan, ending the 17-day war between Pakistan and India of August–September 1965. A cease-fire had been secured by the United Nations Security Council on Sept. 22, 1965.

The agreement was mediated by Soviet premier Aleksey Kosygin, who had invited the parties to Tashkent. The parties agreed to withdraw all armed forces to positions held before Aug. 5, 1965; to restore diplomatic relations; and to discuss economic, refugee, and other questions. The agreement was criticized in India because it did not contain a no-war pact or any renunciation of guerrilla aggression in Kashmir.

**tashlik,** also spelled TASHLIKH, OT TASHLICH (Hebrew: "you will cast"), traditional Jewish religious ceremony, still observed by Orthodox Jews, that entails visiting a body of water following the afternoon service on Rosh Hashana (or, if this falls on the Sabbath, the following day) and reciting biblical verses expressing repentance and forgiveness of sins. One verse includes the words " . . . Thou wilt cast [*tashlikh*] all our sins into the depths of the sea" (Micah 7:19). The ritual at one time called for bread crumbs to be fed to fish to symbolize the wiping out of humanity's past iniquities.

Contemporary Jews sometimes reflect this custom by turning their pockets inside out and brushing small particles into the water. Certain rabbinic sources interpret the ritual as guarantee of protection against the evil eye, while others interpret the custom as a reminder to God of the holiness of Isaac and his father Abraham, founder of the Jewish people.

**Tasian culture,** possibly the oldest-known cultural phase in Upper Egypt (*c.* 4500 BC).

The Tasian culture is best known from evidence found on the east bank of the Nile River at al-Badārī and at Deir Tasa. Tasian remains are somewhat intermingled with the materials of the subsequent Badarian stage, and, although the total absence of metal and the more primitive appearance of its pottery would seem to argue for an earlier date, it is also possible that the Tasian was contemporary with the Badarian. Archaeological remains indicate that the Tasians were settled farmers who cultivated emmer wheat and barley and raised herds of sheep and goats. Pottery vessels were reasonably well made, with open bowls and bag-shaped forms predominating. The dead were usually buried in straw coffins, with the bodies in crouching or bent positions.

**Tasikmalaya,** also spelled TASIKMALAJA, city and *kabupaten* (regency), Jawa Barat *provinsi* ("province"), western Java, Indonesia. The city is located in the mountainous Preanger region, about 50 miles (80 km) southeast of Bandung, at an elevation of 1,151 feet (351 m). Roads and railway link it with Bandung to the northwest and Cilacap to the southeast. The population is made up of Javanese who are *santri* ("devout") Muslims, with some Chinese and Indian settlers. A short-lived separate Muslim state, established in Tasikmalaya during 1948, was crushed by Dutch forces. The city is a trading centre for agricultural produce including rice, corn (maize), peanuts (groundnuts), and rubber. Locally manufactured goods include purses, trays, handbags, floor mats, bowls, straw hats, and paper umbrellas. Tasikmalaya is known for its rattan and pandanus woven goods and tussah silk printed by batik. There is a large mosque located in the city. Pop. (2001 est.) city, 221,500; (1990) regency, 1,444,402.

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**Tasman,** unitary authority, northwestern South Island, New Zealand. It is bounded by Tasman and Golden bays and Nelson city on the northeast. Administratively, it is bordered by Marlborough unitary authority and Canterbury local government region on the east and by West Coast local government region on the south and west. The authority is drained by the Buller, Motueka, and Aorere rivers and their tributaries. Rotoroa is the largest lake. Most of the authority is more than 3,000 feet (900 m) in elevation and largely inaccessible, since it is dissected by the Tasman, Wakamarama, Peel, and Arthur mountain ranges.

In 1642 the Dutch navigator Abel Tasman anchored west of Separation Point in Golden Bay. His encounter there with the Maori was a tragic one, and Tasman sailed away naming the area Murderers' Bay. In 1770 Captain James Cook sailed past Golden Bay beyond Separation Point into Tasman Bay; the latter appeared landlocked, and Cook named it Blind Bay. In 1772–73 Cook returned to Blind Bay and renamed it Tasman Bay, mistaking it for Tasman's Murderers' Bay. In 1827 J.-S.-C. Dumont d'Urville reached Tasman Bay; from that time the nucleus of European settlement was the lowlands south of Tasman Bay. The authority's early development included small-scale farming and timber milling with sporadic coal mining. Gold was found in Buller Gorge in 1859.

Subsequently the mining of asbestos, clay, limestone, and coal became important in the locality. Intensive cultivation of tobacco, fruits, and vegetables is carried on in the valleys and lowland areas. The authority's industries are predominantly rural in nature and include food processing and packaging, manufacture of pulp and paper, sawmilling, and vehicle repair.

The valleys and lowlands in the north contain most of the authority's population, with the major towns being Motueka, Richmond, Wakefield, Riwaka, and Collingwood. Abel Tasman and Nelson Lakes national parks are recreational resources in the region. The only major road traverses the Buller River valley (east to west), connecting Westport (west) with Nelson city and Motueka (east). Pop. (2001 prelim.) 44,394.

**Tasman, Abel Janszoon** (b. 1603?, Lutjegast, Neth.—d. probably before Oct. 22, 1659, certainly before Feb. 5, 1661), greatest of the Dutch navigators and explorers, who discovered Tasmania, New Zealand, Tonga, and the Fiji Islands. On his first voyage (1642–43) in the service of the Dutch East India Company, Tasman explored the Indian Ocean, Australasia, and the southern Pacific; on his second voyage (1644) he traveled in Australian and South Pacific waters.

Tasman entered the service of the Dutch East India Company in 1632 or 1633 and made his first voyage of exploration to Ceram (modern Seram) Island (in modern Indonesia) as captain of the *Mocha* in 1634. He sailed in 1639 under Commander Mathijs Hendrickszoon Quast on an expedition in search of the "islands of gold and silver" in the seas east of Japan. After a series of trading voyages to Japan, Formosa (Taiwan), Cambodia, and Sumatra, he was chosen by the governor-general of the Dutch East Indies, Anthony van Diemen, to command the most ambitious of all Dutch voyages for the exploration of the Southern Hemisphere.

By 1642, Dutch navigators had discovered discontinuous stretches of the western coast of Australia, but whether these coasts were continental and connected with the hypothetical southern continent of the Pacific remained unknown. Tasman was assigned to solve this problem, following instructions based on a memoir by Frans Jacobszoon Visscher, his chief pilot. He was instructed to explore the Indian Ocean from west to east, south of the ordinary trade route, and, proceeding eastward into the Pacific (if this proved possible), to investigate the practicability of a sea passage eastward to Chile, to rediscover the Solomon Islands of the Spaniards, and to explore New Guinea.

Leaving Batavia (modern Jakarta) on Aug. 14, 1642, with two ships, the *Heemskerk* and *Zeehaen*, Tasman sailed to Mauritius (September 5–October 8), then southward and eastward, reaching his most southerly latitude of 49° S at about 94° E. Turning north he discovered land on November 24 at 42°20′ S, and he skirted its southern shores, naming it Van Diemen's Land (now Tasmania). A council of officers on December 5 decided against further investigation, so he missed the opportunity of discovering Bass Strait. Continuing eastward, he sighted on December 13, at 42°10′ S, the coast of South Island, New Zealand, and explored it northward, entering the strait between North Island and South Island, supposing it to be a bay. He left New Zealand on Jan. 4, 1643, at North Cape,

under the impression that he had probably discovered the west coast of the southern continent, which might be connected with the "Staten Landt" (Staten Island) discovered by W.C. Schouten and Jacques Le Maire south of South America—hence the name of Staten Landt, which Tasman gave to his discovery in honour of the States General (the Dutch legislature).

Convinced by the swell that the passage to Chile existed, Tasman now turned northeast, and on January 21 he discovered Tonga and on February 6 the Fiji Islands. Turning northwest, the ships reached New Guinea waters on April 1 and Batavia on June 14, 1643, completing a 10-month voyage on which only 10 men had died from illness. Tasman had circumnavigated Australia without seeing it, thus establishing that it was separated from the hypothetical southern continent.

The council of the company decided, however, that Tasman had been negligent in his investigation of the lands that he discovered and of the passage to Chile. They sent him on a new expedition to the "South Land" in 1644 with instructions to establish the relationships of New Guinea, the "great known South Land" (western Australia), Van Diemen's Land, and the "unknown South Land." Tasman sailed from Batavia on February 29, steering southeast along the south coast of New Guinea, sailing southeast into Torres Strait (which he mistook for a shallow bay), coasting Australia's Gulf of Carpentaria, and then following the north coast and then the west coast of Australia to 22° S.

Although he was rewarded with the rank of commander and was made a member of the Council of Justice of Batavia, his second voyage was also a disappointment to the company because it had failed to reveal lands of potential wealth. In 1647 Tasman commanded a trading fleet to Siam (now Thailand), and in the following year he commanded a war fleet against the Spaniards in the Philippines. He left the service of the Dutch East India Company several years later. (H.M.W.)

**Tasman Peninsula,** peninsula in southeastern Tasmania, Australia, connected to the Forestier Peninsula to the north by a narrow isthmus, Eaglehawk Neck. Measuring 17 by 12 miles (27 by 19 km) and occupying 200 square miles (520 square km), the peninsula comprises three arms bounded by Storm Bay (west), Norfolk Bay (north), and the Tasman Sea. Its heavily wooded hills rise to more than 1,500 feet (460 m). The coastline is very much embayed and eroded into sea cliffs, stacks (isolated, vertical rock formations), and blowholes, into which waves rush to form fountains on the shore.

The peninsula was explored by the Dutch navigator Abel Tasman in 1642. Not until 1830, however, was a settlement, a penal colony at Port Arthur on the south coast, established. The partially restored ruins of the colony are now a tourist attraction. Several small resort towns and the local fruit orchards and sheep farms are linked to Hobart (60 miles [100 km] west) by the Arthur Highway. The entire peninsula has been registered as part of Australia's National Estate (places preserved as part of Australia's national heritage).

**Tasman Sea,** section of the southwestern Pacific Ocean, between the southeastern coast of Australia and Tasmania on the west and New Zealand on the east; it merges with the Coral Sea to the north and encloses a body of water about 1,400 miles (2,250 km) wide and 900,000 square miles (2,300,000 square km) in area. Bass Strait (between Tasmania and Australia) leads southwest to the Indian Ocean, and Cook Strait (between North and South islands, New Zealand) leads east to the Pacific.

The sea was named for the Dutch navigator Abel Tasman, who navigated it in 1642. Its New Zealand and Australian shorelines were explored in the 1770s by the British mariner Captain James Cook and others. With maximum depth exceeding 17,000 feet (5,200 m), the seafloor's most distinctive feature is the Tasman Basin. The South Equatorial Current and trade wind drift feed the southerly moving East Australian Current, which is the dominant influence along the Australian coast. From July to December its effect is minimal, and colder waters from the south may penetrate as far north as latitude 32° S. Lord Howe Island, situated at this parallel, represents the most southerly development of a modern coral reef. In the eastern Tasman Sea, surface circulation is controlled by a stream from the western Pacific from January to June and by colder sub-Antarctic water moving north through Cook Strait from July to December. These various currents tend to make the southern Tasman Sea generally temperate in climate and the northern subtropical. Lying in the belt of westerly winds known as the "roaring forties," the sea is noted for its storminess. The sea is crossed by shipping lanes between New Zealand and southeastern Australia and Tasmania, and its economic resources include fisheries and petroleum deposits in the Gippsland Basin at the eastern end of Bass Strait.

**Tasmania,** formerly VAN DIEMEN'S LAND, island state of Australia, lying off the southeastern corner of the continent.

A brief treatment of Tasmania follows. For full treatment, *see* MACROPAEDIA: Australia.

*Physical and human geography.* The triangular main island of Tasmania is separated from Victoria state on the Australian mainland by the Bass Strait, which connects the Tasman Sea, on the island's eastern coast, with the Indian Ocean, which it fronts on the southwest. In addition to Tasmania Island, the state comprises Bruny Island, just off the southeastern coast near the Tasmanian capital of Hobart; King and Flinders islands in the Bass Strait; numerous smaller islands off the coast of the main island; and subantarctic Macquarie Island, lying about 900 miles (1,450 km) to the southeast. The latitude and climate of the main island are broadly comparable to those of northern California or northwestern Spain.

The state owes its name to Abel Tasman, the Dutch navigator who first sighted the island in 1642. Until 1856, however, it was known as Van Diemen's Land, after Anthony van Diemen, the Dutch colonial administrator who had sent Tasman on his voyage of exploration. The island is essentially mountainous and has much of Australia's hydroelectric-power potential.

Except for areas in the northwest, Tasmanian soils are low in fertility. The island has a humid, equable climate. In general, the wettest areas have temperate rain forest, especially of beech and myrtle; areas having 30 to 60 inches (750 to 1,500 mm) of rain annually have good-quality eucalyptus forest, and the dry areas have poor-quality eucalyptus forest or savanna woodland.

Animal life is virtually absent from the true rain forests but abounds in the extensive eucalyptus forest. Among the birds are the honey eaters, the black jay, black magpie, the black cockatoo, and various parrots. Among the mammals are the wallaby, brush and ringtailed possum, and the marsupial carnivores, such as the native cat, tiger cat, and Tasmanian devil. The sedgeland and moorland are distinctive habitats for the wombat, and the coastal heath for the green rosella and the egg-laying mammals, the platypus and the echidna.

Tasmania's resources are highly diversified. Important mineral deposits include iron, zinc, lead, copper, tin, and tungsten. In the centre and the west there is hydroelectric-power development. The western forests furnish both hardwoods and the raw materials for pulp and paper industries. Dairying and mixed farming characterize the wetter north; the drier midlands and the east coast have extensive sheep grazing, and the southeast specializes in horticulture. Mining generally contributes about one-quarter of the primary production, dairying one-fifth, wool production one-sixth, fruit production one-seventh, and forestry one-eighth. Secondary industries are approximately twice as important in total value of production as are the primary industries. Foremost among the secondary industries are the electrometallurgical and electrochemical specialties dependent on cheap power provided by the Hydro-Electric Commission.

The original Tasmanians, now extinct, were a Negrito people who numbered between 3,000 and 5,000 at the time of European settlement in the early 19th century. In the late 1980s the population of Tasmania was distinctive because it had the highest proportion of people born in Australia.

The state parliament (located at Hobart, the state capital) comprises a House of Assembly, with 35 members elected by proportional representation, and a Legislative Council, traditionally a largely nonpartisan house with 19 single-member constituencies. The main political parties are the Australian Labor Party and the Liberal Party of Australia.

The state assists deserted wives or husbands with children, wives with husbands in prison, and neglected or deserted children, but most social welfare is the responsibility of the national government. Homeownership is highly valued among Tasmanians, and apartments make up less than one-tenth of all dwellings.

For its small population, Tasmania has a remarkably vigorous cultural life. This may be due in part to the University of Tasmania (founded 1890) and to the matriculation colleges (which function as an intermediate step between the more disciplined high school and the university), a Tasmanian innovation in the 1960s. There are numerous amateur musical groups ranging from full orchestra to ensemble, as well as several choral societies and repertory companies. The Australian Broadcasting Corporation, with financial support from the Hobart and Launceston city councils, maintains the Tasmanian Symphony Orchestra. Tasmania has well-established film and arts festivals.

*History.* Humans probably entered Tasmania some 25,000 to 40,000 years ago. With the flooding of the Bass Strait about 11,000 to 12,000 years ago, the southernmost peoples of Australia were cut off from the "mainland" groups. Dutchman Abel Tasman was the first European to investigate the region. In 1642 he landed on the island now known as Tasmania and gave it the name Van Dieman's Land. French and British explorers followed, and in 1798 Matthew Flinders circumnavigated the island. The first decade of European colonization on the island was one of precarious existence; the largely convict European population, including the escapee "bushrangers," and the Aborigines were in competition for food and land and were usually at odds. In 1825 Van Dieman's Land was proclaimed a colony and was separated from New South Wales, and from the 1820s to the 1840s the population increased from 4,350 to more than 57,000, an expansion that took its toll on the original inhabitants. When fewer than 200 Aborigines remained, they were relocated (1831) to Flinders Island, where they failed to thrive; the last Tasmanian, a woman named Truganini, died in 1876. Convict transportation was ended in 1852–53, and colonial self-government was granted in 1855–56, when the name Tasmania became official. Most Tasmanians supported the federation of Aus-

tralia, and Tasmania became a constituent state in 1901. Area 26,200 square miles (67,800 square km). Pop. (1991 prelim.) 452,847.

**Tasmanian,** any member of the extinct Australoid population of Tasmania. The Tasmanians were an isolate population of Aboriginal Australians, not a separate or distinctive population, who were cut off from the mainland when a general rise in the sea level flooded the Bass Strait about 10,000 years ago. Their population upon the arrival of European explorers in the 17th and 18th centuries has been estimated at about 4,000. They were a relatively short people, with generally Australoid physical characteristics. The Tasmanians spoke languages that were unintelligible to mainland Aborigines.

The island was divided among several tribes speaking different dialects, each with a delimited hunting territory. Subsistence was based on hunting land and sea mammals and collecting shellfish and vegetable food. In warm months the Tasmanians moved through the open forest and moorlands of the interior in bands or family groups of 15 to 50 people; in colder months they moved to the coast. Occasionally, bands gathered together for a corroboree (a dance celebrating important events), a hunt, or for protection against attack.

Wooden spears, waddies (clubs, or throwing sticks), and flaked-stone tools and weapons were produced. Bone implements, basketry, and bark canoes for coastal travel were also made. A few rock carvings depicting natural objects and conventionalized symbols have survived.

The first permanent white settlement was made in Tasmania in 1803; in 1804 an unprovoked attack by whites on a group of Tasmanians was the first episode in the Black War. The whites treated the Aborigines as subhumans, seizing their hunting grounds, depleting their food supply, attacking the women, and killing the men. Tasmanian attempts to resist were met with the superior weaponry and force of the Europeans. Between 1831 and 1835, in a final effort at conciliation and to prevent the extermination of the approximately 200 remaining Tasmanians, the Aborigines were removed to Flinders Island. Their social organization and traditional way of life destroyed, subjected to alien disease and attempts to "civilize" them, they soon died. Truganini (d. 1876), a Tasmanian woman who aided the resettlement on Flinders Island, was the last full-blooded Aborigine in Tasmania. Another Tasmanian woman is said to have survived on Kangaroo Island in South Australia until 1888.

**Tasmanian cedar,** any of three species of evergreen conifers of the genus *Athrotaxis,* of the deciduous cypress family (Taxodiaceae), native to the temperate rain forests of Tasmania. Two of the species are small trees, 6 to 12 m (20 to 40 feet) tall and 1 to 1.5 m (3 to 5 feet) in circumference, occasionally grown as ornamentals. The third species, King William pine (*A. selaginoides*), is a timber tree that may grow as high as 30 m (100 feet) and as large in circumference as 2.7 m (9 feet). Its dark green, leathery leaves contain volatile oils.

**Tasmanian devil** (*Sarcophilus harrisii*), stocky carnivorous marsupial with heavy forequarters, weak hindquarters, and a large squarish head. The Australian island-state of Tasmania is its only native habitat. Vaguely bearlike in appearance and weighing up to 12 kg (26 pounds), it is 50 to 80 cm (20 to 31 inches) long and has a bushy tail about half that length. The coat is mainly black, and there is a whitish breast mark; sometimes the rump and sides are white-marked as well.



Tasmanian devil (*Sarcophilus harrisii*)
John Yates—Shostal

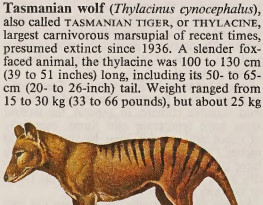
Gaping jaws and strong teeth, along with its husky snarl and often bad temper, result in its devilish expression. It is mainly a scavenger, feeding on carrion such as dead wallabies and sheep. The larvae of certain beetles are its major source of live food, but it has been known to attack poultry.

The teeth and jaws are in many respects developed like those of a hyena. The pouch, when relaxed, opens backward, but, when the muscles are contracted to close it, the opening is central. In most cases four young remain in the pouch for about five months. Overall, female offspring outnumber males about two to one.

The Tasmanian devil became extinct on the Australian mainland thousands of years ago, possibly following the introduction of the dingo. It is still numerous in Tasmania, and it undergoes periodic population surges. Tasmanian devils are related to quolls (*see* native cat); both are classified in the family Dasyuridae. *S. laniarius* is synonymous with *S. harrisii.*

**Tasmanian languages,** extinct languages spoken before 1877 by the indigenous people of Tasmania, who are also now extinct. No relationship between the Tasmanian languages and any other languages of the world has been discovered. Scholars originally divided the Tasmanian languages, all of which were related to each other, into two groups, a western group, spoken in western Tasmania and northern Tasmania, and an eastern group, containing the three languages of eastern Tasmania. More recent studies suggest that there may have been eight or more languages.

**Tasmanian wolf** (*Thylacinus cynocephalus*), also called TASMANIAN TIGER, or THYLACINE, largest carnivorous marsupial of recent times, presumed extinct since 1936. A slender fox-faced animal, the thylacine was 100 to 130 cm (39 to 51 inches) long, including its 50- to 65-cm (20- to 26-inch) tail. Weight ranged from 15 to 30 kg (33 to 66 pounds), but about 25 kg



Tasmanian wolf (*Thylacinus cynocephalus*)
Drawing by Richard Ellis

was average. The Tasmanian wolf was yellowish brown, with 13 to 19 dark bars on the back and rump; the hind legs were longer than the forelegs, and the tail was very thick at the base, tapering evenly to a point. It hunted at night for wallabies and birds. The skull was remarkably similar to that of a dog but had characteristics diagnostic of a marsupial. Other differences include a smaller braincase and jaws with an enormous, almost 90-degree gape. In a shallow pouch that opened rearward, the female carried two to four young at a time.

The thylacine had been found on the Australian mainland and New Guinea and was confined to Tasmania only in historic times. Competition with the dingo probably led to its disappearance from the mainland. It was widely hunted in Tasmania by European settlers because it was considered a threat to the domestic sheep introduced to the island. It was rare by 1914, and the last known individual died in a private zoo in Hobart in 1936; its disappearance from the wild came perhaps two years later. The thylacine was the sole modern representative of the family Thylacinidae.

**tasmiyah** (Islām): *see* basmalah.

**Tass,** abbreviation of TELEGRAFNOE AGENTSVO SOVETSKOVO SOYUZA (Russian: "Telegraph Agency of the Soviet Union"), official news agency of the Soviet Union from 1925 to 1991. Tass was one of the world's major international wire services, distributing news throughout the Soviet Union and the rest of the world. It was established by the Soviet government in 1925 to replace the first Revolutionary news agency, Rosta, which had taken over the tsarist news agency in Petrograd (St. Petersburg).

Until the breakup of the Soviet Union in 1991, Tass was responsible to the Council of Ministers. Its extensive national news networks were the main source of news for all Soviet newspapers and radio and television stations. It had news bureaus and correspondents in more than 100 countries, and its international clients included the wire services of most developed Western nations as well as eastern European and Third World countries. International service was transmitted in Russian, English, French, German, Spanish, and Arabic. Tass dispatched on matters of public policy, and international affairs reflected the official position of the state.

Following the breakup of the Soviet Union in 1991, Tass was reorganized into two branches: the Information Telegraph Agency of Russia, or ITAR, reporting on news of Russia; and the Telegraph Agency of the Countries of the Commonwealth, or Tass, reporting on news of the other countries of the Commonwealth of Independent States.

**Tassie, James** (b. July 15, 1735, Pollokshaws, near Glasgow, Scot.—d. June 1, 1799, London, Eng.), Scottish gem engraver and modeler known for reproductions of engraved gems and for portrait medallions (round or oval tablets bearing figures), both made from a hard, fine-textured substance that he developed with a physician, Henry Quin.

Tassie originally worked as a stonemason, studying modeling at the Foulis Academy, Glasgow, during the same period. In 1763 he moved to Dublin, where he worked as laboratory assistant to Quin, whose hobby was copying antique gems. Together they devised a white enamel composition especially suited for gemstone replicas.

In 1766 Tassie moved to London, where he received commissions to duplicate many famous gems, both ancient and modern. In the early 1780s he was commissioned by Catherine the Great, empress of Russia, to reproduce thousands of pieces for her famous collection, which is now at the Hermitage, St. Petersburg.

Tassie's *Catalogue of Impressions in Sulphur of Antique and Modern Gems* (1775) listed pastes in intaglio and cameo forms sold directly by him and also by London jewelers. In 1791 *A Descriptive Catalogue of a General Collection of Ancient and Modern Gems,* illustrated with 57 plates and describing more than 15,000 reproductions, was issued.

Tassie supplied molds for many pieces cast by the Wedgwood pottery factory, including those for most of the intaglios and cameos listed in their 1773 catalog. Tassie's portrait

medallions, his best-known original works, included many eminent contemporaries among their subjects. They were modeled from life in wax and cast in white paste.

After Tassie's death his nephew continued to make gem reproductions, among them additional pieces for the Russian imperial collection, and also made original portrait medallions, including two of his uncle. His paste seals and gems, inscribed with mottoes and emblems, were especially popular, and he published catalogs of such pieces in 1816, 1820, and 1830. Adding to the collection started by his uncle, he eventually gathered a famous collection of more than 20,000 pieces, including original works by several artists who had been employed by his uncle. William Tassie retired in 1840, after working for 40 years. He willed many molds and impressions to the Board of Manufactures, Edinburgh, and these items were later included in collections at the Scottish National Portrait Gallery and the National Gallery of Scotland.

**Tassigny, Jean de Lattre de:** *see* Lattre de Tassigny, Jean de.

**Tassili-n-Ajjer,** area in southern Algeria where prehistoric rock paintings were discovered in the 19th century. A plateau in the central Sahara, the area is characterized by high cliffs, whose sides are covered with painted scenes. Scholars and archaeologists have been unable to date the rock paintings definitively, and all that is known about the people who lived at the time the paintings were created is what can be determined from studying the paintings themselves.

The rock paintings at Tassili fall into three major stylistic divisions. These divisions are not based on the relative ages of the paintings, as it is assumed that the three styles could have existed concurrently. Some paintings are executed in what is called the "archaic" style: broad planes of colour enclosed by outlines of dark purple. Large animal and human figures—many of the latter masked—are painted in this style. Geometric abstract symbols are placed throughout the scenes. In a second, more naturalistic style, humans and animals are portrayed in great detail in numerous scenes showing cattle running and herdsmen with bows. The third, more "cubist" style utilizes a broken treatment of form in which dark shapes are divided by light areas. The wheel is first depicted in this style.

Stone forms, which were probably used as tomb sculpture, have also been found at the Tassili site. They are monumental forms, frequently symbolizing the genitals. Although there was a considerable amount of stone painting, the early inhabitants of Tassili apparently did not produce much stone carving or engraving. Because scholars have been unable to decipher the hieroglyphic language that is engraved on the rocks, the significance of the art forms and the explanation for the prolific artistic production concentrated in this particular area remains a mystery.

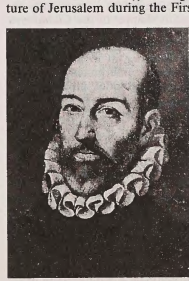


Rock painting of herdsmen and cattle, Tin Tazarift, Tassili-n-Ajjer, Alg.
J.D. Lajoux

**Tasso, Bernardo** (b. Nov. 11, 1493, Bergamo, republic of Venice [Italy]—d. Sept. 5, 1569, Ostiglia, duchy of Mantua [Italy]), Italian courtier and poet who was the father of Torquato Tasso, the greatest Italian poet of the late Renaissance.

Bernardo wrote a great deal of poetry, including 55 odes that were the first original Italian poems in the manner of Horace. His major work was a 100-canto epic called *Amadigi* (published 1560), based on an earlier Spanish chivalric novel about that knight. One critic has termed *Amadigi* "vast, serious, and unreadable." Some critics, however, find Bernardo's amplification of an episode from *Amadigi* more interesting; left incomplete at his death, it was subsequently worked over and published by Torquato as *Floridante* (1587).

**Tasso, Torquato** (b. March 11, 1544, Sorrento, Kingdom of Naples [Italy]—d. April 25, 1595, Rome), greatest Italian poet of the late Renaissance, celebrated for his heroic epic poem *Gerusalemme liberata* (1581; "Jerusalem Liberated"), dealing with the capture of Jerusalem during the First Crusade.



Torquato Tasso, detail of an oil painting by Federico Zuccari, 1594; in a private collection
By courtesy of L. Locatelli-Milesi-Tombini, Bergamo, Italy

*Early life and works.* Tasso was the son of Bernardo Tasso, a poet and courtier, and of Porzia de' Rossi. His childhood was overshadowed by family misfortunes: his father followed the prince of Salerno into exile in 1552; the family estates were confiscated; his mother died in 1556; and there was subsequent litigation about her dowry. Tasso joined his father in Rome in 1554 and two years later at the court of the Duke of Urbino, where he was educated with the duke's son. His imagination had already been fired by stories of the Crusades, and he was struck in 1558 by news of an attack by the Turks on Sorrento, where his sister Cornelia narrowly escaped the accompanying massacre.

While in Venice the following year, Tasso began to write an epic in ottava rima (an Italian stanza of eight 11-syllabled lines), *Gerusalemme,* about the First Crusade (which recovered Jerusalem from the Turks in 1099). He soon interrupted its composition, probably realizing that he was too inexperienced to write a historical epic, and turned to themes of chivalry. The resulting *Rinaldo* (1562) exhibited his technical ability but not as yet his poetic genius.

In 1560 he was sent to study law in Padua and there met the humanist and critic Sperone Speroni, under whose guidance he studied Aristotle's *Poetics.* It was probably then that he started writing his *Discorsi dell'arte poetica* (1587; "Treatise on the Art of Poetry"), explaining therein his qualified acceptance of the rules supposedly laid down by Aristotle in 4th-century-BC Greece. (For instance, Tasso maintained that unity of action should not exclude a variety of episodes.)

In 1565 Tasso entered the service of Luigi, cardinal d'Este, and frequented the court of Duke Alfonso II d'Este at Ferrara, where he enjoyed the patronage of the duke's sisters, Lucrezia and Leonora, for whom he wrote some of his finest lyrical poems. In 1569 his father died; the following year Lucrezia left Ferrara, and Tasso followed the cardinal to Paris, where he met a fellow poet, the Frenchman Pierre Ronsard. Back in Ferrara in 1571, he became one of the duke's courtiers and devoted himself to intense poetic activity. In 1573 he wrote the pastoral drama *L'Aminta* (performed 1573; published 1581), which transcends the convention of artificial rusticity with the sensuous, lyrical inspiration of its picture of Arcadia. The tone of *L'Aminta* is lyrical rather than dramatic; the play presents with great delicacy of feeling a series of vignettes that culminate in the shepherd Aminta's long-sought attainment of his beloved, Silvia. The play reflects in its idealization of court life the ephemeral period of happiness Tasso had enjoyed at Ferrara.

*Composition of the Gerusalemme liberata.* In 1575 Tasso completed his masterpiece, the *Gerusalemme liberata,* on which he had been working since his stay in Ferrara. In this epic poem Tasso narrates the actions of the Christian army led by Godfrey of Bouillon during the last months of the First Crusade, culminating in the conquest of Jerusalem and the Battle of Ascalon. To the poem's principal historical action Tasso added a number of imaginary episodes in which his lyrical and hedonistic imagination could find free expression. The most prominent of these episodes is the story of the Italian hero Rinaldo, including his rebellion, his love for the Saracen girl Armida, and his repentance and decisive participation in the final battle. Tasso also added the story of the Italian hero Tancred and his love for the beautiful Saracen Clorinda, whom Tancred unwittingly kills in battle; the secret passion of Erminia, princess of Antioch, for Tancred; and the intervention of supernatural forces in favour of Aladino, the king of Jerusalem.

In composing the *Liberata,* Tasso tried to establish a balance between the moral aspirations of his times and his own sensuous inspiration, and between the requirements of the formal rules laid down for the epic by Renaissance scholars and the impulse of his own lyrical fantasy. He succeeded in reconciling invention with historical truth by adding the aforementioned romantic and idyllic episodes to the firm groundwork of the principal historical action. These episodes contribute much of the lyrical charm that the poem possesses.

Aware of his epic's poetic novelty, Tasso went to Rome in order to arrange its revision by a group of critics. Back in Ferrara in 1576, he started revising his work in a contradictory mood, in which he felt the urge both to accept the criticism he himself had sought and yet to rebel against this kind of authority. He developed a persecution mania, accompanied by unwarranted scruples about his own religious orthodoxy, and the following years were characterized by sudden departures from Ferrara and by violent crises, the latter culminating in his incarceration in the hospital of Santa Anna (1579–86) by order of the Duke of Ferrara. During his confinement Tasso wrote a number of philosophical and

moral dialogues that, together with his numerous letters, are among the best examples of 16th-century Italian prose. In 1581 the first editions of the *Gerusalemme liberata* and portions of the *Rime e prose* were published. A long controversy started among Italian critics on the respective merits of his epic and of its immediate predecessor, Ludovico Ariosto's chivalric poem *Orlando furioso,* Tasso himself taking part in the controversy with an *Apologia* (1585).

In July 1586 Tasso was released from Santa Anna, thanks to the intervention of Vincenza Gonzaga, prince of Mantua, who received him at his court. After a revival of creative inspiration—at Mantua he completed his tragedy *Galealto,* retitled *Re Torrismondo* (1587)—he relapsed into his usual inquietude and fled from Mantua, wandering mainly between Rome and Naples, where he composed his religious poems *Monte oliveto* (1605; "Mount of Olives") and *Le sette giornate del mondo creato* (1607; "The Seven Days of Creation"). In May 1592 he was given hospitality in Rome by Cardinal Cinzio Aldobrandini, a nephew of Pope Clement VIII. To this patron he dedicated a new version of his epic (*Gerusalemme conquistata,* published 1593), a poetic failure that reveals the extent of Tasso's final submission to the moral and literary prejudices of the times. He wrote two more religious poems (*Lagrime di Maria Vergine* and *Lagrime di Gesù Cristo*), and in June 1594 he went again to Naples, where his *Discorsi del poema eroico* (1594; "Treatise on Epic Poetry") was published. In the *Discorsi* he tried to justify the new version of his epic according to his modified conception of poetic art. On Tasso's return to Rome in November 1594, the pope granted him an annual pension and promised to make him poet laureate. But Tasso fell ill in the following March, was moved to the convent of San Onofrio, and died within a few weeks.

*Reputation and influence.* It was not long before *Gerusalemme liberata* was translated and imitated in many European languages, but its mixed reception following publication aggravated Tasso's melancholic disposition. This melancholy was partly caused by a contrast between his hedonistic ideals—as displayed in his pastoral drama *Aminta*—and his religious aspirations in accordance with the rigid morality of the Counter-Reformation, the Roman Catholic church's movement of revival in answer to Protestantism. The restlessness of the poet's life, his mental illness, his supposed romantic loves, and his alleged persecutions all gave rise to a legend about the man. Tasso became a literary subject first in 17th-century Italy and then in 18th- and 19th-century Europe, being finally represented as the man of genius who is misunderstood and persecuted. Modern criticism refers the peculiarities of his life and character to the moral incertitude of the times. (G.A./Ed.)

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**Tassoni, Alessandro** (b. Sept. 28, 1565, Modena [Italy]—d. April 25, 1635, Modena), Italian political writer, literary critic, and poet, remembered for his mock-heroic satiric poem *La secchia rapita* (*The Rape of the Bucket*), the earliest and, according to most critics, the best of many Italian works in that genre.

Educated at the universities of Bologna, Pisa, and Ferrara in civil and canon law, Tassoni joined the linguistically conservative Accademia della Crusca in 1589. The greater part of his life was spent in the service of various cardinals in Rome. Among his numerous prose works, the most interesting are an attack on Petrarch and his followers, *Considerazioni sopra le rime del Petrarca* (1609; "Observations on Petrarch's Poems"), together with a collection of philosophical, literary, scientific, and political thoughts, *Dieci libri di pensieri diversi di Alessandro Tassoni* (1620; "Ten Books of Diverse Thoughts of Alessandro Tassoni").

Tassoni's best-known work, *La secchia rapita* (1622), is based on the early 14th-century warfare between the Italian cities of Bologna and Modena, during which the Modenese captured the bucket from Bologna's town well as a trophy. (The bucket is on display in Modena's Palazzo Comunale, or city hall.) In Tassoni's poem the Bolognese offer entire towns and groups of hostages for their bucket, and every episode, beginning seriously, ends in some hilarious absurdity.

**taste,** also called GUSTATION, the detection and identification by the sensory system of dissolved chemicals placed in contact with some part of an animal. Because the term taste is commonly associated with the familiar oral taste buds of vertebrates, many authorities prefer the term contact chemoreception, which has a broader connotation. *See* chemoreception; tongue.

**tat tvam asi** (Sanskrit: "thou art that"), in Hindu philosophy, the famous expression of the relationship between the individual and the absolute. The statement is frequently repeated in the sixth chapter of the *Chāndogya Upaniṣad* (*c.* 600 BC), as the teacher Uddālaka Āruṇi instructs his son in the nature of the supreme reality. The identity expressed in this judgment was variously interpreted by the different schools of the orthodox philosophy of Vedānta. The phrase was given its most literal interpretation by the 8th–9th-century thinker Śaṅkara of the Advaita (Nondualist) school, for whom the statement was one of the great assertions fundamental to his doctrine.

**Tata,** oasis, southwestern Morocco. Situated in an arid region at the extreme northwestern edge of the Sahara, Tata oasis is located in a canyon watered by three wadis descending from Mount Bani, an outlier of the Anti-Atlas mountains. The oasis contains about 30 *ksars* (fortified villages) with houses built out of pink clay. The inhabitants of the region include the Shluh Berbers, a seminomadic tribe who live in fortified villages and graze sheep, and the Ḥarāṭīn, a people of mixed Negroid descent who live with the Berber pastoralists and earn their living as agricultural labourers. Crops cultivated in the region's date-palm settlements include olives, lemons, oranges, almonds, and carob. Pop. (1982) 3,142.

**Tata** FAMILY, family of Indian industrialists and philanthropists who founded ironworks and steelworks, cotton mills, and hydroelectric-power plants that proved crucial to India's industrial development.

The Tata were a Parsi priestly family who originally came from the former Baroda state (now in Gujarāt). The founder of the family's fortunes was Jamsetji Nasarwanji Tata (b. March 3, 1839, Navsāri, India—d. May 19, 1904, Nauheim, Ger.). After an education at Elphinstone College in Bombay, he joined his father's export trading firm in 1858 and helped establish branches of the company in Japan, China, Europe, and the United States. In 1872 he concentrated on cotton manufacturing, founding mills at Nāgpur in 1877 and, later, at Bombay and Coorla. His enterprises were noted for efficiency, for improved labour-protection policies, and for the introduction of finer grades of fibre. He also introduced the production of raw silk to India and planned for the Bombay area hydroelectric-power plants that became the Tata Power companies after his death.

Tata began organizing India's first large-scale ironworks in 1901, and these were incorporated in 1907 as Tata Iron and Steel Company. Under the direction of his sons, Sir Dorabji Jamsetji Tata (1859–1932) and Sir Ratanji Tata (1871–1932), the Tata Iron and Steel Company became the largest privately owned steelmaker in India and the nucleus of a group of companies producing not only textiles, steel, and electric power but also chemicals, agricultural equipment, trucks, locomotives, and cement. The family's industrial facilities were concentrated in the new city of Jamshedpur, in Bihār state.

In 1898 Tata donated land for a research institute that was later founded by his sons as the Indian Institute of Science, at Bangalore. The Tata family went on to become perhaps the most important private funder of technical education and scientific research in India.

Upon the death of Sir Dorabji in 1932, Sir Naoroji Saklatvala, one of the founder's nephews, became chairman of the Tata corporate group. On his death in 1938, Jehangir Ratanji Dadabhoy Tata (1904–93), whose father, R.D. Tata, had been a cousin and partner of the founder, became chairman. J.R.D. Tata founded Tata Airlines (1932), which was nationalized in 1953 and split up to form India's chief domestic and international air carriers: Indian Airlines Corporation and Air-India, respectively. By the late 1950s the Tata group of companies controlled the largest single aggregation of Indian industry. J.R.D. Tata was succeeded as chairman by his nephew, Ratan Naval Tata.

**Tatabánya,** town and seat of Komárom-Esztergom *megye* (county), northwestern Hungary. Lying in the valley of the Gallei River, between the Vértes Hills to the south and the Gerecse Mountains to the northeast, the town is the ngary's main mining centre and is located on the country's largest lignite deposit, the Tatabánya-Oroszlány Basin. Mining began there on the outskirts of the existing settlements, including Felsőgalla, Alsógalla. Bánhida, and others, which were incorporated into Tatabánya in 1902, when it was given the status of a separate village. There is a limestone quarry and marlpit. Other heavy industry in Tatabánya includes an aluminum plant, a cement and lime works, and several large thermoelectric-power stations.

The settlements of which Tatabánya was constituted stretch out approximately 7 miles (11 km) in length. The newest district, Ujváros ("New Town"), is on the west. Tatabánya has road and rail connections with Budapest, 35 miles (56 km) to the east. Pop. (1992 est.) 73,916.

**tatami,** plural TATAMI, or TATAMIS, rectangular mat used as a floor covering in Japanese houses. It consists of a thick straw base and a soft, finely woven rush cover with cloth borders. A tatami measures approximately 6 by 3 feet (180 by 90 cm) and is about 2 inches (5 cm) thick. In *shinden* and *shoin* domestic architecture, tatami completely cover the floor.

From primitive times, the floor in Japanese architecture has remained the common surface for sitting and sleeping. To protect the floor and the tatami, outdoor footwear is left in the *genkan,* or entrance hall, before entering. Tatami are susceptible to wear and must be replaced on occasion. Because the floor has an intimate quality for the Japanese, its characteristics are important in establishing the interior space. Thus, the standardized size of the mat has created an important modular unit in the development of Japanese architecture; for example, the shoji, or outer sliding partition doors, are approximately as high as the tatami are long. The number of mats required to cover the floor is often used to indicate the size of a room: *e.g.,* a two-mat room, a six-mat room. The placement of objects in the *toko-no-ma,* an alcove for the display of art, and the construction of the garden are con-



Interior of a *chashitsu* (teahouse) with *toko-no-ma*, shoji, and tatami mats
Harumi Konishi

sidered from the eye level of a person seated on a tatami.

**Tatar,** also spelled TARTAR, any member of several Turkic-speaking peoples that collectively numbered more than 5 million in the late 20th century and lived mainly in west-central Russia along the central course of the Volga River and its tributary, the Kama, and thence east to the Ural Mountains. The Tatars are also settled in Kazakstan and, to a lesser extent, in western Siberia.

The name Tatar first appeared among nomadic tribes living in northeastern Mongolia and the area around Lake Baikal from the 5th century AD. Unlike the Mongols, these peoples spoke a Turkic language, and they may have been related to the Cuman or Kipchak peoples. After various groups of these Turkic nomads became part of the armies of the Mongol conqueror Genghis Khan in the early 13th century, a fusion of Mongol and Turkic elements took place, and the Mongol invaders of Russia and Hungary became known to Europeans as Tatars (or Tartars).

After Genghis Khan's empire broke up, the Tatars became especially identified with the western part of the Mongol domain, which included most of European Russia and was called the Golden Horde. These Tatars were converted to Sunnite Islām in the 14th century. Owing to internal divisions and various foreign pressures, the Golden Horde disintegrated late in the 14th century into the independent Tatar khanates of Kazan and Astrakhan on the Volga River, Sibir in western Siberia, and the Crimea. Russia conquered the first three of these khanates in the 16th century, but the Crimean khanate became a vassal state of the Ottoman Turks until it was annexed to Russia by Catherine the Great in 1783.

In their khanates the Tatars developed a complex social organization, and their nobility preserved its civil and military leadership into Russian times; distinct classes of commoners were merchants and tillers of the soil. At the head of government stood the khan of the foremost Tatar state (the Kazan khanate), part of whose family joined the Russian nobility by direct agreement in the 16th century. This stratification within Tatar society continued until the Russian Revolution of 1917.

During the 9th to 15th centuries, the Tatar economy became based on mixed farming and herding, which still continues. The Tatars also developed a tradition of craftsmanship in wood, ceramics, leather, cloth, and metal and have long been well known as traders. During the 18th and 19th centuries, they earned a favoured position within the expanding Russian Empire as commercial and political agents, teachers, and administrators of newly won Central Asian territories.

More than 1.5 million Kazan Tatars still live in the Volga and Urals regions, and they constitute about half the population within the republic of Tatarstan. They are now known as Volga Tatars and are the wealthiest and most industrially advanced of the Tatar groups. Almost a million more Tatars live in Kazakstan and Central Asia, while the Siberian Tatars, numbering only about 100,000, live scattered over western Siberia.

The Crimean Tatars had their own history in the modern period. They formed the basis of the Crimean Autonomous Soviet Socialist Republic, which was set up by the Soviet government in 1921. This republic was dissolved in 1945, however, when the Soviet leader Joseph Stalin accused the approximately 200,000 Crimean Tatars of having collaborated with the Germans during World War II. As a result, the Crimean Tatars were deported en masse to Uzbekistan and Kazakstan, where their use of the Tatar language was forbidden. They regained their civil rights in 1956 under the de-Stalinization program of Nikita Khrushchev, but they were not allowed to return to the Crimea, which had been incorporated into the Ukrainian S.S.R. in 1954. It was not until the early 1990s that many Crimean Tatars, taking advantage of the breakup of the Soviet central government's authority, began returning to settle in the Crimea after nearly five decades of internal exile. They now number about 270,000.

**Tatar language,** northwestern (Kipchak) language of the Turkic subfamily of Altaic languages. It is spoken in the republic of Tatarstan in west-central Russia and in Romania, Bulgaria, Turkey, and China. There are numerous dialectal forms. The major Tatar dialects are Kazan Tatar (spoken in Tatarstan), Western or Misher Tatar, as well as the minor eastern or Siberian dialects, Kasimov, Tepter (Teptyar), and Astrakhan and Ural Tatar. Kazan Tatar is the literary language.

Crimean Tatar belongs to the same division of the Turkic languages. It has its roots in the language of the Golden Horde in the 13th century and was the official literary language in the Crimea until the 17th century, when it was replaced by Ottoman Turkish. Revived as a literary language in the 19th century, it declined in use in the 20th century after Stalin's deportation of the Crimean Tatars. *See also* Turkic languages.

**Tatar Strait,** Russian TATARSKY PROLIV, also called GULF OF TATARY, narrow passage of the northwest Pacific Ocean from the Sea of Japan (south) to the Sea of Okhotsk between Sakhalin Island (east) and the Asian mainland. From 4.5 to 213 miles (7 to 342 km) in width and 393 miles (632 km) long, it is generally shallow with depths less than 700 feet (210 m). The strait, which receives the Amur River in the north, is the site of the Russian ports of Uglegorsk, Aleksandrovsk-Sakhalinsky, Lesogorsk, and Sovetskaya Gavan. Port operation is severely restricted by ice from mid-November to mid-May.

**Tatarstan,** also called TATARIYA, republic in the east-central part of European Russia. The republic lies in the middle Volga River basin around the confluence of the Volga and Kama rivers. Kazan (*q.v.*) is the capital.

The Volga flows north-south across the western end of the republic, while the Kama, the Volga's largest tributary, forms a roughly east-west axis through the greater part. The Vyatka and the Belaya rivers are major tributaries of the Kama. Generally the relief is that of a low, rolling plain. The area west of the Volga rises to 771 feet (235 m), representing the extreme northern end of the Volga Upland. In the east the land rises to the Urals foreland. The climate is continental, with long, severe winters and hot summers. Annual rainfall is about 17–20 inches (420–510 mm), with a summer maximum.

Most of the republic lies in the forest-steppe zone on degraded, or podzolized, chernozems (black earth). About one-sixth of the territory is forested. Along the rivers are broad floodplain meadows, although those on the Volga and lower Kama have disappeared under the waters of the Nizhnekamsk Reservoir and the Samara Reservoir, which flooded more than 1,100 square miles (2,850 square km) of the republic.

The Tatars, who today constitute approximately half of Tatarstan's population, are a Turkic people. Descendants of the Mongols of the Golden Horde, they established themselves in this area in the mid-13th century, largely replacing or absorbing the native Bulgar population. As the Golden Horde declined in power in the 15th century, it split into separate groups, of which the Kazan khanate was the most northerly. The khanate was long engaged with Muscovy in a struggle that was finally resolved in 1552, when Ivan IV the Terrible besieged and captured Kazan. Russian colonization of the region began after the conquest of Kazan. The republic was formed in 1920. Tatarstan remained a republic within the Russian federation after the breakup of the Soviet Union in 1991, but separatist sentiments emerged soon afterward among its Tatar population.

The republic's diversified economy centres on petroleum production, industry, and agriculture. The first oil well was drilled in 1943, and subsequent development was rapid. Pipelines run east and west from the oil fields at Almetyevsk; production of natural gas is centred in Nizhnaya Maktama.

The chemical industry has developed chiefly at Kazan, Mendeleyevsk, and Nizhnekamsk. Engineering works are concentrated largely in cities along the Volga and the Kama, notably in Kazan, Zelyonodolsk, and Chistopol. Trucks are manufactured at a large plant in Naberezhnye Chelny. Paper and pulp are made in Mamadysh and a group of neighbouring cities. The manufacture of soap and other fat products is important in Kazan. Agricultural products include wheat, corn (maize), millet, legumes, potatoes, sugar beets, hemp, tobacco, apples, dairy products, and livestock.

A heavy freight traffic moves along the rivers; regular passenger services also connect the river ports of the republic with Moscow and all parts of the Volga River basin. Rail service is less developed; two main lines between Moscow and the Urals cross the republic's

northwestern and southeastern corners. Another line runs north-south through the Volga right-bank area.

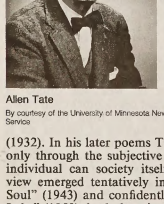
Tatarstan has numerous institutions of higher learning, including the state university at Kazan and specialized institutes. Area 26,300 square miles (68,000 square km). Pop. (1995 est.) 3,755,000.

**Tate, Allen,** in full JOHN ORLEY ALLEN TATE (b. Nov. 19, 1899, Winchester, Ky., U.S.—d. Feb. 9, 1979, Nashville, Tenn.), American poet, teacher, novelist, and a leading exponent of the New Criticism (*q.v.*). In both his criticism and his poetry, he emphasized the writer's need for a tradition to adhere to; he found his tradition in the culture of the conservative, agrarian South and, later, in Roman Catholicism, to which he was converted in 1950.

In 1918 Tate entered Vanderbilt University, Nashville, Tenn., where he helped found *The Fugitive* (1922–25), a poetry magazine for a group of young poets known as the Fugitives. (*See* Fugitive.) Tate introduced the Fugitives to the poetry of T.S. Eliot, whose attitudes toward modern life and whose emphasis on the hollowness of modern man found an echo in Tate's own themes. Tate contributed to the symposium *I'll Take My Stand* (1930), a manifesto defending the traditional agrarian society of the South.

From 1934 Tate taught at Southwestern College in Memphis, Tenn., the Woman's College of the University of North Carolina, Princeton University, and the University of Minnesota (1951–68). Under his editorship (1944–46) *The Sewanee Review* acquired wide importance as a literary magazine.

In his best-known poem, "Ode to the Confederate Dead" (first version, 1926; rev. 1930), the dead symbolize the emotions that the poet is no longer able to feel. The poems written from about 1930 to 1939 broadened this theme of disjointedness by showing its effect on society, as in the sadly ironic "The Mediterranean"



Allen Tate
By courtesy of the University of Minnesota News Service

(1932). In his later poems Tate suggested that only through the subjective wholeness of the individual can society itself be whole. This view emerged tentatively in "Seasons of the Soul" (1943) and confidently in "The Buried Lake" (1953), both devotional poems.

Tate's only novel, *The Fathers* (1938), refashioned the Jason-Medea myth to promulgate agrarian beliefs. His *Collected Poems* appeared in 1977; *Essays of Four Decades* appeared in 1969.

**Tate, James,** in full JAMES VINCENT TATE (b. Dec. 8, 1943, Kansas City, Mo., U.S.) American poet noted for the surreal imagery and ironic stance of his poetry.

Tate studied poetry at Kansas State College (B.A., 1965) in Pittsburg and the University of Iowa (M.F.A., 1967). In 1967 his collection of poems entitled *The Lost Pilot* was published as part of the Yale Series of Younger Poets. After brief teaching stints in Iowa, California, and New York, Tate joined the faculty of the University of Massachusetts in Amherst in 1971. From 1967 he served as poetry editor for the *Dickinson Review,* a literary journal.

In the 25 years after publication of *The Lost Pilot,* Tate published more than two dozen books of verse, including *The Oblivion Ha-Ha* (1970), *Absences* (1972), *Riven Doggeries* (1979), *Constant Defender* (1983), and *Reckoner* (1986). His *Selected Poems* won the 1992 Pulitzer Prize, and *Worshipful Company of Fletchers* received the 1994 National Book Award.

Tate's poetry combines lyrical rhythms, surreal imagery, and ironic detachment to confront the sources of modern despair and what he calls "the agony of communication."

**Tate, Nahum** (b. 1652, Dublin, Ire.—d. July 30, 1715, London, Eng.), poet laureate of England and playwright, adapter of other's plays, and collaborator with Nicholas Brady in *A New Version of the Psalms of David* (1696).

Tate graduated from Trinity College, Dublin, and moved to London. He wrote some plays of his own, but he is best known for his adaptations of the Elizabethan playwrights. His version of Shakespeare's *King Lear,* to which he gave a happy ending (Cordelia married Edgar), held the stage well into the 19th century.

Tate also wrote the libretto for Henry Purcell's opera *Dido and Aeneas* (*c.* 1689). Some of his hymns found a lasting place in Protestant worship: "While shepherds watched," "Through all the changing scenes of life," and "As pants the hart for cooling streams."

Tate was commissioned by the poet John Dryden to write the second part of *Absalom and Achitophel* (1682), although Dryden added the finishing touches (probably including the portraits of Elkanah Settle and Thomas Shadwell) himself.

The best of Tate's own poems is "Panacea: A Poem upon Tea" (1700). He succeeded Shadwell as poet laureate in 1692.

**Tate Gallery,** art museum in London that houses the national collection of British painting and sculpture from the 17th century to the present, as well as a gallery of modern British and European art. It is located on the Millbank in the City of Westminster, London.

The Tate Gallery resulted from the benefaction of sugar tycoon Sir Henry Tate (1819–99), who gave both the building and his art collection to the nation. The Neoclassical building was designed by Sidney Smith and was opened to the public in 1897; it has received six extensions, the last of which, the Clore Gallery, opened in 1987 to house the world's finest collection of works by the British painter J.M.W. Turner. There are branches of the Tate Gallery at Liverpool and at the Barbara Hepworth Museum in St. Ives, Cornwall.

The British collection at the Tate Gallery commences with Elizabethan and Jacobean examples. The 18th and 19th centuries are exceptionally well represented, including works by Reynolds, Gainsborough, Hogarth, Stubbs, Constable, Blake, and the Pre-Raphaelites. The modern European collection houses fine French Impressionist and Postimpressionist works. The Tate Gallery has maintained its modern collection through a well-defined acquisition policy, with all significant movements being represented: Cubism, Futurism, Abstract Expressionism, Dadaism, Surrealism, and Pop art. Picasso and Braque are well represented, as are Hepworth and Moore among the British sculptors.

**Tatebayashi,** city, Gumma *ken* (prefecture), Honshu, Japan. It lies in the northern Kantō Plain along the Isesaki line of the Tōbu railway, north of Tokyo. Founded in the 16th century as a castle town, it developed as a commercial centre for the surrounding rice-producing region. Long known for its silk, the city now also produces woolen textiles, beverages, and processed foods. The Morin Temple is nearby. Tsutsujigaoka Prefectural Park is a well-known azalea garden, and Tatebayashi Park has many cherry trees. Pop. (1990) 76,223.

**Tathāgata** (Sanskrit and Pāli), one of the titles of a buddha and the one most frequently employed by the historical Buddha, Siddhārtha Gautama, when referring to himself. The exact meaning of the word is uncertain; Buddhist commentaries present as many as eight explanations. The most generally adopted interpretation is "one who has thus (*tathā*) gone (*gata*)" or "one who has thus (*tathā*) arrived (*āgata*)," implying that the historical Buddha was only one of many who have in the past and will in the future experience enlightenment and teach others how to achieve it.

In later Mahāyāna Buddhism, Tathāgata came to convey the essential buddha nature hidden in everyone. Tathāgatha is the "thusness" that makes possible enlightenment. Having Tathāgata within, one yearns for enlightenment. As the true state of all that exists, Tathāgata is synonymous with ultimate reality, otherwise indefinable.

**Tathāgataguhyaka** (Buddhist *Tantra*): *see* Guhyasamāja-tantra.

**Tati, Jacques,** byname of JACQUES TATISCHEFF (b. Oct. 9, 1908, Le Pecq, France—d. Nov. 5, 1982, Paris), French filmmaker and actor who gained renown for his comic films that portrayed people in conflict with the mechanized modern world. He wrote and starred in all six of the feature films that he directed; in four of them he played the role of Monsieur Hulot, a lanky, pipe-smoking fellow with a quizzical, innocent nature.

After a stint as a professional rugby player, Tati began a career as a music-hall entertainer in the 1930s, doing pantomimes of athletes and occasionally performing in movies. During World War II he served with the French army.

An important early effort at directing for Tati was the short film *L'Ecole des facteurs* (1947), which was later expanded into his first feature, *Jour de fête* (1948; *The Big Day*), a comic sketch of a postman who tries to introduce efficiency into his provincial post office. His next film, *Les Vacances de Monsieur Hulot* (1953; *Mr. Hulot's Holiday*), introduced his signature character and presented a satiric look at life in a middle-class seaside resort. His subsequent films are *Mon oncle* (1958; *My Uncle, Mr. Hulot*), *Playtime* (1967), *Trafic* (1971; *Traffic*), and *Parade* (1974). In his films Tati forsakes traditional narrative in favour of vignettes that use sight gags, timing, mannerisms, and physical action to reveal the humour and texture of modern living. He typically set the camera at a distance from the action and used numerous long shots to show Hulot moving through the larger society and, at the same time, to invite the viewer to explore the



Tati as M. Hulot in *Mon oncle,* 1958
Specstra/Grey/Allerdal/Centaure (Courtesy Kobal)

frame of the film for the visual and aural variety within. *Les Vacances de Monsieur Hulot* and *Playtime* are widely regarded as Tati's masterpieces.

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**Tatian,** Greek TATIANOS (b. *c.* AD 120, Syria—d. April 173), Syrian compiler of the *Diatessaron* (Greek: "From Four," or "Out of Four"), a version of the four Gospels arranged in a single continuous narrative that, in its Syriac form, served the biblical-theological vocabulary of the Syrian church for centuries. Its Greek and Latin versions influenced the Gospel text. Tatian also founded, or at least was closely associated with, the heretical sect of the Encratites, a community integrating a severe asceticism with elements of Stoic philosophy.

Tatian became a pupil of the 2nd-century Roman theologian Justin Martyr and converted to Christianity. He rejected the classical literary and moral values of the Greeks as corrupt and repudiated their intellectualism, preferring instead the "barbaric" Christian culture. He embraced a vague synthesis of Judeo-Christian monotheism with the Stoic concept of an intermediary logos (Greek: "word"), creating the rational and purposeful cohesion of the universe; the personal dimension was provided by belief in the fallen soul's ultimate return to the cosmic pneuma (Greek: "spirit") whence it came.

After Justin's martyrdom Tatian broke with the Roman church, returned to Syria about 172, and became associated with a school and religious community of the Encratites in order to incorporate his amalgam of religious philosophy. During this period Tatian produced the two works that still survive, the *Diatessaron* and a discourse to the Greeks. The latter, a virulent polemic against Hellenistic (Greek) learning, presented a Christian cosmology and demonology in which Tatian negatively compared Greek polytheistic theology with the Christian concept of a unique deity whose sublimity transcended the foibles of Greek idols. Tatian submitted that the Judeo-Christian tradition furnished Greek moral philosophy with everything it contained of value; the former, however, exhibited a selflessness that was markedly absent from the latter. Tatian's other writings, listed by the 4th-century historian Eusebius of Caesarea, have been lost.

*Consult the* INDEX *first*

**Tatishchev, Vasily Nikitich** (b. April 19 [April 29, New Style], 1686, Pskov, Russia—d. July 15 [July 26], 1750, Boldino, near Moscow), Russian economic administrator and historian who was the first to produce a comprehensive Russian history.

Tatishchev joined the army in 1704 and took part in the siege of Narva and the Battle of Poltava (1709). He spent much of his life as a government administrator of various mining and manufacturing enterprises. Tatishchev managed to collect much historical and geographic data on Russia during his wide-ranging travels through Germany, Sweden, and eastern Russia as a state cartographer.

Tatishchev's great work, the *Istoriya Rossiyskaya s samikh drevneyshikh vremyon,* 5 vol. (1768–1848; *History of Russia from the Most Early Times*), relied on sources that have since to a great extent disappeared. It amassed a great volume of data based on original sources and was a pioneering work in its attempt to depict the development of the Russian state as the result of geographic and historical circumstances rather than as a result of divine providence.

Tatishchev is also known as the founder of the city of Yekaterinburg. He served as the governor of Astrakhan between 1741 and 1745.

**Tatius, Titus:** *see* Titus Tatius.

**Tatler, The,** a periodical launched in London by the essayist Sir Richard Steele in April 1709, appearing three times weekly until January 1711. At first its avowed intention was to present accounts of gallantry, pleasure, and entertainment, of poetry, and of foreign and domestic news. These all were reported and "issued" from various London coffee and chocolate houses. In time *The Tatler* began to investigate manners and society, establishing its principles of ideal behaviour, its concepts of a perfect gentleman and gentlewoman, and its standards of good taste. Dueling, gambling, rakish behaviour, and coquettishness were criticized, and virtuous action was admired. Numerous anecdotes and stories gave point to the moral codes advanced.

The English periodical essay began its first flowering in *The Tatler,* reaching its full bloom in the hands of Joseph Addison. Addison seems to have made his first contribution to it in the 18th issue. Two months after *The Tatler* ceased publication, he and Steele launched the brilliant periodical *The Spectator.*

**Tatlin, Vladimir Yevgrafovich** (b. Dec. 16 [Dec. 28, New Style], 1885, Kharkov, Russian Empire [now in Ukraine]—d. May 31, 1953, Moscow, Russia, U.S.S.R.), Ukrainian painter, sculptor, and architect remembered for his visionary "Monument to the Third International" in Moscow, 1920.



"Monument to the Third International," model designed by Vladimir Tatlin, 1920, reconstruction by U. Linde and P.O. Ullvedt completed in 1968 by A. Holm, E. Nandorf, and H. Östberg; in the Modern Museum, Stockholm, The National Swedish Art Museums

© Tatlin; photograph © Moderna Museet

Tatlin was educated at the Moscow Academy of Fine Arts, graduating in 1910. Late in 1913 he went to Paris, where he visited Pablo Picasso, whose reliefs in sheet iron, wood, and cardboard made a deep impression on him. Returning to Moscow, Tatlin created constructions that he called "painting reliefs," which he exhibited at a Futurist exhibition held in Petrograd (now St. Petersburg) in February 1915. He became the leader of a group of Moscow artists who tried to apply engineering techniques to the construction of sculpture. This developed into a movement known as Constructivism (*q.v.*).

This type of avant-garde art continued for a brief period after the Russian Revolution of 1917, during which time Tatlin created his most famous work—the "Monument to the Third International," which was one of the first buildings conceived entirely in abstract terms. It was commissioned in 1919 by the department of fine arts and exhibited in the form of a model 22 feet (6.7 m) high at the exhibition of the VIII Congress of the Soviets in December 1920. A striking design, it consisted of a leaning spiral iron framework supporting a glass cylinder, a glass cone, and a glass cube, each of which could be rotated at different speeds. The monument's interior would have contained halls for lectures, conferences, and other activities. The monument was to be the world's tallest structure—more than 1,300 feet (396 m) tall—but it was never built owing to the Soviet government's disapproval of nonfigurative art.

About 1927 Tatlin began experimentation with a glider that resembled a giant insect. The glider, which he called *Letatlin,* never flew, but it engaged his interest throughout his later life. After 1933 he worked largely as a stage designer.

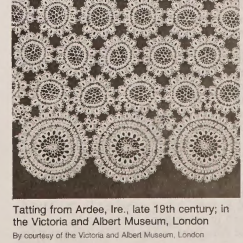
**Tatra Mountains,** also called HIGH TATRAS, Slovak VYSOKÉ TATRY, Polish TATRY WYSOKIE, highest range of the Central Carpathians. The mountains rise steeply from a high plateau and extend for approximately 40 miles (64 km) along the Slovakian-Polish frontier, varying in width from 9 to 15 miles (14 to 24 km). About 300 peaks are identified by name and elevation, the highest being Gerlachovský (or Gerlach) Peak (8,711 feet [2,655 m]). Although it has no glaciers or permanent snowfields, the range otherwise resembles the Alps. South of the Váh River valley is the parallel Low Tatra range, rising to Dumbier (6,703 feet [2,043 m]).

The mountain slopes are covered with spruce woodlands to 6,300 feet, above which is an alpine zone. Fauna includes bears, chamois, marmots, and eagles. The Tatras have many high-lying lakes, hanging valleys, and summer and winter sports resorts. With the Slovakian-Polish frontier running along the summits, the area embraces two national parks: Tatra National Park (Poland), occupying 82 square miles (212 square km), and Tatry National Park (Slovakia), occupying 286 square miles (741 square km).

**Tatsanottine** (people): *see* Yellowknife.

**Tatta** (Pakistan): *see* Thatta.

**tatting,** process by which a fabric akin to lace is made of thread with a small hand shuttle and the fingers. It was once a widely practiced craft, known in Italy as *occhi* and in France as *la frivolité.* The resulting product appears to



Tatting from Ardee, Ire., late 19th century; in the Victoria and Albert Museum, London

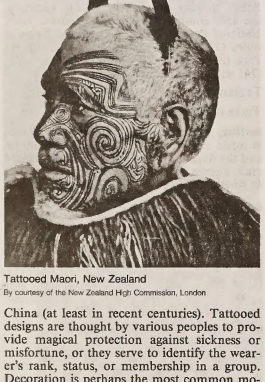
By courtesy of the Victoria and Albert Museum, London

be quite fragile but is indeed both strong and durable.

In tatting, twisted threads are tied around or through small, pointed shuttles that are made of bone, mother-of-pearl, tortoise shell, steel, or plastic and are available in several sizes. The resulting stitches or knots form rings and semicircles that can be used for edgings, insertions, or arrangements that can be stitched together to form doilies and spreads. The thickness of the finished piece is determined by the size of the shuttle and the thread.

**tattler,** any shorebird that is easily alarmed and calls loudly when it senses danger. Broadly, tattlers are birds of the subfamily Tringinae of the family Scolopacidae. Examples are the redshank, greenshank, willet, and yellowlegs. More narrowly, the name is given to the wandering tattler (*Heteroscelus incanus*) and the Polynesian, or gray-rumped, tattler (*H. brevipes*). Both closely resemble the yellowlegs but are short-legged and have barred underparts in summer. The wandering tattler nests on gravel bars in Alaskan rivers and winters from Mexico to western Pacific islands. The slightly smaller Polynesian tattler does not nest on the ground but, instead, often uses the abandoned nests of songbirds. It winters in the Philippines, in Malaysia, and in Australia.

**tattoo,** permanent mark or design made on the body by the introduction of pigment through ruptures in the skin. Sometimes the term is also loosely applied to the inducement of scars (cicatrization). Tattooing proper has been practiced in most parts of the world, though it is rare among populations with the darkest skin colour and absent from most of



Tattooed Maori, New Zealand
By courtesy of the New Zealand High Commission, London

China (at least in recent centuries). Tattooed designs are thought by various peoples to provide magical protection against sickness or misfortune, or they serve to identify the wearer's rank, status, or membership in a group. Decoration is perhaps the most common motive for tattooing.

Tattoos have been found on Egyptian and Nubian mummies dating from about 2000 BC. Their use is mentioned by classical authors in relation to the Thracians, Greeks, Gauls, ancient Germans, and ancient Britons; the Romans tattooed criminals and slaves. After the advent of Christianity, tattooing was forbidden in Europe, but it persisted in the Middle East and in other parts of the world.

In the Americas, many Indian tribes customarily tattooed the body or the face, or both. The usual technique was simple pricking, but some California tribes introduced colour into scratches, and many tribes of the Arctic and Subarctic, most Eskimos, and some peoples of eastern Siberia made needle punctures through which a thread coated with pigment (usually soot) was drawn underneath the skin. In Polynesia, Micronesia, and parts of Malaysia, pigment was pricked into the skin by tapping on an implement shaped like a miniature rake. In *moko*, a type of Maori tattooing from New Zealand, shallow coloured grooves in complex curvilinear designs were produced on the face by striking a miniature bone adze into the skin. In Japan, needles set in a wooden handle are used to tattoo very elaborate multicoloured designs, in many cases covering much of the body. Burmese tattooing is done with a brass penlike implement with a slit point and a weight on the upper end. Sometimes pigment is rubbed into knife slashes (*e.g.*, in Tunisia and among the Ainu of Japan and the Igbo [Ibo] of Nigeria), or the skin is punctured with thorns (Pima Indians of Arizona and Senoi of Malaya).

Tattooing was rediscovered by Europeans when the age of exploration brought them into contact with American Indians and Polynesians. The word tattoo itself was introduced into English and other European languages from Tahiti, where it was first recorded by James Cook's expedition in 1769. Tattooed Indians and Polynesians, and later Europeans tattooed abroad, attracted much interest at exhibits, fairs, and circuses in Europe and the United States in the 18th and 19th centuries.

Stimulated by Polynesian and Japanese examples, tattooing "parlours," where specialized "professors" applied designs on European and American sailors, sprang up in port cities all over the world. The first electric tattooing implement was patented in the United States in 1891. The United States became a centre of influence in tattoo designs, especially with the spread of U.S. tattooers' pattern sheets. The nautical, military, patriotic, romantic, and religious motifs are now similar in style and subject matter throughout the world; characteristic national styles of the early 20th century have generally disappeared.

In the 19th century, released U.S. convicts and British army deserters were identified by tattoos, and later the inmates of Siberian prisons and Nazi concentration camps were similarly marked. Members of 20th-century street or motorcycle gangs frequently identify themselves with a tattooed design. During the late 19th century, tattooing had a short vogue among both sexes in the English upper classes. Tattooing is moribund or extinct in most parts of the world, except for special medical applications and Euroamerican and Japanese types, which were the subjects of a renewal of interest in the 1990s.

The health risks of tattooing include allergic reaction to pigments and, when tattoos are applied under less-than-sterile conditions, the spread of viral infections such as hepatitis B.

Methods of tattoo removal include dermabrasion, skin grafts or plastic surgery, and laser surgery. All such methods may leave scars.

**Tatum, Art,** byname of ARTHUR TATUM (b. Oct. 13, 1910, Toledo, Ohio, U.S.—d. Nov. 5, 1956, Los Angeles, Calif.), blind, self-taught American pianist, considered one of the greatest technical virtuosos in jazz.

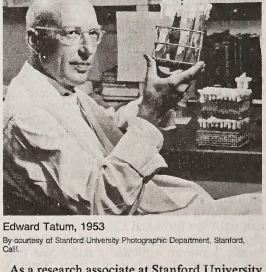
At 13, after starting on violin, Tatum concentrated on the piano and was soon performing on local radio programs. At 21 he moved to New York City, where he made his most impressive recordings during the 1930s and '40s using a stride-style left hand and highly varied right-hand stylings. In 1943 he organized a trio with guitarist Tiny Grimes and bassist Slam Stewart, and he played mostly in the trio format for the rest of his life.

In his improvisations Tatum was given to spontaneously inserting entirely new chord progressions (sometimes with a new chord on each beat) into the small space of one or two measures. His reharmonization of pop tunes became a standard practice among modern jazz musicians, horn players as well as pianists. In rhythmically unpredictable spurts he often generated lines with notes cascading across each other while weaving in and out of tempo.

Few jazz pianists fail to incorporate at least one favourite Tatum run or embellishment in their playing. Several jazz pianists—including Bud Powell, Lennie Tristano, and Oscar Peterson—as well as other jazz musicians clearly exhibit and credit Tatum's influence.

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**Tatum, Edward L.,** in full EDWARD LAWRIE TATUM (b. Dec. 14, 1909, Boulder, Colo., U.S.—d. Nov. 5, 1975, New York, N.Y.), American biochemist whose research into the effects of inherited mutations on the nutritional requirements of certain species of bacteria, yeasts, and molds helped create the field of molecular genetics and brought him (with George Beadle and Joshua Lederberg) the Nobel Prize for Medicine or Physiology for 1958.



Edward Tatum, 1953
By courtesy of Stanford University Photographic Department, Stanford, Calif.

As a research associate at Stanford University (1937–41), Tatum collaborated with Beadle to confirm the following concepts: all biochemical processes in all organisms are ultimately controlled by genes; all these processes are resolvable into series of individual sequential chemical reactions (pathways); each reaction is in some way controlled by a single gene; and mutation of a single gene results only in an alteration in the ability of the cell to carry out a single chemical reaction.

Working with the red bread mold *Neurospora crassa,* Tatum and his colleagues demonstrated that, when a genetic mutation can be shown to affect a specific chemical reaction, the enzyme catalyzing that reaction will be altered or missing. Thus, they showed that each gene in some way determines the structure of a specific enzyme (the one-gene–one-enzyme hypothesis).

As a professor at Yale (1945–48), Tatum successfully applied his methods of inducing mutations and studying biochemical processes in *Neurospora* to bacteria. With Lederberg, he discovered the occurrence of genetic recombination, or "sex," between *Escherichia coli* bacteria of the K-12 strain. Largely because of their efforts, bacteria became the primary source of information concerning the genetic control of biochemical processes in the cell.

Tatum returned to Stanford in 1948 and joined the staff of the Rockefeller Institute for Medical Research (now Rockefeller University), New York City, in 1957.

**Tatya Tope** (Indian mutineer): *see* Tantia Topi.

**tau,** subatomic particle similar to the electron but which, with a mass of 1,784 megaelectron volts (MeV), is approximately 3,500 times heavier. Like the electron and the muon (mass 106 MeV), the tau is an electrically charged member of the family of leptons (*q.v.*). All leptons are fermions (particles with half a unit of intrinsic angular momentum, or spin), and, unlike the particles called quarks, they do not feel the strong force. The tau has negative electric charge, while its antiparticle has positive electric charge. It is believed that the tau, like the electron and the muon, has a neutral partner, the tau-neutrino, although an experiment to demonstrate the existence of a distinct neutrino associated with the tau has yet to be performed.

Being so massive, the tau is unstable, with a mean life of $3 \times 10^{-13}$ second, and decays readily, via the weak force, into other particles. The tau was discovered through observations of its decay to muons and to electrons in the mid-1970s by a group led by Martin Perl at the Stanford Linear Accelerator Center in California. Perl named the new particle, the third charged lepton, after the Greek letter that begins the word "third." Ch.Su.

**Tau Sug,** one of the largest of the Muslim cultural-linguistic groups of the Philippines. Numbering about 500,000 in the late 20th century, they live in the Sulu Archipelago southwest of Mindanao, mainly in the Jolo island cluster.

Like the other Filipino Muslims, the Tau Sug differ markedly from the Christians, who make up the overwhelming majority of the country's population. Land is owned by the clan and controlled by local leaders known as *datus*. The customs of marriage and the family are Islāmic. Kinship solidarity is very strong among the Tau Sug, and married children often live in the same household with the parents of the husband or near them.

The languages of all the Muslim groups are closely related to those of the central Philippines, which belong to the Austronesian (Malayo-Polynesian) family of languages.

Their economy is based upon rice farming. Fishing, trading by sea, and various handicrafts are also pursued.

**Taubaté,** city, southeastern São Paulo *estado* ("state"), southern Brazil, on the Paraíba do Sul River. Founded in the early 17th century by Jacques Félix on the site of a Guaianases Indian village, it was a starting point for many *bandeiras* (expeditions into the interior). Formed as the village of São Francisco das Chagas de Taubaté in 1645, it was chartered as a city in 1842 at the onset of the Paraíba valley coffee boom. Remaining an agricultural centre after the boom declined, it also became industrialized. Engines are manufactured there, and dolomite is quarried nearby. The city includes Chácara do Visconde, birthplace of the writer Monteiro Labato, now a historical museum, and it is the seat of a university (1976). Pop. (1996 prelim.) 203,338.

**Taube, Henry** (b. Nov. 30, 1915, Neudorf, Sask., Can.), Canadian-born American chemist who in 1983 won the Nobel Prize for Chemistry for his extensive research into the properties and reactions of dissolved inorganic substances, particularly oxidation-reduction processes involving the ions of metallic elements. His findings have been applied in selecting metallic compounds for use as catalysts, pigments, and superconductors and in understanding the function of metal ions as constituents of certain enzymes.

Taube was educated at the University of Saskatchewan at Saskatoon and the University of California at Berkeley. He taught at Cornell University in Ithaca, N.Y., and at the University of Chicago before joining the faculty of Stanford (Calif.) University in 1961. He became a U.S. citizen in 1942.

In the late 1940s Taube carried out experiments with isotopes to show that in water solution the ions of metals form chemical bonds with several molecules of water and that the stability and geometric arrangement of the resulting hydrates, or coordination compounds, vary widely, depending on the identity and oxidation state of the ion. He also helped develop other techniques for studying such substances, and he devised an interpretation of their properties in terms of their electronic configurations. Analogous coordination compounds form in the presence of ammonia, chloride ion, or numerous other chemical species, called ligands when they engage in these reactions.

Oxidation or reduction of one metal ion by another involves their exchange of one or more electrons. Many such reactions occur rapidly in aqueous solution despite the fact that the stable shells of water molecules or other ligands should keep the two ions from getting close enough for electron exchange to occur directly. Taube showed that, in an intermediate stage of the reaction, a chemical bond must form between one of the ions and a ligand that is still bonded to the other. This ligand acts as a temporary bridge between the two ions, and its bond to the original ion can later break in such a way as to effect—indirectly—the electron transfer that completes the reaction.

**Tauber, Richard,** original name RICHARD DENEMY, also called ERNST SEIFFERT (b. May 16, 1892, Linz, Austria—d. Jan. 8, 1948, London, Eng.), Austrian-born British tenor celebrated for his work in opera and, especially, operetta.

Tauber was studying voice at Freiberg, Ger., at the time of his highly successful operatic debut, as Tamino in Wolfgang Amadeus Mozart's *The Magic Flute* (*Die Zauberflöte*) at the Chemnitz Neues Stadt-Theatre in 1913. That performance resulted in a five-year contract with the Dresden Opera. He also appeared in leading opera houses in Germany and Austria, gaining particular acclaim in the Mozart roles of Tamino, Belmonte in *The Abduction from the Seraglio,* and Don Ottavio in *Don Giovanni.*

Beginning in the 1920s Tauber's career emphasis shifted to light opera and operetta, in which he was to make his reputation with the general public. He befriended the composer Franz Lehár, who provided him with some of his most successful roles, and he starred in 1943 in one of his own compositions, *Old Chelsea.* He moved to England in 1938, became a British subject two years later, and made several appearances at Covent Garden in London. His last public appearance was as Don Ottavio in London in 1947.

**Tauern, Hohe** (mountains, Austria): *see* Hohe Tauern.

**Tauern, Niedere** (mountains, Austria): *see* Niedere Tauern.

**Taughannock Falls,** waterfalls, central feature of Taughannock Falls State Park, near the west shore of Cayuga Lake, in the Finger Lakes Region, 8 miles (13 km) northwest of Ithaca in west-central New York, U.S. The name originates from the Indian *taghkanic* ("great fall of the woods").

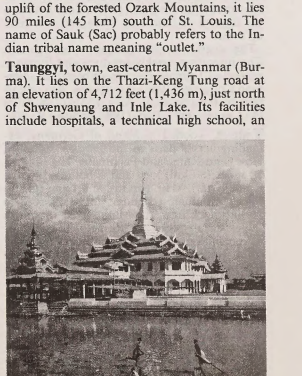
Formed by a creek entering the lake and surrounded by a glen with walls 400 feet (122 m) deep, the fall has a drop of 215 feet (65 m) and is one of the highest east of the Rocky Mountains, 50 feet (15 m) higher than Niagara Falls but with a smaller volume. Dense spray rising from the bottom of the glen shrouds the lower part of the cataract in mist.

**Tauler, Johann** (b. *c.* 1300, Strassburg, Bishopric of Strassburg [now Strasbourg, France]—d. June 16, 1361, Strassburg), Dominican, who, with Meister Eckehart and Heinrich Suso, was one of the chief Rhineland mystics.

Educated at the Dominican convent at Strassburg and the *studium generale* at Cologne, Tauler later became a lector at Strassburg. During a period of exile, he preached and lectured in Basel, Switz., returning again in 1347–48 to his birthplace. He was greatly influenced by Eckehart, though Tauler's teaching, based on St. Thomas Aquinas, stresses practical rather than speculative mystical theology. References to the Friends of God (Gottesfreunde) appear in his sermons, alluding to a circle of like-minded, devout Rhinelanders much influenced by Tauler, Eckehart, and Suso. Tauler's sermons, written in Middle High German, were valued highly by Martin Luther.

**Taum Sauk Mountain,** mountain in Iron county, southeastern Missouri, U.S., highest point (1,772 feet [540 m]) of the St. Francois Mountains and of the state. Part of the main uplift of the forested Ozark Mountains, it lies 90 miles (145 km) south of St. Louis. The name of Sauk (Sac) probably refers to the Indian tribal name meaning "outlet."

**Taunggyi,** town, east-central Myanmar (Burma). It lies on the Thazi-Keng Tung road at an elevation of 4,712 feet (1,436 m), just north of Shwenyaung and Inle Lake. Its facilities include hospitals, a technical high school, an



Leg rowers on Inle Lake, near Taunggyi, Myanmar
Sim Aarons—Photo Researchers

institute for training teachers, the private Kan-Kambawza College (formerly a school for the sons of Shan chiefs), and Taunggyi College, affiliated with Mandalay's Arts and Science University. There is a hunting reserve nearby. Pop. (2001 est.) 154,100.

**Taungu** DYNASTY (Myanmar): *see* Toungoo dynasty.

**Taunton,** city, seat (along with Fall River and New Bedford) of Bristol county, southeastern Massachusetts, U.S., on the Taunton River, 34 miles (54 km) south of Boston. Elizabeth Poole, an early proprietor, probably purchased the site from the Indians in 1638. Organized as a town in 1639 and named for Taunton, Eng., it was a base of operations during the King Philip's War between colonists and Indians (1675–76). When its citizens refused to pay taxes levied in 1684 by Governor Edmund Andros "without their own assent in assembly," it was a forewarning of the future American Revolutionary slogan: "No taxation without representation." Early industries included ironworks, brickmaking, and shipbuilding. Silverware produc-

tion (still important) began with the establishment of the Reed and Barton Company in 1824. The city's varied manufactures now include leather, plastics, textiles, and kitchen ranges. Three state parks—Dighton Rock, Massasoit, and Watson Pond—lie close to Taunton. Inc. city, 1864. Pop. (1991 est.) 49,663.

**Taunton Deane,** district and borough, county of Somerset, England. It lies in the Vale of Taunton Deane, which is sheltered by the Quantock, Black Down, and Brendon hills.

The Anglo-Saxon king Ine founded Taunton town, building its first castle about 710. The first charter was granted in 904. Taunton's second castle, built early in the 12th century, was three times besieged by Royalists during the English Civil Wars of the mid-17th century. It was subsequently largely dismantled except for its gateway and the great hall where the harsh judge George Jeffreys' infamous Bloody Assizes took place after the Duke of Monmouth's rebellion (1685). Taunton is in the diocese of Bath and Wells and is a bishop's seat.

The district is predominantly agricultural. The important weekly produce and livestock market at Taunton dates from before the Norman Conquest (1066). Tourism is also important to the economy. Area 173 square miles (462 square km). Pop. (1991 prelim.) 93,300.

**Taunus,** wooded highland of Germany, extending across parts of the *Länder* (states) of Hesse and Rhineland-Palatinate. The range is 50 miles (80 km) long and is bounded by the Rhine (west), Main (south), and Lahn (north) rivers. Although it stands 5 to 10 miles (8 to 16 km) back from the Main River, the range slopes steeply along the Rhine; it is noted for its precipitous crags, especially downstream from Bingen. The average elevation is 1,500 feet (460 m), with a higher ridge above the Rheingau, the slopes to the Rhine between Biebrich and Bingen. The highest points occur in the east, where the Grosser Feldberg (2,887 feet), Kleine Feldberg (2,710 feet), and Altkönig (2,618 feet) dominate the Wetterau and the valley of the Main River. The hills are generally well wooded with beech and some pine plantations; large areas of forest were cleared for cultivation in the Middle Ages. Where possible, the lower slopes are planted with vineyards, orchards, and chestnut and almond groves. The Rheingaugebirge (mountains) in the Rhine gorge have vineyards that yield grapes for quality white wines. The region is also known for its mineral springs and health resorts, notably Wiesbaden, Königstein, and Bad Homburg von der Höhe.

Among numerous ancient monuments in the Taunus are the Falkenstein castle, the fortress of Königstein, a Cistercian abbey at Eberbach, and two concentric lines of pre-Roman fortifications at Altkönig (mountain). The chief historical monument, however, is the Saalburg, a Roman fort that served as the centre of communications along the limes, which was a fortified frontier line built in the 1st century AD from the Rhine to the Main River by the Roman emperor Domitian. At Niederwald above the town of Rüdesheim stands a gigantic statue commemorating the founding of the German Empire in 1871. The steep crags of the western end of the Taunus, where they abut the Rhine, are rich in the romantic associations of the great river. Notable features also include the rock of the siren Lorelei, the old castles of Stahleck and Pfalz, and the quaint medieval towns of Lorch, Kaub, and Sankt Goarshausen.

**Taupo, Lake,** Maori TAUPOMOANA, lake, the largest in New Zealand, on the volcanic plateau of central North Island. With a total surface area of 234 square miles (606 square km), it lies at an elevation of 1,172 feet (357 m) and has a depth of 522 feet (159 m), covering the remains of several volcanic craters. Draining an area of 1,270 square miles (3,289 square km), the lake receives the upper course of the Waikato River (there called the Tongariro River) from the south and empties by its lower course in the northeast. J.S. Polack and the Reverend Thomas Chapman were the first Europeans to see the lake in the 1830s. Its name derives from the Maori Taupo nui a Tia ("Great Cloak of Tia").

The town of Taupo, standing at the outlet of the Waikato, is the centre of a district supporting dairy and beef cattle, sheep farms, and planted forests. Numerous geothermal springs on the lake's borders are health resorts or are used for generating electricity. Taupo serves as an effective reservoir for hydroelectric plants on the Waikato.

**Tauranga,** city, district, and port, north-central North Island, New Zealand. It is situated on a 2-mile (3-kilometre) neck projecting from the southeastern shore of Tauranga Harbour, a crescent-shaped inlet opening onto the Bay of Plenty. An Anglican mission was established there in 1834, and its Elms Mission House (1838–47) still stands. The Monmouth Redoubt, built as defense against the Maoris during the wars of the 1860s, also remains. The city's name is a Maori word meaning "resting place," or "safe anchorage." Tauranga was incorporated as a borough in 1882 and became a city in the early 1960s. Located along the East Coast Main Trunk Railway to Auckland (179 miles [288 km] northwest), it serves an agricultural district (livestock, fruit, and vegetables). It contains oil installations, flour and cement mills, printing houses, boatyards, and factories that produce clothing and prefabricated materials for houses. The city uses the deepwater port at Maunganui (5 miles [8 km] northeast) for exporting wool, meat, dairy products, pulp, paper, and timber. Pop. (1991) district, 67,333.

**Tauri,** earliest known inhabitants of the mountainous south coast of what is now the Crimea, which itself was known in ancient times as the Tauric Chersonese. The Tauri were famous in the ancient world for their virgin goddess who was identified by the Greeks with Artemis Tauropolos or with Iphigeneia. The Tauric custom of sacrificing shipwrecked strangers to the goddess was the basis for the Greek story of Iphigeneia and Orestes among the Taurians, which became the subject of plays by Euripides (*Iphigenia Among the Taurians*) and J.W. von Goethe (*Iphigenie auf Tauris*). The Tauri often pirated on the Black Sea, and toward the end of the 2nd century BC they were dependent allies of the Scythian king Scilurus, who from their harbour of Symbolon (Balaklava) harassed the Chersonese. Their later history is unknown.

**Tauric Chersonese** (ancient region): *see* Chersonese, Tauric.

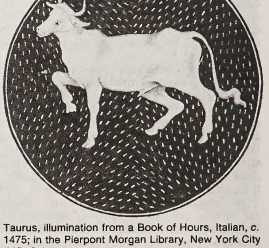
**Tauris** (Iran): *see* Tabrīz.

**Taurobolium,** bull sacrifice practiced from about AD 160 in the Mediterranean cult of the Great Mother of the Gods. Celebrated primarily among the Romans, the ceremony enjoyed much popularity and may have been introduced by the Roman emperor. The nature and purpose of the ceremony seems to have gradually changed during the late 2nd and 3rd centuries. At the beginning it apparently resembled similar sacrifices performed in the cults of other deities, such as Mithra. By about 300, however, the ceremony had changed drastically. The person dedicating the sacrifice lay in a pit with a perforated board placed over the pit's opening. A bull was slaughtered above him, and the person in the pit bathed in the blood streaming down. Thus the ceremony, perhaps influenced by Christianity, gradually took on the elements of moral purification.

**Taurt,** also called TAWERET, or THOUERIS, goddess of ancient Egypt, the benevolent protectress of fertility and childbirth, associated also with the nursing of infants. She was depicted as having the head of a hippopotamus standing upright (sometimes with the breasts of a woman), the tail of a crocodile, and the claws of a lion. Her image often appeared in household shrines and on amulets. Another goddess, called Opet (or Apet), was depicted in the same form.

Taurt was connected in particular with the goddess Hathor. She was also strongly associated with the inundation of the Nile and received particular worship at Jabal al-Silsila, where rituals were performed for the inundation.

**Taurus,** in astronomy, zodiacal constellation lying between Aries and Gemini, at about 4 hours 20 minutes right ascension (the coordinate on the celestial sphere analogous to longitude on the Earth) and 16° north declination (angular distance north of the celestial



Taurus, illumination from a Book of Hours, Italian, *c.* 1475; in the Pierpont Morgan Library, New York City (MS. G.14)

By courtesy of the Pierpont Morgan Library, New York, the Glazier Collection

equator). The constellation's brightest star, Aldebaran (Alpha Tauri), is of the first magnitude. The constellation also contains the Crab Nebula (M1) and the Pleiades and Hyades star clusters.

In astrology, Taurus is the second sign of the zodiac, considered as governing that portion of the year from about April 20 to May 20. Its representation as a bull is related to the Greek myth of Zeus, who assumed the form of a bull to abduct Europa.

**Taurus Mountains,** Turkish TOROS DAĞLARI, mountain range in southern Turkey, a great chain running parallel to the Mediterranean coast. The system extends along a curve from Lake Egridir in the west to the upper reaches of the Euphrates River in the east. Aladağ (10,935 feet [3,333 m]) in the Taurus proper and Mount Erciyes in the outlying offshoot of the Nur Mountains are the highest peaks; many other peaks reach between 10,000 and 12,000 feet (3,000 to 3,700 m).

Scattered forests of pine, cedar, oak, and juniper are found on the slopes up to 8,000 feet (2,500 m). White limestone ridges are common, and in the western Taurus are many enclosed basins with lakes at elevations averaging 3,200 feet (1,000 m). Except for the large areas of deep-soiled fertile lands in the Cicilian Plain below Adana, the coastal plains to the south are small, and the entire region is thinly populated and isolated from the interior by mountain barriers. Of the passageways crossing the mountains, the Cilician Gates (Külek

Boğazı) is the most famous, having been used by caravans and armies since antiquity. Nearby is the only railway line that crosses the Taurus proper, joining Kayseri with Adana. Mineral deposits, partly exploited, include silver, copper, lignite, zinc, iron, and arsenic.

**Tausen, Hans** (b. 1494, Birkende, Island of Fyn, Den.—d. Nov. 11, 1561, Ribe), religious Reformer, known as "the Danish Luther" for his major role in bringing the Reformation to Denmark.

Originally a Roman Catholic, Tausen became a monk in the order of Knights Hospitalers at Antvorskov, near Slagelse, and studied and taught (1516–21) at Rostock and at Copenhagen (1521–22). At the University of Louvain in 1522, he encountered Flemish humanism and became a language scholar, acquiring a knowledge of both Greek and Hebrew.

The next year Tausen went to Wittenberg, where he studied under Luther. His superiors recalled him to Denmark in 1525 because of his growing sympathy with the Reformation, and at Viborg, in Jutland, he was briefly confined in his order's priory. From his prison he preached to the people assembled outside until his prior lent him the pulpit of the church. Soon, Tausen joined with citizens of Viborg in securing a local church for services that included hymns sung in Danish rather than in Latin. The manuals for church services that he published were of great importance in creating a Reformed liturgy in Denmark. Having left his order, in 1526 he was made a Lutheran chaplain by King Frederick I.

Tausen was transferred to Copenhagen in 1529 and rapidly furthered the Reformation as well as his own reputation as a preacher. After the death of Frederick I in 1533, however, he was accused of blasphemy by Bishop Joachim Rønnow and expelled from the dioceses of Sjaelland and Skåne. The citizens then rose in arms against the bishop, who might have been murdered but for Tausen's intervention. Bishop Rønnow rescinded his condemnation, permitting Tausen to preach in the diocese on condition that he moderate his tone. After the final triumph of the Reformation in Denmark in 1536, Tausen was made a lecturer of Hebrew at the University of Copenhagen and in 1542 became Lutheran bishop of Ribe. Among his literary works are sermons, hymns, and a translation from Hebrew to Danish (1535) of the Pentateuch, the first five books of the Old Testament.

**Tausig, Karl** (b. Nov. 4, 1841, Warsaw—d. July 17, 1871, Leipzig), Polish pianist and composer, probably Liszt's greatest pupil.

After four years of study with Liszt at Weimar, Tausig made his public debut in 1858 at a concert in Berlin. He toured Germany (1859–60) and then settled in Vienna in 1862. There he gave a series of concerts with advanced programs of progressive works, but their lack of success led to his temporary retirement from the concert stage. Following his marriage, he returned to Berlin in 1865, where he taught for a short time. He again embarked on concert tours in Russia and Germany but died of typhoid at the age of 29.

Although his playing was considered eccentric in his younger years, Tausig developed a mature style that was praised for technical dexterity, superb tone, and exquisite touch. Unlike Liszt, he was extremely quiet at the piano, hiding all evidence of physical effort. Tausig wrote a few works for piano, including a number of transcriptions.

**Taussig, Frank William** (b. Dec. 28, 1859, St. Louis, Mo., U.S.—d. Nov. 11, 1940, Cambridge, Mass.), American economist whose contributions to trade theory have been of major importance in the 20th century.

Taussig was the son of a successful doctor and businessman who had immigrated to the United States from Prague. Taussig graduated from Harvard in 1879 and obtained his Ph.D. there in 1883 and his law degree in 1886. He was professor of economics at Harvard from 1892 until his retirement in 1935. He acted as an adviser on commercial policy to President Woodrow Wilson and was chairman of the U.S. Tariff Commission (1917–19).

Taussig was the author of a successful text, *Principles of Economics* (1911), and contributed to the theory of wages. His great claim to fame is his outstanding work in the theory of trade policy in which he guided such economists as Jacob Viner, John H. William, and J.W. Angell. He launched and guided a program of "verification," or testing, of international trade theory which he himself had done much to synthesize. This achievement is all the more remarkable because it occurred after the first World War, when Taussig was in his 60s. He also contributed a good deal to the understanding of tariffs, and Viner's later work on customs unions shows evidence of Taussig's influence.

**Taussig, Helen Brooke** (b. May 24, 1898, Cambridge, Mass., U.S.—d. May 20, 1986, Kennett Square, Pa., U.S.), American physician who was the founder of pediatric cardiology.

Taussig studied at Radcliffe College, the University of California (B.A., 1921), Harvard University, and Boston University before earning her medical degree from Johns Hopkins University at Baltimore, Md., in 1927. In 1930 she became the head of a heart clinic in Baltimore, a position she held until 1963. She began carefully studying babies whose congenital birth defects resulted in inadequate oxygenation of their blood, and she pioneered in using fluoroscopy and X rays to study such defects, pinpointing the particular heart malformation responsible for a particular set of symptoms. In the early 1940s Taussig and the surgeon Alfred Blalock devised a surgical treatment for infants born with the condition known as the tetralogy of Fallot, or "blue baby" syndrome; these infants' skin turned blue because a congenital heart defect was causing their blood to be deprived of oxygen. The new operation was a success and subsequently saved the lives of thousands of "blue babies."

Taussig's research spurred the development of many other surgical treatments for common heart disorders. Her book *Congenital Malformations of the Heart,* 2 vol. (1947, rev. ed. 1960–61), comprehensively described specific heart defects and used a wide array of diagnostic tools, techniques, and findings. In 1962–63 Taussig played a key role in alerting American physicians to the dangers of thalidomide, a tranquilizing drug whose use had produced large numbers of deformed newborns in Europe. Her prompt actions prevented a recurrence of the tragedy in the United States itself. Taussig taught at Johns Hopkins University from 1930 to 1963, becoming a full professor there in 1959.

**tautog,** fish of the western Atlantic, a large, commercially imporant species of wrasse (*q.v.*).

**tautology,** in logic, a statement so framed that it cannot be denied without inconsistency. Thus, "All men are rational" is held to assert with regard to anything whatsoever that either it is a man or it is not rational. But this universal "truth" follows not from any facts noted about real men but only from the actual use (or one such use) of "man" and "rational" and is thus purely a matter of definition. The statement cannot but be true because it asserts every possible state of affairs: it is true whichsoever of its constituents are true, and it is also true whichsoever are false.

In the propositional calculus, a logic in which whole propositions are related by such connectives as $\supset$ ("if . . . then"), $\cdot$ ("and"), $\sim$ ("not"), and $\vee$ ("or"), even complicated expressions such as $[(A \supset B) \cdot (C \supset \sim B)] \supset (C \supset \sim A)$ can be shown to be tautologies by displaying in a truth table every possible combination of $T$ (true) and $F$ (false) of its arguments $A$, $B$, $C$ and after reckoning out by a mechanical process the truth-value of the entire formula, noting that, for every such combination, the formula is $T$. The test is effective because, in any particular case, the total number of different assignments of truth-values to the variables is finite; and the calculation of the truth-value of the entire formula can be carried out separately for each assignment of truth-values.

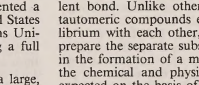
The notion of tautology in the propositional calculus was first developed in the 20th century by Charles Sanders Peirce, the founder of Pragmatism and a major logician. The name tautology, however, was introduced by one of the founding fathers of Linguistic Analysis, Ludwig Wittgenstein, who argued in the *Tractatus Logico-Philosophicus* (1921) that all necessary propositions are tautologies and that there is, therefore, a sense in which all necessary propositions say the same thing—viz, nothing at all.

Wittgenstein's use of the term requires its extension from the propositional calculus to the first-order functional calculus, which can range over classes, sets, or relations as well as over individual variables. This extended notion, further explained by F.P. Ramsey in 1926, is, in fact, a less precise forerunner of what is now usually called validity.

Later, certain Logical Positivists, especially Rudolf Carnap, amended Wittgenstein's doctrine in the light of the distinction that there is an effective test of tautology in the propositional calculus but no such test of validity even in the functional calculus of the lowest (first) order. The Logical Positivists held that, in general, every necessary truth (and, thus, every tautology) is derivable from some rule of language; its only necessity is its being prescribed by a rule in a certain system. Because such derivations are difficult to perform in ordinary language, however, as with the statement "Whatever has a beginning in time must have a cause," attempts have been made—as in Carnap's *Der logische Aufbau der Welt* (1928; *The Logical Structure of the World: Pseudoproblems in Philosophy,* 1967)—to construct an artificial language in which all necessary statements could be demonstrated by appeal to formulas.

**tautomerism,** the existence of two or more chemical compounds that are capable of facile interconversion, in many cases merely exchanging a hydrogen atom between two other atoms, to either of which it forms a covalent bond. Unlike other classes of isomers, tautomeric compounds exist in mobile equilibrium with each other, so that attempts to prepare the separate substances usually result in the formation of a mixture that shows all the chemical and physical properties to be expected on the basis of the structures of the components.

The most common type of tautomerism is that involving carbonyl, or keto, compounds and unsaturated hydroxyl compounds, or enols; the structural change is the shift of a hydrogen atom between atoms of carbon and oxygen, with the rearrangement of bonds as indicated:



keto form enol form

In many aliphatic aldehydes and ketones, such as acetaldehyde, the keto form is the predominant one; in phenols, the enol form is the major component. An intermediate situa-

tion is represented by ethyl acetoacetate, which at room temperature contains about 92.4 percent keto and 7.6 percent enol; at −78° C (−108° F), the interconversion of the two forms is slow enough for the individual substances to be isolated.

In addition to keto–enol tautomerism, several other types are well known, including those of aliphatic nitro compounds and those involving ring and chain structures, especially of molecules of sugars.

**Tavares, Eugénio (de Paulo)** (b. May 11, 1867, Brava Island, Cape Verde Islands—d. Jan. 6, 1930, Brava Island), Cape Verdean poet who was one of the first Cape Verdeans to be published in the islands' vernacular, Crioulo, a creolized Portuguese with African-language influences.

After struggling to get a basic education, Tavares went to New England in the United States to work, but he was soon discouraged and returned home and became a minor public official. His writing was heavily influenced by the islands' folklore, and he wrote poetry both in classical Portuguese and in Crioulo. His first books—*Amor Que Salva* ("The Love That Saves") and *Mal de Amor: Coroa de Espinhos* ("Love's Sickness: The Crown of Thorns")—were published in 1916. His most important book, however, was *Mornas: Cantigas Crioulas* ("Mornas: Creole Songs"), which was published posthumously in 1932.

The *morna* is a uniquely Cape Verdean art form of song and dance, likened by some to the Brazilian samba or the Caribbean beguine. Its origins have not been identified; they are African, Lusitanian, Arabic, or a mixture thereof. Tavares' *mornas* deal with the power of true love, the sorrow of separation, and the sad, sweet longings for and memories of home. Influenced in style by the northeastern Brazilian regionalists and the Portuguese Presença groups, these *mornas* were the most serious poems to be written in Crioulo.

**Tavastehus** (Finland): *see* Hämeenlinna; Häme.

**Tavau** (Switzerland): *see* Davos.

**Tavda,** city and port, Yekaterinburg *oblast* (province), western Russia, on the Tavda River. Its main industries are locomotive repair, sawmilling, and woodworking. The city's timber complex produces prefabricated houses, veneers, and plywood. There is a technical institute devoted to the woodworking industry. Pop. (1991 est.) 46,200.

**tavern,** an establishment where alcoholic beverages are sold for consumption on the premises. Tavern keeping has paralleled the growth of trade, travel, and industry throughout history and virtually worldwide. The Code of Hammurabi of ancient Babylonia (*c.* 1750 BC) provided that the death penalty could be imposed upon a proprietor for diluting beer. In ancient Greece the *leschai,* which was primarily a local club, served meals to strangers as well as to its local members. By the 5th century BC there were sumptuous Greek establishments called *phatne* that served a local and transient clientele of traders, envoys, and government officials.

In ancient Rome no man of any social standing could be seen in a tavern, although one type of establishment, the *lupanar,* flourished behind locked doors on the quietest of side streets, and men with veiled heads entered in the dark of night to dine, drink, or gamble. Nor was the reputation undeserved, for the *deversoria, tabernae, cauponae,* and *bibulae* of republican and imperial Rome were haunts of the jaded and degraded at best, and of criminal types at worst. Yet cooked delicacies and full meals were traditionally served in the *caupona* (low-class inn) and *taberna meritoria* (better-class tavern). These were long chambers having vaulted ceilings, with serving boys standing at semiattention and the proprietor sitting at a raised platform at one end.

The hostelries of Roman England were derived from the *cauponae* and the *tabernae* of Rome itself. These were followed by alehouses, which were run by women (alewives) and marked by a broom stuck out above the door. The English inns of the Middle Ages were sanctuaries of wayfaring strangers, cutthroats, thieves, and political malcontents. The tavern, the predecessor of the modern restaurant, originated the custom of providing a daily meal at a fixed time.

By the middle of the 16th century the dining-out habit was well established among townsmen of all classes. Most taverns offered a good dinner for one shilling or less, with wine and ales as extras. Tobacco was also sold after its introduction into England in 1565. Taverns offered companionship as well as refreshment, and some of the better houses became regular meeting places and unofficial clubhouses. Among the more famous London taverns of Tudor times were the Mermaid, frequented by Ben Jonson and his friends; the Boar's Head, associated with Shakespeare's Sir John Falstaff; and the Falcon, where actors and theatre managers of the day gathered.

The identity of the first public drinking and dining establishment in the United States is obscure. It is certain, however, that it was known as an inn, tavern, or ordinary, names not always interchangeable. It is probable that taverns appeared in the United States almost as soon as the first Dutch settlers arrived. Boston's first tavern, Cole's, opened its doors in 1634. New York's first tavern was opened in Dutch Colonial days by Governor Kieft, who stated that he was tired of entertaining strangers and travelers in his own home and thus opened a tavern to lodge and feed them. The building became New Amsterdam's (and later New York's) city hall and was used for that purpose until the present city hall was built in the 1880s. Colonial courts generally required that some kind of public house be established in each community. These early American taverns were under the strict guardianship of the government, which regulated prices. During the American Revolution, the tavern was the customary locus of political planning sessions.

In the 19th and 20th centuries, the tavern remained a centre of social activity primarily as the neighborhood bar of towns and cities and the roadhouse of more rural areas.

**Taverner, John** (b. *c.* 1490—d. Oct. 15, 1545, Boston, Lincolnshire, Eng.), British composer whose music represents the culmination of early 16th-century English polyphony.

In 1526 Taverner went to Oxford to become master of the choir in the chapel of Cardinal's College (later Christ Church). In 1528 he was imprisoned for concealing heretical books, but John Foxe recorded that Cardinal Wolsey "for his musick excused him, saying, that he was but a musitian, so he escaped." Foxe added that Taverner repented of having composed music for "Popish Ditties." Taverner left Oxford in 1530 and ended his musical career to become a paid agent of Thomas Cromwell in Henry VIII's suppression of English monasteries.

Taverner's church music, which is printed in *Tudor Church Music,* vol. I and III (1923–24), shows a variety and skill, range and power that represent the climax of pre-Reformation English music. It includes eight masses (*e.g., The Western Wind*), a few mass movements, three Magnificats, a *Te Deum,* and 28 motets. In instrumental music, his adaptation of the musical setting of the words *In nomine Domini* from the *Benedictus* of his mass *Gloria tibi trinitas* became the prototype for a large number of instrumental compositions known as *In nomine,* or *Gloria tibi trinitas.*

**Taveuni,** third largest island of Fiji, in the South Pacific. The island has an area of 168 square miles (435 square km). It lies off the southeast coast of Vanua Levu and was sighted by the Dutch navigator Abel Tasman in 1643. Volcanic in origin, it has a central mountain ridge that culminates in Uluinggalau (4,072 feet [1,241 m]). The chief village is Somosomo on the western coast. Copra is the chief product. Most inhabitants are Melanesian. Pop. (1986) including a small part of adjacent Vanua Levu, 11,050.

**Taviani, Paolo; and Taviani, Vittorio** (respectively b. Nov. 8, 1931, San Miniato, near Pisa, Italy; b. Sept. 20, 1929, San Miniato), Italian brothers and filmmakers who combined the social concerns and documentary effects of Neorealism with modernist concerns for outstanding, often poetic, visual and aural effects.

Both Taviani brothers graduated from the University of Pisa. They gained experience for their filmmaking work by writing and staging plays with Valentino Orsini. Inspired by Roberto Rossellini's Neorealist film *Paisà,* they began to study and work in cinema. Their first efforts, often undertaken in collaboration with Orsini, were a series of documentaries on a variety of subjects. *Un uomo da bruciare* (1962; *A Man for the Burning*), made with Orsini's collaboration, was their first feature film. It is a portrait of a murdered trade union leader, and its long tracking shots demonstrate what was to become a Taviani trademark. They made one more film with Orsini before striking out on their own in the mid-1960s. *I sovversivi* (1967; *The Subversives*) mixes documentary footage with a fictional story about the death of a leader and the end of an era for the Italian Left. Their first major success, *Padre Padrone* (1977; "Father Master"), is based on the life of an Italian linguist who in his youth was an illiterate shepherd. In the later *La notte di San Lorenzo* (1982; *Night of the Shooting Stars*), a mother recounts for her child her wartime memories of a night during which her village struggled to stay alive.

**Tavor, Har** (Israel): *see* Tabor, Mount.

**Tavora, Orlando:** *see* Jacinto, António.

**Távoras, Conspiracy of the** (1758–59), event in Portuguese history that enabled the Marquess de Pombal, chief minister to King Joseph I, to crush the higher nobility and the Jesuits, who had opposed him.

On the night of Sept. 3, 1758, three mounted men ambushed the king's carriage; his coachman drove off rapidly, and the king, though wounded, survived. In December a special court was nominated to investigate the matter; all normal legal procedures were waived, and the court was empowered to use torture. Military troops arrested several members of the nobility, including the Marquess de Távora and his wife and two sons, along with Gabriel Malagrida and 12 other Jesuits. Under torture the Duke de Aveiro confessed, and servants of his and of the Távoras gave evidence that implicated the whole Távora family in the conspiracy; much of this evidence was later retracted. Sentence was pronounced against seven members of the nobility—including all four Távoras and Aveiro—and three servants. It was savagely executed, by burning, beheading, or breaking on the wheel and strangling, on Jan. 12, 1759. The verdict of the court was that the Jesuits had collaborated in the plot, and on Sept. 3, 1759, the anniversary of the assassination attempt, they were expelled from Portugal. Malagrida was tried and found guilty of treason and heresy and burned to death on Sept. 20, 1761.

For the rest of Joseph's reign, Pombal was

virtually the sole ruler. Maria I, who became queen in 1777, reopened the case, most of the nobles involved were vindicated, and restitution of confiscated property was made. Pombal was found guilty of unjudicial acts during his unprecedented reign of terror, but because of his advanced age his only punishment was banishment from Lisbon.

**Tavoy,** town, southern Myanmar (Burma). It lies at the head of the Tavoy River estuary on the Andaman Sea. Tavoy is a weaving centre and is engaged in coastal trade with northern Myanmar and the Malay Peninsula. It is served by an airport. A hunting reserve and Mamagan, a popular beach area, are nearby.

The surrounding area lies between the Andaman Sea and lower Thailand and is drained by the Great Tenasserim and Tavoy rivers. It is mountainous, with the Bilauktaung Range on the east forming a 5,000-foot (1,600-metre) barrier between Myanmar and Thailand. Although a major road parallels the Tenasserim coast, the principal access to the area is by sea. The Tavoy River and its many tributaries permit rapid communication. The area is the main source of Myanmar's tin and tungsten. Rice is the staple crop, and timber (particularly teak) production is economically important. Pop. (1983) 69,882.

**ṭawāʾif** (Spanish Muslim factions): *see* taifa.

**Tawau,** port, northeastern East Malaysia (North Borneo). It lies on the northeastern shore of Cowie Harbour, which is an inlet of the Celebes Sea. Once notorious for smuggling with the Philippines and neighbouring Kalimantan, the town is now the administrative and service centre for a developing agricultural district (coconuts, rubber, cocoa, oil palm, and abaca). The port exports timber, copra, and hemp. Tawau has an airport and a small road network. Pop. (2001 est.) 164,000.

**Taweret** (Egyptian goddess): *see* Taurt.

**Tawfiq Pasha, Muḥammad,** also spelled MOHAMMED TEWFIK PASHA, in full MUḤAMMAD TAWFIQ PASHA IBN ISMĀʿĪL IBN IBRĀHĪM IBN MUḤAMMAD ʿALĪ (b. April 30, 1852, Cairo, Egypt—d. Jan. 7, 1892, Ḥulwān), khedive of Egypt (1879–92) during the first phase of the British occupation.

The Ottoman sultan appointed Tawfiq khedive in 1879, when the khedive Ismāʿīl proved obstructive to the interests of the European powers. Tawfiq had little domestic support and was thus forced to meet the demands of his political opponents. A group of military officers led by Aḥmad ʿUrābī Pasha gained increasing influence, and ʿUrābī was named minister of war in 1882. Great Britain was alarmed by the anti-European direction in which events were moving in Egypt, and a British fleet bombarded Alexandria in July 1882; this only increased ʿUrābī's popular support, and Tawfiq was forced to seek the protection of the British. That August the British invaded Egypt and returned Tawfiq to authority. From then on he was controlled by the occupation authorities.

**tawhid,** also spelled TAUHID, Arabic TAWḤĪD ("making one," "asserting oneness"), in Islām, the oneness of God, in the sense that he is one and there is no god but he, as stated in the *shahādah* ("witness") formula: "There is no god but God and Muḥammad is His prophet." Tawhid further refers to the nature of that God—that he is a unity, not composed, not made up of parts, but simple and uncompounded. The doctrine of the unity of God and the issues that it raises, such as the question of the relation between the essence and the attributes of God, reappear throughout most of Islāmic history. In the terminology of Muslim mystics (Ṣūfīs), however, tawhid has a pantheistic sense; all essences are divine, and there is no absolute existence besides that of God. To most Muslim scholars, the science of tawhid is the systematic theology through which a better knowledge of God may be reached, but to the Ṣūfīs, knowledge of God can be reached only through religious experience and direct vision.

**Tawitawi,** island, southwestern Sulu archipelago, Philippines. It lies between the Celebes Sea (southeast) and the Sulu Sea (northwest). Tawitawi Island is of volcanic origin, is hilly and heavily wooded, and is about 34 miles (55 km) long and from 6 to 14 miles (10 to 23 km) wide. The inhabitants are Samals, a Muslim people speaking Samal, a language of the Austronesian family. Tawitawi's westernmost tip is a scant 40 miles (64 km) east of Borneo. The largest settlement on the island is Bato Bato. The climate is warm and moist, and coconut, tobacco, sugarcane, and kapok are the major commercial crops grown in the island's fertile volcanic soils. Rice, corn (maize), citrus fruits, root crops, vegetables, cacao, and coffee are also grown. Shells for mother-of-pearl, capiz shells, and reptile skins are collected. Fishing is of great importance, and the inhabitants are accomplished boatbuilders. Pop. (1990 est.) including nearby Sibutu Island and the distant Cagayan Sulu Island and the Turtle Islands, 244,759.

**Tawney, Richard Henry** (b. Nov. 30, 1880, Calcutta, India—d. Jan. 16, 1962, London, Eng.), English economic historian and one of the most influential social critics and reformers of his time. He was also noted for his scholarly contributions to the economic history of England from 1540 to 1640.

Tawney was educated at Rugby School and at Balliol College, Oxford. After doing social work in London at Toynbee Hall, he became an active member of the Workers' Educational Association in Rochdale, Lancashire, serving as its president from 1928 to 1944. He taught tutorial classes (for working-class students) at Oxford, where he wrote his first major work, *The Agrarian Problem in the Sixteenth Century* (1912). That study of the use of land in an underdeveloped economy that was simultaneously in the midst of a population explosion and a price revolution (caused by the influx of New World gold and silver) opened a new avenue of research for historians. The next year he began teaching at the London School of Economics, becoming professor of economic history in 1931 and professor emeritus in 1949.

Tawney was an ardent socialist who helped formulate the economic and moral viewpoint of Britain's Labour Party in the 1920s and '30s by his influential publications. He served on numerous economic committees and as an adviser to governmental bodies, and he campaigned vigorously for social reforms. Many of them—raising of the school-leaving age, extension of workers' education, fixing of minimum wages—were adopted.

In probably his most provocative and influential book, *The Acquisitive Society* (1920), he held that the acquisitiveness of capitalist society was a morally wrong motivating principle. Acquisitiveness, he said, corrupted both rich and poor. He argued that in capitalist societies work is deprived of its inherent value and thus becomes drudgery, for it is looked at solely as a means to something else.

A few years later Tawney wrote another book that has also become a classic: *Religion and the Rise of Capitalism* (1926). It argued that it was the individualism and the ethic of hard work and thrift of Calvinist Protestantism that had fostered industrial organization and an efficient workforce in northern Europe. He thus shifted and extended the emphasis of the earlier work of Max Weber (of whom Tawney considered himself a disciple). Weber had argued that the ideological stage for the rise of capitalism had been prepared by Calvinist religious doctrines, especially predestination.

**Tawzar,** also spelled TOZEUR, Latin THUSUROS, also called JARĪD, oasis, west-central Tunisia. It is located to the south of Tunisia's steppe region in the *jartd* (palm) country, which displays a colourful landscape marked by numerous *shaṭṭs* (saline depressions) and palm groves. The town is situated on the isthmus that separates the *shaṭṭs* of al-Jarīd and al-Gharsah, and it is referred to as the gate of the desert.

Tawzar was an important Numidian town on the ancient caravan route between Vescra (Biskra, now in Algeria) and Tacape (Qābis), in Tunisia. In the 14th century it was an active marketplace, and it has always been a centre of Berber resistance to Arabization in Tunisia. The characteristic architecture of the region is displayed in the decorated facades of Tawzar's traditional buildings, often of yellow bricks laid in relief forming stylized geometric patterns. This is seen in Sīdī ʿAbīd Mosque, the *zawīyah* (seat of a religious fraternity) Sīdī Mūldī, the Great Mosque built in 1030, and the marabout (holy man) tomb of Sīdī ʿAlī Abū Lifah, which was built in 1282.

The region in which Tawzar is situated is known for its mirages, which are caused by the warm air and the glittering mineral salts of the *shaṭṭs* and which often sent early caravans astray. The region produces two varieties of high-quality dates that have constituted its main exports since the 11th century, together with handwoven rugs and hand-fashioned silver jewelry. Pop. (2000 est.) 32,400.

**tax,** compulsory levy that is the most important source of government revenue. *See* taxation.

**Tax, Sol** (b. Oct. 30, 1907, Chicago, Ill., U.S.—d. Jan. 4, 1995, Chicago), American cultural anthropologist who founded the journal *Current Anthropology.* He was also known for the Fox Project, a study of the culture of the Fox and Sauk Indians.

Tax received his Ph.D. from the University of Chicago (1935), where he was a professor from 1944 until his retirement. He pioneered the use of "transactional analysis" in his study of the Omaha kinship pattern among the Fox. During his work with the Fox (Mesquakie) Indians from 1948 to 1962, he became convinced that the influence of the anthropologist's presence among them deserved not only to be further studied but to be directed toward the benefit of the native peoples. His work led him to champion what he called "active anthropology," to work to develop a pan-Indian organization, and to help native American tribes to preserve their cultural identity.

Throughout his career Tax participated in numerous anthropological societies. In 1959 he served as president of the American Anthropology Association. Tax was founder and general editor of *Current Anthropology: A World Journal of the Sciences of Man* from 1960 to 1974, and he helped coordinate and served as chairman of the National Anthropology Film Center. Among the publications that he edited are *Heritage of Conquest. The Ethnology of Middle America* (1952), *An Appraisal of Anthropology Today* (1953), *Evolution after Darwin,* 3 vol. (1960), *Anthropology Today—Selections* (1962), and *Horizons of Anthropology* (1964).

**Tax Court,** in the United States, a court that hears cases involving tax litigation. Originally, a Board of Tax Appeals was set up in 1924 to hear cases in which, for example, a taxpayer might challenge the findings of an Internal Revenue Service agent who had declared a tax deficiency. The board was to act as a body independent of (though cooperating with) the U.S. Department of Justice in the resolution of such cases. In 1942 the board became the

Tax Court, which in 1969 became a part of the federal court system.

Its basic jurisdiction lies in determining cases cited as being deficient in the payment of any federal tax (income, gift, estate, etc.). Although centred in Washington, D.C., it may sit in any area of the United States at any given time. A taxpayer may appeal an adverse decision from the Tax Court to the U.S. Court of Appeals, or he may pay the disputed deficiency and then sue for repayment either in a federal District Court or the United States Claims Court.

**tax law,** the body of rules under which the public authority has a claim on taxpayers, requiring them to transfer to the public authority part of their income or property.

A brief treatment of tax law follows. For full treatment, *see* MACROPAEDIA: Taxation.

Tax law is concerned only with the legal aspects of taxation, not with its financial, economic, or other aspects. Tax law falls within the domain of public law as distinguished from private law. International tax law is concerned with the problems arising when an individual or corporation operates and is taxed in several countries. The development of comprehensive systems of tax law is a recent phenomenon.

The power to impose taxes is generally recognized as a right of governments and is commonly found specified in constitutions. The limits to the right of the public authority to impose taxes are, in democratic systems, set by the legislature. The fundamental requirement is that the rights of the tax administration and the corresponding obligations of the taxpayer be specified in the law. The implementation of the tax laws is generally the province of the executive power.

In many countries, tax legislation, once enacted, cannot be nullified by the courts on the ground that it is in opposition to constitutional principles, a chief exception being the United States, where the principle of judicial review is firmly established. There are certain limitations on the taxing power of the legislature. There must be at least a minimum connection between the subject of taxation and the taxing power. The extent of income-tax jurisdiction, for example, is essentially determined by two criteria: the residence of the taxpayer and the source of his income. Taxes other than income taxes—such as retail sales taxes, death taxes, registration fees, and stamp duties—are imposed by the authority (national or local) on whose territory the goods are delivered or the taxable assets are located. Another limitation is that the same tax may not be imposed twice on the same person on the same ground. Taxes are generally not levied retroactively. A common limitation on the taxing power is the requirement that all citizens be treated alike. Aside from these constitutional, traditional, or political limitations, there is no restraint on the power of the legislative authority to determine the object, the rate, and the manner of administration of a tax.

The problem of double and concurrent taxation by overlapping governmental authorities has become increasingly important, particularly in international law. International tax law has two parts. One consists of the provisions of internal tax law whereby national taxes are made applicable to nonresidents and to facts or situations located outside the frontiers. The other part consists of a growing number of international agreements, mainly bilateral ones, designed to prevent double taxation. Problems of internal double taxation exist in federal countries where provincial legislatures may tax all income arising in the province, whether received by residents or nonresidents, or all income received by residents, whether arising within or outside the province. When two or more countries form a customs union (free-trade zone), as have the members of the European Community (Common Market), they agree to establish a unified economic and financial market. In tax terms, this means the abolition of all tax (and other) discriminations and distortions.

Administration of the tax law is the responsibility of the executive power. The levying of taxes can be divided into three successive phases. The first is assessment, or the definition of the amount subject to taxation under a particular statute. With the income tax, for example, the taxpayer submits a tax return providing financial and other information. Assessing officials have extensive powers in determining the amount subject to taxation. The taxpayer has the right to appeal the interpretation of the law if he believes that the assessing official is wrong. The second phase is computation, or calculation. In the self-assessment method the liability for income tax is determined by the taxpayer. Many countries provide for prepayment of withholding tax on wages, dividends, and other income. The third phase is enforcement. If the taxpayer fails to pay within a legally prescribed period, the competent tax office undertakes to collect the amount due together with interest or penalty charges. Various civil and criminal penalties are prescribed by law for violations of tax laws.

**Taxaceae,** the yew family, constituting the order Taxales and containing five genera of evergreen trees and shrubs, distributed mainly in the Northern Hemisphere. The plants have many branches, covered with alternate, needlelike leaves. Male and female plants are usually separate; the male reproductive units are contained within conelike structures. The usually solitary seeds are covered by fleshy arils (berrylike or plumlike structures). The seed tip is exposed in species of *Amentotaxus* and *Austrotaxus.*

The genus *Amentotaxus* contains four species of eastern Asian trees and shrubs, some reaching 10 m (about 30 feet) high. The seeds are borne on short stalks and have reddish yellow seed coverings. The genus *Austrotaxus* has only one species (*A. spicata*), native to mountain forests of New Caledonia. Growing from 15 to 25 m tall, the tree resembles the yellow woods in leaf characteristics and growth habit but differs in flower structure and the presence of the seed covering.

The genus *Pseudotaxus* has one species (*P. chienii*), a shrub from eastern China, seldom more than 4 m high. It resembles *Taxus* in general appearance but has a cup-shaped, white seed covering.

The largest genus, *Taxus* (yew), has about eight species and many varieties, distributed in North America, Europe, Asia Minor, and eastern Asia. There are about six species in the genus *Torreya,* found in North America, China, and Japan.

**Taxandria** (region, Belgium): *see* Kempenland.

**taxation,** the imposition of compulsory levies on persons or other entities by governments. In modern economies taxes are the most important source of government revenues. They represent a general obligation of taxpayers and are not levied or paid in exchange for any particular benefit.

A brief treatment of taxation follows. For full treatment, *see* MACROPAEDIA: Taxation.

Taxes are considered to have three functions: (1) fiscal or budgetary, to cover government expenditures, (2) economic, to promote stable economic growth, and (3) social, to lessen inequalities in the distribution of income and wealth. Conflict may arise among these functions. The level or composition of taxes necessary for budgetary purposes may retard economic growth; a highly redistributive tax may have similar consequences. In addition to these main functions, taxes have also been used for nonfiscal ends, such as to encourage or discourage certain activities, (*e.g.*, alcohol consumption, family size).

In the literature of public finance, taxes have been classified in various ways according to who pays them, who bears the ultimate burden of them, the extent to which the burden can be shifted, and other criteria. The most common distinction is between direct and indirect taxes. Direct taxes are those that cannot be shifted by the taxpayer onto someone else. They are primarily taxes on persons and are aimed at the individual's ability to pay as measured by his income or his net wealth. The main types of direct taxes are individual income taxes, taxes on net worth, death duties (*i.e.*, the inheritance tax and the estate tax), gift taxes, and general expenditure or spending taxes. Indirect taxes are those that can be shifted in whole or in part to someone other than the person legally responsible for payment. These include excise taxes, sales taxes, value-added taxes, taxes on legal transactions, and the like. Some taxes cannot be classified as direct or indirect with certainty because they may or may not be shifted depending on circumstances. Taxes may also be distinguished according to the effect they have on the distribution of income and wealth. A proportional tax is one that imposes the same relative burden on all taxpayers. A progressive tax is characterized by a more than proportional rise in the tax liability relative to the increase in the tax base, and a regressive tax is characterized by a less than proportional rise in relative burden.

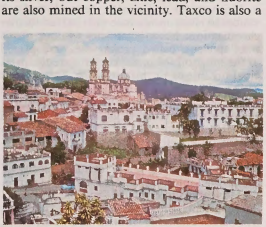
Taxes played a relatively minor role in the ancient world. Tariffs were often more important than internal excises for raising revenue. Poll taxes, real property taxes, and sales taxes were all known in Rome. In modern times the level of general taxation has risen substantially and so has the ratio of tax revenues to national income. Income taxation, both of individuals and of corporations, occupies a leading position in modern tax systems. In addition to general and substantial income taxes, there has been a trend away from excises and tariffs (customs duties). The value-added tax has become increasingly important since World War II.

Adam Smith first systematized the rules that should govern a rational system of taxation: taxes should be based on the individual's ability to pay, and they should be certain, convenient, and economical. Modern criteria of tax systems also include revenue productivity and considerations of social justice. A tax system should provide adequate revenues to cover expenditures and should be capable of producing more on short notice when circumstances require. Conceptions of social justice may require in addition that taxes be more or less redistributive of income or wealth or both. As governments have come to play a larger part in controlling their national economies, taxes have been used to moderate cyclical economic fluctuations, to promote a higher level of economic activity, and to affect the allocation of economic resources.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Taxco,** in full TAXCO DE ALARCÓN, city, northern Guerrero *estado* ("state"), south-central Mexico, on the slopes of Atache Hill, at 5,758 feet (1,755 m) above sea level, in the Sierra de Taxco. The place was a mining centre in pre-Columbian times. The Indian settlement, together with the settlement founded by the Spanish in 1528, became the city of Taxco and was one of the first early mining centres to be inhabited by Spaniards. The city prospered in the colonial period, its silver mines

producing great wealth. It was the birthplace of the 18th-century poet and dramatist Juan Ruiz de Alarcón y Mendoza, memorialized in its full name. The city is still renowned for its silver, but copper, zinc, lead, and fluorite are also mined in the vicinity. Taxco is also a



Taxco, Mex.
Ursula Bernath—EB Inc.

commercial centre for the area, which yields corn (maize), beans, sugarcane, and fruits. It is primarily known for its fine silver handwork and other crafts, being recognized as the outstanding centre for silverwork in the Western Hemisphere; the ancient craft was revived there in the 1930s by a U.S. resident, William Spratling. Because of its colonial character, with its fine Baroque Church of Santa Prisca and other churches and buildings lining its steep, narrow, cobblestone streets, it has been declared a national monument and is a tourist as well as an art centre. It is located 12½ mi (20 km) north of Iguala, through which the Mexico City–Acapulco expressway passes. Pop. (2001 est.) 51,900.

**taxicab,** chauffeur-driven automobile available for hire to carry passengers between any two points within a city or its suburbs for a fare determined by a meter or zone system or a flat rate. The taxicab is named after the taximeter, an instrument invented by Wilhelm Bruhn in 1891 that automatically recorded the distance traveled and/or the time consumed, thus enabling the fare to be accurately measured. The term cab derives from the cabriolet, a two-wheeled, one-horse carriage often let out for hire.

The development of modern taxicabs closely parallels that of automobiles. The first motorized taxicabs were electric-powered vehicles that began appearing on the streets of European and American cities in the late 1890s. Internal combustion-powered taxicabs equipped with taximeters first appeared around 1907 and have dominated taxi travel ever since. Most modern taxis are four-door passenger cars that are especially fitted for taxicab service and provided with modifications designed to withstand the more severe service requirements of taxi operation. Such modifications include reinforced auto-body frames, heavier springs and shock absorbers in the suspension system, and more reliable engine charging. In some cities, such as London, taxicab design must meet legally approved specifications.

Taxicab firms may be organized in any of three ways. They may have regular employees who drive cabs owned by the company; they may use lessees, or independent contractors, who lease cabs from a company and pay a regular fee for the use of the vehicle; or they may consist of owner-drivers, who drive vehicles which they themselves own.

**taxidermy,** the practice of creating lifelike representations of animals, most commonly birds and mammals, by the use of their prepared skins and various supporting structures. Taxidermy may be traced to the ancient custom of preserving trophies of the hunt, but the principal motive for its development into an art was the growth of interest, especially from the time of the Enlightenment, in natural history and the consequent appearance of both private collections and exhibits in public museums of birds, beasts, and curiosities. By the early 18th century, chemical means of preserving skins, hair, and feathers from decay and insects made possible the first crude attempts to re-create the appearance of live animals by stuffing the sewed-up skins with hay or straw. The rapid improvement of methods of preparing skins and the invention of new techniques of mounting them were followed closely by a trend toward realistic display—the animals were shown in positions, often suggesting great activity, observed in nature, and, by the addition of real or artificial vegetation, painted backgrounds, etc., lifelike scenes and even whole habitats were simulated. In the 19th century, taxidermy became firmly established as a museum art in the work of such commercial houses as Maison Verreaux in Paris, founded by a naturalist and explorer, which furnished great numbers of exhibits to museums. The influence of Verreaux was superseded by that of Ward's Natural Science Establishment in Rochester, N.Y., where a group of young enthusiasts, notably Carl Akeley (*q.v.*), devoted themselves to the perfection of taxidermic methods. The techniques for constructing and sculpting anatomically correct manikins of clay and plaster that were developed at Ward's remain the basis of modern taxidermy; subsequent developments concerned mainly the treatment of reptiles, insects, and soft-bodied creatures and the introduction of such new materials as celluloid and other plastics.

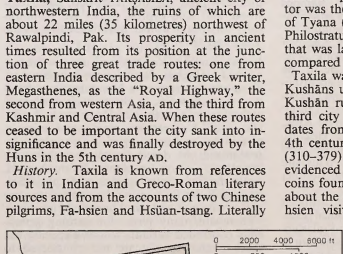
**Taxila,** Sanskrit TAKṢAŚILĀ, ancient city of northwestern India, the ruins of which are about 22 miles (35 kilometres) northwest of Rawalpindi, Pak. Its prosperity in ancient times resulted from its position at the junction of three great trade routes: one from eastern India described by a Greek writer, Megasthenes, as the "Royal Highway," the second from western Asia, and the third from Kashmir and Central Asia. When these routes ceased to be important the city sank into insignificance and was finally destroyed by the Huns in the 5th century AD.

*History.* Taxila is known from references to it in Indian and Greco-Roman literary sources and from the accounts of two Chinese pilgrims, Fa-hsien and Hsüan-tsang. Literally meaning "the city of cut-stone" or "the rock of Takṣa," Takṣaśilā (rendered by Greek writers as Taxila) was founded, according to the Indian epic *Rāmāyaṇa,* by Bharata, younger brother of Rāma, an incarnation of the Hindu god Viṣnu. The city was named for Bharata's son, Takṣa, its first ruler. The great Indian epic *Mahābhārata* was, according to tradition, first recited at Taxila at the great snake sacrifice of King Janamejaya, one of the heroes of the story. Buddhist literature, especially the Jātaka, mentions it as the capital of the kingdom of Gandhāra and as a great centre of learning. Gandhāra (Gandarii) is also mentioned as a satrapy or province in the inscriptions of the Achaemenian (Persian) king Darius I in the 5th century BC. Taxila, as the capital of Gandhāra, was evidently under Achaemenian rule for more than a century. When Alexander the Great invaded India in 326 BC Āmbhi (Omphis), the ruler of Taxila, surrendered the city and placed his resources at Alexander's disposal. Greek historians accompanying the Macedonian conqueror described Taxila as "wealthy, prosperous, and well governed."

Within a decade after Alexander's death, Taxila was absorbed into the Mauryan empire founded by Candragupta Maurya, under whom it became a provincial capital. But this was only an interlude in the history of Taxila's subjection to conquerors from the west. After three generations of Mauryan rule, the city was annexed by the Indo-Greek kingdom of Bactria. It remained under the Indo-Greeks until the early 1st century BC. They were followed by the Śakas, or Scythians, from Central Asia, and by the Parthians, whose rule lasted until the latter half of the 1st century AD.

According to early Christian legend, Taxila was visited by the Apostle Thomas during the Parthian period. Another distinguished visitor was the Neo-Pythagorean sage Apollonius of Tyana (1st century AD), whose biographer Philostratus described Taxila as a fortified city that was laid out on a symmetrical plan and compared it in size to Nineveh.

Taxila was taken from the Parthians by the Kushāns under Kujūla Kadphises. The great Kushān ruler Kaniṣka founded Sirsukh, the third city on the site. (The second, Sirkap, dates from the Indo-Greek period.) In the 4th century AD the Sāsānian king Shāpūr II (310–379) seems to have conquered Taxila, as evidenced by the numerous Sāsānian copper coins found there. There is little information about the Sāsānian occupation, but when Fa-hsien visited the city at about the beginning of the 5th century AD, he found it a flourishing centre of Buddhist sanctuaries and monasteries. Shortly thereafter it was sacked by the Huns. Taxila never recovered from this calamity. Hsüan-tsang, visiting the site in the 7th century AD, found the city ruined and desolate, and subsequent records do not mention




Taxila

Adapted from *Westermann Grosser Atlas zur Weltgeschichte,* Georg Westermann Verlag, Braunschweig

it. Excavations begun by Sir Alexander Cunningham, the father of Indian archaeology, in 1863–64 and 1872–73, identified the local site known as Saraikhala with ancient Taxila. This work was continued by Sir John Marshall, who over a 20-year period completely exposed the ancient site and its monuments.

*Archaeology.* The structural remains at Taxila include the Bhir mound area, the palace area at Sirkap, the Jandiāl and Pippala temples, the Giri fortress, the Mohra Moradu and Jaulian monasteries, and the Dharmarājika, Bhallar, and Kuṇāla stupas (burial mounds). Different types of masonry used in the monuments indicate their period of origin. The earliest remains are those of the Bhir mound. The palace area, modeled on the same lines as its Assyrian counterpart, has several entrances and outer fortifications. It reveals traces of successive settlements with the oldest parts of the buildings consisting of rubble masonry. A spacious Buddhist temple, several small shrines, and blocks of dwelling houses were uncovered there. The shrine of the double-headed eagle is interesting for its pilasters of the Corinthian order on the front and niches in the interspaces. Other antiquities of the palace area include terra-cottas and potteries; small bronze, copper, and iron objects; and beads, gems, and coins of Indo-Greek, Parthian, and early Kushān rulers.

The Dharmarājika stupa, popularly known as the *Chir tope,* is a circular structure with a raised terrace around its base. A circle of small chapels surround the great stupa. Three distinctive types of masonry in the buildings around the main stupa suggest the contributions of different periods to the building activity. A silver scroll inscription in Kharoṣṭi and a small gold casket containing some bone relics of Buddha were found in one of the chapels. The inscription refers to the enshrinement of the relics by a Bactrian named Ursaka from the town of Noacha in the year 136 BC for the bestowal of health on "the great King, Supreme King of Kings, the Son of Heaven, the Kuṣāṇa" (probably Vima Kadphises, son of the Kushān conqueror Kujāla). This site also contained several statues of the Buddha and bodhisattvas.

The Jandiāl temple, set up on an artificial mound, closely resembles the classical temples of Greece. Its Ionic columns and pilasters are composed of massive blocks of sandstone. Built in the Scythio-Parthian period, it is probably the temple described by Philostratus in his *Life of Apollonius of Tyana.* Though the Jandiāl temple is not Buddhist, the Jaulian remains are. These include a monastery and two stupa courts.

Taxila, besides being a provincial seat, was also a centre of learning. It was not a university town with lecture halls and residential quarters, such as have been found at Nālandā in Bihar. At Taxila, the preceptor housed his own pupils, who paid for their board and lodging in cash or in the form of service to the teacher and his family. The Buddhist monasteries also catered to the needs of the students and monks. (B.N.P./Ed.)

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**taximetrics,** also called **NUMERICAL TAXONOMY,** the multivariate analysis of many measurable features (taxonomic characters) to produce a biological classification. Because of the complexity of the analysis—many characters are measured on many individuals or a number of species—the use of a computer is virtually mandatory. No attempt is made, as in evolutionary taxonomy, to weight characters on the basis of their presumed roles in natural selection. For this reason, numerical taxonomy produces a classification that reflects "phenetic distances," *i.e.,* degrees of similarity. Such classifications are rejected by many conventional taxonomists who feel that the relationships expressed in a classification should be strictly evolutionary. *See also* taxonomy.

**Taxis postal system:** *see* Thurn and Taxis postal system.

**Taxodiaceae,** the so-called deciduous cypress family (order Coniferales), consisting of 10 genera with 15 species of ornamental and timber evergreen trees, native to eastern Asia, Tasmania, and North America. The leaves on one tree may be scalelike, needlelike, or a mixture of both; they occur singly and are often spirally arranged on frondlike branchlets. Both male and female reproductive structures are borne on the same tree; the male structures are solitary or clustered and have spirally arranged scales, each of which has three to nine pollen cases. The female cones, solitary and terminal, also have spirally arranged scales. Each scale is fused with a bract (modified leaf), which becomes thick and woody. The two to nine seeds produced per scale are erect in some genera and inverted in others. There are two to eight cotyledons.

Tasmanian cedar, Japanese cedar, China fir, umbrella pine, big tree, redwood, dawn redwood, and bald cypress (*qq.v.*) are economically important timber trees belonging to the Taxodiaceae family.

**taxon,** plural TAXA, any unit used in the science of biological classification, or taxonomy. Taxa are arranged in a hierarchy from kingdom to subspecies, a given taxon ordinarily including several taxa of lower rank. In the classification of protists, plants, and animals, certain taxonomic categories are universally recognized; in descending order, these are kingdom, phylum (in plants, division), class, order, family, genus, species, and subspecies, or race. Rules for naming the various taxa are the province of biological nomenclature (*q.v.*).

There are many terms for naming genetically controlled variants within a species, but these names usually are not considered to be taxa. In a polymorphic species the terms morph and variety are often applied. Among domestic animals, a true-breeding, genetically pure line is usually called a strain. In botany the term cultivar is applied to a recognizable variant that originates under cultivation.

**taxonomy,** in a broad sense, the science of classification, but more strictly the classification of living and extinct organisms, *i.e.,* biological classification. The term is derived from the Greek *taxis* ("arrangement") and *nomos* ("law"). The taxonomist creates from a varied array of organisms a hierarchy of groupings, or taxa (singular: taxon), that have an orderly relationship to each other. The basic unit in taxonomy is the species.

A brief treatment of taxonomy follows. For full treatment, *see* MACROPAEDIA: Biological Sciences.

Most modern taxonomists attempt to group organisms so as to reflect evolutionary (phyletic) relationships. The basic method of taxonomy is to compare the characteristics of the structure of living and extinct organisms by the methods of comparative anatomy and to interpret their differences and similarities in the light of comparative genetics, biochemistry, physiology, embryology, behaviour, ecology, and geography.

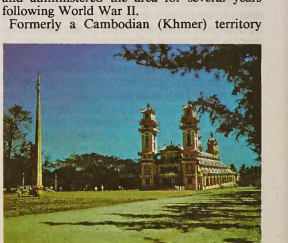
Authorities once divided organisms into two simple categories, or taxa—the kingdoms Plantae and Animalia. A third kingdom, Protista, was later proposed for those organisms that are not clearly plant or animal, such as the protozoa, bacteria, and algae. Improvements in biochemical and genetic research and advances in electron microscopy enabled further classification. Microorganisms without a distinct nucleus, called prokaryotes, are placed in the kingdom Monera; bacteria are the principal organisms in this kingdom. The classification of eukaryotes (microorganisms having a distinct nucleus) remains controversial. At present most authorities classify all living and extinct organisms into either a five-kingdom system or a four-kingdom system. The five-kingdom system recognizes Animalia, Plantae, Monera, Fungi, and Protista (basically all eukaryotic microorganisms—*i.e.,* algae, protozoans, and slime molds), and the four-kingdom system recognizes only the kingdoms Animalia, Plantae, Monera, and Virus; *i.e.,* while recognizing the separation of the eukaryotes and prokaryotes, the four-kingdom system places the protozoans with the animals and the fungi and algae with the plants.

The main subordinate taxa are successively the phylum (or division for plants), class, order, family, genus, and species. The basic units of the classificatory system are readily recognizable kinds, or species. The first step in the process of classification is the systematic grouping together of organisms with related characteristics; for example, single-hoofed animals related to the horse (horse, ass, and zebra) are placed in the genus, *Equus,* and similarly the grouping of acorn-bearing trees into the oak genus, *Quercus.* When the genus name is combined with that of the species, relationships are indicated, and by this means additional species may be included as they are discovered. This scheme of generic and specific names in Latin was established by Carolus Linnaeus in the mid-18th century.

**Tay, River,** longest river in Scotland, flowing about 120 miles (193 km) from its source on the north slopes of Ben Lui to the North Sea below Dundee. The river drains 2,400 square miles (6,216 square km), the largest drainage area in Scotland. Before reaching the stretch of Loch Tay (15 miles [24 km] long) at Killin, the headwaters flow under the names Fillan and Dochart. On leaving Loch Tay at Kenmore, the river receives the tributaries Lyon, Earn, and the outfall from the Tummel-Garry Hydroelectric Scheme, which helps control flooding of the river.

**Tay Ninh,** town, southern Vietnam, situated on a tributary of the Vam Co Tay River, 65 miles (105 km) northwest of Ho Chi Minh City (formerly Saigon) and 25 miles (40 km) from the border with Kampuchea. Tay Ninh is the seat of the Cao Dai, a militant syncretic religious sect founded in 1926 that controlled and administered the area for several years following World War II.

Formerly a Cambodian (Khmer) territory



The cathedral of the Cao Dai sect, Tay Ninh, Vietnam
Robert C. Caplan—Globo

occupied early in the 19th century by the Vietnamese under Emperor Gia Long, the region has Khmer, Chinese, and Cham minorities. The region is noted for its large rubber and sugar plantations; rice and coconuts are also harvested.

Followers of the Cao Dai, who dominate the area, have built a cathedral in Tay Ninh. The region also has concentrations of the Hoa Hao, a rival militant Buddhist sect. Pop. (1989) town, 32,881.

**Tay-Sachs disease,** also called AMAUROTIC FAMILIAL IDIOCY, hereditary metabolic disorder that causes progressive mental and neurologic deterioration and results in death in early childhood. The disease is inherited as an autosomal recessive trait and occurs most commonly among people of eastern European (Ashkenazic) Jewish origin.

In infants born with the disease, abnormally low activity of the enzyme hexosaminidase A allows an unusual sphingolipid, ganglioside $G_{M2}$, to accumulate in the brain, where it soon exerts devastating effects on neurological function. In some affected children, the enzyme is present but the sphingolipid accumulates nonetheless. Tay-Sachs infants appear normal at birth but become listless and inattentive during the first few months of life. As the disease progresses, the child loses motor abilities already gained, such as crawling and sitting, develops uncontrollable seizures, and is unable to lift its head or swallow. A cherry-red spot develops on the retina, and blindness and a general paralysis usually precede death. There is no treatment for the disease.

About 1 in 2,500 Ashkenazic Jewish infants is afflicted with Tay-Sachs disease, as compared to 1 in 360,000 non-Jewish babies. The disease can be detected by prenatal tests. About 1 in 25 Ashkenazic Jews is a carrier of the Tay-Sachs gene. Adult genetic carriers can be identified by measuring the level of hexosaminidase A in their blood or other fluids.

**Tay Son** BROTHERS, collective name for Nguyen Hue (b. *c.* 1752—d. 1792), Nguyen Nhac (b. *c.* 1752—d. Dec. 16, 1793), and Nguyen Lu (b. *c.* 1752—d. 1792); the name was derived from their home village, Tay Son, Vietnam.

They were the leaders from 1771 of an insurrection that was initially local in character but became a national movement known as the Tay Son rebellion. By 1778 the brothers were dominant in central and southern Vietnam, and they finally overcame their opponents in northern Vietnam in 1786–87. The revolt initially had a broad social base, drawing from peasant and merchant classes, and sought political and social reforms. The brothers have been regarded by many historians as precursors of the 20th-century Vietnamese nationalist movement.

Nguyen Hue (later Emperor Quang Trung), the youngest and most capable of the brothers, overthrew the imperial Le dynasty (*see* Later Le dynasty) and the two rival feudal houses of the Nguyen in the south and the Trinh in the north, reuniting all of Vietnam. Reigning from about 1788 to 1793, the brothers each governed a portion of Vietnam. Nguyen Hue ruled in the north, and in 1788–89 he led a peasant army to victory over invading Chinese forces.

Although the brothers initiated some reforms, they failed to attack the basic evils of the landownership system, and their following became disillusioned and drifted away. Nguyen Anh (later Emperor Gia Long; *q.v.*), the last surviving member of the Nguyen dynasty (*q.v.*), defeated the brothers successively in 1792–93. By 1802, with the help of French armaments, Gia Long had eliminated the descendants of the Tay Sons.

**Tayacian industry,** primitive flake-tool tradition of France and Israel, believed to be essentially a smaller edition of the Clactonian industry (*q.v.*).

**Tayama Katai,** original name TAYAMA ROKUYA (b. Jan. 22, 1872, Tatebayashi, Japan—d. May 13, 1930, Tokyo), novelist who was a central figure in the development of the Japanese naturalist school of writing.

Tayama's early work was highly romantic, but with the essay "Rokotsu naru byōsha" (1904; "Straightforward Description") he pointed the way toward the more realistic path he was to follow under French influence. The injunction to observe strict objectivity and to describe things as they are, deriving from the early French naturalists Guy de Maupassant and the brothers Edmond and Jules Goncourt, developed into a major genre in Japanese literature—the *watakushi-shōsetsu,* or "autobiographical novel." *Futon* (1907; "The Quilt") made his reputation; it described in embarrassing detail the attraction of a middle-aged writer (the author) to a young female student. A trilogy of autobiographical novels, *Sei* (1908; "Life"), *Tsuma* (1908–09; "Wives"), and *En* (1910; "The Bond"), fixed the distinguishing form of Japanese naturalism. *Inaka kyōshi* (1909; "A Country Schoolmaster") showed the influence of the Goncourts and of Gustave Flaubert's *Madame Bovary.* Tayama's essay on his own literary theories, "Katai bunwa" (1911; "Katai's Literary Discourses"), introduced into the critical language the term *heimen byōsha* ("plain description"), with which he is identified. In later years, with the decline in the influence of naturalism, he entered a period of personal confusion from which he emerged with a calm, almost religious attitude, which was reflected in *Zansetsu* (1918; "Lingering Snow").

**Tayif** (Saudi Arabia): *see* Ṭā'if, aṭ-.

**Taylor, A.J.P.,** in full ALAN JOHN PERCIVALE TAYLOR (b. March 25, 1906, Birkdale, Lancashire, Eng.—d. Sept. 7, 1990, London), British historian and journalist noted for his lectures on history and for his prose style.

Taylor attended Oriel College, Oxford, graduating with first-class honours in 1927. In 1931 he began writing reviews and essays for the *Manchester Guardian* (later *The Guardian*). He continued his studies in history, and in 1934 his first book, *The Italian Problem in European Diplomacy 1847–1849,* was published. A second book on diplomacy, *Germany's First Bid for Colonies 1884–1885: A Move in Bismarck's European Policy,* appeared in 1938. Taylor was a tutor in modern history at Magdalen College, Oxford, from 1938 to 1963 and a research fellow there until 1976. He became a panel member of a BBC-TV news analysis program in 1950 and made regular television appearances thereafter. He was also popular as a journalist and lecturer.

Though often sparking controversy with his unorthodox views, Taylor nonetheless maintained high standards of scholarship. Among his more than 30 publications are *The Struggle for Mastery in Europe 1848–1918* (1954; published as volume 1 of *The Oxford History of Modern Europe*) and *English History 1914–1945* (1965). His most widely read and controversial book was *The Origins of the Second World War* (1961), in which he maintained that the war erupted because Great Britain and France vacillated between policies of appeasement and resistance toward Adolf Hitler. Taylor's autobiography, *A Personal History,* was published in 1983.

**Taylor, Bayard,** in full JAMES BAYARD TAYLOR (b. Jan. 11, 1825, Kennett Square, Pa., U.S.—d. Dec. 19, 1878, Berlin, Ger.), American author known primarily for his lively travel narratives and for his translation of J.W. von Goethe's *Faust.*

A restless student, Taylor was apprenticed to a printer at age 17. In 1844 his first volume of verse, *Ximena,* was published. He then arranged with *The Saturday Evening Post* and the *United States Gazette* to finance a trip abroad in return for publication rights to his travel letters, which were compiled in the extremely popular *Views Afoot* (1846). In 1847 he began a career in journalism in New York. *Eldorado* (1850) recounted his trials as a newspaper correspondent in the 1849 California gold rush. He continued his trips to remote parts of the world—to the Orient, to Africa, to Russia—and became renowned as something of a modern Marco Polo. In 1862 he became secretary of the U.S. legation at St. Petersburg, Russia. Of his works in this later period, the translation of *Faust* (1870–71) remains his best known. His *Poems of the Orient* appeared in 1855.



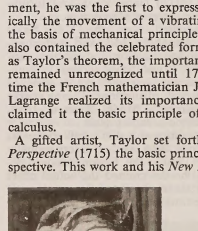
Bayard Taylor, engraving by John Chester Buttre after a photograph
By courtesy of the Library of Congress, Washington, D.C.

**Taylor, Brook** (b. Aug. 18, 1685, Edmonton, Middlesex, Eng.—d. Dec. 29, 1731, London), British mathematician noted for his contributions to the development of calculus.

In 1708 Taylor produced a solution to the problem of the centre of oscillation. The solution went unpublished until 1714, when his claim to priority was disputed by the noted Swiss mathematician Johann Bernoulli.

Taylor's *Methodus incrementorum directa et inversa* (1715; "Direct and Indirect Methods of Incrementation") added to higher mathematics a new branch now called the calculus of finite differences. Using this new development, he was the first to express mathematically the movement of a vibrating string on the basis of mechanical principles. *Methodus* also contained the celebrated formula known as Taylor's theorem, the importance of which remained unrecognized until 1772. At that time the French mathematician Joseph-Louis Lagrange realized its importance and proclaimed it the basic principle of differential calculus.

A gifted artist, Taylor set forth in *Linear Perspective* (1715) the basic principles of perspective. This work and his *New Principles of*



Brook Taylor, detail of a gouache miniature by Joseph Goupy, in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

*Linear Perspective* contained the first general treatment of the principle of vanishing points. Taylor was elected a fellow of the Royal Society of London in 1712 and in that same year sat on the committee for adjudicating Sir Isaac Newton's and Gottfried Wilhelm Leibniz's conflicting claims of priority in the invention of calculus.

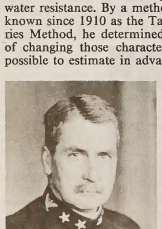
**Taylor, Cecil,** in full CECIL PERCIVAL TAYLOR (b. March 15, 1933, New York, N.Y., U.S.), American jazz musician and composer, the leading free-jazz pianist.

Taylor attended the New York College of Music and the New England Conservatory of Music but was influenced more decisively by the music of Duke Ellington, Thelonious Monk, and Horace Silver. By the mid-1950s he was leading his own small groups. From his first recording (1956) Taylor was known as an uncompromising musical radical. He received high critical acclaim, but the audience for his complex and demanding music proved small. His career gradually began to gather momentum, however, and from 1973 he toured and recorded regularly, either as a solo pianist or with his own small group.

Like Ornette Coleman, who initially overshadowed him, Taylor was one of the first musicians to free jazz improvisation from fixed harmonic structures. Influenced by both classical music and jazz, Taylor became a virtuoso pianist with a unique range of dynamics, attacks, and harmonic resources, including many tone clusters played for percussive, not harmonic, effect. His mastery of improvised form was unprecedented in jazz; he used an extensive repertoire of devices to develop simple material into dense, complex, extended, but structurally unified works. His repertoire consisted of original works, some composed of broken materials in successions of unrelated tempos. In the late 1960s he worked most often with violently fast tempos and long improvisations, and in his later work he steadily expanded his emotional range.

**Taylor, David Watson** (b. March 4, 1864, Louisa county, Va., U.S.—d. July 28, 1940, Washington, D.C.), American marine architect who built the first ship-model testing establishment in the United States at the Washington (D.C.) Navy Yard, and formulated basic principles of ship design.

Taylor graduated from the U.S. Naval Academy in Annapolis, Md., and studied advanced naval construction and marine engineering at the Royal Naval College, Greenwich, Eng., earning the highest grades achieved until then at both institutions. Taking charge of the Experimental Model Basin in 1899, Taylor undertook experiments to discover what characteristics of a ship's hull govern its water resistance. By a method internationally known since 1910 as the Taylor Standard Series Method, he determined the actual effect of changing those characteristics, making it possible to estimate in advance the resistance of a ship of given proportions. His *Speed and Power of Ships* (1910), setting forth this knowledge, is still informative.



David Watson Taylor
By courtesy of the U.S. Navy

In 1917 Taylor became a rear admiral and from 1914 to 1922 was responsible for the design and construction of ships, submarines, and aircraft for the U.S. Navy, including the NC-4, first plane to fly the Atlantic (1919).

**Taylor, Edward** (b. 1645?, in or near Coventry, Warwickshire, Eng.—d. June 24, 1729, Westfield, Mass. [U.S.]), one of the foremost poets in colonial British North America.

Unwilling to subscribe to the required oath of conformity because of his staunch adherence to Congregational principles, Taylor gave up schoolteaching in England, emigrated to New England, and was immediately admitted as a sophomore by the president of Harvard College, Increase Mather. After his graduation in 1671, he became minister in the frontier village of Westfield, Mass., where he remained until his death. He married twice and became the father of 13 children, most of whom he outlived.

Taylor's 400-page quarto manuscript, *Poetical Works,* was not published by his heirs at Taylor's request. It came into the possession of Yale University in 1883 by the gift of a descendant, and the best of his verse was published in 1939. The important poems fall into two broad divisions. "God's Determinations Touching His Elect" is an extended verse sequence thematically setting forth the grace and majesty of God as a drama of sin and redemption. The "Sacramental Meditations," about 200 in number, were described by Taylor as "Preparatory Meditations Before My Approach to the Lord's Supper."

Central to all his poems is the typical Metaphysical mode: the extravagant figure of speech and the association of image and idea intended by its tension to strike poetic sparks. *The Poetical Works of Edward Taylor* (1939), edited by T.H. Johnson, is a selection of poems, a biographical sketch, critical introduction, and notes. *The Poems of Edward Taylor* (1960), edited by Donald E. Stanford, is a comprehensive edition, including the complete text of the "Meditations."

**Taylor, Elizabeth,** in full ELIZABETH ROSEMOND TAYLOR (b. Feb. 27, 1932, London, Eng.), American motion-picture actress.

Taylor's American parents were residing in England at the time of her birth. With the outbreak of World War II her parents returned to the United States, settling in Los Angeles. Her beauty brought her to the attention of a talent scout, and in 1942 she made her first film, *There's One Born Every Minute.* This was closely followed by *Lassie Come Home* (1943) and a role as the girl heroine in *National Velvet* (1944) that made her a star.

Taylor made a smooth transition from juvenile to adult roles in the films *Life With Father* (1947), *Father of the Bride (1950*), and *An American Tragedy* (1951). After appearing in *The Last Time I Saw Paris* (1954), *Giant* (1956), and *Raintree County* (1957), she gave compelling performances in film adaptations of Tennessee Williams' *Cat on a Hot Tin Roof* (1958) and *Suddenly Last Summer* (1959). Her mature screen persona was that of a glamorously beautiful, passionate woman who is easily carried away by emotions of love and anger.

Taylor won an Academy Award for her performance as a New York call girl in *Butterfield 8* (1960). She met and fell in love with the British actor Richard Burton while they were filming *Cleopatra* (1963), and she won a second Academy Award for her performance opposite him in *Who's Afraid of Virginia Woolf?* (1966), directed by Mike Nichols from the play by Edward Albee. She costarred with Burton again in a film adaptation of Shakespeare's *The Taming of the Shrew* (1967), and they made five more films together. After the mid-1970s, however, she appeared only intermittently in films, Broadway plays, and television films.

Taylor's personal life was exceptionally well publicized and tended to overshadow her career on-screen. Among her eight marriages were those to the film producer Michael Todd, the singer Eddie Fisher, the U.S. senator John Warner and two to Richard Burton (1964–74, 1975–76).

**Taylor, Frederick W.,** in full FREDERICK WINSLOW TAYLOR (b. March 20, 1856, Philadelphia, Pa., U.S.—d. March 21, 1915, Philadelphia), American inventor and engineer who is known as the father of scientific management. His system of industrial management has influenced the development of virtually every country enjoying the benefits of modern industry.

Taylor was the son of a lawyer. He entered Phillips Exeter Academy in New Hampshire in 1872, where he led his class scholastically. After passing the entrance examination for Harvard, he was forced to abandon plans for matriculation, as his eyesight had deteriorated from night study. With sight restored in 1875, he was apprenticed to learn the trades of patternmaker and machinist at the Enterprise Hydraulic Works in Philadelphia.

Three years later he went to the Midvale Steel Company, where, starting as a machine shop labourer, he became successively shop clerk, machinist, gang boss, foreman, maintenance foreman, head of the drawing office, and chief engineer.

In 1881, at 25, he introduced time study at the Midvale plant. The profession of time study was founded on the success of this project, which also formed the basis of Taylor's subsequent theories of management science. Essentially, Taylor suggested that production efficiency in a shop or factory could be greatly enhanced by close observation of the individual worker and elimination of waste time and motion in his operation. Though the Taylor system provoked resentment and opposition from labour when carried to extremes, its value in rationalizing production was indisputable and its impact on the development of mass-production techniques immense.



Frederick W. Taylor
By courtesy of the Smithsonian Institution, Washington, D.C.

Studying at night, Taylor earned a degree in mechanical engineering from Stevens Institute of Technology in 1883. The following year he became chief engineer at Midvale and completed the design and construction of a novel machine shop. Taylor might have enjoyed a brilliant full-time career as an inventor—he had more than 40 patents to his credit—but his interest in what was soon called scientific management led him to resign his post at Midvale and to become general manager of the Manufacturing Investment Company (1890–93), which in turn led him to develop a "new profession, that of consulting engineer in management." He served a long list of prominent firms ending with the Bethlehem Steel Corporation; while at Bethlehem,

he developed high-speed steel and performed notable experiments in shoveling and pig-iron handling.

Taylor retired at age 45 but continued to devote time and money to promote the principles of scientific management through lectures at universities and professional societies. From 1904 to 1914, with his wife and three adopted children, Taylor lived in Philadelphia. The American Society of Mechanical Engineers elected him president in 1906, the same year that he was awarded an honorary doctor of science degree by the University of Pennsylvania. Many of his influential publications first appeared in the *Transactions* of that society, namely, "Notes on Belting" (1894); "A Piece-rate System" (1895); "Shop Management" (1903); and "On the Art of Cutting Metals" (1906). *The Principles of Scientific Management* was published commercially in 1911.

Taylor's fame increased after his testimony in 1912 at the hearings before a special committee of the House of Representatives to investigate his own and other systems of shop management. Considering himself a reformer, he continued expounding the ideals and principles of his system of management until his death. (J.F.Me.)

BIBLIOGRAPHY. Frank Barkley Copley, *Frederick W. Taylor: Father of Scientific Management,* 2 vol. (1923, reprinted 1969), is a comprehensive, historical portrayal. Sudhir Kakar, *Frederick Taylor* (1970), is a personality study.

**Taylor, Jeremy** (baptized Aug. 15, 1613, Cambridge, Cambridgeshire, Eng.—d. Aug. 13, 1667, Lisburn, County Antrim, Ire.), Anglican clergyman and writer.

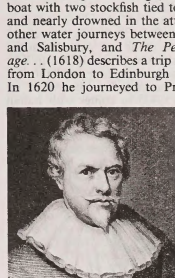
Taylor was educated at the University of Cambridge and was ordained in 1633. He never lacked for patrons: Archbishop Laud granted him a fellowship to All Souls College, Oxford, in 1635; William Juxon, bishop of London, presented him the living of Uppingham in 1638; and Charles I, whom he had joined at Oxford in the Civil War by 1642, made him doctor of divinity by royal decree in 1643. After his capture in Wales in 1645, Taylor set up a school with the grammarian William Nicholson in Carmarthenshire.

By 1655 he had written his enduring works: *The Rule and Exercises of Holy Living* (1650) and *The Rule and Exercises of Holy Dying* (1651). These devotional handbooks were written to help members of the Church of England who were deprived of a regular ministry during the disturbances of the Commonwealth. The books' beauty and spiritual insight made them popular with all denominations, however, and their influence extended to the 18th-century Methodist John Wesley.

A spiritual counselor to the diarist John Evelyn, Taylor was helped by him with gifts of money. He ministered to scattered congregations of Anglican royalists, and in 1658 became a chaplain of Edward, 3rd Viscount Conway, in Ulster. Made bishop of Down and Connor after the Restoration in 1660, he also served on the Irish privy council and helped reconstitute the University of Dublin. He repulsed Scottish efforts to fill Ulster livings with anti-episcopal ministers.

**Taylor, John** (b. Aug. 24, 1580, Gloucester, Gloucestershire, Eng.—d. December 1653, London), minor English poet, pamphleteer, and journalist who called himself "the Water Poet."

Taylor was sent to a grammar school but became, as he said, "mired in Latin accidence" and was apprenticed to a Thames boatman. He served in the navy and saw action at Cádiz (1596) and Flores (1597). Returning to London, he worked as a waterman transporting passengers up and down the River Thames and also held a semiofficial post at the Tower of London for several years. Taylor won fame by making a series of whimsical journeys that he described in lively, rollicking verse and prose published in oddly titled pamphlets. For example, he journeyed from London to Queenborough, Kent, in a paper boat with two stockfish tied to canes for oars, and nearly drowned in the attempt. He made other water journeys between London, York, and Salisbury, and *The Pennyles Pilgrimage. . .* (1618) describes a trip he made on foot from London to Edinburgh without money. In 1620 he journeyed to Prague, where he



John Taylor, engraving by E. Scriven after a portrait by an unknown artist
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

was entertained by the queen of Bohemia. His humorous accounts of his journeys won the patronage of Ben Jonson, among others. Taylor also amused the court and the public in his verbal battles with another eccentric traveler, Thomas Coryate.

When the English Civil Wars began Taylor moved to Oxford, where he wrote royalist pamphlets. After the city surrendered (1645), he returned to London and kept a public house, "The Crown" (later "The Poet's Head"), until his death.

**Taylor, John,** byname JOHN TAYLOR OF CAROLINE (b. Dec. 19?, 1753, Caroline county, Virginia—d. Aug. 21, 1824, Caroline county, Va., U.S.), one of the leading American philosophers of the liberal agrarian political movement—commonly known as Jeffersonian democracy—during the early national period.

Orphaned as a child, Taylor grew up in the home of his uncle, Edmund Pendleton. He received his education from private tutors, a private academy, and the College of William and Mary. Early in the 1770s he began studying law in Pendleton's office, and in 1774 Taylor received his license to practice.

At the outbreak of the American Revolution, Taylor joined the Continental Army. He served until resigning in 1779, after which he fought with the Virginia militia. Elected in 1779 to the Virginia House of Delegates, Taylor emerged as a leader in the movement for religious disestablishment, broader voting rights, and more equitable representation. He served in the House of Delegates from 1779 to 1781 and again from 1783 to 1785.

Taylor was dismayed at the prospect of a strong central government and opposed the ratification of the Constitution. From 1796 to 1800, he was again in the Virginia House of Delegates after filling an unexpired U.S. Senate term from 1792 to 1794. It was while in the Virginia legislature in 1798 that he introduced James Madison's Virginia and Kentucky Resolutions, the states' rights document drawn up in reaction to the passage of the Alien and Sedition Acts. Taylor was a vigorous backer of President Thomas Jefferson. He again filled an unexpired Senate term in 1803.

Except for filling yet another unexpired Senate term, from 1822 to 1824, Taylor devoted the remainder of his life to political writing. *An Inquiry into the Principles and Policy of the Government of the United States* (1814) and *Construction Construed and Constitutions Vindicated* (1820) were highly prolix works but important as defenses of agrarian democracy against the assaults of a too-powerful central government and the monied mercantile classes. Taylor attacked the notion that the Supreme Court could negate state actions and that Congress could restrict the expansion of slavery into the territories.

Taylor's other writings dealt with his experiments in scientific agriculture, and in 1813 he published a collection of his essays under the title *The Arator*. He always thought of himself as a farmer, and he spent most of his life on his plantation—"Hazelwood"—in Caroline county.

**Taylor, John Henry** (b. March 19, 1871—d. Feb. 10, 1963, Northam, Devonshire, Eng.), British professional golfer, a member of the "Great Triumvirate" (with Harry Vardon and James Braid) that won the British Open 16 times between 1894 and 1914, Taylor winning in 1894, 1895, 1900, 1909, and 1913. He was the first English professional to win the Open, which from 1860 through 1893 had been dominated by Scottish golfers.

In 1901 Taylor helped to found the British Professional Golfers' Association and was chosen its first chairman. He retired in 1946 after 47 years as a club professional and subsequently lived in a cottage close to the Royal North Devon course. Taylor also was successful as a manufacturer of golf equipment and as an author on the sport.

**Taylor, Joseph** (b. 1586?, England—d. Nov. 4, 1652, London), English actor mentioned in the First Folio of Shakespeare in 1623 as one of the 26 who took principal parts in all of those plays and one of the 10 actors who signed the dedication of the first folio (1647) of Beaumont and Fletcher.

Taylor acted with the Duke of York's Men in 1610 but left it the next year to join Lady Elizabeth's Men, playing in *The Honest Man's Fortune* (1613), in Beaumont and Fletcher's *Coxcombe* (1613), and as a principal in Ben Jonson's *Bartholomew Fair* (1614). From 1616 to 1619 he was with the Prince's Men, and until his retirement in 1642 he was one of the most prominent members of the King's Men and a leader in the management of that company. He succeeded Richard Burbage as principal actor, playing several of his parts, including Ferdinand in John Webster's *Duchess of Malfi* (1619–20) and the title role in *Hamlet.* There is a legend that Taylor was trained by Shakespeare to play Hamlet, but more likely Shakespeare taught Burbage, who in turn instructed Taylor. He also appeared in Jonson's *Alchemist, Volpone* (as Mosca), and *Epicoene;* Philip Massinger's *Believe as You List;* and Fletcher's *Wild-Goose Chase.* He also owned two shares of the Globe Theatre and one of the Blackfriars.

**Taylor, Joseph H., Jr.,** in full JOSEPH HOOTON TAYLOR, JR. (b. March 24, 1941, Philadelphia, Pa., U.S.), American radio astronomer and physicist who, with Russell A. Hulse, was the corecipient of the 1993 Nobel Prize for Physics for their joint discovery of the first binary pulsar.

Taylor studied at Haverford College, Pa. (B.A., 1963), and earned a Ph.D. in astronomy at Harvard University in 1968. He taught at the University of Massachusetts, Amherst, from 1969 to 1981 and then joined the faculty at Princeton University, where he became the James S. McDonnell professor of physics in 1986.

Taylor and Hulse conducted their prizewinning research on pulsars while Taylor was a

professor at Amherst and Hulse was his graduate student. In 1974, using the large radio telescope at Arecibo, Puerto Rico, they discovered a pulsar (a rapidly spinning neutron star) emitting radio pulses at intervals that varied in a regular pattern, decreasing and increasing over an eight-hour period. They concluded from these signals that the pulsar must be alternately moving toward and away from the Earth—*i.e.*, that it must be orbiting around a companion star, which the two men deduced was also a neutron star.

Their discovery of the first binary pulsar, PSR 1913 + 16, provided an unprecedented test of Albert Einstein's theory of gravitation, which, according to the general theory of relativity, predicts that objects accelerated in a strong gravitational field will emit radiation in the form of gravitational waves. With its enormous interacting gravitational fields, the binary pulsar should emit such waves, and the resulting energy drain should reduce the orbital distance between the two stars. This could in turn be measured by a slight, gradual reduction in the timing of the pulsar's distinctive radio emissions.

Taylor and Hulse timed PSR 1913 + 16's pulses over the next few years and showed that the two stars are indeed rotating ever faster around each other in an increasingly tight orbit, with an annual decrease of about 75 millionths of a second in their eight-hour orbital period. The rate at which the two stars are spiraling closer together was found to agree with the prediction of the theory of general relativity to an accuracy of better than 0.5 percent. This finding, reported in 1978, provided the first experimental evidence for the existence of gravitational waves and gave powerful support to Einstein's theory of gravity. In the following years, Taylor continued making careful measurements of the orbital period of PSR 1913 + 16, and his research group went on to discover several other binary pulsars.

**Taylor, Laurette,** *née* LORETTA COONEY (b. April 1, 1884, New York, N.Y., U.S.—d. Dec. 7, 1946, New York City), American actress whose stage career spanned more than 30 years.

Under the name La Belle Laurette, Taylor made her childhood stage debut in Lynn, Mass. Her first significant work was in a 1903 Boston production of *The Child Wife,* a play that was written for her by her first husband, Charles A. Taylor. She made her New York City debut later that year as Flossie Cooper in *From Rags to Riches.* Her first real success came in the role of Rose Lane in *Alias Jimmy Valentine* (1910), followed by the part of Luana in *The Bird of Paradise* (1912). In 1912 she married the dramatist J. Hartley Manners and won acclaim in the title role in his play *Peg O' My Heart* (1912), which she performed in New York City and other cities. The close working relationship between actress and playwright continued in *Out There* (1917), *Happiness* (1918), and *One Night in Rome* (1919).

In her early career Taylor performed chiefly as a sentimental comedienne. During the 1920s her New York City engagements included the title role in *Sweet Nell of Old Drury* (1923) and Rose in *Trelawny of the Wells* (1925). She appeared in the Chicago production of *The Comedienne* (1927) and returned to Broadway with *The Furies* (1928). Her husband's death in 1928 caused her to leave the theatre for several years, and she performed only occasionally for a decade after that. Eventually, in 1945, she appeared in the role of Amanda in the New York City production of *The Glass Menagerie,* in which her performance won special acclaim.

**Taylor, Maxwell Davenport** (b. Aug. 26, 1901, Keytesville, Mo., U.S.—d. April 19, 1987, Washington, D.C.), U.S. Army officer who became a pioneer in airborne warfare in Europe during World War II.

A 1922 graduate of the U.S. Military Academy at West Point, N.Y., Taylor assisted in the organization of the U.S. Army's first airborne division, the 82nd, early in World War II. At great personal risk, he passed through enemy lines 24 hours before the Allied invasion of Italy (1943) to confer with Italian leaders in Rome. Later he led the 101st Airborne Division in its parachute assaults dur-



Maxwell Taylor, 1962
By courtesy of the U.S. Army

ing the Normandy Invasion and the invasion of The Netherlands, and his division gained wide fame for its defense of Bastogne during the Battle of the Bulge in 1944.

As commanding general of the 8th Army in 1953, Taylor directed United Nations forces in Korea during the closing phases of the Korean War. He then served as Army chief of staff (1955–59), in which post he was an early (and rather isolated) advocate of the strategic doctrine of "flexible response," which emphasized the maintenance of conventional infantry forces as a prudent wartime alternative to the all-out use of nuclear weapons. He was appointed chairman of the Joint Chiefs of Staff in 1962 by President John F. Kennedy, to whom he was a trusted adviser. Two years later he became U.S. ambassador to South Vietnam, which at that time was being given increasing military support by the United States. He resigned that post in July 1965 but served as a special consultant (1965–69) to President Lyndon B. Johnson. Taylor published two volumes on national security: *The Uncertain Trumpet* (1960) and *Precarious Security* (1976).

**Taylor, Myron C.,** in full MYRON CHARLES TAYLOR (b. Jan. 18, 1874, Lyons, N.Y., U.S.—d. May 6, 1959, New York City), American financier and diplomat who was chief executive of the United States Steel Corporation in the 1930s.

Though admitted to the bar in 1895, Taylor spent much of his early career in the textile business, operating mills in New England and elsewhere until 1923. At the behest of J.P. Morgan he became a director of United States Steel, serving as chairman of its finance committee from 1927 to 1934 and as chairman of the board and chief executive officer from 1932 to 1938. The financial reorganization that he implemented helped the corporation to survive the Great Depression. Considered progressive in labour relations, he was the first steel executive to sign a labour contract with the Congress of Industrial Organizations (in 1937). Many smaller steel companies followed U.S. Steel's example, and the nation's steel industry was soon unionized.

After retiring from business in 1938, Taylor was sent by President Franklin D. Roosevelt to a refugee conference in Evian-les-Bains, France, as head of the American delegation. In this capacity he tried to aid the growing numbers of refugees fleeing Nazi Germany. Later he was Roosevelt's special representative to the Vatican, the first to hold such a post since 1867. Though the appointment was criticized by religious leaders as a violation of the separation of church and state, Taylor was reappointed by President Harry S. Truman after World War II. Later he served on other special missions with the rank of ambassador. Active in civic affairs, Taylor donated millions of dollars to humanitarian and cultural institutions, most notably to Cornell University, his alma mater.

**Taylor, Paul (Belville)** (b. July 29, 1930, Wilkinsburg, Pa., U.S.), American modern dancer and choreographer noted for the inventive, frequently humorous, and sardonic dances that he choreographed for his company.

Entering Syracuse University in 1947 on swimming and painting scholarships, Taylor began dance training in 1951. He subsequently studied modern dance with Martha Graham, Doris Humphrey, and José Limón and ballet with Antony Tudor and Margaret Craske. He began his professional career in 1953 with Martha Graham's company, creating such important roles as Aegisthus in *Clytemnestra* (1958), Hercules in *Alcestis* (1960), and Theseus in *Phaedra* (1962). He also performed in works by other modern choreographers, including those of Charles Weidman and Merce Cunningham. He danced a solo created for him by George Balanchine in *Episodes* (1959), a work choreographed by Balanchine and Graham to music by Anton Webern.

As a choreographer Taylor utilized a wide variety of movement styles, some of which he described as "flat" (two-dimensional in appearance), "dance scribbling" (emphasis on action rather than on shape or line), and "lyric" ("long arms"). His avant-garde works range from *Duet* (1957), in which he and his



Paul Taylor and Bettie de Jong in *Scudorama,* 1967
Jack Mitchell

partner remained motionless for four minutes, to *Orbs* (1966), an hour-long composition to Beethoven's last string quartets. Other well-known dances include *Three Epitaphs* (1956), *Aureole* (1962), *Scudorama* (1963), *The Book of Beasts* (1971), *Esplanade* and *Runes* (1975), *Cloven Kingdom* (1976), *Aphrodisiamania* (1977), *Airs* (1978), *Nightshade* (1979), and *Le Sacre du Printemps* (1980). His *Aureole* entered the repertoires of such major ballet troupes as the Paris Opéra Ballet and the Royal Danish Ballet.

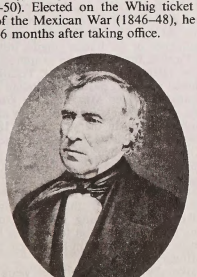
Taylor's company, established in 1954 and usually numbering 13 dancers, first performed in Europe in 1960, toured South America in 1965 under the International Cultural Exchange Program of the U.S. State Department, and in 1978 toured the U.S.S.R. and appeared

on the U.S. public-television network. Taylor also choreographed for the Spoleto (Italy) Festival of Two Worlds and won several prestigious awards. He withdrew from performing in the 1970s.

**Taylor, Richard E(dward)** (b. Nov. 2, 1929, Medicine Hat, Alta., Can.), Canadian physicist who in 1990 shared the Nobel Prize for Physics with Americans Jerome Friedman and Henry Kendall for his collaboration in proving the existence of quarks, now generally accepted as being among the basic building blocks of matter.

Taylor attended the University of Alberta, where he received his bachelor's degree (1950) and his master's degree (1952). He received his doctorate from Stanford University in 1962. He worked for a year at the University of California's Lawrence Berkeley Laboratory, and from 1962 to 1968 he was a staff member at the Stanford Linear Accelerator Center. While there, he and Friedman and Kendall conducted the series of experiments that confirmed the hypothesis that protons and neutrons are made up of quarks. This discovery was crucial to the formulation of the currently accepted theoretical description of matter and its interactions, known as the standard model. Taylor became an associate professor at Stanford in 1968 and a full professor in 1970.

**Taylor, Zachary** (b. Nov. 24, 1784, Montebello, Va., U.S.—d. July 9, 1850, Washington, D.C.), 12th president of the United States (1849–50). Elected on the Whig ticket as a hero of the Mexican War (1846–48), he died only 16 months after taking office.



Zachary Taylor, daguerreotype by Mathew B. Brady
By courtesy of the Library of Congress, Washington, D.C.

After spending his boyhood on the Kentucky frontier, Taylor enlisted in the army in 1806 and was commissioned first lieutenant in the infantry in 1808. He served in the army almost continuously thereafter, advancing to the rank of major general (1846). He commanded troops in the field in the War of 1812, the Black Hawk War (1832), and the Second Seminole War in Florida (1835–42), in which he won promotion to the rank of brigadier general for his leadership in the Battle of Lake Okeechobee (1837). In 1840 he was assigned to a post in Louisiana and established his home in Baton Rouge.

Soon after the annexation of Texas (1845), President James K. Polk ordered Taylor with an army of 4,000 men to the Rio Grande, opposite the Mexican city of Matamoros. A detachment of Mexican troops crossed the Rio Grande and engaged Taylor's forces in a skirmish (April 25, 1846). Two weeks later Mexican troops again crossed the river to challenge Taylor, whose forces decisively defeated the invaders on two successive days in the battles of Palo Alto and Resaca de la Palma (May 8 and 9). On May 13 the United States formally declared war on Mexico. Taylor then led his troops across the Rio Grande and advanced toward Monterrey, capturing it (September 22–23) and granting the Mexican army an eight-week armistice, an action that displeased Polk. Taylor further alienated Polk by writing a letter, which found its way into the press, criticizing Polk and his secretary of war, William L. Marcy. Polk then ordered Taylor to confine his actions to those necessary for defensive purposes and transferred Taylor's best troops to the army of General Winfield Scott. The following February, however, Taylor disobeyed these orders and with his diminished force marched south to the vicinity of Buena Vista, where he won a brilliant victory over a Mexican army that outnumbered his troops by about four to one.

Having thus won the north of Mexico, Taylor emerged as a hero and began to be seen by Whig politicians as a presidential possibility. At their convention in 1848 Taylor gained the nomination on the fourth ballot. He then went on to defeat the Democratic candidate, Lewis Cass, in the general election.

Taylor's brief administration was beset with problems. The most perplexing was the controversy over the status of the newly acquired Mexican territories. Taylor advocated statehood for California and New Mexico, but he encountered resistance by Southerners in Congress who opposed the admission of California as a free state. A further problem was the revelation in mid-1850 of improprieties on the part of three members of his Cabinet. Deeply humiliated, Taylor, who prided himself on honesty, determined to reorganize his Cabinet, but before he could do so, he died. He was succeeded by Millard Fillmore.

BIBLIOGRAPHY. Brainerd Dyer, *Zachary Taylor* (1946, reissued 1967); Holman Hamilton, *Zachary Taylor,* 2 vol. (1941–51, reprinted 1989); and K. Jack Bauer, *Zachary Taylor: Soldier, Planter, Statesman of the Old Southwest* (1985).

**Taymyr,** also spelled TAIMYR, or TAJMYR, formerly DOLGANONENETS autonomous *okrug* (district), Krasnoyarsk *kray* (region), northeastern central Russia. It has an area of 332,850 square miles (862,100 square km) on the hilly Taymyr Peninsula, the most northerly part of the Eurasian continent, and extends south to the northern edge of the Central Siberian Plateau. The *okrug* includes the Severnaya Zemlya archipelago in the high Arctic. The climate is exceptionally severe, with prolonged, bitter winters. Almost everywhere is a tundra of mosses, lichens, and bog. The harsh conditions and remoteness are faced by only a very small population, composed mainly of Russians, Dolgans, Nenets, Ukrainians, and Nganasans. Reindeer herding, hunting, fishing, and fur farming are their principal economic activities. The *okrug* has two urban settlements—Dudinka, the capital, and Dikson, a small port at the mouth of the Gulf of Yenisey. Nordvik, on the Gulf of Khatanga, where salt is obtained, is a main port. Pop. (1990 est.) 55,000.

**Taymyr Peninsula,** also spelled TAIMYR, or TAJMYR, Russian TAYMYRSKY POLUOSTROV, northernmost extension of the Eurasian landmass, in north-central Siberia in Krasnoyarsk *kray* (region), northeastern central Russia. The northernmost point of the peninsula is Cape Chelyuskin, north of which lie Vilkitsky Strait and Severnaya Zemlya. To the west of the peninsula lie the Kara Sea and the Gulf of Yenisey; to the east lie the Laptev Sea and the Gulf of Khatanga. The peninsula occupies an area of approximately 150,000 square miles (400,000 square km). In the centre lie the Byrranga Mountains, reaching a height of 1,650–3,800 feet (500–1,150 m). To the north and south of these stretch tundra-covered lowlands.

**tayra,** also spelled TAIRA (species *Eira* [formerly *Galera,* or *Tayra*] *barbara*), forest-dwelling, weaselike carnivore, family Mustelidae, that ranges from southern Mexico southward throughout Central and South America. It is a slender, short-legged animal about 60–68 cm (24–26 inches) long, plus a tail 39–47 cm (15–18 inches) long. It has coarse, dark brown or black fur, commonly paler on the head and neck and often marked with a



Tayra (*Eira barbara*)
Drawing by H. Douglas Pratt

light chest spot. The head is relatively flat, with small, rounded ears. Active both day and night, the tayra feeds on various animals, fruit, and honey. A typical litter is believed to contain three or four young. Tayras are sometimes tamed as pets.

**Taysafun** (ancient city, Parthia): *see* Ctesiphon.

**Tayside,** region of north-central and eastern Scotland, created by the administrative reorganization of 1975, with an area of about 2,900 square miles (7,510 square km). It includes the former counties of Angus, city of Dundee, Kinross, and most of Perth and is divided into the districts of Angus, City of Dundee, and Perth and Kinross. Pop. (1989 est.) 392,500.

*To make the best use of the Britannica, consult the* INDEX *first*

**Taza,** city, north-central Morocco. Located south of the Er-Rif Mountains, the city is composed of two formerly separate towns built on separate terraces overlooking a mountain valley. The old town (medina) is at an elevation of 1,919 feet (585 m) above sea level and is surrounded by fortifications; the newer town, established by the French in 1920, is located in a fertile plain at an elevation of 1,460 feet (445 m). Fossil remains are evidence that caves in the area were inhabited as early as the Paleolithic Period. The city is located in a mountain pass known as the Taza Gap, through which successive waves of invaders moved westward onto the Atlantic coastal plains of northwestern Africa. Taza was founded by Meknassa Berbers (about the time of the late 7th century Arab [Muslim] conquest), who gave alliance to the Idrīsids in 790 and later joined with the Fāṭimids of Al-Qayrawān. The Almoravids took over Taza in 1074 and were replaced by the Almohads in 1132. In 1248 it was captured by the Marīnids. Although Taza barred the route of Turks from Algiers seeking conquest in what is now Morocco, it fell to the French in 1914. The medina houses barbican monuments, mosques, and a 14th-century madrasah (school). Pop. (1982) 77,216.

**tazia,** Arabic TA'ZIYAH ("condolence"), among Shī'ite Muslims, the commemoration

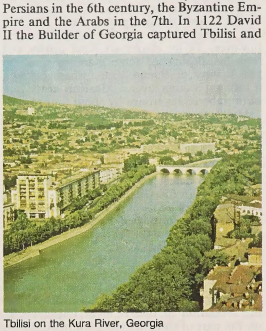
of the martyrdom of Ḥusayn (*see* Ḥusayn ibn ʿAlī, al-), the grandson of the Prophet Muḥammad and the son of ʿAlī ibn Abī Ṭālib, on the battlefield of Karbalāʾ, in southern Iraq, in the year AD 680. The commemoration ceremonies take place during the first 10 days of the Muslim month of Muḥarram and have their climax on the 10th day, or ʿĀshūrāʾ, which is the anniversary of Ḥusayn's death. In its most general sense the word tazia refers to all of the ceremonies that take place during this time. They may include gatherings at which the story of Ḥusayn is recited by professional reciters or preachers (*rawḍah khān*) and which produce a great emotional response of grief in the audience. They may also involve processions in which large numbers of men flagellate themselves with chains, beat their chests, or inflict wounds on themselves while chanting the names of ʿAlī and Ḥusayn, who are the first and third imams in the line recognized by the Twelver Shīʿites. Participants in these processions are often overcome by ecstasy and require the assistance of their fellows. The processions also display symbols of the martyred imam, particularly on the ʿĀshūrāʾ day: his white horse with a bloody cloth on the saddle, his banner, and a representation of his hand (which was severed in the battle) carried on a long pole. In the Indian subcontinent and sometimes elsewhere, the processions are marked by the presence of models of Ḥusayn's tomb in Karbalāʾ, often made with great skill and elaborately and richly decorated with gold and silver foil. The Indian Shīʿites carry these models to the sea or to some other body of water and throw them in, a practice that suggests a parallel with the Hindu treatment of the image of the goddess Kali. In other places the models are carried to the cemetery. Such a model is sometimes called a tazia, especially in India. Local practices differ widely. In the past the ʿĀshūrāʾ processions have often served to mobilize opposition or protest against the government in power; they have also been the occasion for violence between Sunnite and Shīʿite Muslims. In consequence, governments have sought to control and restrict them.

In Iran tazia refers to the passion play in which the life and martyrdom of Ḥusayn are reenacted. These plays are performed on a stage erected especially for the purpose in some public place, and they are often sponsored by a wealthy person as an act of piety. In addition to the actors who play the various parts, there is again a *rawḍah khān* to narrate portions of the story and to express lamentations. The central messages of the tazia are impressed on the audience by constant repetition: the oppression of a just man by tyrannical rulers who usurped his rights, the suffering of Ḥusayn and his family, and the glory of martyrdom. In the more elaborate tazias, there may be a large number of scenes. The central elements, however, are the death of Ḥusayn, the marriage of Ḥusayn's daughter to the soon-to-be-killed son of his brother Ḥasan, and the procession that transports the severed head of Ḥusayn to the caliph, Yazīd I. These plays evoke great outpourings of grief on the part of actors and audience alike.

There has been a difference among scholars over whether or not the tazia indicates a redemptive role for Ḥusayn as the vicarious sacrifice for the sins of his followers. While the Shīʿites believe his sacrifice to have saved true Islām, the basic themes of the tazia performance are the evils of tyranny and injustice and the eventual victory of the imams in overcoming them.

**TB:** *see* tuberculosis.

**Tbilisi,** formerly TIFLIS, capital of the republic of Georgia, on the Kura (Mtkvari) River at its dissection of the Trialeti and Kartliysky (Kartli, or Kartalinian) ranges. Founded in AD 458 (in some sources, 455), when the capital of the Georgian kingdom was transferred there from Mtskheta, the city had a strategic position, controlling the route between western and eastern Transcaucasia. It was often captured and sacked and knew many masters: the Persians in the 6th century, the Byzantine Empire and the Arabs in the 7th. In 1122 David II the Builder of Georgia captured Tbilisi and



Tbilisi on the Kura River, Georgia
Art Resource—EB Inc.

restored it as a capital; but in 1234 it fell to the Mongols and in 1386 it was sacked by Timur. The Turks captured the city on several occasions, and in 1795 it was burned to the ground by the Persians. Finally in 1801 Tbilisi was captured by the Russians, who improved its communications by building the Georgian Military Highway across the Great Caucasus from Vladikavkaz to Tbilisi. In 1872 it was linked by rail to Poti on the Black Sea and in 1883 to Baku on the Caspian Sea. In 1921 it was made capital of the Georgian republic.

Modern Tbilisi is an attractive city: the Kura, bordered on the right bank by a boulevard, lies partly in a steep gorge and is made broader by the Ortachalskaya hydroelectric plant in the city. Beside the river, the old town, with narrow, winding streets, is dominated by the ruins of the old fortress and the huge, symbolic figure of Georgia on a ridge above it. In the old town are the Sioni Cathedral, dating from the 5th century and often reconstructed, the Metekhi Palace of the Georgian kings, and the 6th-century Anchikhati Church. Newer parts of the city lie beneath Mount Mtatsminda, accessible by a funicular rail line. North of the city is a large reservoir fed by irrigation canals.

Tbilisi is a major cultural and educational centre, with a university, several other institutions of higher education, and more than 100 research establishments. The city is a principal industrial centre of the region. Its engineering services are important in the production of electric locomotives, machine tools, agricultural machinery, and electrical equipment and in the repair of locomotives and rolling stock. Other industries make textiles, leather goods and footwear, furniture, beer, wine, and spirits, and a range of foodstuffs. In 1966 an underground railway was opened in Tbilisi. Pop. (1998 est.) 1,398,968.

**TCA cycle:** *see* tricarboxylic acid cycle.

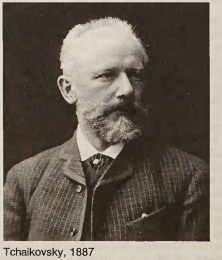
**Tchaikovsky, Peter Ilich,** anglicized form of PYOTR ILYICH TCHAIKOVSKY, Tchaikovsky also spelled CHAIKOVSKY, CHAIKOVSKII, or TSCHAIKOWSKY (b. April 25 [May 7, New Style], 1840, Votkinsk, Russia—d. Oct. 25 [Nov. 6], 1893, St. Petersburg), the most popular Russian composer of all time. His music has always had great appeal for the general public by virtue of its tuneful, open-hearted melodies, impressive harmonies, and colourful orchestration, all of which evoke a profound emotional response. He wrote 7 symphonies, 11 operas, 3 ballets, 5 suites, 3 piano concertos, a violin concerto, 11 overtures, 4 cantatas, 20 choral works, 3 string quartets, a string sextet, and more than 100 songs and piano pieces.

*Early years.* Tchaikovsky was the second of six surviving children of Ilya Tchaikovsky, a manager of the Kamsko-Votkinsk metal works, and Alexandra Assier, a descendant of French émigrés. He manifested a clear interest in music from childhood. At age four he made his first recorded attempt at composition, a song written with his younger sister Alexandra. In 1845 he began taking piano lessons with a local tutor, through which he became familiar with Frédéric Chopin's mazurkas and the piano pieces of Friedrich Kalkbrenner. Since music education was not available in Russian institutions at that time, Tchaikovsky's parents had not considered that their son might pursue a musical career. Instead, they prepared the high-strung and sensitive boy for a career in the civil service.

In 1850 Tchaikovsky entered the prestigious Imperial School of Jurisprudence in St. Petersburg, a boys' boarding school, where he spent nine years. He proved a diligent and successful student who was popular among his peers. At the same time Tchaikovsky formed in this all-male environment intense emotional ties with several of his schoolmates.

In 1854 his mother fell victim to cholera and died. During the boy's last years at the school, Tchaikovsky's father finally came to realize his son's vocation and invited the professional teacher Rudolph Kündinger to give him piano lessons. At age 17 Tchaikovsky came under the influence of the Italian singing instructor Luigi Piccioli, the first person to appreciate his musical talents, and thereafter Tchaikovsky developed a lifelong passion for Italian music. Wolfgang Amadeus Mozart's *Don Giovanni* proved another revelation that deeply affected his musical taste. In the summer of 1861 he traveled outside Russia for the first time, visiting Germany, France, and England, and in October of that year he began attending music classes offered by the recently founded Russian Musical Society. When St. Petersburg Conservatory opened the following fall, Tchaikovsky was among its first students. Having made the decision to dedicate his life to music, he resigned from his clerical post at the Ministry of Justice.

Tchaikovsky spent nearly three years at St. Petersburg Conservatory. Among his earliest orchestral works was an overture entitled *The*



Tchaikovsky, 1887
Photo by Konstantin Shapiro. Central State Archive for Cinematographic, Photographic, and Phonographic Documents, St. Petersburg, Russia

*Storm* (composed 1864). The first public performance of one of his works took place in August 1865, when Johann Strauss the Younger conducted Tchaikovsky's *Characteristic Dances* at a concert in Pavlovsk, near St. Petersburg.

*Middle years.* After graduating in Decem-

ber 1865, Tchaikovsky moved to Moscow to teach music theory at the Russian Musical Society, soon thereafter renamed the Moscow Conservatory. He found teaching difficult, but his friendship with the director, Nikolay Rubinstein, who had offered him the position in the first place, helped make it bearable. Within five years Tchaikovsky had produced his first symphony, *Symphony No. 1 in G Minor* (composed 1866; *Winter Daydreams*), and his first opera, *The Voyevoda* (1868).

In 1868 Tchaikovsky met a Belgian mezzo-soprano named Désirée Artôt, with whom he fleetingly contemplated a marriage, but their engagement ended in failure. *The Voyevoda* was well received, even by the The Five (*q.v.*), an influential group of nationalistic Russian composers who never appreciated the cosmopolitanism of Tchaikovsky's music. In 1869 Tchaikovsky completed *Romeo and Juliet,* an overture in which he subtly adapted sonata form to mirror the dramatic structure of Shakespeare's play. Nikolay Rubinstein conducted a successful performance of this work the following year, and it became the first of Tchaikovsky's compositions eventually to enter the standard international classical repertoire.

In March 1871 the audience at Moscow's Hall of Nobility witnessed the successful performance of Tchaikovsky's *String Quartet No. 1,* and in April 1872 he finished another opera, *The Oprichnik.* While spending the summer at his sister's estate in Ukraine, he began to work on his *Symphony No. 2 in C Minor,* later dubbed *The Little Russian,* which he completed later that year. *The Oprichnik* was first performed at the Maryinsky Theatre in St. Petersburg in April 1874. Despite its initial success, the opera did not convince the critics, with whom Tchaikovsky ultimately agreed. The next opera, *Vakula the Smith* (1874), later revised as *Cherevichki* (1885; *The Little Shoes*), was similarly judged. In his early operas the young composer found it difficult to strike a balance between creative fervour and his critical ability to assess the work in progress. His instrumental works, however, began to earn him his reputation, and, at the end of 1874, Tchaikovsky wrote his *Piano Concerto No. 1 in B-flat Minor,* a work destined for fame despite its initial rejection by Rubinstein. The concerto premiered successfully in Boston in October 1875, with Hans von Bülow as the soloist. During the summer of 1875, Tchaikovsky composed *Symphony No. 3 in D Major,* which gained almost immediate acclaim in Russia.

*Years of fame.* At the very end of 1875, Tchaikovsky left Russia to travel in Europe. He was powerfully impressed by a performance of Georges Bizet's *Carmen* at the Opéra-Comique in Paris; in contrast, the production of Richard Wagner's *Ring* cycle, which he attended in Bayreuth, Germany, during the summer of 1876, left him cold. In November 1876 he put the final touches on his symphonic fantasia *Francesca da Rimini,* a work with which he felt particularly pleased. Earlier that year, Tchaikovsky had completed the composition of *Swan Lake,* which was the first in his famed trilogy of ballets. The ballet's premiere took place on February 20, 1877, but it was not a success owing to poor staging and choreography, and it was soon dropped from the repertoire.

The growing popularity of Tchaikovsky's music both within and outside of Russia inevitably resulted in public interest in him and his personal life. Although homosexuality was officially illegal in Russia, the authorities tolerated it among the upper classes. But social and familial pressures, as well as his discomfort with the fact that his younger brother Modest was exhibiting the same sexual tendencies, led to Tchaikovsky's hasty decision in the summer of 1877 to marry Antonina Milyukova, a young and naive music student who had declared her love for him. Tchaikovsky's homosexuality, combined with an almost complete lack of compatibility between the couple, resulted in matrimonial disaster—within weeks he fled abroad, never again to live with his wife. This experience forced Tchaikovsky to recognize that he could not find respectability through social conventions and that his sexual orientation could not be changed. On February 13, 1878, he wrote his brother Anatoly from Florence: "Only now, especially after the tale of my marriage, have I finally begun to understand that there is nothing more fruitless than not wanting to be that which I am by nature."

The year 1876 saw the beginning of the extraordinary relationship that developed between Tchaikovsky and Nadezhda von Meck, the widow of a wealthy railroad tycoon; it became an important component of their lives for the next 14 years. A great admirer of his work, she chose to become his patroness and eventually arranged for him a regular monthly allowance; this enabled him in 1878 to resign from the conservatory and devote his efforts to writing music. Thereafter he could afford to spend the winters in Europe and return to Russia each summer. Although he and his benefactor agreed never to meet, they engaged in a voluminous correspondence that constitutes a remarkable historical and literary record. In the course of it they frankly exchanged their views on a broad spectrum of issues, starting with politics or ideology and ending with such topics as the psychology of creativity, religious faith, and the nature of love.

The period after Tchaikovsky's departure from Moscow proved creatively very productive. Early in 1878 he finished several of his most famous compositions—the opera *Eugene Onegin,* the *Symphony No. 4 in F Minor,* and the *Violin Concerto in D Major.* From December 1878 to August 1879 he worked on the opera *The Maid of Orleans,* which was not particularly well received. Over the next 10 years Tchaikovsky produced his operas *Mazepa* (1883; based on Aleksandr Pushkin's *Poltava*) and *The Enchantress* (1887), as well as the masterly symphonies *Manfred* (1885) and *Symphony No. 5 in E Minor* (1888). His other major achievements of this period include *Serenade for Strings in C Major,* Opus 48 (1880), *Capriccio italien* (1880), and the *1812 Overture* (1880).

*Final years.* At the beginning of 1885, tired of his peregrinations, Tchaikovsky settled down in a rented country house near Klin, outside of Moscow. There he adopted a regular daily routine that included reading, walking in the forest, composing in the mornings and the afternoons, and playing piano duets with friends in the evenings. At the January 1887 premiere of his opera *Cherevichki,* he finally overcame his longstanding fear of conducting. Moreover, at the end of December he embarked upon his first European concert tour as a conductor. He met with great success and made a second tour in 1889. Between October 1888 and August 1889 he composed his second ballet, *The Sleeping Beauty.* During the winter of 1890, while staying in Florence, he concentrated on his third Pushkin opera, *The Queen of Spades,* which was written in just 44 days and is considered one of his finest. Later that year Tchaikovsky was informed by Nadezhda von Meck that she was close to ruin and could not continue his allowance. This was followed by the cessation of their correspondence, a circumstance that caused Tchaikovsky considerable anguish.

In the spring of 1891 Tchaikovsky was invited to visit the United States on the occasion of the inauguration of Carnegie Hall in New York City. He conducted before enthusiastic audiences in New York, Baltimore, and Philadelphia. Upon his return to Russia, he completed his last two compositions for the stage—the one-act opera *Iolanta* (1891) and a two-act ballet *Nutcracker* (1892). In February 1893 he began working on his *Symphony No. 6 in B Minor* (*Pathétique*), which was to become his most celebrated masterpiece. He dedicated it to his nephew Vladimir (Bob) Davydov, who in Tchaikovsky's late years became increasingly an object of his passionate love. His world stature was confirmed by his triumphant European and American tours and his acceptance in June 1893 of an honorary doctorate from the University of Cambridge.

On October 16 Tchaikovsky conducted his new symphony's premiere in St. Petersburg. The mixed reaction of the audience did not affect the composer's belief that the symphony belonged among his best work. On October 21 he suddenly became ill and was diagnosed with cholera, an epidemic that was sweeping through St. Petersburg. Despite all medical efforts to save him, he died four days later from complications arising from the disease. Wild rumours circulated among his contemporaries concerning his possible suicide, which were revived in the late 20th century by some of his biographers, but these allegations cannot be supported by documentary evidence.

*Assessment.* For most of the 20th century, critics were profoundly unjust in their severe pronouncements regarding Tchaikovsky's life and music. During his lifetime, Russian musicians attacked his style as insufficiently nationalistic. In the Soviet Union, however, he became an official icon, of whom no adverse criticism was tolerated; by the same token, no in-depth studies were made of his personality. But in Europe and North America, Tchaikovsky often was judged on the basis of his sexuality, and his music was interpreted as the manifestation of his deviance. His life was portrayed as an incessant emotional turmoil, his character as morbid, hysterical, or guilt-ridden, and his works were proclaimed vulgar, sentimental, and even pathological. This interpretation was the result of a fallacy that over the course of decades projected the current perception of homosexuality onto the past. At the turn of the 21st century, a close scrutiny of Tchaikovsky's correspondence and diaries, which finally became available to scholars in their uncensored form, led to the realization that this traditional portrayal was fundamentally wrong. As the archival material makes clear, Tchaikovsky eventually succeeded in his adjustment to the social realities of his time, and there is no reason to believe that he was particularly neurotic or that his music possesses any coded messages, as some theorists have claimed.

His artistic philosophy gave priority to what may be called "emotional progression"—*i.e.,* the establishment of an immediate rapport with the audience through the anticipation and eventual achievement of catharsis. His music does not claim intellectual depth but conveys the joys, loves, and sorrows of the human heart with striking and poignant sincerity. In his attempt to synthesize the sublime with the introspective, and also in the symbolism of his later music, Tchaikovsky anticipated certain sensibilities that later became prominent in the culture of Russian modernism.

Tchaikovsky was the leading exponent of Romanticism in its characteristically Russian mold, which owes as much to the French and Italian musical traditions as it does to the German. Although not as ostentatiously as the nationalist composers, Tchaikovsky was clearly inspired by Russian folk music. In the words of the Russian-born composer Igor Stravinsky, "Tchaikovsky drew unconsciously from the true, popular sources of our race."

The first great Russian symphonist, he exhibited a particular gift for melody and orchestration. In his best work, the powerful tunes underlining musical themes are harmonized into magnificent, formally innovative compo-

sitions. His resourceful use of instruments allows easy identification of most of his works by their characteristic sonority. Tchaikovsky excelled primarily as a master of instrumental music; his operas, often eclectic in subject matter and style, do not find much appreciation in the West, with the exception of *Eugene Onegin* and *The Queen of Spades.* Whereas most of his operas met with limited success, Tchaikovsky nonetheless proved eminently successful in transforming ballet, then a grand decorative gesture, into a staged musical drama, and thus he revolutionized the genre.

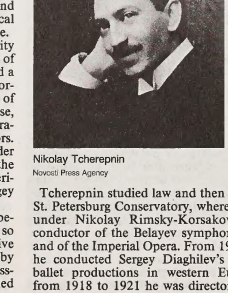
Moreover, Tchaikovsky brought an integrity of design that elevated ballet to the level of symphonic music. To this end, he employed a symphonist's sense of large-scale structure, organizing successive dances through the use of keys to create a cumulative feeling of purpose, in distinction to the more random or decorative layout in the ballets of his predecessors. His special sense of how melody can engender the dance gave his ballets a unique place in the world's theatres. The influence of his experimentation is evident in the ballets of Sergey Prokofiev and Aram Khachaturian.

Tchaikovsky steered an unlikely path between the Russian nationalist tendencies so prominent in the work of his rivals in The Five and the cosmopolitan stance encouraged by his conservatory training. He was both a Russian nationalist and a Westernizer of polished technical skill. He put his personal stamp on the late-19th-century symphony with his last three symphonies; they demonstrate a heightened subjectivity that would influence Gustav Mahler, Sergey Rachmaninoff, and Dmitry Shostakovich and encourage the genre to pass with renewed vigour into the 20th century.

It cannot be denied that the quality of Tchaikovsky's oeuvre remains uneven. Some of his music is undistinguished—hastily written, repetitious, or self-indulgent. But in such symphonies as his *No. 4, No. 5, No. 6,* and *Manfred* and in many of his overtures, suites, and songs, he achieved the unity of melodic inspiration, dramatic content, and mastery of form that elevates him to the premiere rank of the world's composers. (A.P.)

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**Tcherepnin, Nikolay (Nikolayevich),** also called NICOLAS, or NICHOLAS, TCHEREPNIN, Tcherepnin also spelled CHEREPNIN (b. May 3 [May 15, New Style], 1873, St. Petersburg, Russia—d. June 26, 1945, Issy-les-Moulineaux, near Paris, Fr.), prominent Russian composer of ballets, songs, and piano music in the nationalist style of Russian music.



Nikolay Tcherepnin
Novosti Press Agency

Tcherepnin studied law and then entered the St. Petersburg Conservatory, where he studied under Nikolay Rimsky-Korsakov. He was conductor of the Belayev symphony concerts and of the Imperial Opera. From 1908 to 1914 he conducted Sergey Diaghilev's opera and ballet productions in western Europe, and from 1918 to 1921 he was director of the Tiflis (Tbilisi) Conservatory. He then settled in Paris, where he directed a Russian-staffed conservatory. His works include ballets (*Le Pavillon d'Armide, Narcisse et Echo,* and *The Masque of the Red Death*), symphonic poems, piano pieces, and songs.

**Tchernichowsky, Saul (Gutmanovich),** Tchernichowsky also spelled CHERNIKHOVSKY (b. Aug. 20, 1875, Crimea, Ukraine, Russian Empire—d. Oct. 13, 1943, Jerusalem), prolific Hebrew poet, whose poetry, in strongly biblical language, dealt with Russia, Germany, and Palestine and with the themes of love and beauty.

In 1922 Tchernichowsky left the Ukraine, and, after wanderings that took him to the United States in 1928–29, he settled in Palestine in 1931 and became a school physician at Tel Aviv. His production of written material (chiefly poetry), from the age of 14 until a month before his death, was immense. It included sonnet cycles, short stories, idylls of Jewish village life in Russia, and translations of the *Epic of Gilgamesh,* Homer, William Shakespeare, Molière, and Henry Wadsworth Longfellow.

Tchernichowsky's poetry is deeply romantic and suffused with a love of Greek culture; the conflict between this and Judaism gave rise to what some consider to be his finest work.

**Tchibanga,** town, southwestern Gabon. It lies along the north bank of the Nyanga River and at the intersection of roads from Mouila, Ndendé, and Mayumba. It has regular air connections with Port-Gentil, 210 miles (340 km) north-northwest. It is a traditional market center. Gabon's rice cultivation, introduced in 1945, is concentrated in the region around Tchibanga, and a rice mill prepares the grain for the local market. Other local crops include peanuts (groundnuts) and cassava. Pop. (1985 est.) 53,500.

**Tchicaya U Tam'si,** pseudonym of GÉRALD FÉLIX TCHICAYA (b. Aug. 25, 1931, Mpili, near Brazzaville, French Equatorial Africa [now in Congo]—d. April 21 or 22, 1988, Bazancourt, Oise, Fr.), Congolese French-language writer and poet whose work explores the relationships between victor and victim.

As the son of the Congolese first deputy to the French National Assembly, Tchicaya finished his secondary school in Orléans and Paris. When Belgian Congo became independent, Tchicaya went to Léopoldville (now Kinshasa) as chief editor of a new daily paper (which lasted one week). From 1960 he worked with UNESCO in Paris.

Tchicaya's poetry—much influenced by Surrealism and Negritude—includes *Le Mauvais Sang* (1955; "Bad Blood"), *Feu de brousse* (1957; *Brush Fire*), *A triche-coeur* (1960; "A Game of Cheat-Heart"), *Épitomé* (1962), *Le Ventre* (1964; "The Belly"), *L'Arc musical* (1969; "The Bow Harp"), *Selected Poems* (1970), and *La Veste d'intérieur* (1977; "The Inner Failure"). He also published *Légendes africaines* (1969; "African Stories"), a collection of folktales. His later works include a book of short stories, a novel, and two plays.

His poetry relates, through rich and varied imagery, the broken heritage of the African present and the roles of the Roman Catholic church, French colonialism, and education.

**Tczew,** town, Gdańsk *województwo* (province), north-central Poland. It lies along the Vistula River, 19 miles (30 km) above its mouth. Tczew is a major river port, with links to Gdańsk, and a rail junction for lines to Warsaw, Gdańsk, Bydgoszcz, and Chojnice. Shipyards and railroad workshops are located there. A Pomeranian fortress was built on the site in 1252, and municipal rights were granted to the surrounding settlement. It was annexed to Poland in 1282 and occupied by the Teutonic Knights between 1308 and 1466. Seized by Prussia in 1772, it was returned to Poland in 1919. With the extension of the railroad in 1857, one of Europe's first truss bridges was built there. Pop. (1989 est.) 58,400.

**te** (Chinese: "virtue," or "potentiality"), in Chinese Taoism, the potentiality of the mysterious Tao, or Way, the undefinable, transcendent reality that produces all things. In contrast, Confucianism views *te* as the virtue of internal goodness and proper behaviour toward others. As such, it was Confucius' answer to social and political disorders.

As the activity of Tao, *te* occurs in all things and is the latent power that transforms, for example, a seed into a tree with no effort on the seed's part. *Te* is thus a manifestation of the invisible Tao. In the great Taoist classic the *Tao-te Ching* ("Classic of the Way of Power"), *te* is described as the unconscious functioning of the physical self. Whoever is attuned to this inner process will live in harmony with the forces of nature, which, in any case, are irresistible. Personal *te* flourishes when one abandons ambition and the spirit of contention for a life of "naturalness" (*tzu-jan*). Two kinds of strength result: a type of external charisma in the social order whereby others feel compelled to adopt freely a similar way of life, and an internal enlightenment whereby the individual becomes aware of the underlying principle of unity within the universe.

**Te Anau, Lake,** lake, the largest of the Southern Lakes, southwest South Island, New Zealand. About 38 miles (61 km) long and 6 miles (10 km) wide, the lake, with an area of 133 square miles (344 square km), has four western extensions—Worsley Arm and North, Middle, and South fjords. Fed by the Clinton and Eglinton rivers, it drains a 1,275-square-mile (3,302-square-kilometre) basin. Occupying a valley that was deepened by glacial erosion, the lake, whose surface lies 686 feet (209 m) above sea level, has a maximum depth of 906 feet (276 m), placing its bed 220 feet (67 m) below sea level. Water from Te Anau, draining through the Waiau River, is used to maintain a constant level in Lake Manapouri (site of hydroelectric generators). In a superb alpine setting bordered on the west by forested mountains and on the east by farmlands, the lake region is known for fish-

ing and tourism, centred on the town of Te Anau. The lake was first visited (1852) by C.J. Nairn and W.J. Stephen and was surveyed in 1863. The name, probably a shortened form of Te Ana-au, a Maori name meaning "cave of the swirling water," refers to caves on the west shore. In 1948, one of the few remaining habitats of the large flightless rail, or takahe (*Notornis mantelli*), a bird once thought to be extinct, was found on the same shore.

**Te Aroha,** town, Waikato local government region, northern North Island, New Zealand, on the Waihou (Thames) River. The settlement, established in 1880 as a river port for a new gold find, was known as Aroha Gold Field Town, Morgantown, and Aroha. It derives its present name from that of a nearby extinct volcano rising 3,126 feet (953 m) in the Coromandel Range; the term means "the loved one" and refers to an ancient Maori legend. Te Aroha was constituted a town district in 1886. It is linked to Auckland (115 miles [185 km] northwest) by road and rail via Hamilton and is the business centre of the Waihou-Piako basin, a dairying district. The town has joinery, bacon, concrete products, clothing, leather prepation, and engineering works; there are also sawmills and agricultural storage facilities. Mineral springs have made it a popular health resort. Pop. (1987 est.) 3,540.

*To make the best use of the Britannica, consult the* INDEX *first*

**Te-chou,** Pinyin DEZHOU, city on the northern plain of Shantung *sheng* (province), China.

Te-chou has been the name of an administrative district covering the northwest of what is now Shantung province since early times. In AD 583 Te-chou was first established in place of An-te commandery (district controlled by a commander) and of An-te county, which had had its seat there since Han times (206 BC–AD 220). It was known as Te-chou or as P'ing-yüan commandery in subsequent dynasties. In 1409 the Ming dynasty transferred the seat of Te-chou to its present location, formerly known as Ling-hsien. Under the Chinese republic in 1911, Te-chou was made a county, known as Te.

Te-chou has always been a strategic and transportation centre. It lies just east of the Wei River, which has been a northeast-to-southwest route across the North China Plain since early times. From the late 6th century onward, Te-chou was a supply depot and canal port on the Yung-chi Canal, which roughly followed the course of the Wei River. Under the Yüan dynasty (1279–1368), the modern Grand Canal, which again followed the line of the Wei River, was constructed, and Te-chou again became a vital supply centre, especially after the capital was moved to Peking. In Ming times (1368–1644) the city became the main collecting point for the tax grain of northern Shantung and southern Hopeh provinces and a transshipment point for grain from Süchow in Kiangsu province and the Yangtze River region. Two enormous granaries, the Kuang-chi Ts'ang and the Te-chou Ts'ang, were constructed, and in 1511 the city was strongly fortified, with walls almost 7 miles (11 km) in circumference.

In the 20th century, after the Grand Canal had fallen into neglect, Te-chou's importance revived following the construction of the railway from Tientsin to P'u-k'ou, opposite Nanking, completed in 1912. The line, passing through Te-chou, connected at Chi-nan with the railway to Tsingtao, giving Te-chou access to this major port. The Japanese in 1940, during their occupation of the area, built another railway connecting Te-chou with Shih-chia-chuang, in Hopeh province, and with the industrial centres of Shansi province to the west. Te-chou was thus at the junction of the main north-south rail route and a new east-west rail link. The city became a major collecting centre for the agricultural produce of the southern part of the Hopeh Plain, which includes beans, grain, cotton, peanuts (groundnuts), tobacco, and, above all, fruit. The surrounding area is well known for its watermelons, Chinese dates, and pears.

The modern city is a centre for small-scale industry as well as for such medium-scale industries as grain milling, oil pressing, tobacco curing, and the manufacture of cotton textiles. Te-chou is also the centre of an engineering industry dating to the end of the 19th century, when it was the site of a minor arsenal producing arms and ammunition for the Peiyang ("North Ocean") Army. Pop. (1990 est.) 195,485.

**Te Deum laudamus** (Latin: "God, We Praise You"), also called TE DEUM, Latin hymn to God the Father and Christ the Son, traditionally sung on occasions of public rejoicing. According to legend, it was improvised antiphonally by St. Ambrose and St. Augustine at the latter's baptism. It has more plausibly been attributed to Nicetas, bishop of Remesiana in the early 5th century, and its present form—equal sections devoted to the Father and Son, a half-clause to the Holy Spirit, followed by a litany—fit in historically with part of the Arian controversy (over the nature of Christ) of the 4th century. Much of the text is composed of traditional statements of belief; and unlike most hymns, it is prose. The melody derives from various pre-Gregorian and Gregorian melodic styles. It has been set polyphonically by the British composers Henry Purcell, Ralph Vaughan Williams, and Benjamin Britten, as well as by George Frideric Handel, Hector Berlioz, Zoltán Kodály, Anton Bruckner, and Antonín Dvořák.

Following is the Latin text and an English translation of the Te Deum. Numerous English translations have been made; the version given here was prepared by the International Consultation on English Texts, an ecumenical committee of scholars, and was published in *The Liturgy of the Hours* (1975).

Te deum laudamus te dominum confitemur
Te aeternum patrem omnis terra veneratur
Tibi omnes angeli Tibi caeli et universae potestates
Tibi cherubim et seraphim incessabili voce proclamant
Sanctus sanctus sanctus dominus deus sabaoth
Pleni sunt caeli et terra maiestatis gloriae tuae
Te gloriosus apostolorum chorus
Te prophetarum laudabilis numerus
Te martyrum candidatus laudat exercitus
Te per orbem terrarum sancta confitetur ecclesia
Patrem immense maiestatis
Venerandum tuum verum unicum filium
Sanctum quoque paraclytum spiritum
Tu rex gloriae christe
Tu patris sempiternus es filius
Tu ad liberandum suscepisti hominem non horruisti virginis uterum
Tu devicto mortis aculeo aperuisti credentibus regna caelorum
Tu ad dexteram dei sedes in gloria patris
Iudex crederis esse venturus
Te ergo quaesumus tuis famulis subveni quos pretioso sanguine redemisti
Aeterna fac cum sanctis tuis gloria munerari
Salvum fac populum tuum domine et benedic hereditati tuae
Et rege eos et extolle illos usque in aeternum
Per singulos dies benedicimus te
Et laudamus nomen tuum in saeculum et in saeculum saeculi
Dignare domine die isto, sine peccato nos custodire
Miserere nostri domine miserere nostri
Fiat misericordia tua domine super nos quemadmodum speravimus in te
In te domine speravi non confundar in aeternum

You are God: we praise you;
You are the Lord: we acclaim you;
You are the eternal Father:
All creation worships you.
To you all angels, all the powers of heaven,
Cherubim and Seraphim, sing in endless praise:
Holy, holy, holy, Lord, God of power and might,
heaven and earth are full of your glory.
The glorious company of apostles praise you.
The noble fellowship of prophets praise you.
The white-robed army of martyrs praise you.
Throughout the world the holy Church acclaims you:
Father, of majesty unbounded,
your true and only Son, worthy of all worship,
and the Holy Spirit, advocate and guide.
You, Christ, are the king of glory,
the eternal Son of the Father.
When you became man to set us free
you did not spurn the Virgin's womb.
You overcame the sting of death,
and opened the kingdom of heaven to all believers.
You are seated at God's right hand in glory.
We believe that you will come, and be our judge.
Come then, Lord, and help your people,
bought with the price of your own blood,
and bring us with your saints to glory everlasting.
Save your people, Lord, and bless your inheritance.
Govern and uphold them now and always.
Day by day we bless you.
We praise your name for ever.
Keep us today, Lord, from all sin.
Have mercy on us, Lord, have mercy.
Lord, show us your love and mercy;
for we put our trust in you.
In you, Lord, is our hope:
and we shall never hope in vain.

**Te-hua porcelain,** Pinyin DEHUA, Chinese porcelain made at Te-hua in Fukien province. Although the kiln began production some time during the Ming period (1368–1644), it is to the Ch'ing dynasty (1644–1911) that most extant examples are attributed. The characteristic product of Te-hua is the white porcelain



Te-hua porcelain figure of the Buddhist deity Kuan-yin, Ch'ing dynasty, K'ang-hsi period (1661–1722); in The Metropolitan Museum of Art, New York City

The Metropolitan Museum of Art, bequest of Mary Clark Thompson, 1924 (24.80.155); all rights reserved, The Metropolitan Museum of Art

known to the French as blanc de chine, which has the appearance of blancmange, or milk jelly. Figures of Buddhist deities and vases with molded reliefs of plum blossom are typical. Te-hua ware was exported in large quanti-

ties to Europe from the 18th century and also imitated there; *e.g.*, in France at Saint-Cloud and in England at Chelsea and Bow.

**Te Kanawa, Dame Kiri (Janette)** (b. March 6, 1944, Gisborne, North Island, N.Z.), critically acclaimed opera star.

When Kiri was five weeks old she was adopted by Tom and Nell Te Kanawa; Tom, like her biological father, was a Maori, and his wife, like Kiri's biological mother, was of British descent. Kiri attended a Roman Catholic girls' college in Auckland, where one of the sisters was a well-known teacher of singing. After leaving school she won various singing competitions in New Zealand and Australia and in 1966, after a period as a popular singer and recording artist, became a student at the London Opera Centre.

Soprano Te Kanawa shot to stardom in the 1970s with a series of appearances at the Royal Opera House, Covent Garden, London, and the enthusiastic support of conductors such as Sir Colin Davis and Sir Georg Solti. Her first big success was as the Countess in Mozart's *Marriage of Figaro* in 1971. That was followed by a run of Mozart operas and, among others, a production of Puccini's *La Bohème* in which she sang Mimi. Her debut at the Metropolitan Opera, New York City, in 1974 as Desdemona in Verdi's *Otello* was widely acclaimed. In 1981 the Prince of Wales asked her to sing at his marriage, and her rendering of Handel's "Let the Bright Seraphim" reached a worldwide television audience of more than 600,000,000. In 1982 Te Kanawa was created a Dame Commander of the Order of the British Empire.

**Te Rangi Hiroa:** *see* Buck, Sir Peter (Henry).

**Te Rangitake** (Maori chief): *see* Kingi, Wiremu.

**Te Tsung,** Pinyin DE ZONG (reign title), personal name (Wade–Giles romanization) LI K'UO (b. 742, China—d. 805, China), ninth emperor (reigned 779/780–805) of the T'ang dynasty and the only emperor in the latter half of the dynasty to reign more than 20 years. In spite of his long reign, he never successfully controlled the militarists who commanded the provinces and ignored Imperial decrees. In the latter part of his reign Te Tsung gave up interest in the government, confiding only in his eunuchs, whose power at court grew as a result. A poet, he often sent decrees to his ministers in verse.

**Te Tsung** (1087–1143): *see* Yeh-lü Ta-shih.

**Te Tsung** (1871–1908): *see* Kuang-hsü.

**tea,** beverage produced by steeping top leaves and buds of the tea plant (*Camellia sinensis* of the family Theaceae) in freshly boiled water.

A brief treatment of tea follows. For full treatment, *see* MACROPAEDIA: Beverage Production; Farming and Agriculture Technology.

Tea is consumed as either a hot or a cold beverage by about one-half of the world's population, yet it is second to coffee in commercial importance, largely because a significant portion of the world's tea crop is consumed in the growing regions.

The origin of the use of tea as a beverage is lost in antiquity. A Chinese legend places the introduction of tea as a beverage in the reign of the mythical emperor Shen Nung, about 2737 BC. However, the earliest mention to which modern scholars give credence is found in the *Erh Ya,* an ancient Chinese dictionary, about 350 BC. It is believed that tea cultivation began in the interior province of Szechwan in China, gradually extending down the Yangtze Valley to the seaboard provinces. Tea cultivation was introduced into Japan, along with other aspects of Chinese civilization, in about the last decade of the 6th century. At first it was drunk primarily by Zen Buddhist monks, but by the 13th century tea had become a popular beverage in Japan. The ancient tea ceremony, or *cha-no-yu,* is still practiced widely. The Japanese variety of tea was introduced into Java in 1684 by Andreas Cleyer, a German naturalist and doctor of medicine. In 1827 a young Dutch tea taster, J.I.L.L. Jacobson, risked his life to penetrate China's forbidden tea gardens and bring back tea seeds and labourers in order to cultivate the tea plant in the Dutch East Indies.

Tea was first mentioned in European literature in 1559 as *chai catai* ("tea of China") in *Navigationi e viaggi* ("Voyages and Travels") by Gian Battista Ramusio, a noted Venetian author. The first reference to tea by an Englishman, in 1615, is credited to R.L. Wickham, who was in charge of the English East India Company's agency at Firando, Japan. More coffee was drunk in England than anywhere else in the world when tea was first publicly sold at Garway's Coffee House in London in 1657.

One of the most picturesque eras in maritime history was that of the clipper ships, which transported tea from China to England and North America. The world's greatest tea monopoly, the English East India Company—which operated from about 1600 to 1858—played a major role in popularizing the beverage. In an effort to perpetuate this monopoly, the British Parliament passed the Tea Act of 1773, which precipitated the Boston Tea Party and which was a contributory cause of the American Revolution.

The use of tea as a beverage was well established in Holland by the mid-17th century, and the afternoon tea custom spread across the Atlantic to New Amsterdam (now New York City). In England the custom of serving afternoon tea and cakes was originated by the Duchess of Bedford around 1840. Iced tea was introduced at the St. Louis World's Fair of 1904 by Richard Blechynden, an Englishman who, unable to sell the heated beverage because of hot weather, poured it over ice.

The founding of India's tea industry stems from the appointment of a committee by Gov. Gen. Lord William Henry Cavendish Bentinck, in 1834, to formulate a plan for tea cultivation. However, indigenous tea had already been discovered in northern India (upper Assam) in 1823.

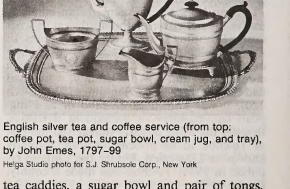
The major tea types, classified according to processing method, include: fermented, or black, tea, producing an amber-coloured, full-flavoured beverage without bitterness; semi-fermented, or oolong, producing a slightly bitter, light brownish-green liquid; and unfermented, or green, tea, resulting in a mild, slightly bitter, pale greenish-yellow beverage. Brick tea, formed of compressed leaves and sometimes other plant parts, is consumed mainly in Tibet and inner Asia. In some Asian countries the leaves may also be pickled and consumed as a vegetable, called *leppet-so* in Burma and *miang* in Thailand.

Tea is commonly sold in loose form, in filter-paper tea bags, or in soluble form. Tea bags were introduced by Thomas Sullivan, a New York wholesaler who sent tea samples to his customers in small silk bags instead of the usual tins. Instant teas, first produced in the 1940s, include flavoured and cold-water-soluble types.

Tea contains only four calories per cup when consumed without added ingredients but is a source of several B-complex vitamins, including $B_2$ and nicotinic acid. Caffeine is responsible for tea's stimulating effect. Flavour is produced by volatile oils, and astringency and colour by tannin. Astringency and flavour development increase with length of the steeping period. Although some varieties produce colour quickly, satisfactory flavour development requires three to five minutes of steeping to achieve the desired maximum caffeine extraction and moderate amount of tannin.

**Tea Act** (1773), in British American colonial history, legislative maneuver by the British ministry of Lord North to make English tea marketable in America. A previous crisis had been averted in 1770 when all the Townshend Acts (*q.v.*) duties had been lifted except that on tea, which had been mainly supplied to the Colonies since then by Dutch smugglers. In an effort to help the financially troubled British East India Company sell 17,000,000 pounds of tea stored in England, the Tea Act rearranged excise regulations so that the company could pay the Townshend duty and still undersell its competitors. At the same time, the North administration hoped to reassert Parliament's right to levy direct revenue taxes on the Colonies. The shipments became a symbol of taxation tyranny to the colonists, reopening the door to unknown future tax abuses. Colonial resistance culminated in the Boston Tea Party (December 1773), in which tea was dumped into the ocean, and in a similar action in New York (April 1774).

**tea and coffee service,** set of vessels and implements for making and serving tea and coffee, the items often of matched design. Elaborate 18th-century examples had tea and coffee pots, a milk or cream jug, a pair of



English silver tea and coffee service (from top: coffee pot, tea pot, sugar bowl, cream jug, and tray), by John Emes, 1797–99
Helga Studio photo for S.J. Shrubsole Corp., New York

tea caddies, a sugar bowl and pair of tongs, teaspoons and a small tray for them, a tea strainer, and cups and saucers. All of these were normally placed on a tray, while an urn or kettle on a separate stand provided hot water. The earliest silver and pottery services to be designed as sets date from the early 18th century, but surviving silver examples dating from before the late 18th century are rare. During the 18th and 19th centuries, services were designed to accompany what had become an important tea-drinking ritual and consequently reached a high degree of artistic refinement.

**tea ceremony,** Japanese CHADŌ, or SADŌ ("way of tea"), or CHA-NO-YU ("hot-water tea"), time-honoured institution in Japan, rooted in the principle of Zen Buddhism and founded upon the adoration of the beautiful in the daily routine of life. It is an aesthetic way of entertaining guests, in which everything is done according to an established order.

The ceremony takes place in a tea house (*cha-shitsu; q.v.*), which ideally is a small structure detached from the main house but which is often simply a special room of the house. Great care is taken in the choice of materials for and construction of the *cha-shitsu* so as to give it a sense of rustic yet refined simplicity. The room is usually about nine feet (three metres) square or smaller; at one end there is an alcove, called the *toko-no-ma* (*q.v.*), in which is displayed a hanging scroll, a flower arrangement, or both. The room also contains a small sunken fireplace (*ro*) that is used in the winter months for heating the tea kettle;

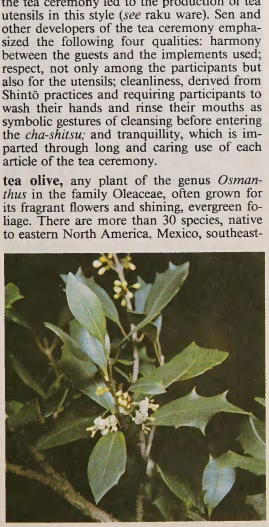
in the summer a portable brazier is used. The *cha-shitsu* is entered through a small, low door, which is designed to suggest humility to the guests.

The tea ceremony consists of the host first bringing the tea utensils into the room, offering the guests special sweets, and then preparing and serving them tea made of pulverized tea leaf stirred in hot water. The prepared tea is usually thin and frothy with a mildly astringent flavour; on certain occasions a much thicker "heavy tea" (*koicha*) is made. The serving of sweets and tea is often preceded by a light meal. After the tea is consumed, the guests are free to inquire about the various implements, which are afterward carried from the room and the ceremony concluded.

Ritual tea drinking, which originated in China, was first practiced in Japan during the Kamakura period (1192–1333) by Zen monks, who drank tea to keep awake during long sessions of meditation. It later became an active part of Zen ritual honouring the first patriarch, Bodhidharma. During the 15th century it came to be a gathering of friends in an isolated atmosphere to drink tea and discuss the aesthetic merits of paintings, calligraphy, and flower arrangements displayed in the *toko-noma* or quite often to discuss the merits of the tea utensils themselves.

The most famous exponent of the tea ceremony was Sen Rikyū, an aesthete at the 16th-century court of the military dictator Toyotomi Hideyoshi, who codified the ceremony into a style known as *wabi* (meaning roughly "simplicity," "quietude," and "absence of ornament"), which still enjoys popularity in Japan. The preference of the *wabi* tea masters for simple, seemingly rustic objects for use in the tea ceremony led to the production of tea utensils in this style (*see* raku ware). Sen and other developers of the tea ceremony emphasized the following four qualities: harmony between the guests and the implements used; respect, not only among the participants but also for the utensils; cleanliness, derived from Shintō practices and requiring participants to wash their hands and rinse their mouths as symbolic gestures of cleansing before entering the *cha-shitsu;* and tranquillity, which is imparted through long and caring use of each article of the tea ceremony.

**tea olive,** any plant of the genus *Osmanthus* in the family Oleaceae, often grown for its fragrant flowers and shining, evergreen foliage. There are more than 30 species, native to eastern North America, Mexico, southeastern Asia, Hawaii, and New Caledonia. Sweet olive, or sweet osmanthus (*Osmanthus fragrans*), a 10-metre (33-foot) tree, produces an edible fruit. Its leaves, used to perfume tea, hide the white flowers. Orange osmanthus (*O. aurantiaca*), 2½ m in height, has fragrant orange flowers. Holly osmanthus, or false holly (*O. heterophyllus*), distinguished by its holly-like leaves, bears white flowers, on 5-m trees. *Osmanthus delavayi* reaches 2 m and has small, oval leaves and white flowers. The main American species, devilwood (*O. americanus*), reaches 15 m and bears greenish-white flowers. Its close-grained, dark-brown wood is valued for carpentry.



False holly (*Osmanthus heterophyllus*)
A to Z Botanical Collection—EB Inc

**Teach, Edward,** Teach also spelled THATCH, byname BLACKBEARD (b. Bristol?, Eng.—d. Nov. 22, 1718, Ocracoke Island, North Carolina), one of history's most famous pirates, who became an imposing figure in American folklore and is still well-known by his nickname Blackbeard.

Thought to have been active as a privateer for the British during the War of the Spanish Succession (1701–13), Teach was first heard of as a pirate late in 1716. The following year he converted a captured French merchantman into a 40-gun warship, "Queen Anne's Revenge," and soon became notorious for outrages along the Virginia and Carolina coasts and in the Caribbean Sea.

In 1718 he established his base in a North Carolina inlet, forcibly collected tolls from shipping in Pamlico Sound, and made a prize-sharing agreement with Charles Eden, governor of the North Carolina colony. At the request of Carolina planters, the lieutenant governor of Virginia, Alexander Spotswood, dispatched a British naval force under Lieut. Robert Maynard, who, after a hard fight, succeeded in killing Teach. The pirate's body was decapitated, and his head was affixed to the end of the bowsprit of his ship.

Apart from the luxuriant black beard which earned him his nickname, the most prominent aspect of the Teach legend is his great buried treasure, which has never been found and probably never existed.

**teachers' college:** *see* normal school.

**teaching,** the profession of those who give instruction, expecially in an elementary or secondary school or a university.

A brief treatment of teaching follows. For full treatment, *see* MACROPAEDIA: Teaching.

Members of the teaching profession usually must meet certain basic requirements: the criteria vary from country to country but generally include going through processes of formal education or training, acquiring specialized knowledge in a particular subject area, securing certification or validation as members of the profession, and maintaining standards of performance that are continually redefined and expanded by the profession.

Professional responsibilities vary from country to country and according to the age level taught. General areas of responsibility include active, and sometimes conflicting, roles in the school as well as in the community. Parent substitute, confidant, disciplinarian, community leader, and acceptable behaviour model are a few of the roles that teachers are expected to fulfill. Approximately two-thirds of the world's teachers are women, the great majority being employed on the elementary level. Teachers in modern societies are usually protected in their positions after a period of satisfactory service. Once they have achieved "tenure," their jobs are guaranteed unless proof of incompetence or moral laxity is established.

Of the three groups of teachers—defined by level as elementary, secondary, or university—university teachers continue to enjoy the greatest advantages of all aspects of the profession, including higher salaries; advanced social status; mobility (because of the usual absence of licensing requirements); relative academic freedom in curriculum planning, teaching methods, and choices of textbook and other teaching materials; and membership in exclusive national and international professional organizations. These distinctions are due in large part to the greater measure of required higher education and the selectivity at this level. There are further demands on most of these professionals for continuous research and publication, which may or may not be directly related to their responsibilities as classroom teachers.

The teaching profession is a relatively new one; in some societies the occupation has still not attained professional status. Traditionally, parents, elders, religious leaders, and sages were responsible for teaching children how to behave, how to think, and what to believe. Adults shared in common activities with children who gradually acquired the knowledge, myths, and general teaching of their culture. Later, teachers were often those young people who had been successful as students; they learned their craft by observing and practicing the methods of their own teachers.

Germany introduced the first formal criteria for the education of teachers in the 18th century, setting examples for other countries and paving the way for the establishment of a real profession. Further development came in the 19th century as society became more industrialized and the concept of schooling became more universal. The amount of preparatory or preservice training required of teachers today varies from country to country and in some cases is still very limited. However, most teachers in developed countries today are university graduates. For prospective elementary and secondary teachers, a program of study usually includes a basic general education with emphasis on a specialized academic, cultural, or vocational course; the study of educational principles; and a series of professional courses combined with practical experience in a typical school setting. Certification requirements reflect the diversities among various countries: England and France, for example, set national standards for teacher certification; whereas, in the United States, Canada, and Australia, requirements are determined by the individual states or provinces. In-service training includes all aspects of continued teacher education such as attending courses, lectures, or seminars, reading newsletters and educational journals, and taking individual programs offered in specific educational institutions. Teachers are often required to show evidence of participation in such in-service programs.

In the 20th century, not only was teacher education upgraded but efforts to gain professional recognition increased: teachers began to view themselves as educators and organized in an effort to improve their status, their working conditions, and the overall quality of educational offerings. The early professional associations were organized according to school type or particular subjects. Such groups later coalesced into national organizations, so that today most countries have at least one major association or union to which membership is often obligatory and members usually pay dues. A movement toward international federations of elementary and secondary national associations resulted in the formation of two competing international groups: the World Federation Teachers' Unions represents the national associations from Communist countries, while the World Confederation of Organizations of the Teaching Profession includes members of national associations from the non-Communist countries.

**teaching machine,** any mechanical device used for presenting a program of instructional material.

There are many types of teaching machines. In general, they all work on the same method, which is to present a question, have the user

indicate the answer, and then provide the user with the correct answer. Some machines may be extremely simple, such as test sheets or books so programmed that the student locates the answers to the questions later. For instance, a book may pose a series of questions, provide spaces for the answers, and then give the correct answers on a different page. Another device may use a plastic cover to hide all but the question and the space for an answer; when the question is answered, the cover is pulled down to reveal the correct answer and the next question. One type uses chemically treated paper so that if the correct answer to a question is marked, the paper turns colour. A more complicated machine presents multiple-choice questions in a window, with various keys to press to indicate the correct answer. The following question appears only if the correct answer was chosen. Computers (*see* comper-aided instruction) and the recording equipment used in foreign language laboratories are examples of teaching machines.

All teaching machines depend on a program, that is, a series of questions presented that provide a student with a certain amount of challenge as well as a chance to learn. (*See* programmed learning.) There are many advantages to the use of teaching machines. They are particularly useful in subjects that require drill, such as arithmetic or a foreign language. Users can proceed at their own pace and also have an opportunity to review their work. If the machines are used in a classroom, they relieve teachers of some of the time-consuming aspects of drilling students, allowing them to give more attention to individuals with specific problems or to concentrate on some particularly difficult area of instruction.

**Teaching of the Twelve Apostles** (ancient Christian document): *see* Didachē.

**Teagarden, Jack,** byname of JOHN WELDON TEAGARDEN (b. Aug. 20, 1905, Vernon, Texas, U.S.—d. Jan. 15, 1964, New Orleans), U.S. jazz trombonist, unique because he developed a widely imitated style that appeared to have arrived fully formed.

Beginning on trombone at age seven, Teagarden was entirely self-taught. After drifting across the Southwest, he eventually arrived in New York City in 1927 and made his recording debut; from that moment he was the acknowledged master of his idiom. He led his own band (1939–47), played with Louis Armstrong (1947–51), and re-formed his band (1951–57); although he never achieved commercial success, he retained his full powers until the end of his life. His movies include *Birth of the Blues* (1941). His style was remarkable for its effortless flow of melodic ideas, technical poise, and the tender beauty of its overall effect. He was also an outstanding jazz singer. His voice, with an engaging Southern drawl, ranged somewhere between the rasp of Louis Armstrong and the smooth sound of Bing Crosby, with whom he was professionally associated from time to time.

Jack's brother, Charlie Teagarden, played trumpet off and on in Jack's bands and did free-lance work for several well-known bandleaders, including Paul Whiteman, Jimmy and Tommy Dorsey, and Bob Crosby.

**Teague, Walter Dorwin** (b. Dec. 18, 1883, Decatur, Ind., U.S.—d. Dec. 5, 1960, Flemington, N.J.), industrial designer who pioneered in the establishment of industrial design as a profession in the United States.

After study at the Art Students League of New York (1903–07) and four years with an advertising agency, Teague became a successful free-lance advertising designer. Increasingly, his clients sought his advice for product design, and in 1926 he formed an office devoted exclusively to industrial design, including products, exhibits, corporate graphics, and interiors. An important opportunity came in 1927, when the Eastman Kodak Company asked Teague to redesign two of their cameras. He insisted on working closely with engineers in the Eastman factory; the results were successful, and the firm remained a client until his death.

In 1930 Teague's revolutionary design for the Marmon 16 automobile attracted widespread attention. Late in the decade he designed a number of exhibits for the New York World's Fair and the Golden Gate (San Francisco) International Exposition (both in 1939–40). Other notable designs were for railway coaches, office machines, and automotive service stations. In the 1950s he designed interiors and furnishings for the Air Force Academy at Colorado Springs, Colo., and the interiors of the Boeing 707 jet airliner. At the time of his death he was senior partner of Walter Dorwin Teague Associates.

His *Design This Day—the Technique of Order in the Machine Age* (1940; rev. ed. 1949) traces the development of modern design and outlines the techniques necessary to the solution of design problems. He also wrote *Land of Plenty, a Summary of Possibilities* (1947) and, with John Storck, *Flour for Man's Bread, a History of Milling* (1952).

**teak** (*Tectona grandis*), large deciduous tree of the family Verbenaceae, or its wood, one of the most valuable timbers. Teak has been widely used in India for more than 2,000 years. The name teak is from the Malayan word *tékka.*

The tree has a straight, but often buttressed, stem (*i.e.,* thickened at the base), a spreading crown, and four-sided branchlets with large quadrangular pith. The leaves are opposite or sometimes whorled in young specimens, about 0.5 metre (1.5 feet) long and 23 centimetres (9 inches) wide. In shape they resemble those of the tobacco plant, but their substance is hard and the surface rough. The branches terminate in many small white flowers in large, erect, cross-branched panicles. The fruit is a drupe (fleshy, with a stony seed), two-thirds of an inch in diameter. The bark of the stem is about 1.3 cm thick, gray or brownish gray, the sapwood white; the unseasoned heartwood has a pleasant and strong aromatic fragrance and a beautiful golden-yellow colour, which on seasoning darkens into brown, mottled with darker streaks. The timber retains its aromatic fragrance to a great age.

Native to India, Burma, and Thailand, the tree grows as far north as about the 25th parallel in these areas and to the 32nd parallel in the Punjab. The tree is not found near the coast; the most valuable forests are on low hills up to about 3,000 feet. Stands are also found in the Philippines and in Java and elsewhere in the Malay Archipelago. Teak is also planted in Africa and Central America.

During the dry season the tree is leafless; in hot localities the leaves fall in January, but in moist places the tree remains green until March. At the end of the dry season, when the first monsoon rains fall, the new foliage emerges. Although the tree flowers freely, few seeds are produced because many of the flowers are sterile. The forest fires of the dry season, which in India usually occur in March and April after the seeds have ripened and have partly fallen, impede the spread of the tree by self-sown seed. In Burmese plantations, teak trees on good soil have attained an average height of 18 m in 15 years, with a girth, breast high, of 0.5 m. In the natural forests of Burma and India, teak timber with a girth of about 2 m (diameter of 0.6 m) is never less than 100 and often more than 200 years old. Mature trees are usually not more than 150 ft high.

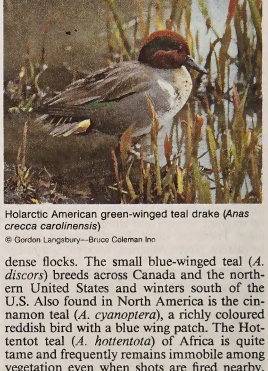
Teak timber is valued in warm countries principally for its extraordinary durability. In India and in Burma, beams of the wood in good preservation are often found in buildings many centuries old, and teak beams have lasted in palaces and temples more than 1,000 years. The timber is practically imperishable under cover.

Teakwood is used for shipbuilding, fine furniture, door and window frames, wharves, bridges, cooling-tower louvres, flooring, panelling, railway cars, and venetian blinds. An important property of teak is its extremely good dimensional stability. It is strong, of medium weight, and of average hardness. Termites eat the sapwood but rarely attack the heartwood; it is not, however, completely resistant to marine borers.

Burma produces most of the world's supply, India, Thailand, Indonesia, and Sri Lanka (Ceylon) ranking next in production.

*Articles are alphabetized word by word, not letter by letter*

**teal,** any of about 15 small ducks of the genus *Anas* (family Anatidae), found on the six major continents and many islands. Within the divisions of true duck species, the teal belong in the dabbling duck (*q.v.*) group. Many of the teal are popular as game birds, the best known being the Holarctic green-winged teal (*A. crecca*), a bird about 33–38 centimetres (13–15 inches) in length, usually found in



Holarctic American green-winged teal drake (*Anas crecca carolinensis*)
© Gordon Langsbury—Bruce Coleman Inc

dense flocks. The small blue-winged teal (*A. discors*) breeds across Canada and the northern United States and winters south of the U.S. Also found in North America is the cinnamon teal (*A. cyanoptera*), a richly coloured reddish bird with a blue wing patch. The Hottentot teal (*A. hottentota*) of Africa is quite tame and frequently remains immobile among vegetation even when shots are fired nearby. Teal are primarily herbivorous, although animal foods may comprise 25 percent of the diet of some species such as the blue-wing. In many species flocks take off as a group and change direction in unison.

**team handball,** also called FIELDBALL, or HANDBALL, game played between two teams of 7 or 11 players who try to throw or hit an inflated ball into a goal at either end of a rectangular playing area while preventing their opponents from doing so. Unrelated to the two- or four-player games (*see* handball and fives), in which a small, hard ball is hit against one or more walls, it is similar to association football (soccer), except that the ball is moved by throwing, catching, punching, or hitting it with any part of the body above the knee, instead of by kicking. In handball, only the goalkeeper may kick the ball.

A game consists of two 30-minute halves with an intermission, and players wear no pro-

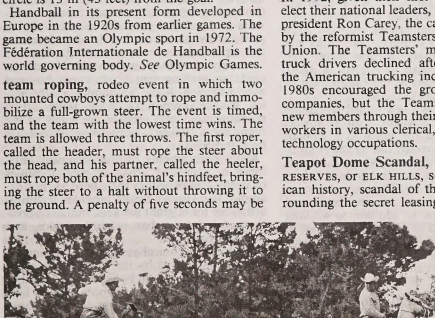
tective equipment. Running more than three steps with the ball and holding it longer than three seconds are illegal.

Attacking players must take their shots at goal from outside an arc marked on the playing surface, within which only the defending goalkeeper may play. Free throws (usually passes to a teammate) are awarded for minor violations of rules and taken from the spot of the violation or from a line a short distance outside the goal circle. Penalty throws at goal are awarded for more serious infractions and are taken from a penalty mark just outside the circle and directly in front of the goal.

The two principal forms of team handball differ in number of players and dimensions of the field. The ball used in both is 58–60 cm (about 23–24 inches) in circumference and weighs 425–475 g (15–17 ounces); women and younger players use a smaller ball. For the seven-man game, usually played indoors, the court is 38–45 m (125–148 feet) long and 18–22 m (59–72 feet) wide, the goal cage is 2 m (about 7 feet) high and 3 m (about 10 feet) wide, and the goal circle is 6 m (20 feet) from the centre of the goal. For the 11-man game, usually played outdoors, the playing area is 90–110 m (295–360 feet) long and 55–65 m (180–213 feet) wide. the goal is 2.44 m (8 feet) high and 7.32 m (24 feet) wide, and the goal circle is 13 m (43 feet) from the goal.

Handball in its present form developed in Europe in the 1920s from earlier games. The game became an Olympic sport in 1972. The Fédération Internationale de Handball is the world governing body. *See* Olympic Games.

**team roping,** rodeo event in which two mounted cowboys attempt to rope and immobilize a full-grown steer. The event is timed, and the team with the lowest time wins. The team is allowed three throws. The first roper, called the header, must rope the steer about the head, and his partner, called the heeler, must rope both of the animal's hindfeet, bringing the steer to a halt without throwing it to the ground. A penalty of five seconds may be added if the second rope catches only one of the steer's legs.



Team roping
E.W. Marugg Photography

**Teamsters Union,** byname of INTERNATIONAL BROTHERHOOD OF TEAMSTERS, CHAUFFEURS, WAREHOUSEMEN AND HELPERS OF AMERICA, formerly (until 1940) INTERNATIONAL BROTHERHOOD OF TEAMSTERS, CHAUFFEURS, STABLEMEN AND HELPERS OF AMERICA (IBT), largest labour union in the United States, representing truck drivers and workers in related industries (such as aviation). The union was formed in 1903 when the Team Drivers International Union (1899) merged with the Teamsters National Union (1902). Local deliverymen using horse-drawn vehicles remained the core membership until the 1930s, when intercity truck drivers rose to predominance. From 1907 to 1952 the union was headed by Daniel J. Tobin, who built it up from 40,000 members in 1907 to more than 1,000,000 members by 1950. By 1940 it was already the nation's largest union. Presidents Dave Beck (1952–57) and James Hoffa (1957–71) converted the Teamsters into a strongly centralized union capable of negotiating nationwide freight-hauling agreements.

The union's size and its ability to bring shipments of essential commodities to a virtual halt gave it great bargaining power. But it also provided some officials with abundant opportunities for violently coercing small employers and profiting, in consort with organized crime, from the manipulation of union pension funds. Disclosures of corruption in their leadership led to the Teamsters' expulsion from the American Federation of Labor–Congress of Industrial Organizations (AFL–CIO) in 1957 after almost 60 years of membership in the AFL.

Between 1957 and 1988 three of the Teamsters' presidents—Beck, Hoffa, and Roy L. Williams—were convicted of various criminal charges and sentenced to prison terms. After his release from prison, Hoffa, who had clear links to organized crime, disappeared in 1975, presumably murdered. The Teamsters Union was readmitted to the AFL-CIO in 1987. In 1988 the Justice Department filed a civil racketeering suit against the union, but the suit was settled out of court in 1989. In 1992, given their first chance to directly elect their national leaders, members chose for president Ron Carey, the candidate supported by the reformist Teamsters for a Democratic Union. The Teamsters' membership among truck drivers declined after deregulation of the American trucking industry in the early 1980s encouraged the growth of nonunion companies, but the Teamsters gained many new members through their efforts to organize workers in various clerical, service, and high-technology occupations.

**Teapot Dome Scandal,** also called the OIL RESERVES, OR ELK HILLS, SCANDAL, in American history, scandal of the early 1920s surrounding the secret leasing of federal oil reserves by the secretary of the interior, Albert B. Fall. After President Warren G. Harding transferred supervision of the naval oil reserve lands from the navy to the Department of the Interior in 1921, Fall secretly granted to Harry F. Sinclair of the Mammoth Oil Company exclusive rights to the Teapot Dome (Wyoming) reserves (April 7, 1922). He granted similar rights to Edward L. Doheny of Pan American Petroleum Company for the Elk Hills and Buena Vista Hills reserves in California (1921–22). In return for the leases, Fall received large cash gifts and no-interest "loans."

When the affair became known, Congress directed President Harding to cancel the leases; the Supreme Court declared the leases fraudulent and ruled illegal Harding's transfer of authority to Fall. Although the president himself was not implicated in the transactions that had followed the transfer, the revelations of his associates' misconduct took a severe toll on his health; disillusioned and exhausted, he died before the full extent of the wrongdoing had been determined. Fall was convicted of accepting a bribe in the Elk Hills negotiations and imprisoned. Doheny and Sinclair were acquitted of charges of bribery and criminal conspiracy, but Sinclair spent 6½ months in prison for contempt of court and contempt of the U.S. Senate. Although the secretary of the navy, Edwin Denby, had signed all the leases, he was cleared of all charges. While "Teapot Dome" entered the American political vocabulary as a synonym for governmental corruption, the scandal had little long-term effect on the Republican Party. Calvin Coolidge, a Republican, was elected president in 1924.

**tear duct and gland,** also called LACHRYMAL, OR LACRIMAL, DUCT AND GLAND, the structures that produce, distribute, and carry away tears (drops of clear saline fluid that are diffused between the eye and eyelid). Tears moisten the membrane that covers the eye (conjunctiva) and facilitate motion. Tears are also secreted as a reflex response to various stimuli, including irritants to the cornea, bright lights, and hot or peppery substances in the mouth. Tear flow that occurs in association with emotional upset is known as crying, or weeping.

Each lachrymal gland lies in a slight hollow in the inner surfaces of the frontal bone, above the outer side of the eye. It is about the size and shape of a shelled almond and is divided by a fibrous partition into an upper and a lower portion, which projects into the back of the upper lid. Ducts from the gland discharge the tears from openings toward the outer side of the edge at the juncture of the conjunctiva lining the upper lid and that which covers the eyeball.

Normal amounts of tears washing down over the front of the eyeball are kept from spilling out onto the cheeks by the oil that the lid glands deposit on the margins of the lids. Tears leave the eye by way of the two lachrymal ducts, which have barely visible openings (puncta lacrimalia) at the nasal end of the upper and lower lid margins. The lachrymal ducts lead to the lachrymal sac; this is an expanded extension of the nasal duct, through which the tears escape into the nasal cavity.

**tear gas,** also called LACRIMATOR, any of a group of substances that irritate the mucous membranes of the eyes, causing a stinging sensation and tears. They may also irritate the upper respiratory tract, causing coughing, choking, and general debility. Tear gas was first used in World War I in chemical warfare, but since its effects are short-lasting and rarely disabling, it came into use by law-enforcement agencies as a means of dispersing mobs, disabling rioters, and flushing out armed suspects without the use of deadly force.

The substances most often used as tear gases are synthetic organic halogen compounds; they are not true gases under ordinary conditions but are liquids or solids that can be finely dispersed in the air through the use of sprays, fog generators, or grenades and shells. The two most commonly used tear gases are ω-chloroacetophenone, or CN, and *o*-chlorobenzylidenemalononitrile, or CS. CN is the principal component of the aerosol agent Mace and is widely used in riot control. It affects chiefly the eyes. CS is a stronger irritant that causes burning sensations in the respiratory tract and involuntary closing of the eyes, but its effects wear off more quickly, after only 5 to 10 minutes of breathing fresh air. Other compounds used or suggested as tear gases include bromoacetone, benzyl bromide, ethyl bromoacetate, xylyl bromide, and α-bromobenzyl cyanide. The effects of tear gases are temporary and reversible in most

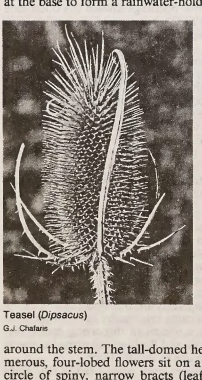
cases. Gas masks with activated charcoal filters afford good protection against them.

**Teasdale, Sara** (b. Aug. 8, 1884, St. Louis, Mo., U.S.—d. Jan. 29, 1933, New York, N.Y.), American poet whose short, personal lyrics were noted for their classical simplicity and quiet intensity.

Teasdale was educated in private schools and was under the care of a chaperon in her extensive travels. She made frequent trips to Chicago, where she eventually became part of Harriet Monroe's *Poetry* magazine circle. After rejecting the poet Vachel Lindsay as a suitor, she married a St. Louis businessman, Ernst Filsinger, in 1914. In 1929 she divorced him and moved to New York City, where she lived in virtual retirement until her suicide.

Her first book, *Sonnets to Duse and Other Poems,* was printed privately in 1907. From the beginning, her work was well received; with *Rivers to the Sea* (1915) she was established as a popular poet; for *Love Songs* (1917) she won the Pulitzer Prize in poetry in 1918. Her familiar "Let It Be Forgotten" is included in *Flame and Shadow* (1920). As her technical competence increased, her poetry became simpler and more austere—*e.g.,* the haunting "An End" (in *Dark of the Moon,* 1926). In her last book, *Strange Victory* (1933), many of the poems foreshadow her death.

**teasel,** any of about 15 species constituting the genus *Dipsacus* of the family Dipsacaceae, native to Europe, the Mediterranean area, and tropical Africa. Many teasels are prickly, coarse biennials with opposite leaves that join at the base to form a rainwater-holding trough



Teasel (*Dipsacus*)
G.J. Chafaris

around the stem. The tall-domed heads of numerous, four-lobed flowers sit on a crownlike circle of spiny, narrow bracts (leaflike structures). Male parts mature before female parts to ensure cross-pollination.

Fuller's teasel (*D. sativus*), nearly 1 m (3 feet) tall, bears pale lilac heads of flowers with hooked bracts. The spiny, dry fruiting heads have been used since Roman times to raise the nap of woolen fabrics in a process known as fulling. The plant is raised commercially in both Europe and North America for this purpose. Common teasel (*D. fullonum,* sometimes *D. sylvestris*) is similar but has upright rather than hooked bracts that are not useful for fulling. Common teasel is treated as a weed in both Europe and North America. *D. inermis* from the Himalayas produces white flowers and leaves that are divided into many segments. Shepherd's rod (*D. pilosus*), native to Europe, has a globe-shaped flower head and white blooms with violet anthers.

**Tebaldi, Renata** (b. Feb. 1, 1922, Pesaro, Italy), Italian operatic soprano, a star at both Milan's La Scala and New York City's Metropolitan Opera.

Tebaldi received her early musical training from her mother, a singer, and studied at the Parma Conservatory. At age 18 she sang for Carmen Melis, of the Arrigo Boito Conservatory in Pesaro, who accepted her as a student. She made her debut in Rovigo in 1944 as Elena in Arrigo Boito's *Mefistofele.*

In 1946 Tebaldi auditioned for Arturo Toscanini, who hired her for the reopening concert of La Scala, which had been closed during World War II. She joined the La Scala company in 1949 and sang with them through 1954. She also appeared at the Teatro San Carlo, Naples; at Covent Garden, London; in San Francisco and Chicago; and at the Metropolitan Opera, of which she was a member after 1954. Her great roles included Giacomo Puccini's Mimì (in *La Bohème*) and Tosca, Giuseppe Verdi's Desdemona (in *Otello*) and Aida, and Umberto Giordano's Madeleine (in *Andrea Chénier*).

**Tébessa,** Latin THEVESTE, town, northeastern Algeria. It is located 146 miles (235 km) by road south of Annaba and 12 miles (19 km) west of the Tunisian frontier. Tébessa was an outpost of Carthage in the 7th century BC and a Roman garrison town in 146 BC. It declined in the 5th and 6th centuries AD and disappeared from history after the Arab invasion of the 7th century. The Turks stationed a small military garrison there, and, after French rule began in Algeria in 1830, Tébessa was developed as the easternmost of the Algerian gateways to the south.

Dominating the town is a walled Byzantine citadel, comprising a square with 12 towers and 4 gateways. To the north is a Roman quadrifrontal arch erected during the reign of the emperor Caracalla (AD 214). An outstanding Christian basilica stands 1 mile (1.6 km) north of the town centre. There are also ruins of a Roman amphitheatre, thermal baths, and a temple of Minerva. In addition to working the phosphate mines of el-Kouif (northeast of the town), the town's present-day inhabitants engage in trade, especially in sheep, esparto grass, and grain, and also weave carpets. Pop. (1987 prelim.) mun., 107,559.

**technetium** (Tc), chemical element, synthetic radioactive metal of Group VIIb of the periodic table, the first element to be artificially produced. The isotope technetium-97 (2,600,000-year half-life) was discovered (1937) by the Italian mineralogist Carlo Perrier and the Italian-born American physicist Emilio Segrè in a sample of molybdenum that had been bombarded by deuterons in the Berkeley (California) cyclotron. This isotope is the longest-lived member of a set from technetium-92 to technetium-107 that has since been produced. The most important isotope, because it is the only one available on a large scale, is technetium-99 (212,000-year half-life); it is produced in kilogram quantities as a fission product in nuclear reactors. Technetium metal looks like platinum but is usually obtained as a gray powder. It crystallizes in the hexagonal close-packed structure and is a superconductor below 11.2 K. Except for technetium-99, technetium-97, and technetium-98 (1,500,000-year half-life), technetium isotopes are short-lived.

Technetium occurs in the Earth's crust as minute traces from the spontaneous fission of uranium; the relatively short half-lives preclude the existence of any primordial technetium on Earth. The American astronomer Paul W. Merrill's discovery in 1952 that technetium-99 is present in S-type stars was a valuable piece of evidence concerning stellar evolution and nucleosynthesis. Technetium, chemically similar to rhenium (atomic number 75), exists in oxidation states of +7, +6, and +4 in compounds such as $KTcO_4$, potassium technetate(VII), $TcCl_6$, technetium(VI) chloride, and $TcS_2$, technetium(IV) sulfide, respectively.

| | |
|---|---|
| atomic number | 43 |
| commonest isotope | (99) |
| melting point | 2,172° C (3,942° F) |
| boiling point | 4,877° C (8,811° F) |
| specific gravity | 11.5 (20° C) |
| valence | 4, 6, 7 |
| electronic config. | 2-8-18-14-1 or (Kr)$4d^5 5s^1$ |

**technical assistance,** form of aid given to less-developed countries by international organizations such as the United Nations (UN) and its agencies, individual governments, foundations, and philanthropic institutions. Its object is to provide those countries with the expertise needed to promote development. Most technical-assistance programs began after World War II, when much of Europe and Southeast Asia lay in ruins and the countries of Africa and Central and South America were attempting to improve their standards of living. The U.S. president Harry Truman's Point Four Program (*q.v.*), announced in 1949, was a notable early example. Technical assistance may involve sending experts into the field to teach skills and to help solve problems in their areas of specialization, such as irrigation, agriculture, fisheries, education, public health, or forestry. Conversely, scholarships, study tours, or seminars in developed countries may be offered, giving individuals from less-developed nations the opportunity to learn special skills that they can apply when they return home. Vocational guidance, management development, business administration, home economics, mathematics, science, accounting, trade skills, urban planning, and legal services are a few of the many areas in which technical assistance has been provided.

Many governments furnish technical assistance to depressed urban or rural localities or needy groups within their borders. For example, the United States provides technical assistance for migrant workers, Indian reservations, run-down urban neighbourhoods, and small farmers.

The largest technical-assistance programs are those administered by the UN and its agencies. They are financed by voluntary contributions from members and concentrate on four major areas: agricultural production, basic-resource surveys and administrative services, health services, and education.

**technical education,** the academic and vocational preparation of students for jobs involving applied science and modern technology. It emphasizes the understanding and practical application of basic principles of science and mathematics, rather than the attainment of proficiency in manual skills that is properly the concern of vocational education. Technical education has as its objectives the preparation of graduates for occupations that are classed above the skilled crafts but below the scientific or engineering professions. People so employed are frequently called technicians. Technical education is distinct from professional education, which places major emphasis upon the theories, understanding, and principles of a wide body of subject matter designed to equip the graduate to practice authoritatively in such fields as science, engineering, law, or medicine. Technical occupations are vital in a wide range of fields, including agriculture, business administration, computers and data processing, education, environmental and resource management, graphic arts and industrial design, and health and medicine; technical educational curricula are correspondingly specialized over a broad range. Technical education is typically offered in post-high-school curricula that are two years in length, are not designed to lead to a bachelor's degree, and are offered in a wide variety of institutions,

such as technical institutes, junior colleges, vocational schools, and regular colleges and universities.

**Technicolor** (trademark), motion-picture process using dye-transfer techniques to produce a colour print. The Technicolor process, perfected in 1932, originally used a beam-splitting optical cube, in combination with the camera lens, to expose three black-and-white films. The light beam was split into three parts as it entered the camera, one beam favouring the red portion of the spectrum, one favouring the green, and one the blue. Each image was captured simultaneously on a separate band of black-and-white film. The three strips were developed separately and printed, after which the prints were passed through their appropriate coloured dyes; when laminated together, they produced a reasonably faithful approximation of natural colour. In a later version of the process, only one integral tri-pack colour negative film was exposed during filming, and three colour-separated negatives could then be made from this. These three colour-separated strips were appropriately dyed and then superimposed on a final emulsion to produce a full-colour image.

**technocracy,** government by technicians who are guided solely by the imperatives of their technology. The concept developed in the United States early in the 20th century as an expression of the Progressive movement and became a subject of considerable public interest in the 1930s during the Great Depression. The origins of the technocracy movement may be traced to Frederick W. Taylor's introduction of the concept of scientific management. Writers such as Henry L. Gannt, Thorstein Veblen, and Howard Scott suggested that businessmen were incapable of reforming their industries in the public interest and that control of industry should thus be given to engineers.

The much-publicized Committee on Technocracy, headed by Walter Rautenstrauch and dominated by Scott, was organized in 1932 in New York City. Scott proclaimed the invalidation, by technologically produced abundance, of all prior economic concepts based on scarcity; he predicted the imminent collapse of the price system and its replacement by a bountiful technocracy. The committee broke up within a year and was succeeded by the Continental Committee on Technocracy, which faded by 1936, and Technocracy, Inc., headed by Scott. Technocratic organizations sprang up across the United States and western Canada, but the technocracy movement was weakened by its failure to develop politically viable programs for change, and support was lost to the New Deal and third-party movements.

BIBLIOGRAPHY. Daniel Nelson, *Frederick W. Taylor and the Rise of Scientific Management* (1980); and William E. Akin, *Technocracy and the American Dream: The Technocrat Movement, 1900–1941* (1977), survey the movement's origins and history.

**technology,** the application of scientific knowledge to the practical aims of human life or, as it is sometimes phrased, to the change and manipulation of the human environment.

The subject of technology is treated in a number of articles in the MACROPAEDIA. A general history is given in Technology, History of. For other general treatments, *see* Industrial Engineering and Production Management; Tools; Work and Employment. For a treatment of the technology of energy conversion and utilization, *see* Atoms; Electricity and Magnetism; Energy Conversion; Particle Accelerators. For treatments of the processing and utilization of biological resources, *see* Agricultural Sciences; Agriculture, History of; Beverage Production; Conservation of Natural Resources; Farming and Agricultural Technology; Fishing and Marine Products, Commercial; Food Processing; Forestry and Wood Production. For particular aspects of industrial production and the utilization of natural resources, *see* Industrial Ceramics; Industrial Glass; Industrial Polymers; Industries, Chemical Process; Industries, Manufacturing; Industries, Textile; Materials Science. For a treatment of medical aspects, *see* Birth Control; Diagnosis and Therapeutics; Drugs and Drug Action; Medicine; Occupational Diseases and Disorders. For a treatment of communications and information technology, *see* Broadcasting; Computers; Drafting; Electronics; Information Processing and Information Systems; Motion Pictures; Photography; Postal Systems; Printing, Typography, and Photoengraving; Publishing; Sound; Telecommunications Systems. For military aspects, *see* War, Technology of; War, Theory and Conduct of. For a treatment of the technology of observation, measurement, and control, *see* Analysis and Measurement, Physical and Chemical; Climate and Weather; Exploration; Mapping and Surveying; Microscopes; Navigation; Radar; Telescopes. For a treatment of the technology of the human environment, *see* Building Construction; Engineering; Police; Public Works; Transportation. For a treatment of trends in modern technology, *see* Automation; Modernization and Urbanization.

For a description of the place of technology in the circle of learning and for a list of MICROPAEDIA as well as MACROPAEDIA articles on the subject, *see* PROPAEDIA: Part Seven.

**Tecomán,** city, southeastern Colima *estado* ("state"), west-central Mexico. It is situated on the Pacific lowlands near the Armería River, at 260 feet (80 m) above sea level. Located in the state's major agricultural region, Tecomán's surrounding area yields coconuts, cotton, various tropical fruits, corn (maize), and beans. Lemon oil and cottonseed oil are the city's principal manufactures. Pop. (1990 prelim.) mun., 80,842.

**tectogene,** great downbuckle of the Earth's crust into the mantle below deep-sea trenches that are filled with marine sediments. The sediments become crumpled and folded within the deep downbuckle; some portions are squeezed downward into the mantle, while others are squeezed upward in highly deformed and dislocated strata. According to the theory of Dutch geophysicists working in Indonesia under the leadership of Felix Andries Vening Meinesz in the 1930s, the development of a tectogene is a necessary precursor to orogenic, or mountain-building, activity. According to this theory, the folded and dislocated trench sediments are incorporated into island arcs, which in turn become the site of Andean-type and, finally, Himalayan-type orogenic belts. *See also* geosyncline; orogeny.

**tectonics,** scientific study of the deformation of the rocks that make up the Earth's crust and the forces that produce such deformation. It deals with the folding and faulting associated with mountain building; the large-scale, gradual upward and downward movements of the crust (epeirogenic movements); and sudden horizontal displacements along faults. Other phenomena studied include igneous processes and metamorphism. Tectonics embraces as its chief working principle the concept of plate tectonics (*q.v.*), a theory that was formulated in the late 1960s by American, Canadian, and British geophysicists to broaden and synthesize the notion of continental drift and the seafloor spreading hypothesis (*qq.v.*).

**tectonism:** *see* diastrophism.

**Tecumseh,** also spelled TECUMTHE, TIKAMTHE, or TECUMTHA (b. 1768, Old Piqua [modern Clark county, Ohio, U.S.]—d. Oct. 5, 1813, near Thames River, Upper Canada [now in Ontario, Can.]), Shawnee Indian chief, orator, military leader, and advocate of intertribal Indian alliance who directed Indian resistance to white rule in the Ohio River valley. In the War of 1812 he joined British forces for the capture of Detroit and the invasion of Ohio. A decisive battle against William Henry Harrison's U.S. troops ended in Tecumseh's defeat and death.

*Early life and training.* Tecumseh was born in an Indian village near present-day Springfield, Ohio. His father was killed by whites in 1774. His mother, a Muskogee (Creek Confederacy), left him, when he was seven years old, to accompany part of the tribe to Missouri and then passed into obscurity. Tecumseh was reared by an elder sister, Tecumapease, who trained him in the strict Shawnee code of honesty; an older brother, Cheesekau, taught him woodcraft and hunting. He was adopted by the Shawnee chief Blackfish and grew to young manhood with several white foster brothers whom Blackfish had captured.

Murder, massacre, and the invasion of the Shawnee's lands and the destruction of their crops deepened a hatred of whites that was instilled in Tecumseh by his mother. When he was about 14 years old, during the U.S. War of Independence, he accompanied Blackfish in combined British and Indian attacks on Americans. As hostile as he was toward whites, however, Tecumseh rebuked his fellow Shawnees about a year later for the cruelty that they themselves practiced, and it was then that he discovered that words could be as powerful as weapons. He had accompanied one of the predatory Shawnee raids on the flatboats that were bringing encroaching white settlers down the Ohio River; he had seen a white man tied to a stake and burned. Horrified, he had showered his fellow tribesmen with such abuse that they never tortured a prisoner in his presence again.

After the war, Tecumseh for a number of years was a marauder, fighting small actions against the whites in the Northwest and assisting the Cherokees in the South. He saw his brother Cheesekau killed in an unsuccessful raid near Nashville, Tenn., in September 1792. Although he was the youngest of the Shawnee band, Tecumseh was chosen leader, fought small actions in the South, and made an acquaintance with the Creeks that helped him later to form an alliance with them.

At the call of Bluejacket, the Shawnee chief who was collecting a force to meet a U.S. army under Major General Anthony Wayne, Tecumseh returned to Ohio, where he directed the unsuccessful attack on Fort Recovery in June 1794. On August 20, he led part of Bluejacket's force when it was decisively defeated by Wayne at Fallen Timbers. There he saw another older brother, Sauwaseekau, killed.

*Break with the "peace" chiefs.* When the leading chiefs of the Old Northwest gathered at Wayne's call at Greenville, in Ohio, Tecumseh held aloof; and, when the Treaty of Greenville was negotiated in August 1795, he refused to recognize it and roundly attacked the "peace" chiefs who signed away land that he contended they did not own. Land, he said, was like the air and water, the common possession of all Indians. This doctrine of communal ownership of the land became the cornerstone of his policy.

Partly because of his superb oratory, which the whites compared with that of the young Henry Clay, the rising political leader in Kentucky, Tecumseh became the spokesman for the Indians in great councils in Ohio, at Urbana (1799) and Chillicothe (1804), that undertook to settle grievances. For a time he studied treaties, spoke at councils, and lived peacefully in Ohio and Indiana.

About 1808 Tecumseh settled in the area of present-day Indiana with his brother Ten-

skwatawa, called "the Prophet" because he claimed to have had a revelation from the "Master of Life." There the brothers sought to induce the Indians to discard white customs and goods and to abjure intertribal wars for unity against the white invader. The code of the Prophet had a mysticism that appealed to the Indians, and many became converts.

*Organizer of Indian confederation.* With inexhaustible energy, Tecumseh began to form an Indian confederation to resist white pressure. He made long journeys in a vast territory, from the Ozarks to New York and from Iowa to Florida, gaining recruits (particularly among the tribes of the Creek Confederacy, to which his mother's tribe belonged). The tide of settlers had pushed game from the Indians' hunting grounds, and, as a result, the Indian economy had broken down.

In 1811, while Tecumseh was in the South, William Henry Harrison, governor of the Indiana Territory, marched up the Wabash River and camped near the brothers' settlement. The Prophet unwisely attacked Harrison's camp and was so decisively defeated in the ensuing Battle of Tippecanoe that his followers dispersed, and he, having lost his prestige, fled to Canada and ceased to be a factor in Tecumseh's plans.

Seeing the approach of war (the War of 1812) between the Americans and British, Tecumseh assembled his followers and joined the British forces at Fort Malden on the Canadian side of the Detroit River. There he brought together perhaps the most formidable force ever commanded by a North American Indian, an accomplishment that was a decisive factor in the capture of Detroit and of 2,500 U.S. soldiers (1812).

Fired with the promise of triumph after the fall of Detroit, Tecumseh departed on another long journey to arouse the tribes, which resulted in the uprising of the Alabama Creeks in response to his oratory, though the Chickasaws, Choctaws, and Cherokees rebuffed him. He returned north and joined the British general Henry A. Procter in his invasion of Ohio. Together they besieged Fort Meigs, held by William Henry Harrison, on the Maumee River above Toledo, where by a stratagem Tecumseh intercepted and destroyed a brigade of Kentuckians under Colonel William Dudley that had been coming to Harrison's relief. He and Procter failed to capture the fort, however, and were put on the defensive by Oliver Hazard Perry's decisive victory over the British fleet on Lake Erie (Sept. 10, 1813). Harrison thereupon invaded Canada. Tecumseh with his Indians reluctantly accompanied the retiring British, whom Harrison pursued to the Thames River, in present-day southern Ontario. There, on Oct. 5, 1813, the British and Indians were routed, and Harrison won control of the Northwest. Tecumseh, directing most of the fighting, was killed. His body was carried from the field and buried secretly in a grave that has never been discovered. Nor has it ever been determined who killed Tecumseh. Tecumseh's death marked the end of Indian resistance in the Ohio River valley and in most of the lower Midwest and South, and soon thereafter the depleted tribes were transported beyond the Mississippi River.

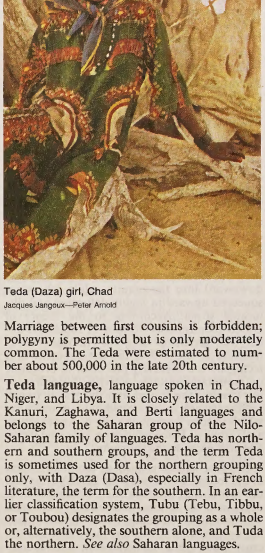
(G.Tu.)

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**Teda,** also called TODA, TODAGA, TODGA, TUDA, or TUDAGA, people of the eastern and central Sahara (Chad, Niger, and Libya). They speak a language belonging to the Saharan group of the Nilo-Saharan language family.

The Teda live either as nomadic herdsmen or as farmers near oases. Dates are a staple, and a variety of grains, legumes, and root crops are cultivated. Cattle, goats, donkeys, camels, and sheep are kept, and caravan trade is an important factor in the economy. Sedentary Teda villagers typically live in palm-thatched, rectangular mud houses or cylindrical huts of mud or stone with conical thatch.

The Teda are Islāmic in religion, and one tribe has a sultan. Real power typically rests with local herdsmen, who inherit their offices. Descent is reckoned in the father's line. Marriage involves a payment, usually of livestock, from the groom's family to the bride's.



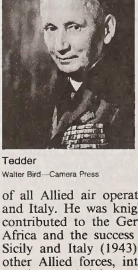
Teda (Daza) girl, Chad
Jacques Jangoux—Peter Arnold

Marriage between first cousins is forbidden; polygyny is permitted but is only moderately common. The Teda were estimated to number about 500,000 in the late 20th century.

**Teda language,** language spoken in Chad, Niger, and Libya. It is closely related to the Kanuri, Zaghawa, and Berti languages and belongs to the Saharan group of the Nilo-Saharan family of languages. Teda has northern and southern groups, and the term Teda is sometimes used for the northern grouping only, with Daza (Dasa), especially in French literature, the term for the southern. In an earlier classification system, Tubu (Tebu, Tibbu, or Toubou) designates the grouping as a whole or, alternatively, the southern alone, and Tuda the northern. *See also* Saharan languages.

**Tedder (of Glenguin), Arthur William Tedder, 1st Baron** (b. July 11, 1890, Glenguin, Stirling, Scot.—d. June 3, 1967, Banstead, Surrey, Eng.), marshal of the Royal Air Force and deputy commander of the Allied Expeditionary Force under General Dwight D. Eisenhower, who contributed significantly to the success of the Allied invasion of Normandy (June 6, 1944) and the German defeat on the Western Front during World War II through his policy of bombing German communications and of providing close air support of ground operations.

Tedder joined the British army in 1913, transferring to the Royal Flying Corps in 1916. Remaining in the Royal Air Force (RAF) after World War I, he became RAF commander of the Far East Command (1936–38) and thereafter director of research and development. Appointed head of the RAF Middle East Command in 1941, he later took control



Tedder
Walter Bird—Camera Press

of all Allied air operations in North Africa and Italy. He was knighted in 1942. Tedder contributed to the German defeat in North Africa and the success of Allied landings in Sicily and Italy (1943) by cooperating with other Allied forces, interdicting enemy supply lines, and giving tactical support to Allied ground troops.

Appointed Eisenhower's deputy in early 1944 and given control of all Allied air operations in western Europe, Tedder repeated his earlier successes by sealing off the Normandy beaches from the air and keeping German reinforcements from reaching the Allied beachhead. His bombing of the German transportation network significantly speeded the Allied advance during the final months of World War II. Elevated to the peerage in 1946, Tedder became the first peacetime chief of the air staff and senior member of the air council. He wrote *With Prejudice* (1966), his account of World War II.

**Teddington,** residential area in the London borough of Richmond upon Thames, about 11 miles (18 km) southwest of central London. Teddington is situated on the north bank of the River Thames, and its large lock (1912) marks both the North Sea tidal limit on the Thames and the upstream limit of the jurisdiction of the Port of London Authority. The National Physical Laboratory is at Teddington.

**teens,** the years 13 to 19 in the human life span, a period roughly equivalent to adolescence (*q.v.*).

**Tees, River,** river in northern England. It rises on Cross Fell in the northern Pennines and flows 70 miles (110 km) east to the North Sea. In its upper course it flows in a typical Pennines dale (valley) where high moorlands flank an attenuated strip of farmland. At Caldron Snout and High Force there are waterfalls where the river crosses the hard dolerite outcrop of the Whin Sill. Below Middleton-in-Teesdale the valley broadens, and the river receives important right-bank tributaries, the Lune, the Balder, and the Greta, from subsidiary dales. Extensive tracts of the upper dales have been flooded to impound water for the needs of the industrial towns of Teesside. Below Barnard Castle the Tees meanders across a fertile clay plain to its estuary below Middlesbrough, where, until the 19th century, it entered the sea by shifting channels among extensive mud flats. The tortuous channel below Stockton has been straightened by artificial cuts, and large areas along the estuary shore have been reclaimed by dumping slag. Until the 20th century, Stockton was the lowest bridging point, but there are now bridges at Middlesbrough. Since 1825, when the Stockton and Darlington Railway was built (it was extended to Middlesbrough

in 1830), the river mouth, Teesside, has been the scene of large-scale industrial development and urbanization, associated with the coal trade, the iron and, later, the steel industry, heavy chemicals, and oil refining.

**Teesdale,** district, county of Durham, northeastern England, occupying an area of 325 square miles (843 square km) in the southwestern part of the county. It is mostly an upland area within the northern Pennines with bleak basalt and limestone moorlands that gradually descend eastward from an elevation of about 2,500 to 600 feet (760 to 185 m) and border the River Tees valley on both north and south. The arable, undulating plain southeast of the River Tees valley and near the district seat of Barnard Castle grows cereals, potatoes, and fodder crops; dairy cattle are also raised in the area.

Coal mining was never as important in Teesdale district as it was in the more northeasterly areas of the county of Durham. A Quaker-owned company mined lead deposits in the narrow upper section of the western Tees valley from about 1750 to the early 20th century, the company's concern for the well-being of its workers can still be seen in the substantial stone buildings it erected for them at Middleton-in-Teesdale and other nearby villages. The stark, often snow-covered mountains of western Teesdale contain waterfalls, rare flowering plants, and reservoirs supplying water to heavy industries near the North Sea.

Medieval remains in the district include the well-preserved Raby Castle near the town ("parish") of Staindrop. The old market centre of Barnard Castle has been preserved through its official designation as a Conservation Area. It was in the town of Barnard Castle in 1838 that Charles Dickens was inspired to write the novel *Nicholas Nickleby.* Pop. (1998 est.) 25,000.

**teetee** (monkey): *see* titi.

**teeth:** *see* tooth.

**Tefé,** city, central Amazonas *estado* ("state"), northwestern Brazil. Founded by missionaries as Nogueira in the 17th century and also called Ega at one time, Tefé lies on the left (north) bank of the portion of the Amazon River known as the Solimões, on the lake formed by the mouth of the Tefé River. River steamers and hydroplanes use facilities at Tefé, which ships Brazil nuts, tobacco, rubber, cassava flour, and dried fish, principally to Manaus, the state capital, located 370 miles (595 km) downstream. Pop. (1996) 47,700.

**tefillin** (Judaism): *see* phylactery.

**Teflon,** trade name for synthetic resin composed of polytetrafluoroethylene (*q.v.*).

**Tefnakhte,** chieftain of Sais, in the northwest Nile delta, later king and founder of the 24th dynasty, which lasted from about 722 to about 715 BC. He was reduced to vassalage by Piye (formerly called Piankhi), a Cushite (Nubian) ruler who invaded Egypt.

From his base in the northwest delta, Tefnakhte, a Libyan prince, advanced south in a bid to conquer Upper Egypt. Securing allies along the way, he succeeded in reaching Hermopolis, a Middle Egyptian town. This action provoked the Cushite, who was the protector of Upper Egypt, to action. In a swift series of attacks, he smashed Tefnakhte's river fleet and drove him back to Memphis, near modern Cairo, where a stubborn siege developed. While Tefnakhte went northward seeking reinforcements, Piye captured Memphis and resumed his advance into the delta. Tefnakhte submitted, but not in person, and swore a loyalty oath as a vassal.

After Piye returned to Cush, Tefnakhte quickly abandoned his oath and proclaimed himself king of Egypt. The king "So," with whom Hosea, king of Israel, conspired according to 2 Kings 17:1–4, has been identified by some scholars as Tefnakhte, "So" probably referring to Sais, his capital. This event, if accurately placed, would predate Piye's intervention in Lower Egypt.

**Tegakwitha, Kateri,** also spelled KATERI TEGAKOUITA: *see* Tekakwitha, Kateri.

**Tegal,** *kotamadya* (municipality) and port Jawa Tengah *provinsi* ("province"), central Java, Indonesia, located on the Java Sea about 160 miles (257 km) east-southeast of Jakarta. Roads and railway link it with Cirebon on the west, Semarang on the east, and Kroya and Yogyakarta on the south and southeast. Its population is mostly Javanese, and Islām is the dominant religion. Tegal is a centre for transshipment of agricultural produce; major exports include sugar and fish. Industries include cotton and sugar milling, iron founding, pottery, and machine and tool manufacture. A fisheries school is located in the city. An area reserved for hunting, about 6 miles (10 km) south of Tegal, is a tourist attraction. Pop. (1995 est.) city, 289,744.

*Where the same name may denote a person, place, or thing, the articles will be found in that order*

**Tegea,** ancient Greek city of eastern Arcadia, 4 miles (6.5 km) southeast of the modern town of Tripolis. The Temple of Athena Alea at Tegea was described by the Greek geographer Pausanias (2nd century AD) as excelling all others in the Peloponnese. Originally built by the city's traditional founder, Aleus, the temple was later rebuilt by Scopas, the famous sculptor. Fragments of the temple have been found. Nine separate communities, at an unknown date, united to form Tegea, which until about 550 BC acted as a curb on Spartan expansion. Tegea, loyal to Sparta until 370, thereafter joined a succession of leagues and, by Augustus' time (early 1st century AD), was the only important town in Arcadia. Tegea survived being sacked by the Goths in AD 395–396 and flourished under Byzantine and Frankish rule. Tripolis, founded in the 14th century, replaced Tegea.

**Tegelen,** *gemeente* (commune), Limburg *provincie,* southeastern Netherlands, bounded on the west by the Maas (Meuse) River. It is known for the Passion Play performed there every few years (May to September). Situated near Venlo in a market-gardening area, Tegelen, as the name implies (*tegel* meaning "tile"), manufactures tiles and pottery; it also has an iron foundry and quarries. Pop. (1981 est.) 17,967.

**Tegernsee,** lake, southern Bayern (Bavaria), southeastern Germany, lying at 2,380 feet (725 m) above sea level, surrounded by wooded mountains on the fringe of the Bavarian Alps, south of Munich. It is nearly 4 miles (6.5 km) long, almost 1 mile wide (1.6 km), and 3.5 square miles (9 square km) in area, with a maximum depth of 236 feet (72 m). Its waters discharge through the Mangfall to the Inn rivers. The lake is a popular summer and winter recreational area, with facilities for yachting and other water sports. Main resorts are Tegernsee village on the eastern shore, with the castle of the Bavarian king Maximilian I (until 1803 a Benedictine abbey, founded in 746); Bad Wiessee on the western shore, a spa with iodine and sulfur springs; and Rottach-Egern on the southern shore at the foot of the Wallberg (5,650 feet [1,722 m]), from whose summit are views across the Mangfall Mountains to the Hohe Tauern and of the Zugspitze, Germany's highest mountain, to the southwest.

**Tegh Bahādur** (b. 1621?, Amritsar, Punjab, India—d. Nov. 11, 1675, Delhi), ninth Sikh Gurū and second Sikh martyr, who gave his life for a religion not his own.

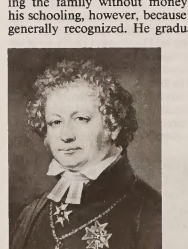
After the eighth Gurū, Hari Krishen, the "child Gurū," told his followers that his successor would be found in the village of Bakāla, a deputation went there and found 22 claimants. Bhai Makhan Shah, a wealthy Sikh merchant, sought out Tegh Bahādur, who, he realized, displayed none of the greed and self-aggrandizement of the other pretenders. Thereupon he proclaimed Tegh Bahādur ninth Gurū.

Tegh Bahādur ran afoul of the Mughal authorities by giving aid and shelter to some Hindu holy men from Kashmīr who had been ordered by the emperor Aurangzeb to accept Islām. The Hindus sent word to the emperor that they would accept Islām if the Gurū became a Muslim. Tegh Bahādur was arrested and confined to the fortress in Delhi. Rivals at court, wishing to harm him further, accused him of having worldly desires because he gazed constantly at the emperor's harem, which lay to the west of the prison. When confronted with this charge, the Gurū is said to have replied: "Emperor, I was not gazing at your queen's apartments. I was looking in the direction of the Europeans who are coming from beyond the western seas to destroy your empire."

Aurangzeb, his patience at an end, ordered the Gurū to embrace Islām or perform a miracle. Tegh Bahādur refused to do either and, after the Gurū recited the *Japjī* (the most important Sikh scripture), the executioner decapitated him. A loyal Sikh took the Gurū's head back to Anandpur, and his body was cremated. A Sikh shrine, Gurdwārā Rakābgunj, marks the spot.

**Tegnér, Esaias** (b. Nov. 13, 1782, Kyrkerud, Swed.—d. Nov. 2, 1846, Östrabo), Swedish teacher, bishop, and most popular poet of his period.

When Tegnér was nine his father died, leaving the family without money. He received his schooling, however, because his talent was generally recognized. He graduated from the University of Lund in 1802 and was appointed professor of Greek there 10 years later. He continued to lecture at Lund until 1824, when he became bishop of Växjö, a position he retained all his life.



Tegnér, oil painting by Johan Gustaf Sandberg, 1836; in the University of Uppsala, Sweden

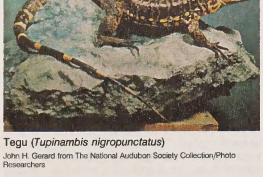
By courtesy of the Konsthistoriska Institutionen, Uppsala Universitet, Sweden

Originally associated with the Romantic movement, he rejected its emotional and mystic aspects. His ideal of poetry became increasingly more Classical but assimilated certain Romantic ingredients. His greatest poetic achievements were the much-translated *Frithiofs saga* (1825), a cycle based on an Old Icelandic saga, and two narrative poems, the sensitive religious idyll *Children of the Lord's*

*Supper* (1820; translated by Henry Wadsworth Longfellow) and *Axel* (1822).

Tegnér, who had been a liberal most of his life, became an ultraroyalist in his later and rather unproductive years.

**tegu** (*Tupinambis*), any of several large, carnivorous, tropical South American lizards of the family Teiidae. All species are black with yellow or white bands across the back. The

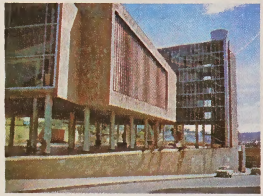


Tegu (*Tupinambis nigropunctatus*)
John H. Gerard from The National Audubon Society Collection/Photo Researchers

scales are small, square, and arranged in regular rings around the body. These lizards range in length up to 1.2 m (4 feet).

**Tegucigalpa,** city and capital of the Republic of Honduras. It is located on hilly terrain hemmed in by mountains, at an elevation of 3,200 feet (975 m) above sea level. Tegucigalpa, founded in 1578 on the slopes of Mount Picacho as a gold- and silver-mining centre, alternated with Comayagua, 35 miles (56 km) to the northwest, as capital from 1824 to 1880, when Tegucigalpa was made the permanent capital of the republic. In 1938 it was combined with the city of Comayagüela, which is located just across the Choluteca River to the south, to form the *distrito central* ("central district").

The city's principal buildings include the presidential and legislative palaces, the National University of Honduras (1847), and an 18th-century cathedral. Industrial production, formerly small and mostly for local consumption, increased in the 1970s with the improvement of road connections. Products include textiles, clothing, sugar, cigarettes, lumber, plywood, paper, ceramics, cement, glass, metalware, plastics, chemicals, tires, electrical ap-



The National Assembly building in Tegucigalpa, Honduras
Ewing Galloway

pliances, and farm machinery. Increasing numbers of *maquiladoras* (duty-free assembly plants) have been established in the metropolitan area since the late 20th century. Silver, lead, and zinc are mined in the area around the city. Tegucigalpa also has an industrial park.

One of the few capitals in the world without a railroad, Tegucigalpa depends largely on the international airport at Toncontín. Freight can be trucked in over the all-weather Inter-Oceanic Highway from Puerto Cortés on the Caribbean coast or San Lorenzo on the Pacific coast. From El Salvador and Nicaragua the Inter-American (Pan-American) Highway intersects the Inter-Oceanic Highway, which leads to the city. Roads to other departments also fan out from Tegucigalpa. Pop. (1999 est.) 988,400.

**Tehrān,** also spelled TEHERAN, city, capital of Iran, situated on the southern slopes of the Elburz Mountains, 62 miles (100 km) from the Caspian Sea. It lies at an elevation of about 3,800 feet (1,200 m) above sea level between the Jājrūd and the Karaj rivers. To the south extends the Central Plateau of Iran. The name Tehrān is derived from the Old Persian *teh,* "warm," and *ran,* "place."

Tehrān is the successor to the ancient Iranian capital of Rayy, which was destroyed by the Mongols in AD 1220; traces of Rayy—where the conqueror Alexander the Great halted while pursuing Darius III, king of Persia, in 330 BC—are still to be found south of Tehrān. The village of Tehrān is believed to have been a suburb of Rayy in the 4th century, and after the fall of Rayy many of the inhabitants moved to Tehrān. The first European to mention Tehrān was Don Ruy González de Clavijo, ambassador to the king of Castile to the court of Timur (Tamerlane), who visited the town in 1404. Tehrān was the home of several Safavid rulers of Persia from the 16th to the 18th century.

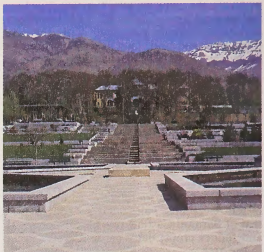
Tehrān became prominent after its capture in 1785 by Āghā Moḥammad Khān, the founder of the Qājār dynasty (1779–1925), who made the city his capital in 1788. Since that date Tehrān has been the capital of Iran. After the deposition of the last of the Qājārs in 1925, the city was greatly expanded under Reza Shah Pahlavi (1925–41). In 1943 the World War II leaders of the Allies, representing the United States, the United Kingdom, and the Soviet Union, met at the Tehrān Conference, at which, among other decisions, they guaranteed the independence of Iran.

During the reign of Mohammad Reza Shah Pahlavi (1941–79) the city was rapidly modernized, partly the result of a booming petroleum industry. Following the overthrow of the shah in 1979, the city's development was hampered by economic difficulties resulting from the Iran-Iraq War, underinvestment, and factional strife. Growth and modernization accelerated during the 1990s, thanks in large part to economic liberalization under President Mohammad Khatami.

Tehrān experiences warm summers and relatively cool winters. High and low mean monthly temperatures are 84° F (29° C) in July and 39° F (4° C) in January. The average annual rainfall is about 8 inches (203 mm); rain usually falls from November to the end of May, and snow also occurs from December to the end of February. Air pollution has worsened as a result of the increase in motor traffic and the increased use of oil fuel by industry.

The ethnic composition of Tehrān is similar to that of Iran in general. The majority of the inhabitants are Muslim. Persian is the language in general use, but approximately one-fourth of the population speaks Azeri. Instability in neighbouring countries during the 1980s and '90s contributed to an increase in immigration to the city, particularly from Afghanistan.

Because it has grown rapidly since 1925, Tehrān, of all Iranian towns, has the least Oriental aspect. Since the 1950s a number of buildings with from 10 to 18 stories have been constructed. The fashionable districts of the city are to the north, and the old town and the bazaar are to the south. Important buildings include the Motahari (formerly Sepāh-sālār) Mosque, the Baharstān Palace (the seat of the Majles, or parliament), the Shams al-Emāreh, and the Niāvaran Palace. The Golestān Palace, the Sa'adābād Palace, and the Marmar (Marble) Palace are now maintained as museums. There is also a notable archaeological museum



The Niavaran Palace, Tehrān, Iran
Robert Harding Picture Library, London

and an ethnographical museum. Tehrān is the seat of the University of Tehrān (1932), the Iran University of Science and Technology (1928), and several other institutions of higher learning.

More than half of Iran's manufactured goods are produced in Tehrān. Industrial plants manufacture such items as textiles, cement, sugar, chinaware and pottery, electrical equipment, and pharmaceuticals. There is also a car-assembly industry, and an oil refinery is in operation at Rayy.

Three paved roads run northward, one runs to the west, two to the south, and one to the east. The Iranian state railway has lines running north, northwest, south, and east from Tehrān; the city is also linked to the trans-Europe railway system via Turkey.

Tehrān is linked by air to major cities in Europe and Asia and to states in the Persian Gulf. Domestic air services also link the capital to major Iranian towns. There is an international airport at Mehrābād, 6 miles (10 km) west of central Tehrān; two smaller airports—at Qal'eh Morghī and Daushan-Tapeh—are used by small aircraft. Pop. (1996) 6,758,845.

**Tehrān Conference** (Nov. 28–Dec. 1, 1943), meeting between the U.S. president Franklin D. Roosevelt, the British prime minister Winston Churchill, and the Soviet premier Joseph Stalin. The chief discussion centred on the "second front" in wartime Europe. Stalin agreed to an eastern offensive to coincide with the forthcoming invasions of German-occupied France.

Though military questions were dominant, the Tehrān Conference saw more discussion of political issues than had occurred in any previous meeting between Allied governmental heads. Not only did Stalin repeat his desire that the Soviet Union should retain the frontiers provided by the German-Soviet Nonaggression Pact of 1939 and by the Russo-Finnish Treaty of 1940, but he also stated that it would want in addition the Baltic coast of East Prussia. Though the settlement for Germany was discussed at length, all three Allied leaders appeared uncertain; their views were imprecise on the topic of a postwar international organization; and on the Polish question the Western Allies and the Soviet Union found themselves in sharp dissension, when Stalin expressed his continued distaste for the London Polish government. On Iran, which Allied forces were partly occupying, they were able to agree on a declaration (published on Dec. 1, 1943) guaranteeing the postwar independence and territorial integrity of that state and promising postwar economic assistance.

**Tehri-Garhwāl,** town, northern Uttar Pradesh state, northern India. The town (usually called simply Tehri) is an agricultural trade centre on the Bhāgīrathi River.

The surrounding region occupies an area of

1,707 square miles (4,421 square km), wholly within the Himalayan Range, and is bounded (south) by the Ganges River. Rice, barley, wheat, and oilseeds are among the main crops. Formerly the princely state of Tehri, it was merged with the United Provinces in 1947–48. Pop. (1991) town, 20,224.

**Tehuacán,** city, southeastern Puebla *estado* ("state"), south-central Mexico. It is situated in the Tehuacán valley of the Sierra Madre Oriental, at an elevation of 5,500 feet (1,700 m). Founded in 1540, Tehuacán is one of the oldest Spanish settlements in Mexico. Its hinterland yields corn (maize), beans, wheat, alfalfa, oranges, grapes, and pomegranates, as well as cattle, pigs, and goats. Rich silver and lead mines are located nearby. The region is known for its mineral waters, which are bottled in the city and distributed throughout the nation. It also has wineries and distilleries. The scenic setting, pleasant climate, colonial buildings, and the local handicrafts of Mixtec Indians have made Tehuacán a tourist centre. The city, southeast of Mexico City, is accessible by highway, railroad, and air. Pop. (1995) 172,510.

**Tehuantepec, Gulf of,** Spanish GOLFO DE TEHUANTEPEC, large inlet of the Pacific Ocean, forming the southern shore of the Isthmus of Tehuantepec, southeastern Mexico. The gulf extends approximately 300 miles (500 km) from Puerto Angel, in Oaxaca state, southeastward to Barra del Suchiate, in Chiapas state, and measures approximately 100 miles (160 km) across its mouth. The Gulf of Tehuantepec's shores are marked by innumerable lagoons, the largest of which are Superior, Inferior, and Muerto. The gulf receives the Tehuantepec River and numerous smaller streams. The largest settlement and main port on the shores of the gulf is Salina Cruz, terminus of the railroad that crosses the Isthmus of Tehuantepec. From Juchitán, near Laguna Superior, a highway and railroad parallel the coast southeastward to Tapachula.

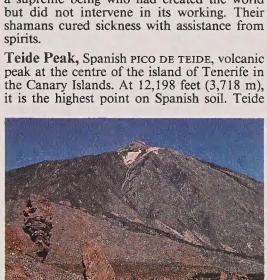
**Tehuantepec, Isthmus of,** Spanish ISTMO DE TEHUANTEPEC, isthmus in southern Mexico, between the Gulf of Campeche on the Gulf of Mexico, to the north, and the Gulf of Tehuantepec on the Pacific Ocean, to the south. From gulf to gulf the isthmus is 137 miles (220 km) wide at its narrowest part; and it is 120 miles (193 km) from the Gulf of Campeche to the head of Laguna Superior, an inlet on the Gulf of Tehuantepec. The isthmus is a broad, plateau-like ridge, hot and malarial except on open elevations, where Pacific winds render it comparatively cool and healthful. The northern side is swampy and densely covered with jungle; the Pacific slopes on the south are drier.

Although the Isthmus has been considered a favourable transportation route since the days of the conquistador Hernán Cortés, it was rejected as an interoceanic canal site because construction of the canal would have been too costly. Instead, a railroad extending 192 miles (310 km) from Coatzacoalcos on the Gulf of Campeche to Salina Cruz on the Gulf of Tehuantepec was opened in 1907. Rail connections to Veracruz, Mexico City, and the Guatemalan border have been completed. Salina Cruz is a free port with large dry docks. The town of Tehuantepec is the cultural centre of the Tehuana Indians, whose social organization is matriarchic and whose gold jewelry is especially distinctive.

**Tehuelche,** South American Indians who formerly inhabited the Patagonian plains from the Strait of Magellan to the Negro River. They were divided into northern and southern branches. Each division had its own dialect; the northerners have been classified as horse nomads, the southerners as foot people. They became famous in European literature for their great stature and physical strength.

Little is known of the original pre-horse culture of the Tehuelche, but their socioeconomic organization probably resembled that of the Ona (*q.v.*) of Tierra del Fuego. The introduction of the horse in the early 18th century transformed the subsistence patterns and social organization of the Tehuelche. They began to exploit the brush-covered steppes of Patagonia much as the Indians of North America took to the Great Plains. They lived mainly on guanaco and rhea meat, as well as some plant food, but practiced no agriculture. The Pampean hunters quickly grew in numbers, and their bands conglomerated; the Tehuelche bands numbered as many as 500 members. These mounted bands hunted and engaged in war. Gradually, the successful war leader replaced the kinship leader in importance. The Tehuelche were eventually defeated and culturally assimilated by the European settlers. They believed in spirits of the bush and in a supreme being who had created the world but did not intervene in its working. Their shamans cured sickness with assistance from spirits.

**Teide Peak,** Spanish PICO DE TEIDE, volcanic peak at the centre of the island of Tenerife in the Canary Islands. At 12,198 feet (3,718 m), it is the highest point on Spanish soil. Teide



Teide Peak at the summit of El Pilón on Tenerife in the Canary Islands
K. Scholz/Shostal Assoc.

is the peak atop El Pilón, a 492-foot- (150-metre-) high volcanic cone that rises from a crater on the upper reaches of the mountain El Teide, which is itself a conglomeration of several volcanoes rising within a 10-mile- (16-kilometre-) wide caldera called Las Cañadas. Snow covers the summit only in winter. Teide Peak has a crater about 260 feet (80 m) in diameter. Hot gases are ejected from vents within the crater and on the slopes. The last eruption of the mountain El Teide was in 1789 from an area called Las Narices del Teide on its southwestern slopes. El Teide dominates Teide National Park (established 1954), in which it is located, as is the entire island chain. An international solar observatory is located at Izaña, about four miles northeast of the park.

**Teignbridge,** district in the southwestern part of the county of Devon, England, lying in the valley of the Teign River between Dartmoor and the sea. Its area is 261 square miles (675 square km). Teignbridge's varied coastline attracts tourists and retired residents to such communities as Starcross, Dawlish, and the port of Teignmouth. Dawlish Warren comprises an area of sand dunes at the mouth of the Teign Estuary. Newton Abbot, at the head of the estuary, is the retail, service, and administrative centre for the district; its light industries include electrical engineering, food processing, and publishing.

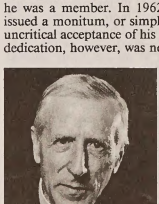
Between the sea and Dartmoor are numerous villages and hamlets linked by country lanes. A fertile loam supports cereals, potatoes, and fodder roots, and the cultivation of flowers is significant near Dawlish. In contrast, the infertile Haldon Hills are stoney and acidic; they have been afforested with conifers. The Bovey Beds, in an old lake basin, produce the majority of Britain's ball clay, used for ceramics and insulating porcelain; some is shipped from Teignmouth, and clay accounts for most of its exports.

Furthest inland is Dartmoor, where the Dartmoor National Park penetrates into the northwest of the district; the scenery is crowned by granite tors. At Haytor is the old quarry that, about 1820, supplied the granite used to build the British Museum, the National Gallery, and old London Bridge; the stone was conveyed on a tramway of granite rails to the Stover Canal and thence to Teignmouth. The area is predominantly heathland, grazed by cattle, sheep, and ponies, and is fringed by irregular fields. Hut circles, enclosures, field boundaries, and stone monuments bear testimony to Bronze Age occupation. Old settlements include Widecombe, with its famous fair, and Ashburton, an old stannary (tin) and wool town on the edge of the moor. Pop. (1998 est.) 119,400.

**Teignmouth,** parish (town), Teignbridge district, county of Devon, England. It lies along the north bank of the Teign Estuary where it joins the English Channel. The Saxon settlement of Tegutun was burned by the Danes in 970 and was again razed by the French in 1338 and 1690. A quay was built in 1831 to ship Dartmoor granite for the rebuilding of London Bridge. The town has 2 miles (3 km) of sandy beach and is a yachting centre. Pop. (1991) 13,528.

**Teika:** *see* Fujiwara Sadaie.

**Teilhard de Chardin, Pierre** (b. May 1, 1881, Sarcenat, Fr.—d. April 10, 1955, New York City), French philosopher and paleontologist known for his theory that man is evolving, mentally and socially, toward a final spiritual unity. Blending science and Christianity, he declared that the human epic resembles "nothing so much as a way of the Cross." Various of his theories brought reservations and objections from within the Roman Catholic Church and from the Jesuit order, of which he was a member. In 1962, the Holy Office issued a monitum, or simple warning, against uncritical acceptance of his ideas. His spiritual dedication, however, was not questioned.



Teilhard de Chardin
© Philippe Halsman

Son of a gentleman farmer with an interest in geology, Teilhard devoted himself to that subject, as well as to his prescribed studies, at the Jesuit College of Mongré, where he began boarding at the age of 10. When he was 18, he joined the Jesuit novitiate at Aix-en-Provence. At 24 he began a three-year professorship at the Jesuit college in Cairo.

Although ordained a priest in 1911, Teilhard chose to be a stretcher bearer rather than a chaplain in World War I; his courage on the battle lines earned him a military medal and the Legion of Honour. In 1923, after teaching at the Catholic Institute of Paris, he made the first of his paleontological and geologic missions to China, where he was involved in the discovery (1929) of Peking man's skull. Further travels in the 1930s took him to the Gobi (desert), Sinkiang, Kashmir, Java, and Burma (Myanmar). Teilhard enlarged the field of knowledge on Asia's sedimentary deposits and stratigraphic correlations and on the dates of its fossils. He spent the years 1939–45 at Peking in a state of near-captivity on account of World War II.

Most of Teilhard's writings were scientific, being especially concerned with mammalian paleontology. His philosophical books were the product of long meditation. Teilhard wrote his two major works in this area, *Le Milieu divin* (1957; *The Divine Milieu*) and *Le Phénomène humain* (1955; *The Phenomenon of Man*), in the 1920s and '30s, but their publication was forbidden by the Jesuit order during his lifetime. Among his other writings are collections of philosophical essays, such as *L'Apparition de l'homme* (1956; *The Appearance of Man*), *La Vision du passé* (1957; *The Vision of the Past*), and *Science et Christ* (1965; *Science and Christ*).

Teilhard returned to France in 1946. Frustrated in his desire to teach at the Collège de France and publish philosophy (all his major works were published posthumously), he moved to the United States, spending the last years of his life at the Wenner-Gren Foundation, New York City, for which he made two paleontological and archaeological expeditions to South Africa.

Teilhard's attempts to combine Christian thought with modern science and traditional philosophy aroused widespread interest and controversy when his writings were published in the 1950s. Teilhard aimed at a metaphysic of evolution, holding that it was a process converging toward a final unity that he called the Omega point. He attempted to show that what is of permanent value in traditional philosophical thought can be maintained and even integrated with a modern scientific outlook if one accepts that the tendencies of material things are directed, either wholly or in part, beyond the things themselves toward the production of higher, more complex, more perfectly unified beings. Teilhard regarded basic trends in matter—gravitation, inertia, electromagnetism, and so on—as being ordered toward the production of progressively more complex types of aggregate. This process led to the increasingly complex entities of atoms, molecules, cells, and organisms, until finally the human body evolved, with a nervous system sufficiently sophisticated to permit rational reflection, self-awareness, and moral responsibility. While some evolutionists regard man simply as a prolongation of the Pliocene fauna—an animal more successful than the rat or the elephant—Teilhard argued that the appearance of man brought an added dimension into the world. This he defines as the birth of reflection: animals know, but man *knows* that he knows; he has "knowledge to the square."

Another great advance in Teilhard's scheme of evolution is the socialization of mankind. This is not the triumph of herd instinct but a cultural convergence of humanity toward a single society. Evolution has gone about as far as it can to perfect human beings physically: its next step will be social. Teilhard saw such evolution already in progress; through technology, urbanization, and modern communications, more and more links are being established between different peoples' politics, economics, and habits of thought in an apparently geometric progression.

Theologically, Teilhard saw the process of organic evolution as a sequence of progressive syntheses whose ultimate convergence point is that of God. When humanity and the material world have reached their final state of evolution and exhausted all potential for further development, a new convergence between them and the supernatural order would be initiated by the Parousia, or Second Coming of Christ. Teilhard asserted that the work of Christ is primarily to lead the material world to this cosmic redemption, while the conquest of evil is only secondary to his purpose. Evil is represented by Teilhard merely as growing pains within the cosmic process: the disorder that is implied by order in process of realization.

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**Teirlinck, Herman (Louis-Cesar)** (b. Feb. 24, 1879, St.-Jans-Molenbeek, Belg.—d. Feb. 4, 1967, Beersel), Flemish novelist, poet, short-story writer, essayist, and playwright whose dramas influenced post-World War I European theatre.

Teirlinck's first book, *Verzen* (1900), was a volume of poetry, but he soon demonstrated in fiction the virtuosity and thematic variety that would characterize his entire career. *De wonderbare wereld* (1902; "The Wondrous World") was a collection of fantastic tales set in rural Flanders, and *'t Bedrijf van den kwade* (1904; "The Demon in Action") and *Het ivoren aapje* (1909; "The Ivory Monkey") took place in Brussels. The highlight of Teirlinck's early career was the publication in 1908 of *Mijnheer J. B. Serjanszoon*, a witty and cynical novel whose elegant manner contrasted sharply with the conventions of Dutch fiction.

In the years after World War I, Expressionism was the dominant movement in Flemish literature. Drama flourished in this environment, and the Flemish popular theatre developed into one of the most original in Europe. There, Teirlinck introduced the concept of "total theatre," combining dance, mime, music, cinematic effects, and echoes of medieval miracle plays. Some of his best-known plays are *De vertraagde film* (1922; "The Slow Motion Picture"), *Ik dien* (1924; "I Serve"), and *De man zonder lijf* (1925; "The Man Without a Body"). During World War II Teirlinck returned to writing fiction. *Zelfportret of het galgemaal* (1955; *The Man in the Mirror*) is considered the best work of his post-World War II career.

*Consult the* INDEX *first*

**Teishebaini,** ancient Urartian fortified town, located on the hill of Karmirblur, near the city of Yerevan in what is now Armenia. Russian excavations at Teishebaini concentrated on the citadel, which occupied the top of the hill and contained about 150 rooms. Among the most important objects uncovered were the remains of wooden stools with their bronze fittings; a statuette of the god Teisheba, after whom the town was named; numerous examples of gold and silver jewelry; and a particularly rich find of bronze armour and other war gear, including pointed helmets, shields, quivers, and belts. Also found in large quantity were stone seals and beads, carved ivory objects, and pottery bowls and vessels. The



Bronze horse head from Teishebaini
From B.B. Piotrovsky, *Urartu: the Kingdom of Van and its Art* (translated by Peter Going); reproduced by permission of Adams and Dart Publishers, Bath, England

citadel was probably destroyed at the beginning of the 6th century BC.

**Teispes,** Old Persian CHISHPISH (fl. mid-7th century BC), early Achaemenid Persian king (reigned *c.* 675–*c.* 640), the forefather of the great kings Darius I and Cyrus II.

He was, perhaps, the son of Achaemenes, whose name was given to the Achaemenid dynasty. Teispes ruled the district of Anshan in Elam (north of the Persian Gulf) and tried to maintain a neutral position between the powerful kingdoms of Elam and Assyria. At his death, Teispes either divided his kingdom between his sons, Ariaramnes and Cyrus I, or provided for an alternation in succession between the senior and junior lines.

**Teisserenc de Bort, Léon (-Philippe)** (b. Nov. 5, 1855, Paris, France—d. Jan. 2, 1913, Cannes), French meteorologist who discovered the stratosphere, thus paving the way for further study of the upper atmosphere.

In 1880 Teisserenc began his career in the meteorological department of the Administrative Centre of National Meteorology in Paris. He journeyed to Africa in 1883, 1885, and 1887 to study geology and terrestrial magnetism, and in 1892 he became chief meteorologist to the centre. Four years later he resigned and set up his own private meteorological observatory at Trappes, near Versailles. One of the pioneers in the use of unmanned, instrumented balloons, he sent them up to study the characteristics of the atmosphere. He found that above an altitude of about 7 miles (11 km), the atmospheric temperature remained relatively constant at all heights. In 1900 he concluded that the atmosphere must be divided into two layers: the troposphere, where the temperature changed constantly and therefore induced changing weather, and the stratosphere, where the temperature was constant and which he considered a region of unchanging weather conditions.

**Teixeira Pinto** (Guinea-Bissau): *see* Canchungo.

**Tejo, Rio** (Europe): *see* Tagus River.

**Tekakwitha, Kateri,** Tekakwitha also spelled TEGAKWITHA, or TEGAKOUITA (b. 1656, probably Ossernenon, New Netherland [now Auriesville, N.Y., U.S.]—d. April 17, 1680, Caughnawaga, Que. [now in Canada]), first North American Indian proposed for canonization in the Roman Catholic church.

At the age of four she was the only member of her family to survive smallpox, which affected her own health. Staying with her anti-Christian uncle, she was deeply impressed at the age of 11 by the lives and words of three visiting Jesuits, the first Christians she had ever encountered. She began to lead a life inspired by the example of these men, and at 20 she was instructed in religion and baptized Katharine by the Jesuit missionary to the Iroquois Indians, Jacques de Lamberville.

Harassed, stoned, and threatened with torture in her home village, she fled 200 miles (322 km) to the Christian Indian mission of St. Francis Xavier at Sault Saint-Louis, near Montreal. There she came to be known as the "Lily of the Mohawks" in recognition of her kindness, prayer, faith, and heroic suffering. Accounts of her life written by de Lamberville and fellow missionaries contributed significantly to the documentation necessary for her beatification, which began in 1932 and was proclaimed by Pope John Paul II in 1980.

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**Tekapo, Lake,** lake in central South Island, New Zealand, occupying 37 square miles (96 square km) of a valley that has been dammed by a moraine (glacial debris). The lake is about 15 miles (24 km) long and 3.5 miles (6 km) wide and drains a 550-square-mile (1,425-square-kilometre) basin. The lake's major affluents, east of the Southern Alps, are the Godley and Macaulay rivers. Near the resort town of Lake Tekapo at its southern tip, the lake empties through the Tekapo River.

Lake Tekapo lies at an elevation of 2,346 feet (715 m) and is about 620 feet (190 m) deep, but its level may vary as much as 25 feet (8 m), as water is drawn off by an outlet dam for hydroelectric stations downstream. The name Tekapo is derived from two Maori words, *taka,* or *teka* ("sleeping mat"), and *po* ("night").

**Teke, Kingdom of** (African history): *see* Anziku, Kingdom of.

**Tekirdağ,** formerly RODOSTO, city, European Turkey, on the Sea of Marmara. Probably founded in the 7th century BC as a Greek settlement called Bisanthe, it was renamed Rhaedestus when it became the capital of Thrace in the 1st century BC. Taken by the Ottoman Turks in the second half of the 14th century, it was later occupied successively by Russia (1877–78), Bulgaria (1912), and Greece (1920–22). For centuries it served as the port for the Adrianople (modern Edirne) area, but it declined when Alexandroupolis (Dedeağaç, now in Greece) on the Aegean Sea became the terminus of the railway up the Maritsa River in 1896. The city's historical buildings include the Rüstem Paşa Cami (mosque) and the Bedestan (covered bazaar), both attributed to the 16th-century Ottoman architect Sinan. An agricultural market for the region, modern Tekirdağ lies on the main highway from İpsala, on the Greek border, to Istanbul, and is linked by road with the Edirne-Istanbul railway at Muratlı. The surrounding area is primarily agricultural and exports flax and sunflower seeds, though it is also known for its vineyards and wines. Pop. (1990 prelim.) 80,207.

**tekke** (Islām): *see* zāwiyah.

**Tekke carpet,** floor covering woven by the nomadic Tekke Turkmens of Turkmenistan. Tekkes are the carpets that were formerly sold as Royal Bokharas and are generally considered the finest of Turkmen carpets. The standard field pattern for the large rugs is a repeat in rows of a parti-coloured, multifoiled lozenge, a basic motif that serves as the symbol, or gul, of the Tekke tribe. The guls, which may be connected by the dark blue lines of a rectangular grid, are alternated with rows



Tekke carpet from Russian Turkistan, 19th century; in the Metropolitan Museum of Art, New York City
By courtesy of the Metropolitan Museum of Art, New York City, gift of J.F. Ballard; photograph, Otto E. Nelson

of a subordinate radial figure that usually is somewhat stellate. In smaller pieces, such as the faces of bags, or *jovāls,* the gul may be flattened and appear within a system of rectangular panels. Borders are intricate and may differ at the ends.

Many of the carpets had elaborate aprons in pile and, later, in kilim (pileless) weave, with rectangular patterning or rows of delicate plant forms. The basic colour throughout is red, in a great variety of shades from scarlets through wine reds to liver colours, the brightest appearing in new rugs from Pakistan. The knotting, normally Senna (Sehna), is usually fine, and the material, whether wool or goat hair, is of excellent quality. The pile is short, so the rug is thin and flexible.

**tektite,** any of a class of small, natural glassy objects that are found only in certain areas of the Earth's surface. The term is derived from

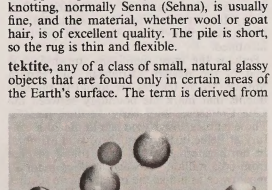


Figure 1: Microtektites from the Australasian strewn-field (magnified 28 ×)
By courtesy of B.P. Glass

the Greek word *tēktos,* meaning "melted," or "molten." Tektites have been the subject of intense scientific scrutiny throughout much of the 20th century owing to their unknown and possibly extraterrestrial origins, but they are now recognized as having formed from the melting and rapid cooling of terrestrial rocks that have been vaporized by the high-energy impacts of large meteorites, comets, or asteroids upon the surface of the Earth. The extremely high temperatures and enormous pressures generated by such impacts melted the rocks at the site, producing clouds of molten silicate droplets that quickly cooled to a glassy form before falling back to Earth.

Tektites range in size from a few tens of micrometres to about 10 cm (4 inches) in diameter. Those larger than a few millimetres are all rich in silica; they are somewhat like terrestrial obsidians but differ from them and other terrestrial volcanic glasses by their lower water content. Chemically, tektites are further distinguished from acid igneous (granitic) rocks by their lower content of soda and potash and their higher content of lime, magnesia, and iron. Under the microscope, tektites are seen to lack the small crystals (microlites) characteristic of terrestrial volcanic glasses.

Tektites are of varied colour, shape, and surface sculpture. In colour they range from green or dark brown to black. Some are lustrous and others have a delicate sheen from minute alternating ridges and furrows that swirl over the entire surface. The younger, less-corroded tektites include those with spherical, elliptical,

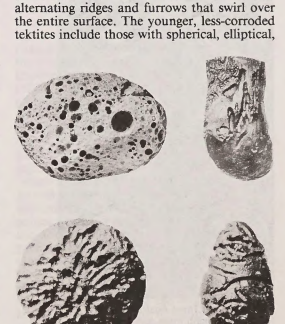


Figure 2: Splash-form tektites
By courtesy of (top left) the U.S. National Museum, Washington, D.C., (top right) Museum National d'Histoire Naturelle, Paris

lenticular, teardrop, dumbbell, disk, and button shapes.

Microtektites of millimetre and smaller size, first discovered in 1968, exhibit wider variation in composition than the large tektites; *e.g.,* their silica content can be as low as 50 percent, similar to that of terrestrial basalts. Microtektites have been found so far only in deep-sea sediments, probably because of the difficulty of distinguishing them in the more abundant and coarser land sediments. They are distinguished from volcanic ash by their rounded shapes and composition, which is identical with that of the large tektites.

*Form and markings.* Four principal tektite types can be distinguished: (1) microtektites, (2) Muong-Nong type tektites, (3) splash-form tektites, and (4) australites.

Microtektites (*see* Figure 1) have diameters of less than 2 mm (0.08 inch). Their form is most often nearly spherical, although a few are oblate spheroids, and some are shaped like rods, teardrops, and dumbbells. These forms are those typically taken up by rotating liquid drops. Some microtektites also appear to be corroded, having deep grooves or pits.

Muong-Nong type tektites, named for the site in Vietnam where they were first found, are centimetre- to decimetre-size objects and include the largest known tektites. They are chunky in form, often tablet-shaped, and often show layering, each of the layers being 1 mm or so in thickness.

Splash-form tektites (*see* Figure 2) have shapes like the microtektites but are about one million times as massive. Spheres (the

majority), oblate spheroids, and a few dumbbells, teardrops, disks, and cylinders are found. Splash-form tektites are always marked by corrosion. The two most common kinds of corrosion are (1) a system of hemispherical pits of all sizes and (2) a system of straight grooves of uniform width on a given specimen. Some tektites also show long furrows that meander over the surface like worm tracks. Many specimens display a set of fine lines that are the surface exposures of a system of contorted layers (schlieren) extending through the tektite and corresponding to variations in the silica content. They grade into the layering of the Muong-Nong tektites.

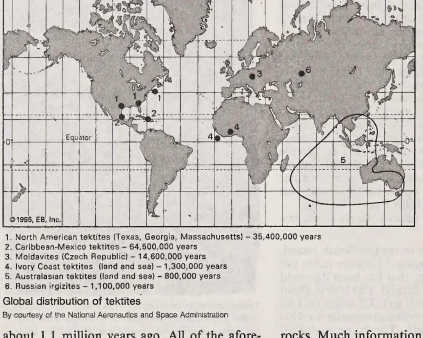


Figure 3: (Left) Three Australian button tektites and (right) three glass models ablated by aerodynamic heating; actual size ranges from 16 to 25 mm

By courtesy of Dean Chapman and the National Aeronautics and Space Administration, Ames Research Center, Moffet Field, California

Australites and related forms comprise about 10 percent of the tektites found in Australia. They show a characteristic lenslike form, with an attached flange around the edge (*see* Figure 3), the whole having the shape of a saucer of ice cream. Flanged australites have clearly been formed by the heating and melting of bodies that are much like the splash-form tektites. Transition forms between the splash-form tektites and the australites have been recovered.

*Distribution.* Tektites are known on every continent except Antarctica and South America. They formed in groups at widely different times over Earth history, with none being formed in between. They occur only within definite areas, called strewn-fields (*see* map), and are given distinctive names according to where they are found. The North American strewn-field, dated at 35.4 million years ago, has yielded a few tens of thousands of tektites, mostly splash-form in type. The strewn-field in the Czech Republic, dated at 14.6 million years ago, has produced a few tens of thousands of specimens, basically of the same types as those found in the North American region and known as moldavites. The Ivory Coast (Côte d'Ivoire) strewn-field has yielded a few hundred tektites; it is about 1.3 million years old. Most of its specimens are of the splash-form type. The Australasian strewn-field extends from South China over the Malay Archipelago to Australia and Tasmania and has been dated about 800,000 years old. It is the single most abundant source of tektites; millions of specimens have been recovered, mostly of splash-form type, and are referred to as australites. The Russian strewn-field lies in the southern Ural Mountains; its tektites are known as irgizites and date from about 1.1 million years ago. All of the aforementioned strewn-field areas are on land, the specimens usually found mixed with gravels and other coarse sediments. The North American, Australasian, and Ivory Coast fields have associated microtektite fields lying in oceanic sediments adjacent to the areas of land occurrence.




1. North American tektites (Texas, Georgia, Massachusetts) – 35,400,000 years
2. Caribbean-Mexico tektites – 64,500,000 years
3. Moldavites (Czech Republic) – 14,600,000 years
4. Ivory Coast tektites (land and sea) – 1,300,000 years
5. Australasian tektites (land and sea) – 800,000 years
6. Russian irgizites – 1,100,000 years

Global distribution of tektites

By courtesy of the National Aeronautics and Space Administration

Several strewn-fields are associated with major impact craters. The Russian irgizites, for example, are found in and around the Zhamanshin meteorite crater, while the Ivory Coast tektites occur in the general area of the Bosumtwi Crater in neighbouring Ghana and the moldavites of the Czech Republic occur near the Ries Crater in neighbouring Germany. Impact craters for the Australasian and North American tektites have not yet been identified.

Perhaps the most significant strewn-field is that of the western Caribbean and eastern Mexico, where tektites are found in the sediments that mark the boundary between the Late Cretaceous and early Tertiary periods. These tektites, discovered late in the 20th century at Beloc in Haiti and Arroyo el Mimbral in northeastern Mexico, were found to date from 64.5 million years ago, making them almost twice as old as the oldest known tektites to have been previously dated. Those from Haiti were found in a layer of iridium-rich sedimentary rock that marks the Cretaceous-Tertiary boundary and are thought to represent debris from a massive asteroid impact with the Earth. The presence of the tektites supports the theory of an extremely high-energy collision that may have led to mass extinctions and the demise of the dinosaurs. Microscopic-sized glassy spherules resembling microtektites in shape and composition have been found in rocks 367 million years old in Belgium and may represent evidence of a large impact event associated with a mass extinction that occurred during the Late Devonian Period (about 374 to 360 million years ago).

*Chemistry and petrography of tektites.* Ordinary tektites are typically composed of about 70 percent silica ($SiO_2$) and are much like granites in composition, though deficient in sodium monoxide ($Na_2O$) and potassium oxide ($K_2O$) and enriched in magnesium oxide (MgO) and ferrous oxide (FeO). These trends are similar to those found in rocks intermediate between the shales and sandstones. Tektites are thus generally considered to have been derived from sedimentary rather than igneous rocks. Refined analyses have shown that water is present only to the extent of about 100 parts per million (ppm) in tektites—far below the value for terrestrial igneous or sedimentary rocks. Much information about tektite history is obtained by radioisotopic dating; the ages cited above for the tektite strewn-fields were found by potassium-argon dating.

*The problem of tektite origin.* The origin of tektites was a subject of intense debate throughout much of the 20th century owing to their unusual shape and their chemical composition, which differs from glassy rocks of igneous terrestrial origin. It was assumed that tektites formed from the molten ejecta of high-energy impacts, but the question remained whether such impacts had taken place on the Earth or on the Moon or elsewhere in space. Radioisotope measurements indicated that tektites could not have originated from beyond the Earth-Moon system but did not rule out a possible lunar origin. Under this theory, tektites were lunar rocks melted by the impact of meteorites on the Moon's surface. These tektites were thrown up into space, and some of them eventually landed on the Earth. The lunar theory was most strongly supported by the distinctive lens-and-flange shape of australites, which suggested that they came from outside the Earth's atmosphere. The shape of these tektites could only be explained by two heating events; the first, which created the glass, and a second episode of heating apparently due to air-friction melting as the australite entered the Earth's atmosphere at a relatively high velocity. The lens-and-flange shape apparently results from a glassy sphere melting on its forward side (the area of greatest friction); as the object slows down, some melt flows toward the lee and curls to form a flange. (The same could happen, of course, to tektites thrown outside the Earth's atmosphere which then underwent aerodynamic heating in the course of their reentry.)

The lunar-origin theory was advocated by a number of scientists, but one important argument against it was the localized distribution of tektites on the Earth. If tektites came from the Moon, their distribution over the Earth's surface should be completely uniform, which is certainly not the case. More importantly, the analysis of lunar rocks obtained by the Apollo space missions in the late 1960s and early '70s showed that they were not suitable parent rocks for tektites, thus fatally weakening the lunar-origin theory.

In support of tektites' terrestrial origin, it was long pointed out that the composition of tektites strongly resembles that of some rocks that are widespread in the Earth's crust. It was

only with the emerging recognition of the links between impact craters with some strewn-field areas on Earth, however, that the theory of terrestrial origin gained general support. The correlations between tektite strewn-fields and terrestrial impact craters are numerous and impressive. Ivory Coast tektites, for example, occur 300–1,600 km (180–960 miles) from the Bosumtwi Crater in Ghana; and the formation of both the tektites and the crater has been dated at 1.3 million years ago. Similarities have been traced between the crater glass of Bosumtwi and the Ivory Coast tektites in chemical composition, radioisotopic ratios, and other aspects. The same similarities can be traced for several other impact craters and their associated tektite groups. The cumulative effect of this data is impressive, and a generic connection between craters and tektite fields is now claimed by virtually all authorities.

**Tel Aviv–Yafo,** also spelled TEL AVIV–JAFFA, or JOPPA, Arabic YĀFA, also called TEL AVIV, city of Israel that lies on the Mediterranean coast and is the hub of the nation's largest urban centre. It was formed in 1950 by the incorporation of the ancient port of Jaffa, or Yafo, with its former suburb, Tel Aviv.

Jaffa was an old Canaanite city that was taken by Thuti, general of Thutmose III of Egypt, in the 15th century BC and became a provincial capital during the Egyptian New Kingdom. In the Old Testament the city is assigned to the tribe of Dan, but the Philistines early controlled it. The Israelite kings David and Solomon occupied it, the latter using it as the port for landing Lebanon timber floated down the coast from Tyre. In 701 BC the Assyrian king Sennacherib captured Jaffa, then belonging to Ascalon. Later it was ruled by the Persians, but by about 350 BC it is recorded as independent. After Alexander the Great's conquest, the Ptolemies held it. In Maccabaean times the Syrians garrisoned the city, but the Israelite Jonathan captured it in 148 BC; Simon recaptured it, installed a garrison, and completed the harbour. In AD 68 the Roman emperor Vespasian captured it on his way to Jerusalem; by that time the superior artificial harbour and port city of Caesarea to the north was already bringing decline to Jaffa, an inadequate port. In Christian times it became the see of a bishop. The crusaders captured it (1126) but lost it to Saladin (1187). It was recaptured by Richard I of England (1191) and finally lost in 1196. Jaffa was razed and its harbour choked by the Mamlūks of Egypt in 1345 because of a threatened new Crusade. Toward the end of the 17th century it began to develop again as a seaport.

Although Jaffa has a long history, Tel Aviv is a comparatively new city, founded in 1909 when the Jewish quarter of Jaffa had become overcrowded from an influx of immigrants. The Zionist founders of Tel Aviv set out to build a European-style suburb, with straight, wide streets, parks, and modern urban facilities and services. Tel Aviv was named for Theodor Herzl's novel *Altneuland* (1902), which was translated into Hebrew as *Tel Aviv (tel,* "hill"; *aviv,* "spring"; hence "Hill of Spring"). During World War I the population of Tel Aviv, as well as the Jewish population of Jaffa, was expelled northward by the Turkish military authorities; only several months after Jaffa and Tel Aviv were taken by the British, on Nov. 10, 1917, did many of the residents return to their homes.

Renewed growth began in 1920, with the wave of Jewish immigration that followed the Balfour Declaration and the establishment of the British mandate over Palestine (1923–48). Tel Aviv was separated from Jaffa and granted the status of a town in 1921, following anti-Jewish riots in Jaffa. By 1926 Tel Aviv's population had reached 38,000, and the town had become a thriving business centre. Its growth gathered momentum in the early 1930s, after the Nazis rose to power in Germany, and a substantial part of the flood of immigrants that sought refuge in British Palestine settled in and around the town. By 1936 its population had risen to 130,000, making Tel Aviv the largest and most important city in Palestine. When Jaffa surrendered to Jewish military forces during the first Arab-Israeli War in 1948, almost its entire Arab population of 65,000 fled, and Jewish immigrants took over a virtually empty city. The years following the birth of the State of Israel (1948) led to another growth explosion in Tel Aviv, and with the incorporation of Jaffa in 1950, the united city became known officially as Tel Aviv–Yafo. It has since become the nation's main business, communications, and cultural centre. The urban area of which it is the centre contains some two million people, or about a third of the entire Israeli population.

Modern Tel Aviv–Yafo is a long, narrow city fronting the Mediterranean for about 6 miles (10 km) along the south-central part of the Israeli coastline. The city is built over three low ridges of sandstone hills that run roughly parallel to the coast. These ridges have decisively influenced the city's layout, with long main streets running north-south in the shallow troughs between ridges and short east-west streets crossing gaps in the ridges. The central business district, which is the economic heart of Israel, occupies the older part of Tel Aviv, while to the south and east lies the main manufacturing district. Most government offices lie northeast of the business centre. Farther to the east and south, Tel Aviv blends into a continuous built-up area that includes the substantial suburbs of Ramat Gan, Giv'atayim, Bat Yam, and Ḥolon.

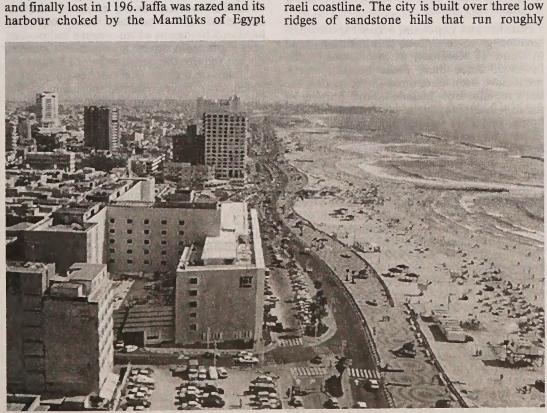
More than half of Israel's industrial plants are found in the Tel Aviv metropolitan area. The main industries are textile and clothing, food and tobacco, metal and engineering, vehicles and transport equipment, diamond polishing, furniture and wood products, printing and publishing, and electric and electronic instruments and equipment. Israel's only stock exchange is located in Tel Aviv, and virtually all the banks, insurance companies, and other enterprises operating in Israel locate their main offices in the city. Most of Israel's newspapers, periodicals, and books are published in Tel Aviv. The city is also the main centre of Israel's important tourist industry and has many hotels. Herzliyya, a seaside resort just north of Tel Aviv, is the only other tourist centre of the region.

Road transport is dominant in Israel, and Tel Aviv is the main national route focus and the headquarters of all major bus and truck companies. There are two small railway stations, in the north for Haifa-bound trains and in the southeast for Jerusalem and Beersheba. Ben Gurion International Airport, 9 miles (14 km) to the southeast, serves the city's international air traffic.

The port of Jaffa was the country's second largest before it was shut down in 1965, on the inauguration of the modern port at Ashdod, which lies 19 miles (31 km) south of Tel Aviv.

Tel Aviv University—incorporating the three leading regional hospitals for teaching purposes—was founded in 1953 and inaugurated in 1956. The Bar-Ilan University, a religious university in Ramat Gan, was founded in 1953. Tel Aviv also has several rabbinical and theological institutes (yeshivas), but the main concentration of such schools is in the outlying suburb of Bene Beraq, to which students are drawn from Jewish communities in all parts of the world.

The Israel Philharmonic Orchestra has its home in Tel Aviv, as do the Chamber Ensemble, Israel's two leading choirs (Rinat and Zadikov), the Israeli Opera, housed at the Golda Meir Centre for the Performing Arts, and nearly all of Israel's dozen or so theatres, including the Habima National Theatre and the Cameri Theatre, the country's most popular. Pop. (1999 est.) 348,100.



Beachfront along Hayarkon Street in Tel Aviv
© Werner Braun

**Tel Ḥay,** also spelled TEL ḤAI, or TEL CHAI, former settlement, now a national memorial, in Upper Galilee, northern Israel, near the Lebanese border. One of the first Jewish settlements in northern Palestine, it was intermittently inhabited from 1905, and permanently settled as a pastoral camp and border outpost in 1918. The name (Hebrew: "Hill of Life") is an onomatopoetic derivation from the former Arabic name, Talha.

According to the secret Sykes-Picot Agreement between Great Britain and France (1916), an expanded Lebanon, including all of eastern Upper Galilee, was to come under French rule after World War I. This satisfied neither the Muslims, who desired an independent Arab Greater Syria, nor the Jews, who preferred British rule. After the war the Muslim Arabs began attacks both on the

Christian villages of southern Lebanon and on the isolated Jewish settlements of Upper Galilee. Tel Ḥay and adjacent Kefar Gil'adi were determined to defend themselves, and Tel Ḥay was reinforced from Jerusalem by members of ha-Shomer, the Jewish workers' protective organization, under the command of Joseph Trumpeldor, Zionist pioneer and former hero of the tsarist army. On March 1, 1920, the settlement was attacked by a large band of Arabs; six of the defenders, including Trumpeldor, were killed. The resistance of Tel Ḥay not only became legendary throughout Jewish Palestine but also was an important factor in the final determination (December 1920) of the northern boundary of mandated Palestine, which, as finally drawn, gave all of Upper Galilee and a "finger" of territory reaching almost to the sources of the Jordan River to Great Britain, to the disadvantage of France. This territory became part of Israel upon its attainment of independence (1948).

Tel Ḥay was resettled in 1921, and in 1926 was absorbed into the kibbutz of Kefar Gil'adi. Its eight defenders (including two killed earlier in 1919 and 1920) were buried on an adjoining hill overlooking the Hula Valley; the site is marked by a monumental memorial statue of the Lion of Judah, with Trumpeldor's last words ("It is good to die for our country") on its base. The Hebrew date of the 11th of Adar—the anniversary of the fall of Tel Ḥay—is celebrated as "Tel Ḥay Day" in Israel, and pilgrimages are made to the site, particularly by youth groups. The cemetery there, containing the graves of other members of ha-Shomer, and of members of the Israel Defense Forces killed in the Arab-Israeli wars, has become a national pantheon. A youth hostel and a military museum have been established at the site. The nearby town of Qiryat Shemona (Hebrew: "Town of the Eight"), founded 1949, is named for the martyrs of Tel Ḥay.

**Tela,** city, northern Honduras. It lies along Tela Bay, off the Gulf of Honduras. The old village of Tela lies across the Tela River from the modern port works and town, which were constructed by the United Fruit Company. Tela gained fame as a banana port, but it now exports coconuts and citrus fruits as well. It also manufactures palm and vegetable oils, lumber, plywood, paper, and cement products. Fish caught in nearby waters are packed or frozen in processing plants. Various branches of the Tela Railway, nationalized in 1975, bring crops to the port, and there are railroad and extensive highway connections to other centres and an airport. Pop. (1992 est.) 24,300.

**Telakhon,** English FRUIT OF WISDOM, one of the oldest Buddhist-influenced prophet cults among the Karen hill peoples of Myanmar (Burma). In their mythology, the restoration of their lost Golden Book by their white younger brothers heralds the millennium. Ywa, a withdrawn high god whose offer of the book to their ancestors was ignored, would then arise to deliver the Karen from oppression by the Burmans or the British. The cult was founded in the mid-19th century by Con Yu. It banned traditional animal sacrifice, practiced a strict ethic, and maintained Karen culture. In 1962–65 the cult's seventh successive head, the Phu Chaik ("Elder of the Faith"), was presented with vernacular Bibles by American missionaries. Expectations rose on both sides and membership (mostly in eastern Myanmar) increased to 10,000, but the Bible was rejected as not revealing the mysteries of Western knowledge. Renewed opposition to the Burmese led to armed clashes and the removal and death of the Phu Chaik in 1967. A similar cult, the Leke (founded 1860), is still in existence but others have become Christian churches or have declined.

**Telangāna Plateau,** plateau in western Andhra Pradesh state, southeastern India. Comprising the northeastern part of the Deccan Plateau, the Telangāna Plateau has an area of about 57,370 square miles (148,000 square km), a north-south length of about 480 miles (770 km), and an east-west width of about 320 miles (515 km). Mentioned in one of the Mauryan emperor Aśoka's edicts, the region was successively ruled by the Sātavāhanas, Pallavas, Eastern Cālukyas, Kakatīyas, and the Vijayanagar kings until it became part of the Quṭb Shāhī kingdom of Golconda. It later came under the rule of the Niẓām Shāhī dynasty of Hyderābād. Since the establishment of the Indian Union in 1947, there have been repeated demands for the creation of a Telangāna state, separate from Andhra Pradesh.

Geologically, the plateau is chiefly composed of Precambrian gneiss. Its senile peneplain is marked by undulations, almost completely graded valleys, and monadnocks that range from hill groups to tors and arrangements of massive boulders. The plateau is drained by the Godāvarī River taking a southeasterly course; by the Krishna River, which divides the peneplain into two regions; and by the Penneru River flowing in a northerly direction. The plateau's forests are moist deciduous, dry deciduous, and tropical thorn.

Most of the population of the region is engaged in agriculture; cereals, oilseeds, cotton, and pulses (legumes) are the major crops. There are multipurpose irrigation and hydroelectric-power projects, including the Pochampad, Bhaira Vanitippa, and Upper Penneru. Industries (located in Hyderābād, Warangal, and Kurnool) produce cotton textiles, sugar, foodstuffs, tobacco, paper, machine tools, and pharmaceuticals. Cottage industries are forest-based (timber, firewood, charcoal, bamboo products) and mineral-based (asbestos, coal, chromite, iron ore, mica, and kyanite). There is a dense network of roads, as well as railways and waterways; Hyderābād, capital of Andhra Pradesh, is linked by air with major cities in India. The language of the plateau is Telugu of the Dravidian family. The plateau's important cities and towns are Hyderābād, Warangal, Kurnool, and Niẓāmābād.

**telangiectasia, hemorrhagic:** *see* Osler-Rendu-Weber disease.

**Telanthropus capensis,** original species designation given to a fossil hominid jaw found by John T. Robinson at Swartkrans, S.Af., in 1949. Since then, other hominid specimens have been uncovered there, so that the site's remains now include a large number of fossils—including teeth, jaws, craniums, leg bones, and other skeletal fragments.

There was considerable debate among paleontologists over the years about the classification of the *Telanthropus* jaw. Some thought that it was representative of a separate genus, more modern than the South African *Australopithecus* of more than 2.3 million years ago but within that general group, and some thought that it should be classified with those species that came later. The debate was finally ended in the mid-1970s, and it has since been believed that the fossil jaw is of a South African specimen of *Homo erectus* (the species from which *Homo sapiens* is thought to have evolved) that lived from about 1.2 million years ago.

**Telde,** city, Las Palmas *provincia,* Canary Islands *comunidad autónoma* ("autonomous community"), Spain. It lies on the southeastern part of the island of Gran Canaria (Grand Canary). It extends beneath the Telde Cliff south of Las Palmas city, near the eastern coast. The island's aboriginal inhabitants, the Guanches, were first subdued (1480) by Pedro de Vera Mendoza, who built a fort on the present site called Telde (derived from *telle,* a name given to a local fig tree). The nearby Montaña de Cuatro Puertas ("Mountain of Four Doors"), held sacred by the Guanches, is now the site of archaeological excavations. Telde was once a major producer of sugar, wines, and dyes, which were exported via Melenara Bay to the southeast. The trade declined in the 18th century as a result of Spanish-American colonial competition. Telde's economy is now based on banana and tomato cultivation, although the production of ammonium sulfate, fishing, and stock raising are also significant. There are mineral springs at nearby Las Salinetas. Pop. (1991 prelim.) 75,594.

*Consult the* INDEX *first*

**telecommunications system,** any set of devices and techniques employed for the transmission of voice, facsimile, data, teleprinter, or television signals.

A brief treatment of telecommunications systems follows. For full treatment, *see* MACROPAEDIA: Telecommunications Systems.

All telecommunications systems operate according to the same basic principles. They differ from each other chiefly in the specific types of information handled and the media over which they are transmitted. Familiar examples of such systems are radios, televisions, telephones, telegraphs, and computer-based data exchange or retrieval systems. In most cases, telecommunications systems transmit information via wire, optical fibre, terrestrial radio, or space satellite.

Wire transmission involves sending electrical signals over various types of wire lines, such as twisted pair, multipair cable, and coaxial cable. These lines can be used to transmit voice frequencies, telegraph messages, computer-processed data, and television programs. In optical transmission, electrical signals converted to light signals by a laser transmitter carry both speech and data over bundles of thin glass filaments.

Terrestrial radio communication entails the transmission of electromagnetic waves in specific frequency bands through the air. It includes both amateur and commercial broadcasting (the latter consisting of AM, FM, and TV broadcasting for general public use), radio navigation, and radio telephony.

Satellite communication refers to the exchange of signals between widely separated locations by means of microwave radio—*i.e.,* very short radio waves. Since satellite systems do not require the construction of intermediate relay or repeater stations, as do ground-based microwave systems, they can be put into service much more rapidly.

Either of two transmission techniques—analog or digital—are utilized in telecommunications. In analog transmission, voice and visual information are sent over communications media through the use of signals that correspond to the sound or image being relayed. In digital transmission, signals are processed by a special coding component of the transmitter, which translates them into digital form (*e.g.,* the two digits 0 and 1 of binary arithmetic). The coding process is omitted in the transmission of computer-generated data, however, because the signals are already in digital form.

Whether in analog or digital form, the signal is subsequently routed to a modulator. This device impresses the intelligence signal onto a carrier wave of the appropriate frequency for the particular transmission medium in use. In most cases, high-frequency signals are employed for radio transmission and low-frequency signals in coaxial cables and other wire lines.

Noise and interference are often encountered by a communications signal as it travels along the transmission path. Some of these dis-

turbances originate from malfunctioning circuits or poorly designed antennas, but most are produced by solar flares, electrical storms in the Earth's atmosphere, nearby electrical circuits, and signals from other transmitters in the same frequency range. Various coding schemes and modulation techniques have been devised to help minimize noise and signal distortion problems. In fact, one of the primary reasons for employing binary signal transmission is its relative immunity to noise.

Communication between a large number of information sources has been accomplished through the organization of the sources into networks. Networking has made it possible to concentrate communications traffic in localized areas, with interconnections provided between the various points of concentration to effect efficient and economical distribution of transmission signals. Telephone and telegraph networks (*e.g.,* Telex) have long been in operation. More recently, cable television and telemetry networks (such as those used in the remote control of automobile traffic and widely distributed industrial operations) have become prominent. Rapid advances in computer technology also have led to a dramatic growth of data-retrieval and exchange networks. These networks are composed of individual computers and "intelligent" peripheral equipment (*e.g.,* automatic teller machines and point-of-sale terminals) that are interconnected by telephone lines, microwave relays, and other high-speed communications links. Computer networking has developed on all levels, from local to international. Computer-to-computer communication has also become commonplace for owners of home computers. Subscribers to special information services can interact with a host computer to access educational and entertainment materials as well as news and stock-market reports.

**teledu,** also called SKUNK BADGER, or MALAYAN STINK BADGER, species of badger (*q.v.*) found in Southeast Asia.

**Telefunken AG:** *see* AEG AG.

**Telegonus,** in Greek mythology, especially the *Telegonia* of Eugamon of Cyrene, the son of the hero Odysseus by the sorceress Circe. Telegonus went to Ithaca in search of his father, whom he killed unwittingly. His spear had been tipped with the point of a stingray, thus fulfilling the prophecy in the *Odyssey* that death would come to Odysseus "from the sea." Telegonus then married Penelope, Odysseus' widow.

**telegraph,** any system that allows the transmission of encoded information by signal across a distance. The word was coined about 1792 from the Greek *tēle,* "far," and *graphein,* "to write," but the principle is far older. While telegraph systems have used a variety of signaling methods and devices, the term is most often applied to the electric telegraph developed in the 19th century.

A brief treatment of the telegraph follows. For full treatment, *see* MACROPAEDIA: Telecommunications Systems.

The earliest forms of telegraphy were probably smoke, fire, or drum signals. In the late 18th century optical telegraphs were invented by Claude Chappe in France and by George Murray in England. Called semaphores, these telegraphs relayed messages from hilltop to hilltop with the aid of telescopes. Chappe's system used a vertical timber holding a movable crossbar with indicators at each end that could assume various configurations, like a signalman with flags. Murray's system used a large tower-mounted box with six panels that opened and closed in different combinations according to a code.

Rapid development of telegraph systems came with the discovery that electric impulses could be used to transmit signals along a wire. Among the many electric systems attempted was the needle telegraph, based on Hans Christian Ørsted's discovery in 1819 that an electric current caused an adjacent magnetized needle or pointer to deflect. The Cooke and Wheatstone five-needle telegraph of 1837 utilized this phenomenon with a panel imprinted with letters and numerals to which the five needles pointed singly or in pairs. This apparatus was widely used in Great Britain, especially for railroad signaling.

The development of the electromagnet about that time provided the American inventor Samuel Morse with a way to transmit and receive electric signals. Together with Alfred Vail, his partner from 1837, Morse developed the simple operator key, something like a single typewriter key, which when depressed completed an electric circuit and sent a signal to a distant receiver, which was originally a device that embossed a series of dots and dashes on a paper roll. The use of dots and dashes to represent letters, numbers, and operating functions became known as the Morse Code. About 1856 a sounding key was developed; skilled operators could listen to what the key "said" and write the messages directly, or, after 1878, type them. Telegraph lines quickly spread across North America and Europe in the 1840s, and were extended to Asia, Africa, and Australia later in the century. Because of the size and high cost of telegraph systems and their importance in international affairs—they were seen by European powers as critical strategic resources that would rationalize colonial administration and improve military security (especially in British India), and by emerging nations like Russia and China as aids to economic and social modernization—telegraph companies were among the largest business enterprises of the 19th century, and included firms that were privately held, state-subsidized, or state-owned.

With growing telegraph traffic, refinements were necessary. The duplex circuit, developed in Germany, made it possible for messages to travel simultaneously in opposite directions on the same line. Thomas Edison devised a quadruplex in 1874 that permitted four messages to travel at once, two going in either direction. The most revolutionary innovation belonged to Jean-Maurice-Émile Baudot. His time-division multiplex, invented in 1871, consisted of a brush arm that traveled around a copper ring divided into equal sectors. In each sector there were five contacts that would be opened or closed in one of 32 possible combinations, each five-bit combination encoding a letter or symbol. As the brush arm moved in its circle it would pick up a code combination from one sector and then the next and so on. As many messages as there were sectors could be sent simultaneously. The Baudot Code was widely used in teleprinters.

By the end of the 19th century the world was crisscrossed by telegraph lines, including numerous cables across the Atlantic Ocean. Some early telegraphs using keyboards and typewheels were capable of producing tapes of printed messages, which were long used in stock tickers. In 1903 Donald Murray of England combined Baudot's time-division multiplex system and its five-level code with a system for punching tape devised by Wheatstone to produce a system that transmitted page form telegrams. Between 1924 and 1928 the simplex printer or teleprinter, commonly known by the American Telephone and Telegraph trade name Teletype, was developed to serve the simple back-and-forth needs of business communication through subscription networks such as telex. Teleprinters in 1933 were capable of printing up to 500 characters per minute. By 1964 improved teleprinters were using the American Standard Code for Information Interchange, a seven-level code capable of producing 128 alphanumeric and control signals. Some versions produced 900 characters per minute.

The invention and technical improvement of the telephone at first made a new range of technology available to telegraphy, particularly in the field of high-speed transmission. Other important developments in telegraphy in the 20th century included the use of microwave radio links, satellite transmission, and computerized switching. By the end of the century, though, the growing capacity of the telephone system to support high-speed data transmission (particularly facsimile and electronic mail) reduced the telegraph system to a minor role in telecommunication.

**Teleki, Pál, Gróf** (count) (b. Nov. 1, 1879, Budapest, Hung., Austria-Hungary—d. April 3, 1941, Budapest), Hungarian prime minister who cooperated with Nazi Germany in the early stages of World War II.

A member of the Hungarian Parliament from 1905, Teleki, an eminent geographer, was a delegate to the Paris Peace Conference (1919) after World War I. In 1921 he withdrew from party politics, in which he had never greatly believed.

After teaching geography at Budapest University, Teleki returned to office as minister of education in May 1938 and became prime minister again on Feb. 15, 1939. As prime minister he dissolved various Fascist parties, although he allowed anti-Semitic laws to stand. Teleki strongly advocated revision of the Treaty of Trianon (1920). While he hoped to use Germany's might in winning back territories lost through the treaty, he realized the danger to Hungary of too great a dependence on the German leader Adolf Hitler. He supported Hitler's dismemberment of Czechoslovakia and Romania's forced cession of northern Transylvania but in 1940 negotiated a treaty of friendship with Yugoslavia. When Germany invaded that country in 1941, Teleki was caught between German demands for Hungarian help against the Yugoslavs (thus breaking his pledge given in the treaty) and British threats against helping the Germans. Facing these counterpressures, he committed suicide.

**Teleki, Sámuel, Gróf** (count) (b. Nov. 1, 1845, Saromberke, Transylvania [now Dumbrăvioara, Rom.]—d. March 10, 1916, Budapest, Hung., Austria-Hungary), Hungarian explorer who discovered and named Lake Rudolf (now also called Lake Turkana) and Lake Stefanie (now Chew Bahir), in northern Kenya and southern Ethiopia. He also added significantly to the knowledge of the previously unexplored highlands of East Africa.

Teleki set out from Pangani (now in Tanzania) in February 1887 in the company of an Austrian naval officer, Ludwig von Höhnel, and they traversed all of what is now Kenya to the southern end of Ethiopia. They climbed Kilimanjaro and Mount Kenya in March 1887 and then followed the interior river system to Lakes Rudolf and Stefanie, which they reached in March 1888. During the return to the East African coast, which they reached at Mombasa in October 1888, Teleki discovered an active volcano (in southern Kenya) subsequently named for him.

**Telemachus,** in Greek mythology, son of the Greek hero Odysseus and his wife, Penelope. When Telemachus reached manhood, he visited Pylos and Sparta in search of his wandering father. On his return, he found that Odysseus had reached home before him. Then father and son slew the suitors who had gathered around Penelope. According to later tradition, Telemachus married Circe (or Calypso) after Odysseus' death.

**Telemann, Georg Philipp** (b. March 14, 1681, Magdeburg, Brandenburg [Germany]—d. June 25, 1767, Hamburg), German com-

poser of the late Baroque period, who wrote both sacred and secular music but was most admired for his church compositions, which ranged from small cantatas to large-scale works for soloists, chorus, and orchestra.



Telemann, engraving by Georg Lichtensteger
By courtesy of the Kunsthalle, Hamburg

*Life.* Telemann was the son of a Protestant minister and was given a good general education but never actually received music lessons. Though he showed great musical gifts at an early age, he was discouraged by his family from becoming a professional musician, at that time neither an attractive nor a remunerative occupation. By self-teaching, however, he acquired great facility in composing and in playing such diverse musical instruments as the violin, recorder, oboe, viola da gamba, chalumeau, and clavier. In 1701 he enrolled at the University of Leipzig as a law student, but musical activities soon prevailed and were to engross him for the rest of his life.

Leipzig became the stepping-stone for Telemann's musical career. The municipal authorities there realized that, apart from his musical gifts, the young firebrand possessed extraordinary energy, diligence, and a talent for organization. They commissioned him to assist the organist of the Thomaskirche, Johann Kuhnau, by composing church cantatas for alternate Sundays, and also gave him a position as organist at the university chapel, Neuenkirche. Telemann reorganized the collegium musicum, the student musical society, into an efficient amateur orchestra that gave public concerts (then a novelty) and became director of the Leipzig Opera, for which he also composed. Telemann's next positions were at two princely courts: first as kapellmeister (conductor of the court orchestra) in Sorau (now Żary, Pol.; 1704–08), then as *konzertmeister* (first violinist) and later kapellmeister in Eisenach (1708–12). By playing, conducting, studying, and composing he gained the musical knowledge, practical experience, and facility in composing that were to be vital when he assumed the musical directorship of Frankfurt am Main (1712–21) and Hamburg (1721–67). In Frankfurt he was musical director of two churches and in charge of the town's official music. As in Leipzig, he reorganized the students' collegium musicum and gave public concerts with the group. In Frankfurt Telemann started publishing music that made him famous not only in Germany but also abroad. As musical director of Hamburg, one of the outstanding musical positions of the time, he supplied the five main churches with music, was in charge of the Hamburg Opera, and served as cantor at Hamburg's renowned humanistic school, the Johanneum, where he also was an instructor in music. In Hamburg, too, he directed a collegium musicum and presented public concerts. In 1729 he refused a call to organize a German orchestra at the Russian court. He had also declined an offer in 1722 from municipal authorities in Leipzig to succeed Kuhnau as organist of the Thomaskirche. This proffered position, which had been promised him 17 years earlier by authorities in the event of Kuhnau's death, manifested the high esteem in which even the young Telemann was held. (Following Telemann's refusal, the position fell to Johann Sebastian Bach.) In addition to all his activities in Hamburg, he also supplied (by contract) the courts of Eisenach and Bayreuth, as well as the town of Frankfurt, with music and continued to publish his compositions.

A master of the principal styles of his time—German, Italian, and French—he could write with ease and fluency in any of them and often absorbed influences of Polish and English music. He composed equally as well for the church as for opera and concerts. His music was natural in melody, bold in harmonies, buoyant in rhythm, and beautifully orchestrated. Profound or witty, serious or light, it never lacked quality or variety. Telemann's printed compositions number more than 50 opuses, among them (counting each as one item) the famous collection *Musique de table* (published in 1733; containing three orchestral suites, three concerti, three quartets, three trios, and three sonatas); the first music periodical, *Der getreue Music-Meister* (1728–29; containing 70 compositions); *Der harmonische Gottesdienst* (1725–26; 72 church cantatas); and 36 fantasias for harpsichord.

Except for a brief journey to France (1737–38), where he was enthusiastically received, Telemann never left Germany. He married twice and had eight sons and three daughters. His first wife died young in childbirth; his second wife absconded with a Swedish officer, leaving Telemann with a debt of 3,000 taler. Apart from being a prolific composer, he was also a keen writer; his two autobiographies of 1718 and 1739 are comparatively well documented. He published a long poem after his first wife's death, and many words in his vocal compositions came from his own pen. Especially noteworthy are Telemann's many prefaces to collections of his music, which contain a great amount of practical advice on how his compositions (as well as those of his contemporaries) should be performed. A friend of Bach and Handel, he was godfather to Bach's son Carl Philipp Emanuel, who succeeded as musical director of Hamburg after Telemann's death at the age of 86.

*Assessment.* In the eyes of his 18th-century contemporaries, Georg Philipp Telemann was the greatest living composer. The dreaded critic Johann Mattheson wrote of him that "Corelli and Lully may be justly honoured but Telemann is above all praise." Through his public concerts Telemann introduced to the general public music previously reserved for the court, the aristocracy, or a limited number of burghers. His enormous output of publications provided instrumental and vocal material for Protestant churches throughout Germany, for orchestras, and for a great variety of amateur and professional musicians.

The multiplicity of Telemann's activities and the great number of his compositions are remarkable, indeed. In his lifetime he was most admired for his church compositions. These vary from small cantatas, suitable for domestic use or for use in churches with limited means, to large-scale works for soloists, chorus, and orchestra. His secular vocal music also has a wide range, from simple strophic songs to the dramatic cantata *Ino,* written at the age of 84. Of his operas the comic ones were the most successful, particularly *Pimpinone.* His orchestral works consist of suites (called *ouvertures*), concerti grossi, and concerti. His chamber works are remarkable for their quantity, the great variety of instrumental combinations, and the expert writing for each instrument.

After Telemann's death, the new music styles of Haydn and Mozart obliterated the older ones. And in the 19th century, when the works of Bach and Handel were reappraised, Telemann's reputation was reduced to that of a prolific but superficial scribbler. In the 20th century, however, a historically and aesthetically more correct opinion has been formed, largely through studies by Max Schneider and Romain Rolland. New editions of his work have appeared, especially since the 1930s, and the interest of players, conductors, and publishers has increased. (W.G.B.)

MAJOR WORKS. *Operas.* More than 50, including *Der gedultige Socrates* (first performed 1721); *Der neu-modische Liebhaber Damon* (1724); *Pimpinone* (1725).

*Oratorios and cantatas. Der Tag des Gerichts* (1762); *Ino* (1766); *Die Tageszeiten; Der Tod Jesu; Die Auferstehung Christi; Seliges Erwägen,* 46 Passions.

*Instrumental. Musique de table,* productions 1–3 (published 1733); innumerable concerti, suites, quartets, and sonatas, for varying instrumental combinations.

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**Telemark,** *fylke* (county), southeastern Norway. It extends from the Hardanger Plateau in the northwest to the Skagerrak, an arm of the North Sea in the southeast. The mountains in the northwest become hills, interspersed with many long, narrow glacial lakes in the central portion, and rolling lowlands near the coast. Langesunds Fjord and other smaller inlets cut into the rocky coastline. Three of the many lakes, Bandak, Heddalsvatnet, and Norsjå, are connected by canals with Telemark's county seat and main port, Skien, in the southeast. The canal system also extends east almost into Vestfold *fylke.* Hydroelectric resources have been developed, the largest project being at Rjukan, in the northeast. The economy is based on lumbering, fishing, the chemical industry, manufacture of wood and paper products, mining (copper, iron, and molybdenum), farming and stock raising, and small diversified industries. Area 5,913 square miles (15,315 square km). Pop. (1995 est.) 163,143.

**telemetry,** highly automated communications process by which measurements are made and other data collected at remote or inaccessible points and transmitted to receiving equipment for monitoring, display, and recording. Originally, the information was sent over wires, but modern telemetry more commonly uses radio transmission. Basically, the process is the same in either case. Among the major applications are monitoring electric-power plants, gathering meteorological data,

and monitoring manned and unmanned space flights.

The original telemetry systems were termed supervisory because they were used to monitor electric power distribution. In the first such system, installed in Chicago in 1912, telephone lines were used for transmitting data on the operation of a number of electric-power plants to a central office. Such systems spread to other fields besides power networks and underwent extensive improvements, culminating in the introduction in 1960 of the so-called interrogation-reply principle, a highly automated arrangement in which the transmitter-receiver facility at the measuring point automatically transmits needed data only on being signalled to do so. The technique is applied extensively throughout the world in such fields as oil-pipeline monitor-control systems and oceanography, in which a network of buoys transmits information on demand to a master station.

Aerospace telemetry dates from the 1930s, with the development of the balloon-borne radiosonde, a device that automatically measures such meteorological data as temperature, barometric pressure, and humidity and that sends the information to an Earth station by radio. Aerospace telemetry for rockets and satellites was inaugurated with the Soviet satellite Sputnik, launched in 1957, and systems have grown in size and complexity since then. Observatory satellites have performed as many as 50 different experiments and observations, with all data telemetered back to a ground station. The techniques developed in aerospace have been successfully applied to many industrial operations, including the transmission of data from inside internal-combustion engines during tests, from steam turbines in operation, and from conveyor belts inside mass-production ovens.

*Telemetering systems and components.* A typical telemetering system consists of an input device called a transducer, a medium of transmission (usually radio waves), equipment for receiving and processing the signal, and recording or display equipment.

*The transducer.* The transducer converts the physical stimulus to be measured, such as temperature, vibration, or pressure, into an electrical signal and thus operates as the actual measuring instrument. Transducers can take many forms. They can be self-generating or externally energized. An example of the self-generating type is a vibration sensor based on the use of a piezoelectric material—*i.e.,* one that produces an electrical signal when it is mechanically deformed. Many externally energized transducers operate by producing an electrical signal in response to mechanical deformation. Typical physical inputs producing such deformations are pressure, mechanical stress, and acceleration. A simple mechanical transducer-sensing device is a strain gauge based on the change in electrical resistance of a wire or a semiconductor material under strain. Another externally energized transducer, called the variable-reluctance type, is one in which the magnetic circuit is broken by an air gap. The mechanical movement to be measured is used to change this air gap, thus changing the reluctance, or opposition, to the production of a magnetic field in the circuit. The change in reluctance is then translated into an electrical signal.

Temperature sensors can be divided into two classifications: temperature-dependent resistance elements and self-generating thermocouples. Thermistors are of the first type; they have a high negative temperature coefficient—*i.e.,* their resistance drops very rapidly as the temperature increases. The thermistor is small and provides rapid response to changes in temperature. Thermocouples are wire junctions of dissimilar metals that produce an electrical current when heated; they have a very low output, and each must be used with a second thermocouple held at a constant cold temperature for a reference point.

There are many types of specialized sensors and transducer systems. One is the previously mentioned radiosonde system, designed specifically to radio weather data from a balloon to a ground station. Most weather-sensing and transmitting elements measure temperature, pressure, and humidity. In manned space probes, sensors for measuring such factors as the astronaut's blood pressure, heartbeat, and breathing rate are employed. Sensors have also been developed to indicate the rate of flow of a fluid through a pipe.

*Communications links.* Communications facilities for telemetry consist primarily of radio or wire links. Alternatives such as light beams or sonic signals are used in a few cases, but environmental factors (*e.g.,* atmospheric obstructions) and local masking noises make them impractical for most applications.

Radio communication is used for aerospace work and for supervisory systems in which it is impractical to provide wire line links. For public utility installations in built-up areas, radio communication is usually ruled out by the difficulty of finding antenna sites and unobstructed line-of-sight radio paths. In such cases, cables and line links are used.

An important consideration in radio links is the choice of operating frequency, a choice limited to bands allocated by international agreement. Propagation varies enormously over the range of frequencies involved. For aerospace applications in which transmissions must penetrate the atmosphere, the frequency range is 100 megahertz (100,000,000 cycles per second) to 10,000 megahertz. Line links for supervisory applications usually employ a comparatively narrow band. They may utilize the whole or only a section of a conventional voice channel with a bandwidth of 3,000 hertz (cycles per second). The link may be either a direct wire circuit or one of the channels in a carrier communications system.

*Multiplexing and sampling.* A telemetry system ordinarily must handle more than one channel of information (*e.g.,* routine measurements from an orbiting satellite, or flow rate and reservoir levels in a water-distribution network). These data-measurement channels are brought together by a process known as multiplexing, which combines the channels into one composite signal for transmission over the communications link. Multiplexing may be based on either a time division or a frequency division. In time division, channels are combined one after another in time sequence; in frequency division, each channel is assigned on an individually allocated, discrete frequency band, and these bands are then combined for simultaneous transmission. Finally, data may be handled within the telemetry system in a continuous (analog) or discrete (digital) way. The latter systems are relatively more complex because it is necessary to convert analog signals to digital form, a process known as encoding, for a purely digital arrangement.

Time-division multiplexing involves a sequential action in which samples are selected in turn from a number of different measurement channels for transmission to the receiving point. In fixed cycle selection, a switching device connects a particular channel to the output communications link in accordance with a prearranged sequence.

With a so-called address-reply system, data are sent only as a result of a command signal: sampling is in accordance with a predetermined scanning program. The program is flexible because it can be arranged to meet priority requirements for information, as, for instance, when an alarm condition develops.

*Transmission.* A process called modulation is used to impress the information on the carrier frequency. Of the many design choices that must be made, that of the modulation method is among the most important. Not only does it have a direct influence on system performance but it also tends to define areas of design in both the sender and the receiver.

Modulation methods fall into two divisions. The first includes amplitude and frequency modulation (as in commercial AM and FM broadcasting) and related types. These related types include two pulse-based methods in which several pulses are spaced out in time, each pulse representing one information channel. The two types are pulse-width (or pulse-duration) modulation and pulse-position modulation. In the first, the information produces variations in the width (or duration) of the pulse; in the second, the variation is in the position of the pulse with respect to time. In the second main class, pulse-code modulation, the information is coded digitally into groups of pulses and then transmitted.

In most telemetering systems, modulation is carried out in two stages. First, the signal modulates a subcarrier (a radio-frequency wave the frequency of which is below that of the final carrier), and then the modulated subcarrier in turn modulates the output carrier. Frequency modulation is used in many of these systems to impress the telemetry information on the subcarrier. If frequency-division multiplexing is used to combine a group of these frequency-modulated subcarrier channels, the system is known as an FM/FM system.

*Processing the received signal.* At the receiving end of the telemetry chain, two tasks must be performed: the original measurement data must be extracted from the received signal, and it must be presented or displayed in intelligible form. The extraction of the data takes place in two stages and is the reverse of the steps taken in producing the modulated composite transmitting signal. Initial demodulation produces the modulated subcarrier; this subcarrier is then split up into its original measurement channels by demultiplexing (the reverse of multiplexing). The separated signals are fed individually to their respective points in the presentation system. Data is presented in "real time"—that is, at the instant the variable is being measured—and in one or more recorded forms. Magnetic tape is the most widely used recording medium.

The presentation of aerospace data differs from that of supervisory data. For the routine requirements of the latter, formal diagram displays normally are provided, together with printout of the data by electric typewriter. Aerospace systems, on the other hand, being experimental in nature, generally display a wide range of measurements. Almost without exception, data are recorded in a form suitable for processing by computers.

*Special applications and techniques.* New applications of telemetry are constantly appearing, particularly in the fields of research and scientific investigation. An important area is biomedical research, in which biological information is telemetered from inside patients by means of microminiature transmitters that are either swallowed or surgically implanted. External monitoring of body conditions can be carried out with surface transducers.

Another scientific area in which telemetry is applied is oceanography. In this case, unmanned instrumented buoys are interrogated by a central master station at appropriate intervals. Both oceanographic data (*e.g.,* water temperature and salinity) and surface meteorological information are recorded, ready to be transmitted to the master station in response to interrogation.

In mechanical engineering, information is transmitted from inside prime movers (*e.g.,* electric, gas, steam, and diesel engines) over various types of radio links to an external receiver. The information normally includes temperature and pressure.

Telemetry is often provided by television-like facilities usually employing a low-bandwidth communications link. This type of facility is advantageous when a visual indication is desired of a process inaccessible to humans. Applications include rocket-motor testing and remote observation of operations with highly radioactive material.

**teleological ethics** (Greek *telos,* "end"; *logos,* "science"), theory of morality that derives duty or moral obligation from what is good or desirable as an end to be achieved. It is opposed to deontological ethics (from the Greek *deon,* "duty"), which holds that the basic standards for an action's being morally right are independent of the good or evil generated.

A brief treatment of teleological ethics follows. For a full treatment, *see* MACROPAEDIA: Ethics.

Modern ethics, especially since the 18th-century German deontological philosophy of Immanuel Kant, has been deeply divided between a form of teleological ethics (utilitarianism) and deontological theories.

Teleological theories differ on the nature of the end that actions ought to promote. Eudaemonist theories (Greek *eudaimonia,* "happiness"), which hold that ethics consists in some function or activity appropriate to man as a human being, tend to emphasize the cultivation of virtue or excellence in the agent as the end of all action. These could be the classical virtues—courage, temperance, justice, and wisdom—that promoted the Greek ideal of man as the "rational animal"; or the theological virtues—faith, hope, and love—that distinguished the Christian ideal of man as a being created in the image of God.

Utilitarian-type theories hold that the end consists in an experience or feeling produced by the action. Hedonism, for example, teaches that this feeling is pleasure—either one's own, as in egoism (the 17th-century English philosopher Thomas Hobbes), or everyone's, as in universalistic hedonism, or utilitarianism (the 19th-century English philosophers Jeremy Bentham, John Stuart Mill, and Henry Sidgwick), with its formula the "greatest pleasure of the greatest number." Other utilitarian-type views include the claims that the end of action is survival and growth, as in evolutionary ethics (the 19th-century English philosopher Herbert Spencer); the experience of power, as in despotism (the 16th-century Italian political philosopher Niccolò Machiavelli and the 19th-century German Friedrich Nietzsche); satisfaction and adjustment, as in pragmatism (20th-century American philosophers Ralph Barton Perry and John Dewey); and freedom, as in existentialism (the 20th-century French philosopher Jean-Paul Sartre).

The chief problem for eudaemonist theories is to show that leading a life of virtue will also be attended by happiness—by the winning of the goods regarded as the chief end of action. That Job should suffer and Socrates and Jesus die while the wicked prosper, as the Psalmist (73) points out, then seems unjust. Eudaemonists generally reply that the universe is moral and that, in Socrates' words, "No evil can happen to a good man, either in life or after death," or, in Jesus' words, "But he who endures to the end will be saved."

Utilitarian theories, on the other hand, must answer the charge that ends do not justify the means. The problem arises in these theories because they tend to separate the achieved ends from the action by which these ends were produced. One implication of utilitarianism is that one's intention in performing an act may include all of its foreseen consequences. The goodness of the intention then reflects the balance of the good and evil of these consequences, with no limits imposed upon it by the nature of the act itself—even if it be, say, the breaking of a promise or the execution of an innocent man. Utilitarianism, in answering this charge, must show either that what is apparently immoral is not really so or that, if it really is so, then closer examination of the consequences will bring this fact to light. Ideal utilitarianism (G.E. Moore and Hastings Rashdall) tries to meet the difficulty by advocating a plurality of ends and including among them the attainment of virtue itself, which, as Mill affirmed, "may be felt a good in itself, and desired as such with as great intensity as any other good."

**teleology** (from Greek *telos,* "end"; *logos,* "reason"), explanation by reference to some purpose or end; also described as final causality, in contrast with explanation by efficient causes only. Human conduct, insofar as it is rational, is generally explained with reference to ends pursued or alleged to be pursued; and human thought tends to explain the behaviour of other things in nature on this analogy, either as of themselves pursuing ends, or as designed to fulfill a purpose devised by a mind transcending nature. The most celebrated account of teleology was that given by Aristotle when he declared that a full explanation of anything must consider not only the material, the formal, and the efficient causes, but also the final cause—the purpose for which the thing exists or was produced.

With the rise of modern science in the 16th and 17th centuries, interest was directed to mechanistic explanations of natural phenomena, which appeal only to efficient causes; if teleological explanations were used, they took the form not of saying (as in Aristotelian teleology) that things develop toward the realization of ends internal to their own natures but of viewing even biological organisms as machines ingeniously devised by an intelligent being. In the 18th century, William Paley, a Protestant apologist, gave classic expression to this kind of teleology.

Immanuel Kant's *Kritik der Urtheilskraft* (1790; *Critique of Judgment*) dealt at length with teleology. While acknowledging—and indeed exulting in—the wondrous appointments of nature, Kant cautioned that teleology can be, for man's knowledge, only a regulative and not a constitutive principle; *i.e.,* a guide to the conduct of inquiry rather than to the nature of reality.

In the late 19th century, controversy centred on whether the phenomena of growth, regeneration, and reproduction characteristic of living organisms could be explained in purely mechanistic terms. The vitalism of Hans Driesch, a German biologist and philosopher, according to which an Aristotelian entelechy, or immanent agency, must be postulated in every organism, found little support after his death. There remains, however, the question of whether biological processes can be explained in purely physicochemical terms, or whether the problems of structure, function, and organization necessitate some kind of teleology. Organismic conceptions, such as those espoused in the mid-20th century by Ludwig von Bertalanffy, an Austrian-Canadian theoretical biologist, have thrown these issues into a new perspective.

**Teleorman,** *judeţ* (county), south-central Romania. It is bounded on the south by Bulgaria. The Danube River drains eastward, constituting the southern border of the county. The Vedea, Teleorman, Olt, and Neajlov rivers flow southeastward, emptying into the Danube. Lake Suhaia lies in the south. Alexandria (*q.v.*), the county seat, has industries that produce textiles and processed food. Turnu-Măgurele is a chemical- and timber-production centre. Machinery is manufactured in Roşiori de Vede, and leather products are made in Zimnicea. Agricultural activities consist of livestock raising and cereal growing. A history museum is found in Alexandria. Videle, Balaci, and Crîngeni are other towns. Highway and railway connections extend throughout the county and focus on Alexandria, Turnu Măgurele, and Roşiori de Vede. A major highway connection between Bucharest and Craiova crosses the county. Area 2,224 square miles (5,760 square km). Pop. (1992 prelim.) 482,300.

**teleost,** any member of the infraclass Teleostei, a large and extremely varied group of ray-finned fishes (class Actinopterygii) that are considered to be the most advanced of the bony fishes.

A brief treatment of teleosts follows. For full treatment, *see* MACROPAEDIA: Fishes.

The teleosts comprise about 20,000 species and account for more than 95 percent of all extant species of fish. Virtually all of the important commercial and sport fishes are teleosts. The most distinctive feature of teleosts is their homocercal tail—*i.e.,* one whose upper and lower halves are of about equal size. The fins are supported by rays or spines, and the tooth-bearing bones of the jaw are attached to the front end of the snout. The dorsal and anal fins aid in swimming and turning, and paired pectoral and pelvic fins stabilize the body.

Teleosts vary more widely in their body structure, size, functions, colour, and behaviour than any other major group of vertebrate animals. They range in size from tiny gobies less than one inch long to large marlins exceeding 3.4 m (11 feet) in length and 550 kg (1,200 pounds) in weight. Among the teleosts are eels, sea horses, sunfishes, flounders, and scorpion fishes, as well as many species of more conventional body type. Such teleosts as tuna, herring, anchovy, salmon, trout, perch, carp, catfish, and cod are extremely important to humans as a food supply. Other, smaller species of teleosts are popular aquarium fish.

Teleosts inhabit a wider variety of aquatic environments than any other major group of fishes. They are found in all the world's oceans and major bodies of freshwater; they inhabit tropical, temperate, Arctic, and Antarctic latitudes; and they range in habitat from torrential mountain watercourses to the deep ocean floor. Most species live in temperate or tropical waters, either marine or freshwater. In general, teleosts remain in one habitat throughout their life cycle, though some, such as the salmon, hatch and develop in freshwater, then migrate to the sea before returning to their birthplace to spawn and die.

Most teleosts lay eggs that either float in the ocean or sink to the bottom. A few species hatch the eggs in their mouths, carrying them through the entire incubation period, and a few other species give birth to live young. A few hermaphroditic species such as the sea bass are able to produce both eggs and sperm. The behaviour of teleosts is as varied as their other attributes. Some live in closely packed schools, while others live and hunt alone.

**telepathy,** direct transference of thought from one person (sender or agent) to another (receiver or percipient) without using the usual sensory channels of communication, hence a form of extrasensory perception (ESP). While the existence of telepathy has not yet been proved, some parapsychological research studies have produced favourable results using such techniques as card guessing with a special deck of five sets of five cards. The agent may simply think of a random order of the five card symbols while the percipient tries to think of the order on which the agent is concentrating. In a general ESP test the sender concentrates on the face of one card at a time while the receiver tries to think of the symbol. Both subjects are, of course, separated by a screen or some greater obstacle or distance. Scores significantly above chance are extremely rare, particularly as testing methods have become more rigorous.

**telephone,** an instrument that is designed for the simultaneous transmission and reception of the human voice. Inexpensive, simple to operate, and offering its user a personal type of communication that cannot be obtained through the written word, the telephone has become the most widely used telecommunications device. Hundreds of millions of telephone sets are in use throughout the world. Each business day almost two billion telephone transmissions take place in the United States alone.

A brief treatment of telephones follows. For full treatment, *see* MACROPAEDIA: Telecommunications Systems.

For international statistical data on telephones, *see* BRITANNICA BOOK OF THE YEAR.

The word telephone, from the Greek roots *tēle,* "far," and *phonē,* "sound," was applied as early as the late 17th century to the string telephone familiar to children and was later used to refer to the megaphone and the speaking tube; but in modern usage it refers solely to electrical devices derived from the inventions of Alexander Graham Bell and others. The U.S. patent granted to Bell in March 1876 (No. 174,465) for the development of a device to transmit speech sounds over electric wires is often said to be the most valuable ever issued. The general concepts involved in the invention of the telephone—of speech sounds as a complex of vibrations in air that is transferrable to solid bodies and of the convertibility of those vibrations to electrical impulses in conducting metals—had by then been understood for decades. Bell was but one of a number of workers racing to pull them together into a practical instrument for the transmission of speech.

Within 20 years of the Bell patent, the telephone instrument, as modified by Thomas Watson, Emil Berliner, Thomas Edison, and others, acquired a form that has not changed fundamentally in a century. Since the invention of the transistor in 1947, metal wiring and other heavy hardware have been replaced by lightweight and compact microcircuitry. Advances in electronics have improved the performance of the basic design, and they also have allowed the introduction of a number of "smart" features such as automatic redialing, call-number identification, and analog-to-digital conversion for transmission over digital circuits. Such advances supplement, but do not replace, the basic telephone design. As it has since the early years of telephone communication, the telephone instrument comprises the following functional components: a power source, a switch hook, a dialer, a ringer, a transmitter, a receiver, and an anti-sidetone circuit. These components are described in turn below.

*Power source.* In the first experimental telephones, the electric current that powered the circuit was generated at the transmitter, by means of an electromagnet activated by the speaker's voice. Such a system could not generate enough voltage to produce audible speech in distant receivers, so every transmitter since Bell's patented design has operated by producing variations in a direct current supplied by an independent power source. The first sources were batteries located in the telephone instruments themselves, but since the 1890s current has been generated at the local switching office. The current is supplied through a two-wire circuit called the local loop. The standard voltage in the Bell system is 48 volts.

Cordless telephones represent a return to individual power sources in that their low-wattage radio transmitters are powered by a small (*e.g.,* 3.6-volt) battery located in the portable handset. When the telephone is not in use, the battery is recharged through contacts with the base unit. The base unit is powered by a transformer connection to a standard electric outlet.

*Switch hook.* The switch hook connects the telephone instrument to the direct current supplied through the local loop. In early telephones the receiver was hung on a hook that operated the switch by opening and closing a metal contact. This system is still common, though the hook has been replaced by a cradle to hold the combined handset (enclosing both receiver and transmitter). In some modern electronic instruments, the mechanical operation of metal contacts has been replaced by a system of transistor relays.

When the telephone is "on hook," contact with the local loop is broken. When it is "off hook" (*i.e.,* the handset is lifted from the cradle), contact is restored, and current flows through the loop. The switching office signals restoration of contact by transmitting a low-frequency "dial tone" (actually two simultaneous tones of 350 and 440 hertz).

*Dialer.* The dialer is used to enter the number of the party that the user wishes to call. Signals generated by the dialer activate switches in the local office, which establish a transmission path to the called party. Dialers are of the rotary and push-button types.

The traditional rotary dialer, invented in the 1890s, is rotated against the tension of a spring and then released, whereupon it returns to its position at a rate controlled by a mechanical governor. The return rotation causes a switch to open and close, producing interruptions, or pulses, in the flow of direct current to the switching office. Each pulse lasts approximately one-tenth of a second; the number of pulses signals the number being dialed.

In push-button dialing, introduced in the 1960s, the pressing of each button generates a "dual-tone" signal that is specific to the number being entered. Each dual tone is composed of a low frequency (697, 770, 852, or 941 hertz) and a high frequency (1,209, 1,336, or 1,477 hertz), which are sensed and decoded at the switching office. Unlike the low-frequency rotary pulses, dual tones can travel through the telephone system, so that push-button telephones can be used to activate automated functions at the other end of the line.

In both rotary and push-button systems, a capacitor and resistor prevent dialing signals from passing into the ringer circuit.

*Ringer.* The ringer alerts the user to an incoming call by emitting an audible tone or ring. Ringers are of two types, mechanical or electronic. Both types are activated by a 20-hertz, 75-volt alternating current generated by the switching office. In the Bell system, the ringer is activated in two-second pulses, each pulse separated by a pause of four seconds.

The traditional mechanical ringer was introduced with the early Bell telephones. It consists of two closely spaced bells, a metal clapper, and a magnet. Passage of alternating current through a coil of wire produces alternations in the magnetic attraction exerted on the clapper, so that it vibrates rapidly and loudly against the bells. Volume can be muted by a switch that places a mechanical damper against the bells.

In modern electronic ringers, introduced in the 1980s, the ringer current is passed through an oscillator, which adjusts the current to the precise frequency required to activate a piezoelectric transducer (a device made of a crystalline material that vibrates in response to an electric current). The transducer may be coupled to a small loudspeaker, which can be adjusted for volume.

The ringer circuit remains connected to the local loop even when the telephone is on hook. A larger voltage is necessary to activate the ringer because the ringer circuit is made with a high electrical impedance in order to avoid draining power from the transmitter-receiver circuit when the telephone is in use. A capacitor prevents direct current from passing through the ringer once the handset has been lifted off the switch hook.

*Transmitter.* The transmitter is essentially a tiny microphone located in the mouthpiece of the telephone's handset. It converts the vibrations of the speaker's voice into variations in the direct current flowing through the set from the power source.

In traditional carbon transmitters, developed in the 1880s, a thin layer of carbon granules separates a fixed electrode from a diaphragm-activated electrode. Electric current flows through the carbon against a certain resistance. The diaphragm, vibrating in response to the speaker's voice, forces the movable electrode to exert a fluctuating pressure on the carbon layer. Fluctuations in the carbon layer create fluctuations in its electrical resistance, which in turn produce fluctuations in the electric current.

In modern electret transmitters, developed in the 1970s, the carbon layer is replaced by a thin plastic sheet that has been given a conductive metallic coating on one side. The plastic separates that coating from another metal electrode and maintains an electric field between them. Vibrations caused by speech produce fluctuations in the electric field, which in turn produce small variations in voltage. The voltages are amplified for transmission over the telephone line.

*Receiver.* The receiver is located in the earpiece of the telephone's handset. Operating on electromagnetic principles that were known in Bell's day, it converts fluctuating electric current into sound waves that reproduce human speech. Fundamentally, it consists of two parts: a permanent magnet having pole pieces wound with coils of insulated fine wire, and a diaphragm driven by magnetic material that is supported near the pole pieces. Speech currents passing through the coils vary the attraction of the permanent magnet for the diaphragm, causing to it vibrate and produce sound waves.

Through the years the design of the electromagnetic system has been continously improved. In the most common type of receiver, introduced in the Bell system in 1951, the diaphragm, consisting of a central cone attached to a ring-shaped armature, is driven as a piston to obtain efficient response over a wide frequency range. Telephone receivers are designed to have an accurate response to tones with frequencies of 350 to 3,500 hertz—a dynamic range that is narrower than the capabilities of the human ear but sufficient to reproduce normal speech.

*Anti-sidetone circuit.* The anti-sidetone circuit is an assemblage of transformers, resistors, and capacitors that perform a number of functions. The primary function is to reduce sidetone, which is the distracting sound of the speaker's own voice coming through the receiver from the transmitter. The anti-sidetone circuit accomplishes this reduction by interposing a transformer between the transmitter circuit and the receiver circuit and by splitting the transmitter signals along two paths. When the divided signals, having opposite polarities, meet at the transformer, they almost entirely cancel each other in crossing to the receiver circuit. The speech signal coming from the other end of the line, on the other hand, arrives at the transformer along a single, undivided path and crosses the transformer unimpeded.

The anti-sidetone circuit also matches the low electrical impedance of the telephone instrument's circuits to the higher electrical impedance of the telephone line. Impedance matching allows a more efficient flow of current through the system.

**Telepinus** (Hittite king): *see* Telipinus.

**teleprinter,** also called TELETYPEWRITER, any of various telegraphic instruments that

transmit and receive printed messages and data via telephone cables or radio relay systems. Teleprinters became the most common telegraphic instruments shortly after entering commercial use in the 1920s. They were used by operators in local telegraph offices and switching centres, by press associations and other private networks, and by subscribers to international telegraphic message services such as telex (*q.v.*) Since the advent of low-cost, high-speed data transmission in the 1980s, teleprinters have steadily given way to computer terminals and facsimile (fax) machines.

Printing telegraphs of various types were designed from the beginning of electric telegraphy in the mid-19th century. The few successful designs all required an elaborate set-up procedure as well as skilled operators who knew the telegraphic codes employed. Teleprinters opened telegraphy to broader use essentially by adapting it to the typewriter, which was then becoming a standard business machine and which could be operated by less-skilled personnel. Early teletypewriters were developed around the turn of the 20th century by Donald Murray in Britain, by the Morkrum Company in the United States, and by Siemens & Halske AG in Germany. In 1924 the Teletype Corporation introduced a series of teletypewriters which were so popular that the name Teletype became synonymous with teleprinters in the United States.

The teleprinter consists of a typewriter-like keyboard and a printer, powered by an electric motor. The two devices are coupled to the motor by clutches that are brought into operation automatically when required. A message is sent by typing on the keyboard. Each key stroke generates a sequence of coded electrical pulses, which are then routed by electronic switching through an appropriate transmission system to the destination. There a receiving teleprinter decodes the incoming pulses and prints the message on paper. To this basic electromechanical design, some modern teleprinters have added such electronic devices as magnetic memory and video display.

Two different coding schemes have been used for teleprinters. The first to be used (beginning in the 1920s) was a variation of the Baudot Code, in which letters, numbers, punctuation marks, and keyboard functions were represented by 32 combinations of 5 "on" and "off" pulses. With the advent of digital computers in the 1960s, a new coding scheme, the American Standard Code for Information Interchange (ASCII), was developed and came to be widely used by teleprinters. ASCII employed 7 code pulses and was thus able to provide 128 combinations, giving a much more extensive range of symbols that could be transmitted. Teleprinters utilizing the ASCII code could transmit messages at speeds up to 150 words per minute, compared to 75 words per minute for machines using the Baudot Code.

**telescope,** device used to form magnified images of distant objects. In the first telescopes, visible light was focused by refraction through lenses; in later instruments, the same result was obtained by reflection from curved mirrors. Since the 1930s, radio telescopes have been used to form images from radio waves emitted by celestial objects. More recently other wavelength bands, notably the infrared and X-ray regions, have been exploited by appropriately designed telescopes.

A brief treatment of telescopes follows. For full treatment, *see* MACROPAEDIA: Telescopes.

The optical telescope was apparently invented in the Netherlands in 1608. Among the earliest of the optical systems were the Galilean telescopes, so called because they were modeled after the simple instruments built by Galileo. These telescopes consisted of two lenses mounted in a tube whose length was the difference between the focal lengths of the two lenses.

In 1611 the German astronomer Johannes Kepler proposed an improved version of the Galilean telescope, which became the basis for modern refracting instruments. The Keplerian telescope employed a convex eyepiece positioned in back of the focus, a feature that significantly enlarged the field of view. It also increased the possibilities for magnification by 1,000 times or more.

Later developments in the refracting telescope have been mainly matters of detail. By the end of the 19th century this form of telescope had reached its apogee in the 1-metre (40-inch) instrument built for Yerkes Observatory at Williams Bay, Wis.

The reflecting telescope, in which light is gathered and focused by a mirror and then magnified by an eyepiece, came into its own after the British astronomer William Herschel used an instrument of this type to discover the planet Uranus in 1781. The reflector became the predominant astronomical instrument in the 20th century. The world's largest reflecting telescopes are the 6-metre (236-inch) instrument at the Special Astrophysical Observatory on Mount Pastukhov, Caucasus, Russia, and the 5-metre (200-inch) Hale Telescope on Mount Palomar in California, U.S.

Another type of optical system, a catadioptric telescope, was invented in 1930 by Bernhard Schmidt of the Bergedorf Observatory in Hamburg for use as a wide-angle camera. In the Schmidt telescope, a weak lens, called a correcting plate, is placed in front of a spherically curved mirror to correct its aberration. There is no magnifying eyepiece. The result is an instrument with high light-gathering power, high resolution, and a wide field of view that is ideal for sky surveys.

The Earth's atmosphere is transparent not only to visible light but also to radio waves extending from 1 mm (0.04 inch) to approximately 10 m (33 feet). It was not until 1931, however, that this radio "window" was opened to astronomical observations. Today, astronomers systematically study radio emissions from many kinds of celestial objects, including stars, galaxies, and quasars. The most familiar type of radio telescope is a radio reflector consisting of a large parabolic antenna that is commonly known as a "dish." The largest single instrument of this kind is the 305-metre (1,000-foot) fixed dish of the Arecibo Observatory in Puerto Rico (*see also* radio telescope).

Since the early 1960s increasing efforts have been made to study the celestial sphere at other wavelength bands of the electromagnetic spectrum. Instruments similar to optical telescopes but more sensitive to radiation of wavelengths somewhat longer than visible light have been installed on high mountain peaks, such as Mauna Kea on the island of Hawaii, to make infrared observations. Infrared telescopes also have been carried high above the atmosphere by Earth-orbiting satellites.

Ultraviolet, X-ray, and gamma-ray observations can be made only from spacecraft, because the atmosphere is completely opaque to electromagnetic radiation of wavelengths less than about 3,000 angstroms. Ultraviolet telescopes resemble reflectors, but their optical surfaces require special coatings that provide high reflectivity. A good example of such an instrument is the one on the Hubble Space Telescope. X-ray telescopes, on the other hand, differ radically in design from conventional optical systems. Because of their extremely high energy, X-ray photons cannot be focused by lenses and will penetrate mirrors if they are arranged as in ordinary reflectors. Consequently, X-ray telescopes, such as the one on the HEAO-2 satellite (the so-called Einstein Observatory), are equipped with highly polished, cylindrical mirrors mounted so as to reflect the incoming photons at a shallow grazing incidence angle (*i.e.,* an extremely low angle, usually less than 4°) onto a focal plane; the image formed is recorded by an electronic detector. Similar grazing-incidence techniques are employed in gamma-ray telescopes. Such instruments are carried aboard orbiting satellites to observe neutron stars, supernova remnants, galaxy clusters, and other high-energy cosmic systems.

**telescope, radio:** *see* radio telescope.

**Telesio, Bernardino** (b. 1509, Cosenza, Kingdom of Naples [Italy]—d. October 1588, Cosenza), Italian philosopher and natural scientist who inaugurated the Renaissance empiricist reaction against the practice of reasoning without reference to concrete data.

Born of noble parentage, Telesio received a doctorate in 1535 and joined the group of thinkers known as the Accademia Cosentina. After spending nine years in a monastery, he lived in Naples and Cosenza. The first two books of his major work, *De natura juxta propria principia* ("On Nature According to Its Own Principles"), were published in 1565, and the complete edition of nine books appeared in 1586. Although Telesio had been encouraged in his writings by contemporary Roman Catholic popes, this work and two of his minor works remained on the Roman Catholic church's *Index of Forbidden Books* from 1596 until 1900.

The central proposition of *De natura* held that the only way to understand the things of the natural world was to study nature itself. This should be done, Telesio asserted, with attention to the physical properties of matter and to the aspects of heat and cold. He stated that matter is not "pure potency," the concept ascribed to Aristotle, but rather a tangible datum, and his studies of plants and animals led him to believe that heat is the source of life, a conclusion based on the warmth that he perceived. Cold complements heat as the other active principle that explains all natural phenomena. Such a shift to evidence that is available to the senses, in place of the Aristotelian emphasis on conceptual analysis without reference to sense data, led Francis Bacon to refer to Telesio as "the first of the moderns."

Despite his stress on the study of nature, however, and the relative lack of theological speculation in his works, Telesio also maintained a belief in God, the human soul, and immortality. Later philosophers who further developed his empirical method include the Italian thinker Tommaso Campanella and the English philosopher Thomas Hobbes.

**Telesphorus,** SAINT (d. *c.* 136, Rome [Italy]; feast day January 5), pope from about 125 to about 136. Telesphorus is said to have been a Greek, possibly from Calabria. Successor to St. Sixtus I, he was the eighth pope and a witness to the persecution of Christians by the Roman emperor Hadrian. He is considered the first pope after St. Peter to be martyred and is commemorated in the Greek and Roman churches.

**teletypewriter:** *see* teleprinter.

**television,** an electronic system for transmitting still or moving images and sound to receivers that project a view of the images on a picture tube or screen and re-create the sound.

A brief treatment of television follows. For full treatment, *see* MACROPAEDIA: Broadcasting.

For international statistical data on television, *see* BRITANNICA BOOK OF THE YEAR.

The technology of television has been made possible by a quirk in human vision: images are retained by the retina for a brief time after they strike it. Making use of this phenomenon, bits of a picture are displayed on

a television screen fast enough that a viewer sees them assembled as complete pictures. By rapidly changing the pictures on the screen (a rate of between 25 and 30 pictures per second is sufficient), an illusion of motion is created.

A television's audiovisual signal begins with the conversion of an image and accompanying sound into an electronic code by a television camera. The resulting electronic signals are usually recorded on tape, and for transmission, or broadcasting, they are impressed on high-frequency radio waves that act as carriers. After transmission by a broadcasting antenna, the carrier waves are picked up by a receiving antenna, which carries them to the television receiver. Inside the receiver the video and audio signals are separated and amplified; they then pass into the picture tube, which re-creates a picture of the original image from the video signals by means of a narrow beam of electrons that bombard the back of a screen coated with a fluorescent compound in a scanning motion. The electrons cause the coating of the screen to light up with the desired brightness in each area of the picture. The electron beam scans across the screen in horizontal lines (525 lines per picture in the United States and 625 in Europe). Each picture is scanned twice, with alternate lines illuminated on each scan. This technique tricks the eye into ignoring the flicker effect caused by displaying successive images too slowly, because it doubles the number of images displayed.

Experimentation to create á workable television system began in the late 19th century. In 1884 Paul Nipkow, a German scientist, patented his ideas for a complete television system, the key to which was a rotating disc with holes in a spiral pattern. This provided an effective mechanical means of image scanning that was used until electronic scanning was technically possible. Developments in the period from 1900 to 1920 produced early versions of the picture tube, methods of amplifying an electronic signal, and the theoretical formulation of the electronic-scanning principle; these later became the basis of modern television. In 1926 in England, John L. Baird first demonstrated a true television system by electrically transmitting moving pictures. In 1932 the Radio Corporation of America demonstrated all-electronic television using a camera tube called the iconoscope (patented by Vladimir Zworykin in 1923) and a cathode-ray tube in the receiver.

By the early 1950s a colour-television system had been developed based on the idea of separating the black-and-white and colour signals. The black-and-white signal gives a high level of detail and can be received by all television sets. The colour signal is projected into the clear areas of the black-and-white signal, in much the same way that one fills colour into the outline of a child's colouring book. This system also has the advantage of being compatible with black-and-white sets, which can still get a good picture from the same combined signal.

Since thè 1950s the improvements in colour-television technology have resulted in larger picture tubes with clearer images. Cable television systems for distributing signals over coaxial cables give improved reception and additional viewing channels. In addition, a device for projecting television onto a large screen became available in the late 1970s. Machines that can record television signals for later playback or play recorded material from videotape cassettes (especially videocassette recorders, or VCRs) or videodiscs have also become common.

By the late 20th century, efforts were under way to develop high-definition television, or HDTV; this term denotes any system yielding significantly greater picture resolution than that of the ordinary 525-line screen. Initial efforts centred on increasing the density of picture lines to more than 1,000, but these were overtaken in the 1990s by the adaptation of digital technology to television transmission and reception. Conventional television transmits signals in analog form—*i.e.,* as a series of waves that can reproduce the original images and sounds captured by cameras and microphones; these waves are then decoded and amplified within the television set. Digital HDTV systems, by contrast, transmit pictures and sounds in the form of digital data—*i.e.,* in the 0's and 1's of the binary computer code. This numerical data is broadcast using the same high radio frequencies that carry analog waves, and computer processors within the digital television set then decode the data. Digital HDTV can provide sharper, clearer pictures and sound with very little interference or other imperfections. Perhaps more importantly, digital television sets would potentially be able to send, store, and manipulate images as well as receive them, thereby merging the functions of the television set with those of a small computer.

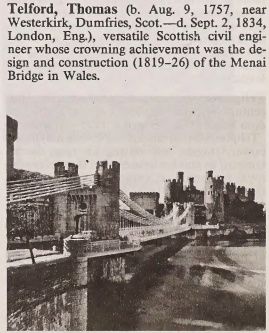
**telex,** international telegraphic message-transfer service consisting of a network of teleprinters. Subscribers to a telex service can exchange textual communications and data directly with one another. Communication is opened by entering the assigned call number of the destination subscriber, using a dial or the teleprinter's keyboard. The typed message is converted to a low-bit-rate electrical signal, which is transmitted over channels leased from the telephone system and routed by switching centres operated by the telex provider. When the message arrives at the destination teleprinter, it is either printed immediately or stored for subsequent printing or display on a cathode-ray tube monitor.

Telex systems originated in the United Kingdom and several other European countries during the early 1930s. In 1931 the American Telephone and Telegraph Company (AT&T) introduced its teletypewriter exchange service, TWX. Since that time telex systems in the United States have been operated by private corporations, while in most other countries they have been operated by government agencies responsible for postal, telegraph, or telephone services. In 1962 the Western Union Telegraph Company established its Telex system in the United States (where the name Telex is a registered trademark); eight years later it acquired TWX from AT&T. Telex and TWX could not communicate directly with one another because the keyboard coding schemes and transmission speeds were different for the two systems. The Telex system employed the five-bit Baudot Code, while TWX employed the seven-bit American Standard Code for Information Interchange (ASCII). The Telex system transmitted at a maximum of 75 words per minute, while the TWX system transmitted at approximately 150 words per minute. The amalgamated systems were connected by processing computers that translated between the two codes during transmission. This permitted direct communication, though on a somewhat delayed basis.

The ability to conduct high-speed digital communication—particularly facsimile (fax) transmission—over nonleased, dial-up telephone lines has led to a decline in the use of telex. (Western Union sold its Telex network to AT&T in 1990, before declaring bankruptcy in 1993.) Nevertheless, telex is still available as a data-transmission service for applications in which high transmission speeds are not necessary or for areas where more modern data equipment may not be available. In many countries the system has been modernized by computer-based switching, which provides enhanced performance and also allows automated conversion to and from formats used in other data-transmission services. *See also* teleprinter.

**Telford,** new town in The Wrekin district, county of Shropshire, England. It lies north and east of the hill of The Wrekin (1,335 feet [407 m]). The original Dawley new town was designated in 1963 to draw off population and industry from the city of Birmingham and the adjacent industrial region known (because of its pollution-coated landscapes) as The Black Country, but in 1968 the area of the new town was enlarged to 30 square miles (78 square km) and the official name changed to Telford new town. With intense development in housing and factory building in the area, its population was expected to reach 250,000 by the year 2001. Pop. (1981) 103,646.

**Telford, Thomas** (b. Aug. 9, 1757, near Westerkirk, Dumfries, Scot.—d. Sept. 2, 1834, London, Eng.), versatile Scottish civil engineer whose crowning achievement was the design and construction (1819–26) of the Menai Bridge in Wales.



Suspension bridge, Conwy, Wales, by Thomas Telford, 1822–26
A.F. Kersting

Telford began his career as a mason and educated himself to become an architect. In 1786 he was appointed surveyor of public works for Shropshire, a post that entailed the construction of buildings and bridges. Among the spans he built in this era were three over the River Severn, at Montford, Buildwas, and Bewdley, the second being of cast iron.

In 1793 Telford became agent and engineer to the Ellesmere Canal Company. His two great aqueducts, which carry his canal over the Ceiriog and Dee valleys in Wales at Chirk and Pont Cysylltau, employed a novel use of troughs of cast-iron plates fixed in the masonry. These brought him national fame. Employed in 1803 by the government to assist in the development of the Scottish Highlands, he was responsible for the Caledonian Canal; harbour works at Aberdeen, Dundee, and elsewhere; and the building of more than 900 miles (1,450 km) of roads, including many bridges. Subsequently, in the course of improving the roads from Chester and Shrewsbury to Holyhead, he built his two famous suspension bridges over the River Conwy and the Menai Straits (Wales).

Telford was then employed in improving and building canals to meet the threat of railway competition; this work included a new canal from Wolverhampton to Nantwich and a new tunnel at Harecastle, Staffordshire, on the Trent and Mersey Canal. Among Telford's other works were the Göta Canal in Sweden; the St. Katherine Docks, London; roads in the Scottish Lowlands; and the bridges over the Severn at Tewkesbury and Gloucester. Telford was the first president of the Institution of Civil Engineers (founded 1818).

**telharmonium,** also called DYNAMOPHONE, earliest musical instrument to generate sound

electrically. It was invented in the United States by Thaddeus Cahill and introduced in 1906. The electrophonic instrument was of the electromechanical type, and it used rotating electromagnetic generators (and thus was a predecessor of the Hammond organ) to produce electric impulses that were converted into sound by telephone receivers. It was soon superseded by more practical electronic instruments.

**Telingāna,** also spelled TELANGĀNA, or TELENGĀNA, also called ANDHRA, historical and linguistic region of peninsular India, comprising the north-central and northeastern portions of Andhra Pradesh state. The Dravidian Telugu tongue is chiefly spoken there. The region was ruled by the Andhra Buddhist kings (Sātavāhanas) from the 3rd century BC to the 3rd century AD. The main cities in the region are Hyderābād, Warangal, Vijayawāda, Rajāhmundry, and Vishākhapatnam.

**Telipinus,** also spelled TELEPINUS (fl. 16th century BC), last king of the Hittite Old Kingdom in Anatolia (reigned *c.* 1525–*c.* 1500 BC).

Telipinus seized the throne during a dynastic power struggle, and during his reign he attempted to end lawlessness and to regulate the royal succession. His stipulations, now called the Edict of Telipinus, form one of the best sources available for a study of the Hittite Old Kingdom. In his edict, Telipinus designated the *pankus* (a general assembly) as high court in cases of constitutional crimes. In the case of murder, even the king was subject to its jurisdiction. The initiative seems to have been successful, for the stipulations of the edict were generally observed until the end of the New Kingdom (*c.* 1400–*c.* 1190 BC). Little else is known of Telipinus' reign, and historical records fail from his time until the beginning of the 14th century BC.

**tell,** also spelled TEL, Arabic TALL ("hill," or "small elevation"), in Middle Eastern archaeology, a raised mound marking the site of an ancient city. For specific sites, *see under* substantive word (*e.g.,* Hasi, Tel).

The slope of a tell is generally that of a low truncated cone. In ancient times, houses were constructed of either piled-up mud (pisé), lumps of clay pressed together (adobe), or (later) sun-dried or kiln-baked bricks strengthened with straw, gravel, or potsherds. All mud structures, however, crumble easily when exposed to the elements, and that feature, combined with the repeated wholesale destructions from man-made or natural causes, made repairs and rebuildings frequent. Earlier debris was simply leveled off, and new buildings were erected on top of it. Thus, most tells are stratified, with the lower strata usually being older than those above them.

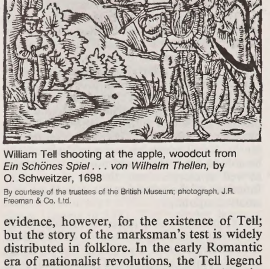
Two other terms, *hüyük* and *tepe,* have almost the same meaning as *tall* and are often used by archaeologists when referring to ancient sites in other parts of the Middle East.

**Tell** (Arabic: "Hill," or "Mound"): *see under* substantive word (*e.g.,* Amarna, Tell el-).

**Tell, William,** German WILHELM TELL, Swiss legendary hero who symbolized the struggle for political and individual freedom.

The historical existence of Tell is disputed. According to popular legend, he was a peasant from Bürglen in the canton of Uri in the 13th and early 14th centuries who defied Austrian authority, was forced to shoot an apple from his son's head, was arrested for threatening the governor's life, saved the same governor's life en route to prison, escaped, and ultimately killed the governor in an ambush. These events supposedly helped spur the people to rise up against Austrian rule.

The classic form of the legend appears in the *Chronicon Helveticum* (1734–36), by Gilg Tschudi, which gives November 1307 as the date of Tell's deeds and New Year 1308 as the date of Switzerland's liberation. There is no



William Tell shooting at the apple, woodcut from *Ein Schönes Spiel . . . von Wilhelm Thellen,* by O. Schweitzer, 1698

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

evidence, however, for the existence of Tell; but the story of the marksman's test is widely distributed in folklore. In the early Romantic era of nationalist revolutions, the Tell legend attained worldwide renown through the stirring play *Wilhelm Tell* (1804) by the German dramatist Friedrich von Schiller.

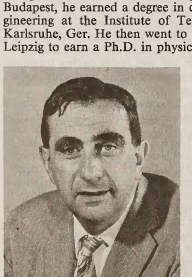
**Tell Atlas,** also called MARITIME ATLAS, French ATLAS TELLIEN, Arabic TEL AL-ʿATLAS, range of the Atlas Mountains in North Africa, extending about 1,000 miles (1,600 km) from eastern Morocco through Algeria to Tunisia. In Morocco, from Ceuta east to Melilla (150 miles [240 km]), the Er-Rif mountain range of the Tell Atlas faces the Mediterranean Sea, and there, as along the whole coast eastward to Cape Bon in Tunisia, many rugged rocks rise dramatically above the general level. In Algeria there are five chief ranges, the highest being the Great Kabylie, which reaches a height of 7,572 feet (2,308 m) at Lalla Khedidja. In Tunisia the Tell comprises coastal hills and an inland plateau, with high points rising to 4,500 feet (1,370 m).

**Tell el-Amarna style** (Egyptian art): *see* Amarna style.

**tellem figure** (devotional image): *see* telum figure.

**Teller, Edward,** Hungarian EDE TELLER (b. Jan. 15, 1908, Budapest, Hung., Austria-Hungary), Hungarian-born American nuclear physicist who participated in the production of the first atomic bomb (1945) and who led the development of the world's first thermonuclear weapon, the hydrogen bomb.

Teller was from a family of prosperous Hungarian Jews. After attending schools in Budapest, he earned a degree in chemical engineering at the Institute of Technology in Karlsruhe, Ger. He then went to Munich and Leipzig to earn a Ph.D. in physical chemistry



Teller

By courtesy of the University of California Lawrence Berkeley Laboratory, Berkeley, Calif.

(1930). His doctoral thesis, on the hydrogen molecular ion, helped lay the foundation for a theory of molecular orbitals that remains widely accepted today. While a student in Munich, Teller fell under a moving streetcar and lost his right foot, which was replaced with an artificial one.

During the years of the Weimar Republic, Teller was absorbed with atomic physics, first studying under Niels Bohr in Copenhagen and then teaching at the University of Göttingen (1931–33). In 1935 Teller and his bride, Augusta Harkanyi, went to the United States, where he taught at George Washington University, Washington, D.C. Together with his colleague George Gamow, he established new rules for classifying the ways subatomic particles can escape the nucleus during radioactive decay. Following Bohr's stunning report on the fission of the uranium atom in 1939 and inspired by the words of President Franklin D. Roosevelt, who had called for scientists to act to defend the United States against Nazism, Teller resolved to devote his energies to developing nuclear weapons.

By 1941 Teller had taken out U.S. citizenship and joined Enrico Fermi's team at the University of Chicago in the epochal experiment to produce the first self-sustaining nuclear chain reaction. Teller then accepted an invitation from the University of California at Berkeley to work on theoretical studies on the atomic bomb with J. Robert Oppenheimer; and when Oppenheimer set up the secret Los Alamos Scientific Laboratory in New Mexico in 1943, Teller was among the first men recruited. Although the Los Alamos assignment was to build a fission bomb, Teller digressed more and more from the main line of research to continue his own inquiries into a potentially much more powerful thermonuclear hydrogen-fusion bomb. And when he wanted the U.S. government's nuclear-weapons development priorities shifted to the hydrogen bomb. Hiroshima, however, had had a profound effect on Oppenheimer and other Manhattan Project scientists, and few had the desire to continue in nuclear-weapons research.

Teller accepted a position with the Institute for Nuclear Studies at the University of Chicago in 1946 but returned to Los Alamos as a consultant for extended periods. The Soviet Union's explosion of an atomic bomb in 1949 made him more determined that the United States have a hydrogen bomb, but the Atomic Energy Commission's general advisory committee, which was headed by Oppenheimer, voted against a crash program to develop one. The debate was settled by the confession of the British atomic scientist Klaus Fuchs that he had been spying for the Soviet Union since 1942. Fuchs had known of the American interest in a hydrogen bomb and had passed along early American data on it to the Soviets. In response, President Harry Truman ordered the go-ahead on the weapon, and Teller laboured on at Los Alamos to make it a reality.

Teller and his colleagues at Los Alamos made little actual progress in designing a workable thermonuclear device until early in 1951, when the physicist Stanislaw M. Ulam proposed to use the mechanical shock of an atomic bomb to compress a second fissile core and make it explode; the resulting high density would make the burning of the second core's thermonuclear fuel much more efficient. Teller in response suggested that radiation, rather than mechanical shock, from the atomic bomb's explosion be used to compress and ignite the thermonuclear second core. Together these new ideas provided a firm basis for a fusion weapon, and a device using the Teller-Ulam configuration, as it is now known, was successfully tested at Enewetak atoll in the Pacific on Nov. 1, 1952; it yielded an explosion equivalent to 10 million tons (10 megatons) of TNT.

Teller was subsequently credited with developing the world's first thermonuclear weapon, and he became known in the United States as "the father of the H-bomb." Ulam's key role in conceiving the bomb design did not emerge from classified government documents and other sources until nearly three decades after the event. Still, Teller's stubborn pursuit of the weapon in the face of skepticism, and even hostility, from many of his peers played a major role in the bomb's development.

At the U.S. government hearings held in 1954 to determine whether Oppenheimer was a security risk, Teller's testimony was decidedly unsympathetic to his former chief. "I would feel personally more secure," he told the inquiry board, "if public matters would rest in other hands." After the hearings' end, Oppenheimer's security clearance was revoked, and his career as a science administrator was at an end. Although Teller's testimony was by no means the decisive factor in this outcome, many prominent American nuclear physicists never forgave him for what they viewed as his betrayal of Oppenheimer.

Teller was instrumental in the creation of the United States' second nuclear-weapons laboratory, the Lawrence Livermore Laboratory, in Livermore, Calif., in 1952. For almost the next four decades it was the United States' chief factory for making thermonuclear weapons. Teller was associate director of Livermore from 1954 to 1958 and from 1960 to 1975, and he was its director in 1958–60. At the same time, he was professor of physics at the University of California at Berkeley from 1953 to 1960 and was professor-at-large there until 1970.

A staunch anticommunist, Teller devoted much time in the 1960s to his crusade to keep the United States ahead of the Soviet Union in nuclear arms. He opposed the 1963 Nuclear Test-Ban Treaty, which banned nuclear-weapons testing in the atmosphere, and he was a champion of Project Plowshare, an unsuccessful federal government program to find peaceful uses for atomic explosives. In the 1970s Teller remained a prominent government adviser on nuclear-weapons policy, and in 1982–83 he was a major influence in President Ronald Reagan's proposal of the Strategic Defense Initiative, an attempt to create a defense system against nuclear attacks by the Soviet Union.

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**Tellicherry,** also spelled THALASSERY, city, northern Kerala state, southwestern India. It was established in 1683 by the British for the pepper and cardamom trade and was their first settlement on the Malabar Coast. A fort was built there in 1708 and was attacked unsuccessfully by the Indian ruler and military commander Hyder Ali of Mysore in 1781. Tellicherry is still a major port for the export of pepper, coffee, sandalwood, and coconuts. It has a thriving furniture industry as well as coffee-curing, rope- and mat-making, and other industries. It is the site of Government Brennen College (established 1862). Pop. (1991) 103,577.

**Tellier, François-Michel Le:** *see* Louvois, François-Michel Le Tellier, marquis de.

**Tellier, Michel Le:** *see* Le Tellier, Michel.

**Telloh** (Iraq): *see* Lagash.

**telluric current,** also called EARTH CURRENT, natural electric current flowing on and beneath the surface of the Earth and generally following a direction parallel to the Earth's surface. Telluric currents arise from charges moving to attain equilibrium between regions of differing electric potentials; these differences in potential are set up by several conditions, including very low-frequency electromagnetic waves from space, particularly from the magnetosphere incident upon the Earth's surface, and moving charged masses in the ionosphere and the atmosphere. Telluric currents are often used by geophysicists to map subsurface structures, such as sedimentary basins, layered rocks, and faults. An anomalous current density or gradient may be indicative of a subsurface structural feature.

**tellurium** (Te), semimetallic chemical element in the oxygen family (Group VIa of the periodic table), closely allied with the element selenium in chemical and physical properties. It was discovered in 1782 by Franz Joseph Müller von Reichenstein, a mining inspector in Transylvania. Tellurium is not an abundant element, although it is widely distributed around the world. It is rarely found in the uncombined state and usually occurs as tellurides of copper, lead, silver, gold, iron, or bismuth. The chief sources from which the element is extracted are the slimes from copper and lead refineries in addition to flue dusts from the processing of telluride gold ores.

Tellurium exists in two forms: a silvery white, brittle, crystalline solid that has a metallic lustre and an amorphous powder that is dark gray to brown. The element is not very metallic in character; it is a poor conductor of heat and only a fair conductor of electricity. Tellurium burns in air or in oxygen with a blue-green flame, forming the dioxide ($TeO_2$). It is unaffected by hydrochloric acid, but either nitric acid or aqua regia (a mixture of nitric acid and hydrochloric acid) oxidizes it to tellurous acid ($H_2TeO_3$). It reacts with the halogens (fluorine, chlorine, bromine, and iodine) to form halides, and it combines with most metals at elevated temperatures to form tellurides.

Although there are adequate supplies of the element, no single use has been developed that creates a large demand for it. Small amounts of tellurium increase the ductility of aluminum alloys, the hardness and tensile strength of tin alloys, and the machinability of stainless steel and copper; in lead and in manganese-magnesium alloys, it increases resistance to corrosion. Bismuth telluride and lead telluride are semiconducting materials that have been used in thermoelectric devices either as sources of electricity or for cooling purposes.

| | |
|---|---|
| atomic number | 52 |
| atomic weight | 127.60 |
| masses of stable isotopes | 120, 122, 123, 124, 125, 126, 128, 130 |
| melting point | 449.8° C (841.6° F) |
| boiling point | 989.9° C (1,813.8° F) |
| oxidation states | −2, +2, +4, +6 |
| electron config. | 2-8-18-18-6 or $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^4$ |

**Tellus,** also called TERRA MATER, ancient Roman earth goddess. Probably of great antiquity, she was concerned with the productivity of the earth and was later identified with the mother-goddess Cybele. Her temple on the Esquiline Hill dated from about 268 BC. Though she had no special priest, she was honoured in the Fordicidia and Sementivae festivals, both of which centred on fertility and good crops. *See also* Great Mother of the Gods.

**Telstar,** series of communications satellites whose successful launching, beginning in 1962, inaugurated a new age in electronic communications. The first experimental communications satellite was made in 1960 by John Robinson Pierce of Bell Telephone Laboratories in the United States, who seized the opportunity presented by the planned launching of Echo 1 (*q.v.*), an aluminum-coated



Telstar 2 communications satellite
By courtesy of AT&T Bell Laboratories/AT&T Archives

balloon satellite. At Pierce's instigation, Echo was equipped to receive telephone signals and reflect them back to Earth. Telstar, a far more sophisticated conception, was designed to amplify a signal received from the ground and to relay it back to another ground station. Weighing only 77 kg (170 pounds), it was powered by nickel-cadmium batteries, recharged by 3,600 solar cells, and contained more than 1,000 transistors. Its heart was a traveling-wave tube capable on its own of amplifying signals 10,000 times, and far more with the aid of other components. Following Telstar's launch on July 10, 1962, a giant movable horn antenna near Andover, Maine, locked onto the satellite when its shifting orbit (apogee 5,600 km [3,500 miles]) reached an appropriate point. Minutes later the first television pictures were transmitted across the Atlantic Ocean and received, via relay stations in England and France, on European television screens. Telephone, telegraph, data, telephoto, and facsimile transmissions were also successfully made.

Telstar operated successfully until February 1963, when it ceased to communicate, probably as a result of radiation from American nuclear-weapons testing in the atmosphere. Telstar 2, a heavier but basically similar satellite, was launched on May 7, 1963, into a higher orbit (apogee 10,720 km [6,700 miles]). Successors to Telstar were placed in higher circular orbits, permitting them to keep fixed positions in respect to the Earth; three such satellites can provide continuous transmission to practically all points on the globe.

**Telugu language,** language of the Dravidian family, spoken in southeastern India; it is the official language of the state of Andhra Pradesh. There are several distinct regional dialects in Telugu, as well as three social dialects—Brahman, non-Brahman, and Harijan (Untouchable). The formal, or literary, language is also distinct from the spoken dialects, a situation known as diglossia. Telugu, like the other Dravidian languages, has a series of retroflex consonants (*e.g., ṭ, ḍ, ṇ;* sounds pronounced with the tip of the tongue curled back against the roof of the mouth), and it indicates such grammatical categories as case, number, person, and tense with suffixes. Reduplication (repetition of words or syllables to create new forms) is common—*e.g., pakapaka:* "suddenly bursting out laughing"; *garagara:* "clean, neat, nice."

Written materials in Telugu date from AD 633, and its literature begins with a version of the Hindu epic *Mahābhārata* by the Telugu writer Nannaya, dating from the 10th or 11th century. The Telugu script is derived from that of the Calūkya dynasty (6th century) and is related to that of Kannada.

**Telugu literature,** body of writings in Telugu, a Dravidian language spoken in an area north of Madras, India, and running inland to Bellary. The literature, beginning in the 10th or 11th century, is mainly poetry and secular and religious epics, with the *śataka* ("century" of verses) as a very popular form. Telugu literature flowered in the early 16th century under the Vijayanagar empire, of which Telugu was the court language. From the 19th century, experiments were made in such Western literary forms as the novel.

**Teluk Intan,** formerly TELOK ANSON, port, northwestern Peninsular (West) Malaysia. It lies on a deltaic peninsula formed by the confluence of the Perak and Bidor rivers. Formerly called Telong Melintang, the port was renamed in the 1880s for Lieutenant Governor George Anson of Penang (or Pinang). It is now an administrative centre and an important petroleum depot. Active in coastal trade, the port ships tin (from the Kinta Valley), rubber, and copra. Pop. (2001 est.) 73,700.

**Telukbetung** (Indonesia): *see* Bandar Lampung.

**telum figure,** also spelled TELLEM FIGURE, small, devotional image carved from wood or stone, probably used in private rather than communal ancestor worship in primitive societies. *Telum* figures are known on the northwestern coast of New Guinea and in the Dogon art of The Sudan. Extant examples from both regions are rare, probably because they were summarily carved and thus had less intrinsic value than the more carefully executed statues used in fertility rites or formal ceremonies of ancestor worship.

In The Sudan the figures were commonly placed in open grottoes. Both wooden and stone *telums* have been discovered in New Guinea. There are some fine wooden examples from the region of Astrolabe Bay, in which the facial features are strongly delineated. Not as well preserved, only one complete example of a stone *telum* from New Guinea is known. Almost certainly, these New Guinea *telums* are not merely representations of human progenitors but images of divinities that were worshiped by the natives as their mythical ancestors.



Wooden *telum* figure from Bogadjim, Astrolabe Bay area, northeast coast of Papua New Guinea; in the collection of N. Heinrich, Stuttgart, Ger.

By courtesy of N. Heinrich, Stuttgart, Ger.

**Tem** (Egyptian god): *see* Atum.

**Tema,** city and port, southeastern Ghana. It lies along the Gulf of Guinea (Atlantic Ocean), 18 miles (29 km) east of Accra.

By 1950 Takoradi and Ghana's older open-sea ports proved unable to handle Ghana's increased international trade. Construction of a second deepwater harbour was needed to specifically serve the eastern part of the country and the Volta River basin. Tema was chosen in 1951 for its proximity to the Volta and Accra rivers, its local supplies of construction materials for breakwaters, and its deep offshore waters that minimize dredging. Opened formally in 1962, Tema's harbour encloses 410 acres (166 hectares) of sea and is Africa's largest man-made harbour. There are 3 miles (5 km) of breakwaters, 12 deepwater berths, an oil-tanker berth, and a dockyard, warehouses, and transit sheds. A separate fishing harbour with cold-storage and marketing facilities is east of the lee breakwater.



Fish market in Tema, Ghana

Jacques Jangoux

The government acquired 64 square miles (166 square km) of land north of the harbour and entrusted it to the Tema Development Corporation (1952). The "New Town" that was subsequently built on the site was planned as an industrial-residential complex. There was a large influx of population beginning in the 1960s owing to the new employment opportunities, but the corporation was unable to construct housing and provide other services to meet the needs of this migration. The result was the creation near Tema in an area called Ashiaman of a large slum area consisting of shacks. The slum area has persisted despite building projects undertaken by the Tema Municipal Council. Pop. (1988 est.) 109,975.

**Témbi** (Greece): *see* Tempe, Vale of.

**Tembu,** also spelled THEMBU, Bantu-speaking people who inhabit the upper reaches of the Mzimvubu River in Eastern province, South Africa. The Tembu speak a dialect of Xhosa, a Bantu language of the Nguni group that is closely related to Zulu.

In the early years of the 19th century the Tembu shared the cultural patterns associated with other Nguni-speaking groups, including patrilineal descent and virilocal residence systems; exogamous marriage with the payment of bridewealth (lobola) in cattle; and a division of labour in which women engaged mainly in hoe agriculture, cultivating millet and corn (maize), while men practiced animal husbandry. In the early and mid-19th century, however, the Tembu were caught between expansion of European settlement from the southwest and the demographic and political dislocations caused by the Mfecane ("the Crushing") that occurred with the expansion of the Zulu state under Shaka from their northeast. In 1825 a group of Mfengu refugees, fleeing southward from the Zulu, defeated the Tembu. At the same time, the Tembu were pressed by a growing Xhosa population that was unable to expand into new lands because of the steady expansion of European settlers from the west.

One by one the Xhosa groups were defeated by the Europeans, and the remaining Xhosa and Tembu were restricted to a shrinking geographical zone. Finally, in 1857, these pressures resulted in the cataclysmic cattle-killing episode, which occurred after a young girl had a vision that foretold the end of the European presence in the area if the people killed their cattle and destroyed their foodstuffs. As a result of their obedience to this vision, many Xhosa and Tembu died of starvation. With their domestic economy shattered, many Tembu and Xhosa had to leave the land to become migrant labourers.

Although they were never conquered by an army, the reputation of the Tembu chiefs suffered a decline after 1857. The British governor, Sir George Grey, was able to appoint European magistrates in Tembu country who came to be accepted as alternatives to the chiefs by many of the people. The work of Christian missionaries accelerated the erosion of the traditional Tembu way of life and their structures of authority. They split into progressives, or "School" people, who favoured modernization along western lines; and traditionalists, or "Red" people, so named because of their use of red ochre in decorations, who spurned modern values and followed traditional ways.

Like the other peoples of South Africa, the Tembu have joined in the labour migrations that have characterized the South African economy since the establishment of the gold mines in the Witwatersrand in 1886. The people living in the areas of Tembuland have thus become increasingly dependent upon remittances sent home by migrant labourers for their survival. This dependence has been heightened by a decline in the ecological health of the Temba homeland because of overpopulation, overgrazing, and soil erosion.

**Temen** (people): *see* Temne.

**temenggong,** in the traditional Malay states, an official who was responsible for maintaining law and order and for commanding the police and army. This important nonhereditary position became delineated during the development of the 15th-century Malaccan state, which emerged as an intermediate point in the trade between India, China, and Southeast Asia.

The *temenggong* was instrumental in maintaining the peaceful domestic conditions that were a prerequisite for the Malaccan state's prosperous commerce. His duties included keeping the peace, caring for criminals, building jails, patrolling city streets, and assuring the accuracy of weights and measures in the marketplace. In Malacca the *temenggong* occupied a seat in the all-important inner Council of Four and ranked second only to the *bendahara,* or chief minister, of whose family he usually was a member. Although Malacca's greatness waned after the 15th century, its administrative structure, including the office of *temenggong,* was adopted by other Malay states, where it flourished and survived into the 19th century.

**Temes River** (north-central Balkans): *see* Timiș River.

**Temesvár** (Romania): *see* Timişoara.

**Temin, Howard Martin** (b. Dec. 10, 1934, Philadelphia, Pa., U.S.—d. Feb. 9, 1994, Madison, Wis.), American virologist who in 1975 shared the Nobel Prize for Physiology or Medicine with his former professor Renato Dulbecco and another of Dulbecco's students, David Baltimore, for his codiscovery of the enzyme reverse transcriptase.

While working toward his Ph.D. under Dulbecco at the California Institute of Technology, Temin began investigating how the Rous sarcoma virus causes animal cancers. One puzzling observation was that the virus, the essential component of which is ribonucleic acid (RNA), could not infect the cell if the synthesis of deoxyribonucleic acid (DNA) was stopped. Temin proposed in 1964 that the virus somehow translated its RNA into DNA, which then redirected the reproductive activity of the cell, transforming it into a cancer cell. The cell would reproduce this DNA along with its own DNA, producing more cancer cells.

Skeptics pointed out that Temin's suggestion contradicted the contemporary tenet of molecular biology: that genetic information always passed from DNA to RNA, rather than the reverse. But in 1970 both Temin and Baltimore proved Temin's hypothesis correct. They identified an enzyme (reverse transcriptase) in the virus that synthesizes DNA that contains the information in the viral RNA.

Temin obtained his Ph.D. in 1959, and after spending another year with Dulbecco, he joined the faculty of the University of Wisconsin in Madison, where he taught and conducted research until his death.

**Temirtau,** city, east-central Kazakhstan. It lies on the Samarkand Reservoir of the Nura River. The settlement, a satellite city of Karaganda, came into being when the reservoir was built in 1934; until 1945 it was called Samarkandsky. Later, small industrial plants were built there. In World War II a steel mill using scrap metal was established, and by 1945 the city had more than 25,000 inhabitants.

The huge Karaganda Metallurgical Works produced its first pig iron in 1960–61 and was still being expanded in the 1970s, when it had become one of the largest iron and steel plants in the Soviet Union. The city's chemical industry includes a synthetic-rubber works and a chemical plant producing calcium carbide. Pop. (1991 est.) 213,100.

**Temminck's cat,** Asian mammal of the cat family, a species of golden cat (*q.v.*).

**temmoku ware,** temmoku also spelled TENMOKU; *see* Chien ware.

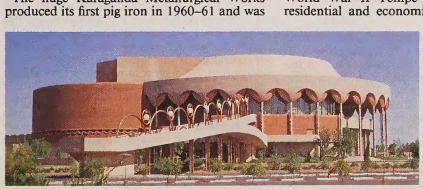
**Temne,** also spelled TEMEN, or TIMNI, people of northwest Sierra Leone who speak a language of the West Atlantic branch of the Niger-Congo family. The Temne are mainly farmers whose staple crop is rice, supplemented by peanuts (groundnuts), cotton, cassava, and millet; cash crops are palm kernels and kola nuts. Rice, cattle, and goats are also important. The household consists of a husband and his wife or wives, their children, and other dependents. A Temne settlement contains a central meetinghouse surrounded by circles of mud-and-wattle houses with thatched roofs. Inheritance and succession are governed by patrilineal descent.

The Temne are divided into numerous independent chiefdoms, each governed by a paramount chief. Chiefdoms are divided into sections governed by subchiefs and containing one or more villages or hamlets. The village in turn is under the authority of a headman, formerly a descendant of the village founder but now an elected official.

The chief's office is partly religious, and he is sometimes a member of the *ragbenle* and *poro* male secret societies. The *ragbenle* is responsible for curing certain diseases and performing ceremonies to promote the growth of crops. The women's *bundu* society mainly prepares girls for marriage. Traditional religious beliefs in a supreme god and in nature and ancestral spirits are declining, being replaced by Christianity and Islām.

**Temora,** town, south-central New South Wales, Australia. It lies in the Western Slopes district of the fertile Riverina. Founded in 1879 during a gold rush, the town derives its name from a Celtic term meaning "an eminence commanding a wide view." Proclaimed a municipality in 1891, it is now a major rail junction and a storage and shipment centre for wheat grown in the Riverina. The town also handles fat lambs and cattle, has meat-freezing plants and flour mills, and manufactures clothing, plaster, and bricks. It has rail and air links to Sydney (214 miles [344 km] northeast). Pop. (1991) 4,279.

**Tempe,** city, Maricopa county, south-central Arizona, U.S. It lies along the Salt River and is a southern suburb of Phoenix. First settled (1872) by Charles Hayden, father of former Arizona senator Carl Hayden, it was called Hayden's Ferry until renamed (1880) for the Vale of Tempe, Greece. It is the site of Arizona State University (1885), whose campus contains the Grady Gammage Memorial Auditorium, designed by Frank Lloyd Wright. After World War II Tempe experienced marked residential and economic growth with light-industrial development. Agriculture (through the Salt River Irrigation Project) also remains a basic economic factor. Since 1971 Tempe has been the host of the Fiesta Bowl (college football). Inc. town, 1894; city, 1964. Pop. (1992 est.) 148,320.



Grady Gammage Memorial Auditorium, designed by Frank Lloyd Wright, 1958 (completed 1964), Arizona State University, Tempe, Ariz.
Frank Lloyd Wright Foundation

**Tempe, Vale of,** Modern Greek TÉMBI, narrow valley between the southern Olympus and northern Ossa massifs of northeastern Thessaly, Greece. The valley is lined by cliffs that rise to 1,650 feet (500 m) on the south; in places it is only 90 to 165 feet (25 to 50 m) wide, and it is only about 6 miles (10 km) long. The Piniós River flows through the valley before emptying into the Aegean Sea. Legends attribute the glen's formation to both an earthquake and cleaving by the trident of the sea god, Poseidon; geologists believe the grassy defile or gorge to be a fracture ravine carved by local stream action. It was formed in the Quaternary Period (1.6 million years ago to the present) when the valley's stream eroded back sufficiently to provide an outlet for the Larissian Lake, which dammed up the Piniós River. The lake drained away through the vale's stream, which became the lower course of the Piniós River.

Inspired by the lushness of its vegetation, the ancient Greeks dedicated Tempe to the cult of Apollo, who, legend says, purified himself in the waters of the Piniós after killing the serpent Python. A temple was built in a recess on the right bank, and every eighth year a procession came from Delphi to gather sacred laurels awarded to the victors of contests.

Because it provides access from the coast of Macedonian Greece to the Thessalian plain, the vale has been a traditional invasion route. Known to the Byzantines as Lykóstomo ("Wolf's Mouth"), it was called Boğaz ("Gorge") by the Turks. The ruins of castles and fortifications extending from the Roman period to the Middle Ages mark strong points of Tempe, which the Greeks attempted to defend in 1941 during the German invasion.

*To make the best use of the Britannica, consult the* INDEX *first*

**Tempelhof,** district of Berlin, Ger. It is the site of an airport that became well known during the Soviet blockade of West Berlin (1948–49); the airport was enlarged to serve as the main terminus for regular Allied airlifts of supplies. In September 1975 the new Tegel Airport became West Berlin's only civilian airport, and until 1990 Tempelhof Airport accommodated only U.S. military aircraft. Appliances, machinery, phonographs, and metal products are manufactured in the Tempelhof district. Pop. (1986 est.) 162,100.

**tempera painting,** painting executed with pigment ground in a water-miscible medium. The word *tempera* originally came from the verb *temper*—that is, "to bring to a desired consistency"; dry pigments are made usable by "tempering" them with a binding and adhe-



"The Passion of Sacco and Vanzetti," tempera painting by Ben Shahn, 1931–32; in the Whitney Museum of American Art, New York City
By courtesy of the Whitney Museum of American Art, New York, gift of Edith and Milton Lowenthal in memory of Juliana Force

sive vehicle. Such painting was distinguished from fresco painting, the colours for which contained no binder. Eventually, after the rise of oil painting, the word gained its present meaning.

The standard tempera vehicle is a natural emulsion, egg yolk, thinned with water. Variants of this vehicle have been developed to widen its use. Among the man-made emulsions are those prepared with whole egg and linseed oil, with gum, and with wax.

The special ground for tempera painting is a rigid wood or wallboard panel coated with several thin layers of gesso, a white, smooth, fully absorbent preparation made of burnt gypsum (or chalk, plaster of Paris, or whiting) and hide (or parchment) glue. A few minutes after application, tempera paint is sufficiently resistant to water to allow overpainting with more colour. Thin, transparent layers of paint produce a clear, luminous effect, and the colour tones of successive brushstrokes blend optically. Modern tempera paintings are sometimes varnished or overpainted with thin, transparent oil glazes to produce full, deep-toned results, or they are left unglazed for blond effects.

**temperament,** in psychology, an aspect of personality concerned with emotional dispositions and reactions and their speed and intensity; the term often is used to refer to the prevailing mood or mood pattern of a person. The notion of temperament in this sense originated with Galen, the Greek physician of the 2nd century AD, who developed it from an earlier physiological theory of four basic body fluids (humours): blood, phlegm, black bile, and yellow bile. According to their relative predominance in the individual, they were supposed to produce, respectively, temperaments designated sanguine (warm, pleasant), phlegmatic (slow-moving, apathetic), melancholic (depressed, sad), and choleric (quick to react, hot tempered). More recent theories emphasize the influence of the endocrine glands on emotional reactivity. Modern psychology attributes primary importance to the activity of the autonomic nervous system, particularly its sympathetic branch, in emotional reactivity: autonomic over-responsiveness is intimately linked with neurotic dispositions. Because such responses can be conditioned, individual differences in ease of conditioning (also probably innate) also play a part in determining temperament. *See also* character.

**temperament** (music): *see* tuning and temperament.

**temperament, equal** (music): *see* equal temperament.

**temperance movement,** organization dedicated to promoting moderation and, more often, complete abstinence in the use of intoxicating liquor. Although an abstinence pledge had been introduced by churches as early as 1800, the earliest temperance organizations seem to have been those founded at Saratoga, N.Y., in 1808 and in Massachusetts in 1813. The movement spread rapidly under the influence of the churches; by 1833 there were 6,000 local societies in several U.S. states.

Some temperance advocates, notably Carrie Nation (*q.v.*), worked to great effect outside the organized movement. The earliest European organizations were formed in Ireland; the movement began to make effective progress in 1829 with the formation of the Ulster Temperance Society. Thereafter, the movement spread throughout Ireland, to Scotland, and to Britain. The Church of England Temperance Society, the largest such organization at mid-20th century, was founded in 1862 and reconstituted in 1873. In 1969 it was united with the National Police Court Mission to form the Church of England Council for Social Aid. On the continent, the earliest temperance organizations seem to have been in existence in Norway and Sweden in 1836 and 1837.

Temperance and abstinence became the objects of education and legislation in many regions. Besides combining moral and political action, the modern temperance movements were characterized by international scope and the organized cooperation of women. The first international temperance organization appears to have been the Order of Good Templars, formed in 1851 at Utica, N.Y., which gradually spread over the United States, Canada, Great Britain, Scandinavia, several other European countries, Australasia, India, South and West Africa, and South America. In 1909 a world prohibition conference in London resulted in the foundation of an International Prohibition Confederation.

A U.S. organization that became international was the National Woman's Christian Temperance Union, founded in Cleveland, Ohio, in 1874, which employed educational and social as well as political means in promoting legislation. During the 1880s the organization spread to other lands, and in 1883 the World's Woman's Christian Temperance Union was formed. *See also* prohibition.

*To make the best use of the Britannica, consult the* INDEX *first*

**temperature,** measure of hotness or coldness expressed in terms of any of several arbitrary scales and indicating the direction in which heat energy will spontaneously flow, *i.e.*, from a hotter body (one at a higher temperature) to a colder one (one at a lower temperature). Temperature is not the equivalent of the energy of a thermodynamic system; *e.g.*, a burning match is at a much higher temperature than an iceberg, but the total heat energy of the much more massive iceberg is greater than the energy of the match. Temperature, like pressure or density, is called an intensive property—one that is independent of the quantity of matter being considered—as distinguished from extensive properties such as mass or volume.

Three temperature scales are in general use today. The Fahrenheit (°F) temperature scale (*q.v.*) is used in the United States and a few other English-speaking countries. The Celsius (°C) temperature scale (*q.v.*) is employed in virtually all countries that have adopted the metric system of measure and is also widely used in the sciences. The Kelvin (K) scale, an absolute temperature scale (*q.v.*), is recognized as the international standard for scientific temperature measurement. In certain fields of engineering, another absolute temperature scale, the Rankine, is preferred over the Kelvin scale. Its unit of measure—the degree Rankine (°R)—equals the Fahrenheit degree, as the Kelvin equals one Celsius degree. A scale rarely used in recent years is the Réaumur (°Re) temperature scale (*q.v.*). *See* the Table on the next page for details on the relationships between these various temperature scales and instructions for converting values from one scale to another.

**temperature–humidity index** (THI), combination of temperature and humidity that is a measure of the degree of discomfort experienced by an individual in warm weather; it was originally called the discomfort index. The index is essentially an effective temperature based on air temperature and humidity; it equals 15 plus 0.4 times the sum of simultaneous readings of the dry- and wet-bulb temperatures. Thus, if the dry-bulb temperature is 90° F (32° C) and the wet-bulb temperature is 50° F (10° C), the discomfort index is 15 + 0.4 (140), or 71. Most people are quite comfortable when the index is below 70 and very uncomfortable when the index is above 80 to 85. In the U.S. the highest average daily values of the THI, exceeding 80, consistently occur in the southern California deserts and southwestern Arizona in July and August. *Compare* wind chill.

**temperature inversion,** increase of air temperature with altitude. Such an increase represents a reversal of the normal temperature condition of the troposphere (the region of the atmosphere in contact with the Earth's surface), where temperature usually decreases with height.

Inversions play an important role in determining cloud forms, precipitation, and visibility. An inversion acts as a lid on the vertical movement of air in the layers below. As a consequence, convection produced by heating the air from below is limited to levels beneath the inversion. Diffusion of dust, smoke, and other air pollutants is likewise limited. In regions where a pronounced inversion is present at a low level, convective clouds cannot grow high enough to result in showers and, at the same time, visibility may be greatly reduced below the inversion, even in the absence of clouds, by the accumulation of dust and smoke particles. Because the air near the base of the inversion is cool, fog is frequently present there.

Another important influence of inversions is reflected in the diurnal range in temperature. The principal heating of the air during the day is produced by contact with the ground, the temperature of which is raised by the Sun's radiation to which the air is transparent. The solar radiation is absorbed by the ground, and the heat is communicated to the air by conduction and convection. Since the inversion base represents the upper limit to which heat is carried by convection, only a shallow layer of air will be heated if the inversion is low and large, and the rise in temperature will be great.

Inversions are commonly classified into four basic types: (1) ground, (2) turbulence, (3) subsidence, and (4) frontal.

A ground inversion develops when the air is cooled by contact with a colder surface until it becomes cooler than the overlying air; this occurs most often on clear nights, when the ground cools off rapidly by radiation. If the temperature of the surface air drops below its dew point, fog may result. Topography greatly affects the magnitude of ground inversions. If the land is rolling or hilly, the cold air formed on the higher land surfaces tends to drain into the hollows, producing a larger and thicker inversion above low ground and little or none above the higher points.

A turbulence inversion often forms when quiet air overlies turbulent air. Within the turbulent layer, vertical mixing carries heat downward and cools the upper part of the layer. The unmixed air above is not cooled and eventually is warmer than the air below; an inversion then exists.

A subsidence inversion develops when a layer of air descends bodily. The layer is compressed by the resulting increase in atmospheric pressure, so that its upper portion descends farther than does its lower part. As a consequence, the heat of compression will be greater for the upper part than for the lower, and the lapse rate (*q.v.*) of temperature will be reduced. If the air mass sinks low enough, its upper part becomes hotter than its lower part and a temperature inversion is produced. Subsidence inversions are common over the northern continents in winter and over the subtropical oceans; these regions have generally subsiding air because they are dominated by large high-pressure centres.

A frontal inversion occurs when a cold air mass undercuts a warm air mass and lifts it aloft; the front between the two air masses then has warm air above it and cold air below.

**Temperature equivalents**

*Instructions* for converting °F into °C or K, and °C into °F or °R: Find the figure you wish to convert in the middle column. If this figure is in °F, the corresponding °C and K will be found in the fourth and fifth columns; if the figure is in °C, the corresponding °F and °R will be found in the second and first columns.

| °Rankine (°R) | °Fahrenheit (°F) | figure to be converted | °Celsius (°Centigrade) (°C) | kelvin (K) |
|---|---|---|---|---|
| ... | ... | −459.67 | −273.15 | 0 |
| ... | ... | −400 | −240.00 | +33.15 |
| ... | ... | −300 | −184.44 | +88.71 |
| 0 | −459.67 | −273.15 | −169.53 | +103.62 |
| +131.67 | −328.0 | −200 | −128.89 | +144.26 |
| +311.67 | −148.0 | −100 | −73.33 | +199.82 |
| +329.67 | −130.0 | −90 | −67.78 | +205.37 |
| +347.67 | −112.0 | −80 | −62.22 | +210.93 |
| +365.67 | −94.0 | −70 | −56.67 | +216.48 |
| +383.67 | −76.9 | −60 | −51.11 | +222.04 |
| +401.67 | −58.0 | −50 | −45.56 | +227.59 |
| +419.67 | −40.0 | −40 | −40.00 | +233.15 |
| +437.67 | −22.0 | −30 | −34.44 | +238.71 |
| +455.67 | −4.0 | −20 | −28.89 | +244.26 |
| +473.67 | +14.0 | −10 | −23.33 | +249.82 |
| +491.67 | +32.0 | 0 | −17.78 | +255.37 |
| +493.47 | +33.8 | +1 | −17.22 | +255.93 |
| +495.27 | +35.6 | +2 | −16.57 | +256.48 |
| +497.07 | +37.4 | +3 | −16.11 | +257.04 |
| +498.87 | +39.2 | +4 | −15.56 | +257.59 |
| +500.67 | +41.0 | +5 | −15.00 | +258.15 |
| +502.47 | +42.8 | +6 | −14.44 | +258.71 |
| +504.27 | +44.6 | +7 | −13.89 | +259.26 |
| +506.07 | +46.4 | +8 | −13.33 | +259.82 |
| +507.87 | +48.2 | +9 | −12.78 | +260.37 |
| +509.67 | +50.0 | +10 | −12.22 | +260.93 |
| +527.67 | +68.0 | +20 | −6.67 | +266.48 |
| +545.67 | +86.0 | +30 | −1.11 | +272.04 |
| +549.27 | +89.6 | +32 | 0.00 | +273.15 |
| +563.67 | +104.0 | +40 | +4.44 | +277.59 |
| +581.67 | +122.0 | +50 | +10.00 | +283.15 |
| +599.67 | +140.0 | +60 | +15.56 | +288.71 |
| +617.67 | +158.0 | +70 | +21.11 | +294.26 |
| +635.67 | +176.0 | +80 | +26.67 | +299.82 |
| +653.67 | +194.0 | +90 | +32.22 | +305.37 |
| +671.67 | +212.0 | +100 | +37.78 | +310.93 |
| +851.67 | +392.0 | +200 | +93.33 | +366.48 |
| +1031.67 | +572.0 | +300 | +148.89 | +422.04 |
| +1211.67 | +752.0 | +400 | +204.44 | +477.59 |
| +1391.67 | +932.0 | +500 | +260.00 | +533.15 |
| +1571.67 | +1112.0 | +600 | +315.56 | +588.71 |
| +1751.67 | +1292.0 | +700 | +371.11 | +644.26 |
| +1931.67 | +1472.0 | +800 | +426.67 | +699.82 |
| +2111.67 | +1652.0 | +900 | +482.22 | +755.37 |
| +2291.67 | +1832.0 | +1000 | +537.78 | +810.93 |
| +4091.67 | +3632.0 | +2000 | +1093.33 | +1366.45 |
| +5891.67 | +5432.0 | +3000 | +1648.89 | +1922.05 |

All systems of measuring temperature in degrees or units (kelvins) on a scale are based on the interval between the freezing and boiling points of water and differ only in the number of degrees or units into which this interval is divided.

Fahrenheit: interval is divided into 180 degrees (32° to 212°); 0° is at 32° below the freezing point of water.

Rankine: degree is same as Fahrenheit degree; 0° is at absolute zero (−459.67° F).

Celsius: interval is divided into 100 degrees; 0° is at the freezing point of water.

kelvin: interval is same as Celsius degree; 0 K is at absolute zero (−273.15° C).

Réaumur: interval is divided into 80 degrees; 0° is at the freezing point of water.

*Temperature conversion instructions:*

| | | |
|---|---|---|
| °Fahrenheit | into °Rankine | add 459.67 |
| °Fahrenheit | into °Celsius | subtract 32, multiply by 5, divide by 9 |
| °Fahrenheit | into °Réaumur | subtract 32, multiply by 4, divide by 9 |
| °Celsius | into °Fahrenheit | multiply by 9, divide by 5, add 32 |
| °Celsius | into kelvin | add 273.15 |
| °Celsius | into °Réaumur | multiply by 4, divide by 5 |
| °Réaumur | into °Fahrenheit | multiply by 9, divide by 4, add 32 |
| °Réaumur | into °Celsius | multiply by 5, divide by 4 |

This kind of inversion has considerable slope, whereas other inversions are nearly horizontal. In addition, humidity may be high, and clouds may be present immediately above it.

**tempering,** in metallurgy, process of improving the characteristics of a metal, especially steel, by heating it to a high temperature, though below the melting point, then cooling it, usually in air. The process has the effect of toughening by lessening brittleness and reducing internal stresses. Suitable temperatures for tempering vary considerably, depending on the type of steel and designed application; for tool steels, the hardness of which must be retained, the range is usually from 200° to 250° C (400° to 500° F). The term is also used for hardening by cold-working, as in drawing wire or rolling sheet steel.

**Tempest, Dame Marie,** original name MARIE SUSAN ETHERINGTON (b. July 15, 1864, London—d. Oct. 15, 1942, London), English actress, known as "the queen of her profession," who had a 55-year career as a star of light opera and legitimate comedy.

Tempest was educated on the European continent but returned to London to study voice with Manuel Garcia, the tutor of Jenny Lind. She debuted in 1885 as Fiametta in the operetta *Boccaccio,* but it was the title role in *Dorothy* (1887), which ran for 931 performances, that established her reputation. In 1890 she appeared in New York City as Kitty Carol in *The Red Hussar* and continued to tour the United States and Canada in such operettas as *The Bohemian Girl, Pirates of Penzance,* and *The Fencing Master;* during this period she was considered one of the few rivals of Lillian Russell. In 1895 George Edwardes bought out her American bookings so that she could return to London to star in *An Artist's Model,* which ran for 400 performances.

In 1899 Tempest forsook operettas for straight comedy; in 1900 she created the role of Nell Gwynne in *English Nell,* followed by *Peg Woffington, Becky Sharp,* and Polly Eccles in *Caste.* These and other roles provided the opportunity to combine charm and "roguishness"—a unique quality in which she excelled. In 1908 Somerset Maugham's *Mrs. Dot* provided her with her finest role. After World War I she toured throughout the empire until 1922. Nöel Coward wrote the role of Judith Bliss in *Hay Fever* (1925) especially for her, and her popularity in *Passing Brompton Road, The Cat's Cradle,* and *The First Mrs. Fraser* continued unabated. She toured Great Britain in the latter role only one year prior to her death. In May 1935 she celebrated her stage jubilee with a benefit that was attended by the king and queen. The proceeds were donated to St. George's Hospital for use by members of the theatrical profession. She was made a Dame Commander of the Order of the British Empire in 1937.

**Tempietto,** small circular chapel erected in the courtyard of San Pietro in Montorio in Rome on the supposed site of the martyrdom of St. Peter. It was commissioned by Ferdinand and Isabella of Spain and was built in 1502 after designs made by Donato Bramante.

The design was inspired by a particular type of classical temple—and specifically by the temple of Vesta at Tivoli—built on a circular plan and surrounded by columns. Bramante added a dome (since altered) and chose the Doric order for the structure's decoration. Remarkable for its elegantly simple reinterpretation of classical forms, the Tempietto is regarded as one of the finest examples of High Renaissance architecture.

**Templar,** also called KNIGHT TEMPLAR, member of POOR KNIGHTS OF CHRIST AND OF THE TEMPLE OF SOLOMON, religious military order of knighthood established at the time of the Crusades. It was founded during the early years of the kingdom of Jerusalem, when the crusaders controlled only a few strongholds in the Holy Land, and pilgrims to the holy places were often endangered by marauding Muslim bands. Pitying the plight of such pilgrims, eight or nine French knights, led by Hugues de Payens, vowed in late 1119 or early 1120 to devote themselves to their protection and to form a religious community for that purpose. Baldwin II, king of Jerusalem, gave them quarters in a wing of the royal palace in the area of the former Jewish Temple, and from this they derived their name.

The Templars were divided into four classes: knights, sergeants, chaplains, and servants. Only the knights wore the Templars' distinctive regalia, a white surcoat marked with a red cross. The Templars' order was headed by a

grand master, and each temple, or subsidiary (local) branch, of the order was ruled by a commander who owed obedience to the grand master. Each individual Templar took vows of poverty and chastity.

The Templars performed courageous service in the Holy Land, and their numbers increased rapidly, partly because of the propaganda writing of St. Bernard of Clairvaux, who wrote their rule of life. The Templars had originally vowed obedience to the patriarch of Jerusalem, but Pope Innocent II in 1139 placed the Templars directly under the pope's authority: the Templars thus were exempted from the jurisdiction of any bishop in whose diocese they might hold property. Thenceforth the Templars rapidly diversified their activities. They soon became a vital element in the defense of the Christian crusader states of the Holy Land, and they garrisoned every town of any size there. At their height the Templars numbered about 20,000 knights.

The Templars also came to acquire considerable wealth. The kings and great nobles of Spain, France, and England gave lordships, castles, seigniories, and estates to the order, so that by the mid-12th century the Templars owned properties scattered throughout western Europe, the Mediterranean, and the Holy Land. The Templars' military strength enabled them to safely collect, store, and transport bullion to and from Europe and the Holy Land, and their network of treasure storehouses and their efficient transport organization caused the Templars to be used as bankers both by kings and by pilgrims to the Holy Land. In this way the order, with its vast resources spread throughout every country in Christendom, grew to wield great financial power.

The Templars were not without enemies, however. They had long engaged in a bitter rivalry with the other great military order of Europe, the Hospitalers, and by the late 13th century proposals were being made to merge the two contentious orders into one. The fall to the Muslims in 1291 of Acre, the last remaining crusader stronghold in the Holy Land, removed much of the Templars' reason for being. Moreover, by 1304 rumours (probably false) of irreligious practices and blasphemies committed by the Templars during their secret rites of initiation had begun to circulate through Europe. At this juncture, King Philip IV the Fair of France had every Templar in France arrested on Oct. 13, 1307, and sequestered all the Templars' property in France. The reasons why Philip sought to destroy the Templars are unclear; he may have genuinely feared their power, or he may have simply seen an opportunity to seize their immense wealth, being chronically short of money himself. At any rate, Philip accused the Templars of heresy and immorality and had many of them tortured to secure false confessions to these charges. Pope Clement V, himself a Frenchman, came under strong pressure from Philip at this time, and in response the pope ordered the arrest of the Templars in every country in November 1307. Philip eventually succeeded in having the pope suppress the order (March 22, 1312), and the Templars' property throughout Europe was transferred to the Hospitalers or confiscated by the state. Many Templars were executed or imprisoned, and in 1314 the order's last grand master, Jacques de Molay, was burned at the stake.

The question of the guilt of the Templars has been a matter of fierce controversy for centuries, but modern opinion inclines to the idea that the Templars were victims of a highly unjust and opportunistic persecution.

**Temple,** city, Bell county, central Texas, U.S. It lies along the Little River, just southeast of Belton Lake (impounded on the Leon River) and 36 miles (58 km) south-southwest of Waco. Founded by the Gulf, Colorado, and Santa Fe Railroad in 1880, it was incorporated in 1882 and named for B.M. Temple, a railroad engineer. Soon thereafter it became a division point with railroad shops after the Missouri, Kansas, and Texas Railroad came through. The city's growth as a commercial centre for livestock and farm produce was fostered by the establishment of three hospitals (Santa Fe [1892], King's Daughters [1897], and Scott-White [1904]). Temple Junior College was founded in 1926, and Mary Hardin–Baylor College (1845) is in nearby Belton.

The city is headquarters for several state and regional agencies of the U.S. Department of Agriculture and for agricultural-research centres. Manufactures include school and office furniture and farm machinery. Pop. (1990) city, 46,109; Killeen-Temple MSA, 255,301.

**temple,** edifice constructed for religious worship. Most of Christianity calls its places of worship churches; many religions use temple, a word derived in English from the Latin word for time, because of the importance to the Romans of the proper time of sacrifices. The name synagogue, which is from the Greek for a place of assembly, is often interchangeable with Jewish temple. Mosque is roughly an Arabic equivalent for temple. The Church of the Latter-day Saints, or Mormon, temples are not places of worship but centres for sacred ordinances to and for the living and for the dead.

Because of the importance of temples in a society, temple architecture often represents the best of a culture's design and craftsmanship, and, because of ritual requirements, temple architecture varies widely between one religion and another. The ziggurats of the Mesopotamian culture were elaborately designed and decorated, and their "stair-step" style ascended to a point where a god or gods could dwell and where only special priests were entitled. Ancient Egypt had temples to gods, but because the primary concern of its religion was the afterlife of souls, its pyramidal tombs became its primary shrines and most familiar architectural heritage.

In the ancient Greek religion the various gods were the most important focus, and Classical Greek temple architecture created structures that emphasized that focus. An inner, windowless room, or cella, housed an image of a god, and an altar stood outside the temple, usually at the eastern end and often enclosed. Most Greek temples were built of marble or other stone, richly carved and polychromed, situated on a hill or stepped platform (stylobate) and having sloping roofs supported on a portico by columns in a variety of styles (*see* order) and placements. The design and decoration of Greek temples had a profound effect on architecture of later eras in the West, beginning with the Roman.

During the 3rd and 2nd centuries BC, Roman temples began to evince Greek influence, using the Greek decorative style but placing the altar within the temple and eventually creating entire forums, or meeting places, of which the temple was the centre. In Roman temple architecture, the columns, in their various styles, soon became engaged rather than freestanding, and circular as well as rectangular temples were built. Byzantine and Western church architecture developed from these bases in the Hellenistic styles, and the names and designs of this style of temple architecture still survive in the West.

In the East and Middle East, too, temple design expresses the nature of the religion. For example, the asceticism and rich symbolism of Jainism is reflected in that religion's beautifully decorated monastery-like structures in India, both above the ground in simple cloisters and below the ground in caves. Other Indian temple architecture, although it tends to follow the pattern of a simple floor plan with a richly decorated facade, differs according to the ritual. Hindu temples, which vary regionally in style, usually consist of a towering shrine and a columned hall surrounded by an elaborate wall. Buddhist temples range from half-buried sanctuaries with richly carved entrances to single, carved towers or statues. Muslim temples in India, as elsewhere, are usually domed structures decorated with coloured tiles on the outside and covering a large central sanctuary and arcaded courtyards within.

The Chinese (and later, Japanese) version of the Buddhist temple tends to be a one-story building of richly carved, painted, or tiled timber constructed around an atrium used for worship, although pagodas, which were sometimes built as temples, were towering stacks of brightly coloured, wing-roofed stories over a small shrine. By contrast, the Shintō temples of Japan are almost huts, so simple and rustic are their design.

In the Americas, Incan and Mayan temples were constructed of stone and were often highly carved. In general, because of the available technology as well as the religious belief, they were stair-stepped pyramids, with the shrine at the top. Chichén Itzá, the ruins of which remain in the Yucatán Peninsula, has excellent examples of this type of pre-Columbian temple architecture.

Modern temple architecture, especially in North America but elsewhere in the world as well, is for the most part eclectic, with both traditional and modern designs being used to accommodate the needs of the religion for which the temple is designed. *See also* architecture.

**Temple, Frederick** (b. Nov. 30, 1821, Levkás, Greece—d. Dec. 23, 1902, London), archbishop of Canterbury and educational reformer who was sometimes considered to personify, by his rugged appearance and terse manner as a schoolmaster and bishop, the ideal of "manliness" fashionable during the Victorian era (1837–1901) in Britain.

Ordained a priest in 1847, Temple left his position as a lecturer at the University of Oxford, where he had been educated, in 1848 to work in the national Education Office. From



Frederick Temple, detail from a portrait by Sir Hubert von Herkomer, 1896; in Lambeth Palace, London

By courtesy of the Archbishop of Canterbury; photograph, Courtauld Institute of Art, London

1850 to 1855 he was principal of Kneller Hall Training College and from 1855 to 1857 was a government inspector of schools. On the recommendation of the English poet Matthew Arnold, whose father, Thomas Arnold, had been a reformer at Rugby, Temple was appointed headmaster of the school in 1857. While serving simultaneously as Queen Victoria's chaplain, he expanded the Rugby curriculum, especially in the areas of history, science, and music, and commissioned several new buildings.

Despite the controversy aroused by his con-

tribution "The Education of the World" to *Essays and Reviews* (1860), which was considered too liberal in its religious views, Temple went on to establish his reputation as an educational reformer in his work for the Schools Enquiry Commission (1864–67). An Anglican convocation in 1864, however, censured his essay, and, upon his appointment as bishop of Exeter in 1869, the earlier opposition was renewed; Temple agreed after his consecration to withdraw his essay from future editions of the 1860 volume. Temple was named bishop of London in 1885. In 1896 he was made archbishop of Canterbury and thereby spiritual head of the Anglican Church. A year later, with the archbishop of York, W.D. Maclagan, he issued an emphatic rebuttal to Pope Leo XIII's bull denying the validity of Anglican priestly orders. The two archbishops spoke together again in 1899 in a pronouncement that processional lights and the use of incense were illegal practices in Anglican liturgics. Frederick Temple's son William was also archbishop of Canterbury (1942–44) and helped to further his father's goals of educational reform, reflected in particular by the Education Act of 1944.

**Temple, George Nugent Temple-Grenville, 2nd Earl:** *see* Buckingham, George Nugent Temple-Grenville, 1st Marquess of.

**Temple, Le,** in Paris, originally a fortified monastery of the Templars and later a royal prison. It was built in the 12th century northeast of the city in an area commanded by the Templars; the area is now the Temple quarter of Paris (3rd *arrondisement*).

By the 13th century the Temple, especially its keeps, or towers, was being used to store the treasures not only of the Templars but also of the king of France. After the collapse of the order in the 14th century, the towers served primarily as a royal prison, for both criminals and debtors. In the vast complex there were also living quarters for artisans.

On Aug. 10, 1792, the Jacobin rabble of Paris attacked the Tuileries and forced the removal of Louis XVI, Marie-Antoinette, and their family to the *petite tour* ("little tower") of the old Temple, later to the main tower, as prisonors of the Paris Commune. There they remained until they were individually tried and guillotined over the following year. Other important persons were incarcerated there until the buildings were demolished in 1811.

**Temple, Richard Grenville-Temple, 1st Earl,** VISCOUNT COBHAM, BARON COBHAM, original name RICHARD GRENVILLE (b. Sept. 26, 1711, London, Eng.—d. Sept. 12, 1779, Stowe, near Buckingham, Buckinghamshire), English statesman, the brother-in-law of William Pitt, under whom he served as first lord of the Admiralty.

The eldest son of Richard Grenville (d. 1727) and Hester, afterward Countess Temple, he was educated at Eton and was member of Parliament from 1734 to 1752. In 1752 he inherited his mother's title together with the estates of Stowe and Wotton and took his mother's maiden name of Temple in addition to his own surname of Grenville. From the time of the marriage in 1754 of his sister Hester to William Pitt, Temple's career was linked with that of his new brother-in-law.

In November 1756 Temple became first lord of the Admiralty in the ministry of the Duke of Devonshire and Pitt. He was disliked by King George II, who dismissed both him and Pitt from office in April 1757. But when the coalition Cabinet of the Duke of Newcastle and Pitt was formed in June of the same year, Temple received the office of keeper of the privy seal. He alone in the Cabinet supported Pitt's proposal to declare war with Spain in 1761, and they resigned together in October. From this time Temple became one of the most violent and factious of politicians, and it is difficult to account for the influence that he exerted over his brother-in-law.

By 1765, however, the old friendship between the brothers-in-law was dissolving; and when at last in June 1766 Pitt consented to form a government, Temple refused to join, being bitterly offended because, although offered the head of the Treasury, he was not to be allowed an equal share with Pitt in nominating to other offices. Temple then began to inspire the most virulent libels against Pitt; and with his brother George Grenville he concentrated the whole Grenville connection against the government. After George Grenville's death in 1770 Temple retired almost completely from public life.

**Temple, Shirley,** married name SHIRLEY TEMPLE BLACK (b. April 23, 1928, Santa Monica, Calif., U.S.), internationally popular American child star of the 1930s, who was Hollywood's greatest box-office attraction at the age of seven in sentimental musicals. She displayed a genuine talent for singing and dancing but, more important, an ability to soften adult hearts, which made it seem credible that on the screen she was able to straighten out marriages and to shame criminals into becoming law-abiding citizens.

Selected for a screen test from her dancing class, Temple made her motion-picture debut in *Baby Burlesks*, a series of shorts, starring children, that humorously mimicked serious feature films. She gained recognition for *Stand Up and Cheer* (1934) and was featured in *Little Miss Marker* (1934), *Baby Take a Bow* (1934), *Now and Forever* (1934), and *Bright Eyes* (1934), in which she sang one of her most popular songs, "On the Good Ship Lollipop." By the end of 1934 she was a star with a huge following. She went on to earn a Special Academy Award for her contributions to screen entertainment. Other films include *The Little Colonel* (1935), *Wee Willie*



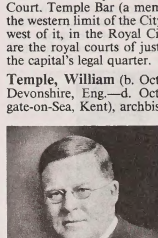
Shirley Temple
Brown Brothers

*Winkie* (1937), and *The Little Princess* (1939). Though she reached her peak of popularity before she reached her teens, she continued to make films until her retirement from acting in 1950. Seven years later she initiated a popular television series for children, *Shirley Temple's Storybook* (1957–59).

As Shirley Temple Black, she was a civic leader in San Francisco and an active member of the Republican Party. In 1967 she ran unsuccessfully for the office of United States representative to Congress from California. From 1969 to 1970 she was a member of the United States delegation to the UN General Assembly. She was U.S. ambassador to Ghana (1974–76), chief of protocol for President Gerald R. Ford (1976–77), and a member of the U.S. Delegation on African Refugee Problems in 1981. In 1988 her autobiography, *Child Star,* was published.

**Temple, The,** series of buildings on Fleet Street, London, named for the Templars, a medieval religious and military order that once owned the property. The buildings surrounding the Temple Church now belong to the lawyers' societies of the Inner Temple and the Middle Temple, two of the four Inns of Court. Temple Bar (a memorial pillar) marks the western limit of the City of London; to the west of it, in the Royal City of Westminster, are the royal courts of justice and the rest of the capital's legal quarter.

**Temple, William** (b. Oct. 15, 1881, Exeter, Devonshire, Eng.—d. Oct. 26, 1944, Westgate-on-Sea, Kent), archbishop of Canterbury



William Temple
Elliott & Fry

who was a leader in the ecumenical movement and in educational and labour reforms.

Temple was the son of Frederick Temple, who also served as archbishop of Canterbury (1896–1902). The younger Temple lectured in philosophy at Queen's College, Oxford (1904–10), and was ordained to the priesthood in 1909. While headmaster of Repton School (1910–14) and rector of St. James's, Piccadilly, London (1914–17), he became the leader of the Life and Liberty movement, an unofficial body designed to stimulate change in the governance of the Church of England. He was successively a canon of Westminster (1919–21), bishop of Manchester (1921–29), archbishop of York (1929–42), and archbishop of Canterbury (1942–44).

Temple was a man of considerable energy and intellectual ability and wrote constantly, completing his largest philosophical work, *Mens Creatrix* (1917; "The Creative Mind"), the night before his marriage. Among other works are a volume of Gifford Lectures, *Nature, Man, and God* (1934), *Christianity and Social Order* (1942), and *The Church Looks Forward* (1944). Temple's sympathetic attitude toward the Labour movement led him to join the Labour Party (1918–25); he was also president (1908–24) of the Workers' Educational Association. He was chairman of an international and interdenominational Conference on Christian Politics, Economics and Citizenship held in 1924, an Anglican delegate to the ecumenical Faith and Order Conference at Lausanne in 1927, and chairman of the Faith and Order Conference held in Edinburgh in 1937. The British Council of Churches and the World Council of Churches owe their formation largely to the initiatives provided by Temple, and his influence both inside and outside Parliament brought the various churches of the country to support the Education Act of 1944. Temple's theological position has been described as a Hegelian Idealism, affirming links between church and state and thus making it appropriate for Christian pronouncements to be made on social problems and economic policies.

**Temple, Sir William,** BARONET (b. April 25, 1628, London, Eng.—d. Jan. 27, 1699, Moor Park, Surrey, Eng.), English statesman and diplomat who formulated the pro-Dutch

foreign policy employed intermittently during the reign of King Charles II. In addition, his thought and prose style had a great influence on many 18th-century writers, particularly on Jonathan Swift.

Temple began his diplomatic career in 1665 as a protégé of Charles II's secretary of state, Henry Bennet (later earl of Arlington) and in 1666 was awarded a baronetcy. In 1668



Sir William Temple, detail of a painting attributed to Peter Lely, 1660; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Temple, as ambassador at The Hague, and Bennet negotiated the Triple Alliance between England, the United Provinces of the Netherlands, and Sweden. In spite of this, England declared war on the Dutch in 1672; he negotiated the treaty ending the Dutch War (1674), and in 1677 he and the King's chief minister, Thomas Osborne, earl of Danby, arranged the marriage between Charles II's niece Princess Mary and William of Orange, stadholder of Holland (later King William III and Queen Mary II of England). Upon Danby's fall in April 1679, Temple reorganized the Privy Council and for a time enjoyed considerable influence in the new body. Nevertheless, by 1681 he found himself out of step with Charles's policies, and he retired from politics.

Temple's *Observations upon the United Provinces* (1673) has been hailed by 20th-century scholars as a pioneer work in the sympathetic interpretation of the people of one country to those of another. The majority of his essays, however, were written after his retirement and collected for publication by Jonathan Swift, who was his secretary for most of the period from 1689 to 1699. Temple's graceful, conversational style provided a model for Swift's own writing, and Swift's celebrated "Battle of the Books" is a reply to critics of Temple's essay "Upon Ancient and Modern Learning."

Temple had no surviving male heir (his only son was a suicide in 1689), and the baronetcy became extinct upon his death.

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**Temple of ———:** *see under* substantive word (*e.g.*, Jerusalem, Temple of).

**Templewood, Samuel (John Gurney) Hoare, Viscount:** *see* Hoare, Sir Samuel (John Gurney).

**Tempo, Il** (Italian: "The Times"), morning daily newspaper published in Rome, one of Italy's outstanding newspapers and one with broad appeal and influence in the Roman region. It was founded in 1945 by Renato Angiolilie as a conservative paper with a strong anti-Communist bias. *Il Tempo* quickly became recognized as a serious morning daily with excellent, balanced news coverage. It has maintained its independence of political parties, and, because its operation has been profitable, it has been able to remain largely independent of the direct commercial or industrial subsidies common in Italy.

**Tempō reforms** (1841–43), unsuccessful attempt by the Tokugawa shogunate (1603–1868) to restore the feudal agricultural society that prevailed in Japan at the beginning of its rule. Named after the Tempō era (1830–44) in which they occurred, the reforms demonstrated the ineffectiveness of traditional means in dealing with Japan's problems of growing urban crime and poverty, over-rigid administration, and agrarian discontent.

Initiated by Mizuno Tadakuni, chief adviser to the shogun, the Tempō reforms emphasized frugality in governmental and personal affairs; many officials were eliminated from the administration, and lewd works of art and literature were censored. Debts incurred by the shogun's followers to merchants were cancelled, further migration to the cities was restricted, merchant guilds were discouraged, and price controls were encouraged. Attempts to consolidate the shogun's land around Edo (modern Tokyo) and Ōsaka by forcing holders of tracts there to exchange them for less arable land aroused the opposition of the landowning classes and had to be dropped. The reforms that were completed proved ineffective, demonstrating that the economy had become too complex to be regulated by fiat.

**Tempskya,** genus of fossil tree ferns of Mesozoic age (65,000,000 to 225,000,000 years old), constituting the family Tempskyaceae, order Filicales. It was among the most bizarre of plants, with an unbranched trunk up to 40 centimetres (16 inches) across, tapering bluntly to a height of about 6 metres (20 feet) and covered densely on its upper two-thirds with small leaves. The lower trunk was almost entirely composed of fibrous roots; stems continued higher up scattered among the roots, becoming free but compressed together throughout the upper trunk.

**Tempyō style,** Japanese sculptural style of the Late Nara period (724–794), greatly influenced by the Chinese Imperial style of the T'ang dynasty (618–907). During this prolific era, many of the supreme sculptural achievements of Japanese Buddhist art were created in unbaked clay, solid wood, and especially lacquered cloth molded on a removable core or wooden armature (a technique called dry lacquer, or *kanshitsu* [*q.v.*]).

The Tempyō style is characterized by a closer fusion of parts into a unified whole than is found in works of the Early Nara period. Forms flow into one another and drapery is integrated with the structure of the body in a more naturalistic way, giving a sense of activity and realistic observation. The lacquer and clay sculpture shows beautiful modelling of hands and face. Because the wooden armature used in sculpture executed in these techniques imposed a vertical balance and a certain rigidity of pose, the artist was driven to concentrate on facial expression. The new realism is especially notable in the development of portrait sculpture. The period was also notable for multiple-armed and many-headed images, literal iconographical portrayals of the esoteric Buddhist doctrines that were to gain popularity in the 9th century.



Ashura, dry lacquer (*kanshitsu*) sculpture in the Tempyō style, Late Nara period (724–794); in the Kōfuku-ji, Nara, Japan

Asuka-en, Japan

**Temuco,** capital of Cautín province and of Araucanía region, southern Chile, lying on the Río Cautín in the heart of the region. It was founded in 1881 as a frontier outpost, after the area was ceded to Chile in a treaty signed on nearby Cerro (hill) Nielol with the Araucanian Indians, long inhabitants of the region. Temuco's development was aided by the arrival of European settlers, especially Germans. Wheat, apples, cattle, timber, barley, oats, and other products are processed. Temuco has a military air base, a cathedral, and several missionary schools. Accessible by the Pan-American Highway and the main north–south railroad, Temuco is regarded as a gateway to Chile's



A display in the Araucanian Indian market in Temuco, Chile

Peter L. Gould

lake district to the south and is the base for the ski resort of Volcán (volcano) Llaima (peak; 10,249 ft [3,124 m]), 50 mi (80 km) east. Pop. (1985 est.) 170,188.

**Temüjin,** also spelled TEMUCHIN (Mongol ruler): *see* Genghis Khan.

**Temür** (b. 1267, China—d. 1307, China), grandson and successor of the great Kublai Khan; he ruled as emperor of China (from 1295 to 1307) and as great khan of the Mongol Empire. He was the last ruler of the Yüan (Mongol) dynasty (1279–1368) to maintain firm control over China, but he never exercised real power over Mongol territories in Russia and the Middle East.

Temür staved off attacks from disputants to the throne on the northwest border of China and put down rebellions in Korea and South China. He fought the large-scale corruption within his empire. After his death the power of the court and the empire began to disintegrate. He was given the posthumous title of Ch'eng Tsung ("Accomplished Ancestor").

**Ten, The,** group of 10 American painters who first exhibited together in 1898, in New York City, and continued to do so for the next 20 years. The group was founded not because its members' work differed radically in technique or subject matter from that of artists who participated in the large annual exhibitions of the Society of American Artists and the National Academy of Design but because the members hoped to draw public attention to their small, independent group and thereby to their paintings. The members of The Ten were Childe Hassam, John Henry Twachtman, J. Alden Weir, Thomas W. Dewing, Joseph De Camp, Frank W. Benson, Willard Leroy Metcalf, Edmund Charles Tarbell, Robert Reid, and E.E. Simmons. When Twachtman died, in 1902, he was replaced by William Merritt Chase.

**Ten Commandments,** also called DECALOGUE (Greek *deka logoi*, "10 words"), list of religious precepts that, according to various passages in Exodus and Deuteronomy, were divinely revealed to Moses on Mt. Sinai and were engraved on two tablets of stone. The Commandments are recorded virtually identically in Ex. 20: 2–17 and Deut. 5: 6–21. The rendering in Exodus (Revised Standard Version) appears as follows:

> I am the Lord your God, who brought you out of the land of Egypt, out of the house of bondage.
>
> You shall have no other gods before me.
>
> You shall not make for yourself a graven image, or any likeness of anything that is in heaven above, or that is in the earth beneath, or that is in the water under the earth; you shall not bow down to them or serve them; for I the Lord your God am a jealous God, visiting the iniquity of the fathers upon the children to the third and the fourth generation of those who hate me, but showing steadfast love to thousands of those who love me and keep my commandments.
>
> You shall not take the name of the Lord your God in vain; for the Lord will not hold him guiltless who takes his name in vain.
>
> Remember the sabbath day, to keep it holy. Six days you shall labor, and do all your work; but the seventh day is a sabbath to the Lord your God; in it you shall not do any work, you, or your son, or your daughter, your manservant, or your maidservant, or your cattle, or the sojourner who is within your gates; for in six days the Lord made heaven and earth, the sea, and all that is in them, and rested the seventh day; therefore the Lord blessed the sabbath day and hallowed it.
>
> Honor your father and your mother, that your days may be long in the land which the Lord your God gives you.
>
> You shall not kill.
>
> You shall not commit adultery.
>
> You shall not steal.
>
> You shall not bear false witness against your neighbor.
>
> You shall not covet your neighbor's wife, or his manservant, or his maidservant, or his ox, or his ass, or anything that is your neighbor's.

Traditions differ in numbering the Ten Commandments. In Judaism, the prologue ("I am the Lord your God, who brought you out of the land of Egypt, out of the house of bondage") constitutes the first element, and the prohibitions against false gods and idols the second. Medieval Roman tradition, accepted by Luther, regards all these elements as one and preserves the number 10 by separating the prohibitions against coveting another's wife and coveting another's possessions. In the Greek Orthodox and Protestant Reformed traditions, the prologue and the prohibition against false gods are one commandment and the prohibition against images is the second.

Dating the Ten Commandments involves an interpretation of their purpose. Some scholars propose a date between the 16th and 13th centuries BC because Exodus and Deuteronomy connect the Ten Commandments with Moses and the Sinai Covenant between Yahweh and Israel. For those who regard the Ten Commandments as an epitome of prophetic teachings, the date would be some time after Amos and Hosea (after 750 BC). If the Ten Commandments are simply a summary of the legal and priestly traditions of Israel, they belong to an even later period.

The Commandments contain little that was new to the ancient world and reflect a morality common to the ancient Middle East. They are a description of the conditions accepted by the community of Israel in its relationship to Yahweh. The differences found in Exodus and Deuteronomy indicate that the process of transmission from generation to generation brought with it modifications.

The Ten Commandments had no particular importance in Christian tradition until the 13th century, when they were incorporated into a manual of instruction for those coming to confess their sins. With the rise of Protestant churches, new manuals of instruction in the faith were made available and the Ten Commandments were incorporated into catechisms as a fundamental part of religious training, especially of the young.

**Ten Days of Penitence,** Hebrew ASERET YEME TESHUVA, the first 10 days of the Jewish religious year. *See* yamim nora'im.

**1054, Schism of,** also called EAST–WEST SCHISM, event that precipitated the final separation between the Eastern Christian churches (led by the patriarch of Constantinople, Michael Cerularius) and the Western Church (led by Pope Leo IX). The mutual excommunications by the Pope and the Patriarch that year became a watershed in church history.

The relation of the Byzantine Church to the Roman may be described as one of growing estrangement from the 5th to the 11th century. In the early church three bishops stood forth prominently, principally from the political eminence of the cities in which they ruled—the bishops of Rome, Alexandria, and Antioch. The transfer of the seat of empire from Rome to Constantinople and the later eclipse of Alexandria and Antioch as battlegrounds of Islām and Christianity promoted the importance of Constantinople. Concurrently, the theological calmness of the West, in contrast to the often violent theological disputes that troubled the Eastern patriarchates, strengthened the position of the Roman popes, who made increasing claims to preeminence. But this preeminence, or rather the Roman idea of what was involved in it, was never acknowledged in the East. To press it upon the Eastern patriarchs was to prepare the way for separation; to insist upon it in times of irritation was to cause a schism.

The theological genius of the East was different from that of the West. The Eastern theology had its roots in Greek philosophy, whereas a great deal of Western theology was based on Roman law. This gave rise to misunderstandings and at last led to two widely separate ways of regarding and defining one important doctrine—the procession of the Holy Spirit from the Father or from the Father and the Son—with the Roman churches, without consulting the East, incorporating the Son into their creed. The Eastern churches also resented the Roman enforcement of clerical celibacy, the limitation of the right of confirmation to the bishop, and the use of unleavened bread in the Eucharist.

Political jealousies and interests intensified the disputes; and at last, after many premonitory symptoms, the final break came in 1054, when Pope Leo IX struck at Michael Cerularius and his followers with an excommunication and when the Patriarch retaliated with a similar excommunication. There had been mutual excommunications before, but they had not resulted in permanent schisms. At the time there seemed possibilities of reconciliation, but the rift grew wider; in particular, the Greeks were bitterly antagonized by such events as the Latin capture of Constantinople in 1204. Western pleas for reunion (on Western terms), such as those at the Council of Lyon (1274) or the Council of Ferrara-Florence (1439), were rejected by the Byzantines. The schism has never been healed.

**Ten Kingdoms** (907–*c.* 980), period in Chinese history when southern China was ruled by nine small independent kingdoms, with one more small kingdom in the far north. It corresponded generally with the Five Dynasties period, or rule, in the north; and, like the northern period, it was a time of unrest and political confusion. In neither case, however, were the economic condition and cultural level of the society seriously disrupted.

The Ten Kingdoms were mostly situated in the valley of the Yangtze and farther south. They were the Wu (902–937), the Southern T'ang (937–975/976), the Southern P'ing (924/925–963), the Ch'u (927–951), the Former Shu (907–925) and Later Shu (934–965), the Min (909–945/946), the Northern Han (951–979), the Southern Han (917–971), and the Wu-yüeh (907–978), the latter near the Yangtze Delta. Some of these regimes were relatively stable, but none was powerful enough to unify the south. The cultural legacy of the T'ang found fertile ground in these southern parts. Religious thought moved toward a synthesis of Buddhism, Taoism, and Confucianism. The southern landscape gave new vitality to the ancient traditions of poetry. The flourishing courts of the south gave great impetus to pottery in the region, and a fine celadon was produced in the kingdom of Wu-yüeh. The King of the Southern T'ang was a noted poet.

The Ten Kingdoms were also marked by their relative economic prosperity. Intensive farming techniques using irrigation and selective crops contributed bountiful harvests to a flourishing economy. Technological advances in the production of iron and growing regional and overseas trade further stimulated commercial activity.

Southeastern China retained its cultural excellence and economic vitality as the Ten Kingdoms were successively absorbed back into a unified China under the Sung dynasty in the 970s.

**Ten Lost Tribes of Israel,** 10 of the original 12 Hebrew tribes, which, under the leadership of Joshua, took possession of Canaan, the Promised Land, after the death of Moses. They were named Asher, Dan, Ephraim, Gad, Issachar, Manasseh, Naphtali, Reuben, Simeon, and Zebulun—all sons or grandsons of Jacob. In 930 BC the 10 tribes formed the independent Kingdom of Israel in the north and the 2 other tribes, Judah and Benjamin, set up the Kingdom of Judah in the south. Following the

conquest of the northern kingdom by the Assyrians in 721 BC, the 10 tribes were gradually assimilated by other peoples and thus disappeared from history. Nevertheless, a belief persisted that one day the Ten Lost Tribes would be found. Eldad ha-Dani, for instance, a 9th-century Jewish traveler, reported locating the tribes "beyond the rivers of Abyssinia" on the far side of an impassable river called Sambation, a roaring torrent of stones that becomes subdued only on the sabbath, when Jews are not permitted to travel. Manasseh ben Israel (1604–57) used the legend of the lost tribes in pleading successfully for admission of Jews into England during Oliver Cromwell's regime. Peoples who at various times were said to be descendants of the lost tribes include the Nestorians, the Mormons, the Afghans, the Falashas of Ethiopia, the American Indians, and the Japanese. Among the numerous immigrants to the State of Israel since its establishment in 1948 were a few who likewise claimed to be remnants of the Ten Lost Tribes. The descendants of the tribes of Judah and Benjamin have survived as Jews because they were allowed to return to their homeland after the Babylonian Exile of 586 BC.

**ten-pounder:** *see* ladyfish.

**Ten Sleep,** town, Washakie county, north-central Wyoming, U.S., situated in the Bighorn Basin, west of the Bighorn Mountains, 25 miles (40 km) east of Worland. The site, at the junction of Nowood and Ten Sleep creeks, was an Indian rest stop, so called because it was 10 days travel, or "10 sleeps," from Fort Laramie (southeast), Yellowstone Park (west-northwest), and the Indian Agency at Stillwater, Mont. (northwest). The scenic Ten Sleep Canyon and Powder River Pass (9,666 feet [2,946 m]) are immediately to the east. Near the entrance to the canyon is the Girl Scouts National Center West, acquired in 1968 and one of the world's largest encampments (15,000 acres [6,070 hectares]) with facilities for workshops and seminars. A conservation buffalo herd was begun at a nearby ranch in 1974. The village is a supply point for a livestock and tourist region. Pop. (1990) 311.

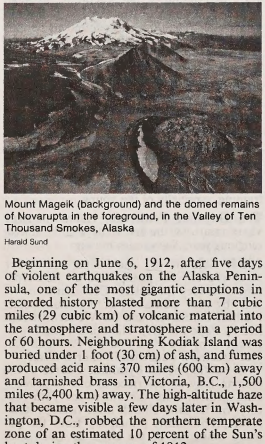
**Ten Thousand Immortals,** in Persian history, core troops in the Achaemenian army, so named because their number of 10,000 was immediately reestablished after every loss. Under the direct leadership of the *hazarapat*, or commander in chief, the Immortals, who formed the king's personal bodyguard, consisted primarily of Persians but also included Medes and Elamites. They apparently had special privileges, such as being allowed to take concubines and servants along with them on the march. On coloured glazed bricks and carved reliefs found at the Achaemenian capitals, such as the Palace of Artaxerxes at Susa, the Immortals are often represented standing stiffly at attention, each soldier's wooden spear with its silver blade and pomegranate insignia held upright and resting firmly on his toe. They wore elaborate robes and much gold jewelry. An elite 1,000 of the Immortals were further distinguished by having gold pomegranates on their spears.



Two of the Ten Thousand Immortals, glazed bricks from the Palace of Artaxerxes at Susa, Achaemenian period (539–330 BC); in the Louvre, Paris

By courtesy of the Musee du Louvre, Paris; photograph, Cliche Musees Nationaux, Paris

**Ten Thousand Smokes, Valley of,** volcanic region, southern Alaska, U.S., 265 miles (425 km) southwest of Anchorage. The valley was created in 1912 by the eruption of the Novarupta and Mount Katmai volcanoes. Its name derives from the myriad fumaroles (fissures spouting smoke, gas, and steam) that developed in the valley floor. Covering about 56 square miles (145 square km), it is now a part of Katmai National Park and Preserve.



Mount Mageik (background) and the domed remains of Novarupta in the foreground, in the Valley of Ten Thousand Smokes, Alaska

Harald Sund

Beginning on June 6, 1912, after five days of violent earthquakes on the Alaska Peninsula, one of the most gigantic eruptions in recorded history blasted more than 7 cubic miles (29 cubic km) of volcanic material into the atmosphere and stratosphere in a period of 60 hours. Neighbouring Kodiak Island was buried under 1 foot (30 cm) of ash, and fumes produced acid rains 370 miles (600 km) away and tarnished brass in Victoria, B.C., 1,500 miles (2,400 km) away. The high-altitude haze that became visible a few days later in Washington, D.C., robbed the northern temperate zone of an estimated 10 percent of the Sun's heat during the summer of 1912.

The uninhabited site of the holocaust was not located until four years later, at which time the valley was alive with tens of thousands of jets of steam and gas ranging up to 1,200° F (649° C) issuing from vents in the Earth up to 150 feet (46 m) across. Over more than 40 of the valley's 56 square miles lay a covering of ash up to 700 feet (210 m) in depth. The summit of adjacent Mount Katmai had collapsed or been blown asunder, leaving a crater measuring 3 by 2 miles (5 by 3 km) and a lake 3,700 feet (1,100 m) below the rim. A new volcano, named Novarupta, had risen in the valley, just southwest of Mount Katmai. All plant and animal life had been destroyed, and the trees on the mountainsides had been completely carbonized by scorching winds.

More than 60 years later, the fumaroles giving the valley its name numbered fewer than 12, but the region had been so scarred that in the 1960s it was used in training U.S. astronauts for moon landings.

The Mount Katmai region had been explored in 1898. It was rich in animal and plant life, though without human habitation. The explorations after the 1912 eruption were followed by extensive geologic studies lasting into the 1950s, and detailed seismological investigations continued.

Numerous hypotheses about the sequence of events that created the Valley of Ten Thousand Smokes have been advanced as a result of these studies. Many aspects remain conjectural, however, and some details remain unexplained.

Geologists were long puzzled, for example, by the presence of a small amount of banded pumice, or volcanic glass, mixed in the great ash flow. The most recent theories about the events of the eruption offer a plausible hypothesis. Based on map compilations of the relative thickness of the ash layer, these theories suggest that the main, as well as the initial, activity came from Novarupta. It first exploded in a torrent of incandescent acidic lava, or rhyolite, that cascaded across the valley floor. Lava flowed also from nearby fissures. Hot gases, mainly steam from buried streams and springs, began rising through countless holes and cracks, to be augmented later by gases from the cooling lava.

Following this first series of blasts, an enormous column of molten material that had lain quiescent beneath Mount Katmai apparently found access into newly created underground fissures leading to the erupting column of rhyolite beneath Novarupta. Almost as quickly as the two lavas mingled, they frothed upward and were erupted as the hybrid pumice, which chilled quickly to preserve the marbleized effect.

It is thought that the top of Mount Katmai was demolished soon after the lava flow from beneath it began. There is evidence of volcanic activity in the crater itself, however, including a small cone, recent fumarole activity, and the fact that the lake remains unfrozen in winter.

A number of explanations have been offered for the origin of the ash flow in the valley, none of them conclusive. The relatively short duration of the fumaroles, however, is explained by their origin mainly from gases sweated out of the ash as it cooled and settled. Other details remain puzzling; for example, the only remaining fumarole activity is at a place where the ash layer is relatively thin. Certain rocks and successions of ash layers also remain unaccounted for in the presently accepted sequence of events.

Plant life was slow to return to the devastated valley. Moss and algae first appeared around some of the fumaroles, but some higher plants have begun to grow on the valley floor. The valley is unable to sustain animal life, but moose and bear may cross it from time to time.

In recent years the valley has become a popular tourist attraction, reached by bus and foot from the National Park Service Lodge at Brooks River.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Tena,** town, eastern Ecuador, located in El Oriente region, the tropical rain forest section of Ecuador east of the Andean cordilleras, on an affluent of the Napo River. A missionary settlement, it has a subsistence economy based on some stock raising and on barter among the lowland Quechua Indians, who constitute almost the entire population. Pop. (1989 est.) 8,127.

**tenant:** *see* landlord and tenant.

**tenant farming,** agricultural system in which landowners contribute their land and a measure of operating capital and manage-

ment while tenants contribute their labour with various amounts of capital and management, the returns being shared in a variety of ways. Payment to the owner may be in the form of a share in the product, or in cash, or in a combination of both. Tenants and their families probably constitute two-fifths of the world's population engaged in agriculture.

The extent and form of farm tenancy vary. Tenancy is widespread in England and Wales, for example; in Thailand and Denmark, on the other hand, tenants constitute only 5 percent of the total number of farmers. Under one arrangement, known as sharecropping, the landowner furnishes all the capital and sometimes the food, clothing, and medical expenses of the tenant and may also supervise the work. In other forms of tenant farming, the tenant may furnish all the equipment and have a substantial degree of autonomy in the operation of the farm.

Tenant farming can be highly efficient, as has been demonstrated in the United Kingdom and in the midwestern United States. Abuses occur when the landowners' power is excessive and when the tenants are poor or of inferior social status. Since World War II, governments have increasingly acted to improve the condition of tenant farmers. Such measures usually centre on rent limitations, minimum lease periods, and the right of tenants to compensation for capital improvements that they have made. In Marxist societies landowners' properties are sometimes expropriated, subdivided, and allocated to farmers.

**Tenasserim,** narrow coastal region, southeastern Myanmar (Burma), bordered to the east by Thailand and to the west by the Andaman Sea. The Mergui Archipelago, with more than 200 islands of varying sizes, fringes the western shore. Tenasserim is dominated by the Tenasserim Range, which reaches a height of 6,80[illegible] feet (2,074 m), and is bisected by the Great Tenasserim River, which flows south to the Andaman Sea. Swamp forests are found on the east coast. The Tenasserim plains to the north are drained also by short and rapid rivers, which enter the Gulf of Martaban. The ethnic composition of the area consists of Karens in the west and north, Thai in the south, and Burmans who speak a unique dialect of Burmese in the other areas.

Long disputed between Myanmar and Thailand, the region was awarded to Myanmar after the Thai-Burmese wars ended in the late 18th century. After the first Anglo-Burmese War (1824–26), Tenasserim was the first part of Burma to be surrendered to the British. In 1941, when Japanese troops landed in Tenasserim, the British began evacuating Burma. The Japanese occupation lasted from 1941 to 1945, and Burma gained independence from Britain in 1948.

Paddy rice is cultivated in the river valleys of Tenasserim, particularly near Tavoy. Vegetables, coconuts, rubber, and teak are grown, and salt fields are worked. Soil erosion has been a problem on the upland ridges of the region. Wood and bamboo products are manufactured in Tavoy. Tin, tungsten, and iron-ore mines operate near Tavoy and Mergui, and there is a tin purification plant in Heinda that is powered by a hydroelectric station in Phaungtaw. A coastal paved road has branches that run into Thailand.

**Tenby,** Welsh DINBYCH-Y-PYSGOD, market town and resort, South Pembrokeshire district, Dyfed county, Wales, on Carmarthen Bay. Though Scandinavian settlement probably occurred there, the town essentially dates from the building of a Norman castle and walled borough in the 12th century; parts of the walls survive, but the castle is in ruins. Fishing has long been an important activity, and the fine beaches, cliffs, and attractive narrow streets have brought a flourishing holiday trade. Pop. (1981 prelim.) 4,814.

**tench** (species *Tinca tinca*), widely distributed European food and sport fish of the carp family Cyprinidae (order Cypriniformes), noted



Tench (*Tinca tinca*)
W.S. Pitt—Eric Hosking

for its ability to survive low oxygen conditions. The tench is a stout, small-scaled fish with a barbel at each corner of its mouth and a thick, slimy skin. It is greenish or blackish and usually 18–35 cm (7–14 inches) long with a weight of about 2 kg (4½ pounds). Most abundant in quiet, mud-bottomed waters thick with plants, it feeds mainly on small animals and plants. It was once thought able to cure injured fishes and was also applied to human wounds. The golden tench is a red-gold variety of the species sometimes kept in ponds.

**Tench, Watkin** (b. *c.* 1758, England?—d. May 7, 1833, Devonport, Devonshire, Eng.), British army officer whose two books about early Australia have become classics.

Commissioned a lieutenant in the British army (1778), Tench shipped out for Australia nine years later as a captain lieutenant of marines, arriving in Botany Bay on Jan. 20, 1788. A year later he published in London *A Narrative of the Expedition to Botany Bay,* in which he described his voyage and life in the settlement. An immediate popular success, the book went into three editions and was translated into several languages. He sailed for Europe in 1791, and his *Complete Account of the Settlement at Port Jackson* appeared in 1793. Made a prisoner of war by the French in 1794, two years later he published an account of his captivity, *Letters Written in France to a Friend in London.*

**Tenchi** (Japanese emperor): *see* Tenji.

**Tencin, Claudine-Alexandrine Guérin de** (b. April 27, 1682, Grenoble, Fr.—d. Dec. 4, 1749, Paris), French author and literary patroness whose associations with celebrated writers and political personalities ensured her position as one of the prominent social figures of the 18th century.

Tencin became a nun early in life but soon abandoned her vows in obscure circumstances



Mme de Tencin, lithograph by C. Pegeron
Boyer—H. Roger-Viollet

around which many legends grew. After the death of Louis XIV, she sought her fortune at court and became the mistress of Cardinal Dubois (prime minister for a time), of the regent, and of other influential men. The philosopher Jean Le Rond d'Alembert was her son by one of her lovers, the chevalier Destouches. Falsely charged with murder, she was imprisoned in the Bastille in 1726 and was released only after the intervention of her brother Pierre, then an archbishop and later a cardinal. Thereafter, she sought less scandalous distinction as a hostess. The writers Bernard de Fontenelle, Pierre de Marivaux, and Jean-François Marmontel, as well as the philosopher Montesquieu (whom she twice assisted in publication of his works), frequented her salon. Her best-known work is an autobiographically inspired novel, *Mémoires du Comte de Comminges* (1735).

**Tencin, Pierre Guérin de** (b. Aug. 22, 1679/80, Grenoble, Fr.—d. March 2, 1758, Lyon), French statesman, cardinal, and anti-Jansenist of the 18th century.

Tencin owed his quick advance to power to his sister, Claudine-Alexandrine Guérin de Tencin, influential mistress of a famed salon. He was successively abbé of Vercelay (1702), vicar general of Sens (1703), ambassador to the Holy See (1721–24, 1739–42), archbishop of Embrun (1724–40), cardinal (from 1739), archbishop of Lyon (from 1740), and a minister of state for Louis XV (1742–50). He joined in bitter pamphlet debates against the supporters of Jansenism.

**Tenda Pass,** Italian COLLE DI TENDA, French COL DE TENDE, pass (6,135 feet [1,870 m]) in the Maritime Alps, lying on the French-Italian border near the resort of Limone Piemonte. Two parallel tunnels carry a railroad and highway beneath the Tenda Pass to connect Nice, Fr., with Turin, Italy. Some Alpine specialists consider the pass to be the western end of the main Alps.

**Tendai** (Buddhism): *see* T'ien-t'ai.

**Tendai Shintō** (Japanese religion): *see* Sannō Ichijitsu Shintō.

**tendinitis,** also spelled TENDONITIS, inflammation of the sheaths of the tendons. These sheaths are composed of thin, filmy tissue that permits the sliding motion of tendons within them. The cause of inflammation is irritation of the sheaths by prolonged or abnormal use of the tendons. Less often it may follow invasion of the tendon sheaths by bacteria with subsequent infection. It is in many instances an occupational hazard (wrist tendons in the typist; tendons about the shoulder in baseball pitchers; or tendons about the elbow in pneumatic drill operators).

Inflammation in the sheath of the tendon produces swelling, redness, and pain along the course of the involved tendon, and motion of the tendon produces severe pain. Swelling of the sheath narrows the space through which the tendon may slide, causing stiffness in the involved area. A grating sensation may be felt as the tendon moves.

Treatment of the condition depends upon placing the involved tendon and its sheath at complete rest by means of splints, cast, or bandages. With rest the inflammation subsides and motion may gradually be resumed. Local injections of corticosteroids may hasten the abatement of the inflammation. Recurrences following improvement are not uncommon. Repeated episodes of tendinitis may produce permanent thickening of the sheath, which limits motion of the tendon within it.

**tendon,** in anatomy, tissue that attaches a muscle to other body parts, usually bones. Tendons are the connective tissues that trans-

mit the mechanical force of muscle contraction to the bones; the tendon is firmly connected to muscle fibres at one end and to components of the bone at its other end. A tendon is composed of dense, fibrous connective tissue made up primarily of spindle-shaped cells called fibroblasts and of collagenous fibres (*see* collagen). Its composition is similar to that of ligaments and aponeuroses. The great tensile strength of tendons, which is necessary to withstand the stresses generated by muscular contraction, is made possible by the large quantity of collagenous fibres, which are remarkably tough and strong. *See also* connective tissue.

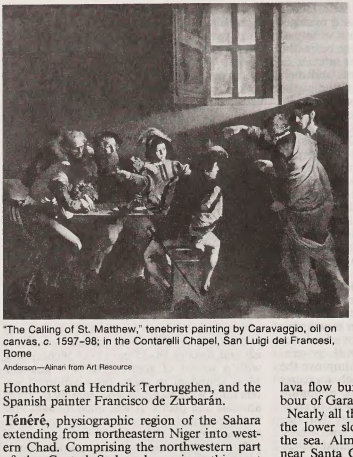
**tendril,** in botany, plant organ specialized to anchor and support vining stems. Tendrils may be modified leaves, leaflets, leaf tips, or leaf stipules; they may, however, be derived as modified stem branches (*e.g.,* grapes). Other special plant structures fulfill a similar function, but the tendril is distinctive in being a specialized lateral organ strongly possessing a twining tendency causing it to encircle any object encountered.

A tendril is a slender whiplike or threadlike strand, produced usually from the node of a stem, by which a vine or other plant may climb. Its anatomy may be of stem tissue or of leafstalk tissue. Common examples of tendril-producing plants are the grape, members of the squash or melon family (Cucurbitaceae), the sweet pea (*Lathyrus odoratus*), and the passionflowers (*Passiflora* species).

Tendrils are prehensile and sensitive to contact. When stroked lightly on its lower side, the tendril will, in a minute or two, curve toward that side. As it brushes against an object, it turns toward it and—the shape of the object permitting—wraps about it, clinging for as long as the stimulation persists. Later, strong mechanical tissue (sclerenchyma) develops in the tendrils, thus rendering them strong enough to support the weight of the plant. In addition to their twining character, some tendrils produce terminal enlargements that, on contact with a firm surface, flatten and secrete an adhesive, firmly cementing the tendril to the substrate.

**Tendring,** district, county of Essex, England. It occupies the low-lying North Sea coastal tract between the estuaries of the Rivers Stour and Colne. Most of the district's population is concentrated in urban communities on the coast, including the old port of Harwich in the north, the string of resorts situated south of the low promontory of the Naze, and the yachting centre of Brightlingsea in the shelter of Colne Point. The coastal towns possess good rail communications with the interior, and many residents commute to work in Colchester, Chelmsford, or even London. Seaside resorts such as Walton, Frinton, and Clacton make tourism a major industry in Tendring. Agriculture dominates the inland portions of the district. Area 130 square miles (337 square km). Pop. (1991 prelim.) 125,100.

**tenebrism,** in the history of Western painting, the use of extreme contrasts of light and dark in figurative compositions to heighten their dramatic effect. (The term is derived from the Latin *tenebrae,* "darkness.") In tenebrist paintings the figures are often portrayed against a background of intense darkness, but the figures themselves are illuminated by a bright, searching light that sets off their three-dimensional forms by a harsh but exquisitely controlled chiaroscuro (*q.v.*). The technique was introduced by the Italian painter Caravaggio (1571?–1610) and was taken up in the early 17th century by painters influenced by him, including the French painter Georges de La Tour, the Dutch painters Gerrit van



"The Calling of St. Matthew," tenebrist painting by Caravaggio, oil on canvas, c. 1597–98; in the Contarelli Chapel, San Luigi dei Francesi, Rome

Anderson—Alinari from Art Resource

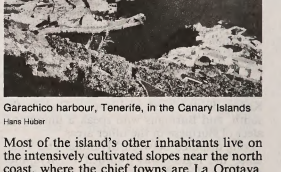
Honthorst and Hendrik Terbrugghen, and the Spanish painter Francisco de Zurbarán.

**Ténéré,** physiographic region of the Sahara extending from northeastern Niger into western Chad. Comprising the northwestern part of the Central Sudan depression, this vast level plain of sand extends over approximately 154,440 square miles (400,000 square km). It is bounded by the Aïr massif (west), the Ahaggar (Hoggar) mountains (northwest), the Djado Plateau (northeast), the Tibesti mountains (east), and the Lake Chad basin (south). Ténéré is one of the most forbidding regions of the Sahara, with an extremely hot and dry climate and virtually no plant life. Vast expanses of sand and sand dunes in the southeast are known as ergs, and the gravel-covered plains of the northwest are called regs. Bilma oasis, near the centre of the Ténéré, has maximum and minimum July temperatures (summer average) of 108° F (42° C) and 75° F (24° C). Hot, dusty east or northeast winds (the harmattan) blow across the Ténéré generally year-round; irregular annual rainfall is about 1 inch (25 mm). Often there are no wells in the area for hundreds of miles.

Fossils confirm that this arid desert was, in the Late Carboniferous Period (320 to 286 million years ago), a seafloor and later became a humid tropical forest. Middle Paleolithic (about 60,000 BC) human habitation is indicated in this region by flint axes, arrowheads, and stone artifacts; rock engravings and rock pictures of animals are indicative of Neolithic (8,000–5,000 BC) inhabitants. The Tuareg and Teda nomads who frequent the Ténéré use sand dunes as landmarks. The addax, a rare desert antelope, survives in the Ténéré.

**Tenerife,** also spelled TENERIFFE, island, largest of the Canary Islands, Santa Cruz de Tenerife *provincia,* in the *comunidad autónoma* ("autonomous community") of Canarias, Spain. It lies in the Atlantic Ocean opposite the northwest coast of Africa. The island has an area of 795 square miles (2,058 square km). The narrower northeastern part rises sharply to a jagged mountain ridge of volcanic origin, except near La Laguna, where a corridorlike depression forms the island's only extensive lowland. The remaining two-thirds of Tenerife is a vast composite dome surmounted by Teide Peak, the highest point on Spanish soil (12,198 feet [3,718 m]). This volcanic peak, with its supports and spurs, occupies nearly two-thirds of the island. The area continues to be the site of volcanic activity; perhaps the most destructive eruption occurred early in the 18th century, when a lava flow buried much of the town and harbour of Garachico on the northern coast.

Nearly all the inhabitants of Tenerife live on the lower slopes and within a few miles of the sea. Almost half the population is in or near Santa Cruz de Tenerife (*q.v.*), the capital, and La Laguna, the former capital. La Laguna University was established in 1701.



Garachico harbour, Tenerife, in the Canary Islands

Hans Huber

Most of the island's other inhabitants live on the intensively cultivated slopes near the north coast, where the chief towns are La Orotava, Icod, and Puerto de la Cruz. Near the south coast, where the climate is drier and camels are common beasts of burden, there are many small villages, but Güimar is the only town.

The economy of Tenerife is mainly agricultural; tourism is based on beach-resort facilities. The international airport at Los Rodeos suffered a catastrophic airplane collision (582 fatalities) in 1977 and was replaced by a new international airport, Queen Sofia Tenerife South, in 1978. Pop. (1982 est.) 658,884.

**Ténès,** also spelled TENEZ, town, northern Algeria. A small Mediterranean port, it is built on the site of the ancient Phoenician and Roman colonies of Catenna. Ruins of the Roman colony's ramparts and tombs remain, and the Roman cisterns are still in use. Old Ténès, probably founded in AD 875 by Spanish colonists, belonged to the city of Tlemcen from 1299 until its capture by the corsair Khayr ad-Din (Barbarossa) in 1517. It was occupied by the French in 1843. The modern town of Ténès rests on a rocky plateau overlooking the Wadi Allalah estuary and a harbour sheltered on the east by Cape Ténès. The remains of Old Ténès are 1 mile (1.5 km) southeast. The modern town's industry includes fish canning and the production of soft drinks. Pop. (1987 prelim.) mun., 26,510.

**Teng Hsiao-p'ing** (Chinese official): *see* Deng Xiaoping.

**Tenggerese,** second smallest of the ethnic groups indigenous to the island of Java in Indonesia, living mainly on the high slopes of a large volcanic crater in the Tengger Mountains and numbering about 50,000 in the early 1970s. They are believed to be the only surviving remnants of the Majapahit Empire in its later period (*c.* 1500). Because of the high altitude and climate, the Tenggerese cannot grow the Indonesian staple crop of rice. They sow corn (maize), potatoes, onions, and cabbage in a two-season year and keep a small number of buffalo. Lacking the economic base for large-scale political integration, the Tenggerese community unit (with an elected headman) is the village, consisting of large, thatched wooden houses sheltering several families and surrounded by a bamboo palisade. The Tenggerese are largely isolated from external influences and the cultural interaction typical of coastal Java. Although some have converted to Islām, most observe a religious animism influenced by Hinduism. A priest, the *dukun,* performs sacrifices on the sacred crater.

**Tengiz, Lake,** Russian OZERO TENGIZ, salt lake in the northern part of the Kazakh Upland, Tselinograd *oblast* (province), Kazakhstan. The largest lake in northern Kazakhstan, it has an area of 614 square miles (1,590 square km) and a maximum depth of more than 20 feet (6 m); it lies in an area of sparsely inhabited dry steppe and semidesert. It is fed by the Nura and Kulanutpes rivers, and its level is subject to sharp fluctuations. The shore is mostly low lying and clayey, and along the jagged eastern shore are several islands. The lake is the most northerly habitat of the pink flamingo, and its brine is rich in the mineral mirabilite.

**Tengnoupal,** district, Manipur state, eastern India. Formerly part of the Central district, it is a hilly region in the Eastern Himalayas south of the Imphāl Valley, has an area of 1,303 sq mi (3,375 sq km), and varies in altitude from 2,500 ft (760 m) to 10,000 ft. Pakhangha established a dynasty in AD 33 that continued until integration with the Indian Union in 1947. A manuscript of local literature, written during the reign of King Irengba, dates from 1074. The area was invaded by the Chinese in 1631 and was bombed by the Japanese in 1942 during World War II. The Manipur and Barāk rivers flow from north to south (the latter through narrow valleys); the district also has numerous lakes that serve as important fisheries. Lake vegetation includes lotus and water lilies, and orchids are found on the plains. Goral, *kharsha* (wild pig), tiger, leopard, and greylag (geese) inhabit the forested areas. Agriculture is the basis of the economy; crops (grown in small, scattered plots) include rice, wheat, mustard, potatoes, and pulse (legumes). Mangoes and lemons are also grown. Industries include handloom weaving and embroidering (Manipuri saris are known for their durability and fine embroidery), blacksmithing, agricultural implement making, and goldsmithing. Pottery, cane products, soap, and paper are also made. Rock salt, copper, limestone, and iron ore are mined in small quantities. The district is populated mostly by different tribes of Mongolian origin who speak the Manipuri language. A national highway connects Chāndil, the district headquarters, with Imphāl, the state capital; the Barāk River is navigated by small boats. Pop. (1981) 56,444.

**Tengréla,** also spelled TINGRÉLA, town, administrative centre (since 1980), of Tengréla *département,* extreme northern Côte d'Ivoire, situated on a road connecting the Côte d'Ivoire town of Boundiali (south) with the country of Mali (north). The town serves as a centre for international trade among Côte d'Ivoire, Mali, and Burkina Faso (formerly Upper Volta). The *département* is a densely-populated wooded savanna area known for cotton, corn (maize), yams, sorghum, linseed oil, and cattle raising. The Senufo people, one of 60 ethnic groups in Côte d'Ivoire, constitute the town's population. Pop. (2001 est.) town, 33,400; *département,* 82,800.

**tengu,** in Japanese folklore, a type of mischievous supernatural being, sometimes considered the reincarnated spirit of one who was proud and arrogant in life. *Tengu* are renowned swordsmen and are said to have



A flight of *tengu* rescuing Tametomo from the attack of a giant fish, woodblock print by Utagawa Kuniyoshi (1797–1861)
By courtesy of the Victoria and Albert Museum, London

taught the military arts to the Minamoto hero Yoshitsune. They live in trees in mountainous areas. A group of *tengu* is headed by a chief, who is depicted with a prominent nose, angry and threatening expression, dressed in red robes and carrying a feather fan. He is served by a group of retainers called *koppa tengu* ("leaflet" *tengu*) who act as his messengers. In popular art they are shown as smaller winged creatures with long red noses or beaklike mouths.

**Teniers, David,** THE ELDER (b. 1582, Antwerp—d. July 29, 1649, Antwerp), Flemish Baroque painter of genre scenes, landscapes, and religious subjects.

Teniers apparently began his career as a pupil of his brother Juliaen; he is also said to have studied in Italy under Elsheimer and Rubens. He became a master in the Antwerp guild in 1606–07, and in the 1630s is recorded as an art dealer. A number of paintings in the style of his more famous son were formerly attributed to him, but in fact almost nothing is known about his work except that religious subjects seem to have predominated.

**Teniers, David,** THE YOUNGER (baptized Dec. 15, 1610, Antwerp—d. April 25, 1690, Brussels), prolific Flemish painter of the Baroque period known for his genre scenes of peasant life.

He was the son and pupil of David Teniers the Elder. In 1637 he married Anna, daughter of the painter Jan Brueghel the Elder. Teniers painted almost every kind of picture, but chiefly genre scenes of peasant life, many of which were subsequently used for tapestry designs in the 18th century. His early works in this vein show the influence of Adriaen Brouwer (*e.g.,* "Peasants Playing Music," Alte Pinakothek, Munich). Many of his finer works date from 1640 to 1650. He was brilliant at handling crowd scenes in an open landscape and adept at characterizing his figures with a warm, human, and often humorous touch (*e.g.,* "The Village Fête," 1646; Hermitage, St. Petersburg). His landscape settings are atmospheric, and his still-life details precise. In the same decade he also painted a number of monumental processions (*e.g.,* "Procession of the Antwerp Civic Guards," 1643; Hermitage, St. Petersburg). Teniers developed a second career in 1651 when he moved to Brussels, becoming court painter and keeper of the art collections to the regent of the Netherlands, the archduke Leopold William. He painted several views of the Archduke's picture gallery (*e.g.,* "The Archduke Leopold Wilhelm in His Picture Gallery in Brussels," 1647; Prado, Madrid). He also made many small-scale individual copies of paintings in the Duke's collection by foreign artists, especially Italians. Of these, 244 were engraved in 1660 under the title "Theatrum Pictorium." As a pictorial inventory of a great 17th-century collection, this book of engravings was unique in its time and still constitutes a valuable source for the art historian. Teniers was also court painter to Don John of Austria, who succeeded the Archduke as regent in 1656, and was one of



Detail of "A Country Festival near Antwerp," oil on canvas by David Teniers the Younger, 1643; in the National Gallery, London
By courtesy of the trustees of the National Gallery, London; photograph, A.C. Cooper

the prime movers in the foundation of the Brussels Academy of Fine Arts (1663) and subsequently the Academy in Antwerp (1665). Teniers' son, also named David (1638–85), often imitated his father's work. There are several of his altarpieces in churches in Belgium.

**Tenji,** in full TENJI TENNŌ, Tenji also spelled TENCHI, original name NAKANO ŌE (b. 625/626, Japan—d. Jan. 7, 672, Ōtsu, Ōmi province), 38th emperor of Japan, from 668 to 672, and the ruler who freed the Japanese court from the domination of the Soga family. Tenji implemented a series of reforms that strengthened the central government in accord with the Chinese model and restored power to the emperor.

The Soga family had begun to dominate the Imperial family in the late 6th century AD, and by 645 it appeared that Iruka, the son of the head of the Soga clan, would attempt to usurp the throne for himself. Nakano Ōe, then an Imperial prince, conspired with Nakatomi Kamatari, the head of the powerful Nakatomi family, to murder Iruka at court, the only place where he was not surrounded by bodyguards. When the assassin faltered at the last minute, the prince picked up the spear and slew Iruka. Defection to Nakano's side on the part of some disgruntled members of the Soga family caused opposition to the coup to collapse, and Iruka's supporters were soon dispersed.

The empress Kōgyoku, Nakano's mother (who reigned a second time as the empress Saimei), abdicated on the following day, and the former Imperial prince Karu was enthroned as the emperor Kōtoku. Named heir apparent, Nakano Ōe was free to promulgate a series of reforms, drawn up with Kamatari (*see* Taika era reforms), requiring the great nobles to recognize the supremacy of the emperor. Private property in the form of land or workers was abolished, the region around the capital was set up as an administrative district, and governors were appointed for the provinces. Moreover, the population was registered, the arable land surveyed, and a new system of taxation instituted. These reforms transformed Japan into a powerful centralized nation, resembling (on a smaller scale) T'ang China.

In 662 Nakano Ōe became emperor, although he was not officially enthroned until 668. Meanwhile, the Korean kingdom of Packche was invaded by Chinese troops. The new emperor, Tenji, came to the aid of the Koreans, but his troops were decisively defeated. Unable to challenge Chinese sovereignty in the area, he withdrew and abandoned all Japanese interests in Korea. Japanese troops remained off the Korean peninsula until 1598, when they were again defeated by China.

**Tenjiku** (Japanese: "Indian Style"), one of the three main styles of Japanese Buddhist architecture in the Kamakura period (1192–1333). The style is impressive for the size and multiplicity of its parts. Its unique and most characteristic feature is the elaborate bracketing of beams and blocks under the eaves.

The introduction of Tenjiku to Japan seems to have been an accidental by-product of the revival of Nara Buddhism. It was used most extensively in the rebuilding of the Tōdai Temple (Tōdai-ji)—its most impressive monument being the Nandai-mon, or Great South Gate. The decision to adopt the style apparently was that of a single priest, Chōgen, of the Pure Land, or Jōdō, sect, who was put in charge of the reconstruction. The style rapidly declined in popularity after his death in 1205, its character being so alien to Japanese taste. By the late 13th century, it had been assimilated into a more congenial style, and by the 14th century, except for restorations of buildings originally constructed in the style, it had been almost completely forgotten.



Detail of Tenjiku bracketing on the Great South Gate (Nandai-mon), Kamakura period (1192–1333), at the Tōdai Temple, Nara, Japan
Saburo Ohmachi

**Tenjin** (Japanese deity): *see* Sugawara Michizane.

**Teṉkalai,** one of two Hindu subsects of the Śrīvaiṣṇava, the other being the Vaḍakalai. Though the two sects use both Sanskrit and Tamil scriptures and centre their worship on Vishnu, the Teṉkalai places greater reliance on the Tamil language and the *Nālāyira Prabandham,* a collection of hymns by the Āḻvārs, a group of South Indian mystics. The Teṉkalai grew apart from the Vaḍakalai in the 14th century.

The main doctrinal difference between the two sects centres on the question of Vishnu's grace. The Teṉkalai believes that the process of final deliverance begins with Vishnu and that the devotee need not make any effort beyond surrendering himself to Vishnu's will. It uses as an illustration the helplessness and complete dependence of a kitten being carried by its mother; hence its doctrine is known as *mārjāra-nyāya* (the analogy of the cat). The two schools also differ in their views concerning Vishnu's consort, Śrī (Lakṣmī). The Teṉkalai holds that she is finite, though divine, and can act only as a mediator between the devotee and Lord Vishnu.

Piḷḷai Lokācārya is commonly regarded as the founder of the Teṉkalai sect, and Manavala, or Varavara Muni (1370–1443), as its most important leader. The sect's main centre is at Nanganur, near Tirunelveli (Tamil Nadu state), and the Teṉkalai are referred to as the southern school of the Śrīvaiṣṇava. *Compare* Vaḍakalai.

**Tennant, Frederick Robert** (b. Sept. 1, 1866, Burslem, Staffordshire, Eng.—d. Sept. 9, 1957, Cambridge, Cambridgeshire), English philosophical theologian, a powerful apologist with a wide range of interests who essayed a harmony of science and religion within an empirical approach to theology.

Tennant studied science at Caius College, Cambridge, and was ordained while teaching science at Newcastle-under-Lyme High School (1891–94), becoming lecturer in theology and fellow of Trinity College, Cambridge, in 1913.

In four early books Tennant discussed the concepts of sin (1902, 1912), the fall (1903), and miracles (1925). In the first volume (1928) of his chief work, *Philosophical Theology,* Tennant shows himself temperamentally and philosophically unsympathetic to mysticism and argues that justification of the claims of religious experience to reveal God requires an independently established theism, derived by a "laborious ascent" from such knowledge about the self and the world as is supplied by epistemology, psychology, and the natural sciences. Volume II (1930) describes this ascent and gives Tennant's version of the argument from design. His bold endeavour to combine scientific and theological thinking was, however, overtaken by developments within both empirical philosophy and theology, where, on different grounds, claims for the reasonableness of Christianity were soon to be condemned.

**Tennant, Kylie,** married name KYLIE TENNANT RODD, *née* KYLIE TENNANT (b. March 12, 1912, Manly, N.S.W., Australia—d. Feb. 28, 1988, Sydney), Australian novelist and playwright famed for her realistic yet affirmative depictions of the lives of the underprivileged in Australia.

Tennant attended the University of Sydney but left without a degree and then worked as an assistant publicity officer for the Australian Broadcasting Commission. After her marriage in 1932 she became a full-time writer.

Tennant did field research for her novels; before beginning a novel she would thoroughly study the people and environment that she intended to depict. Her first book *Tiburon* (1935), set in a New South Wales country town, accurately and sensitively describes life among the unemployed during the Great Depression. For her novels set in the slums of Sydney—*Foveaux* (1939), *Ride On, Stranger* (1943), and *Tell Morning This* (1967)—Tennant lived in poor areas of the city and took jobs ranging from social worker to barmaid. In preparation for *The Battlers* (1941), about migrant workers, Tennant traveled for months with the unemployed along the roads of Australia, and several years later she lived in a fishing village for a while and worked as a boat builder before publishing *Lost Haven* (1946), a story of wartime shipbuilders. Her best-known play *Tether a Dragon* (1952), about the early Australian prime minister Alfred Deakin, was conceived while she was in the process of researching her first nonfiction piece, *Australia: Her Story: Notes on a Nation* (1953; rev. ed. 1964, 1971).

After spending time with the Aborigines of Australia and Papua New Guinea, Tennant wrote her first volume of children's stories, *All the Proud Tribesmen* (1959), specifically for the native children who, she learned, were having difficulty reading because they could not identify with white heroes.

From 1959 to 1969 Tennant worked as a journalist, a publisher's reader, and a literary adviser and editor. In 1969 she resumed writing full-time, and her later works included more histories and biographies, children's plays, short stories, poems, travel books, critical essays, and an autobiography (*The Missing Heir,* 1986). She received a number of national awards for her writings and was named a life patron of the Fellowship of Australian Writers.

*Consult the* INDEX *first*

**Tennant Creek,** town, central Northern Territory, Australia, on Tennant Creek, which was explored in 1860 by the Scot John McDouall Stuart and named after a South Australian pastoralist. Earliest settlement of the site began in 1872 with the construction of a station on the Overland Telegraph Line. Although gold was discovered in 1930 in the surrounding low, flat-topped hills, the town was not officially proclaimed until 1954. The discovery in 1955 of copper and silver has made Tennant Creek the Northern Territory's leading mineral production centre. A large smelter was built in the mid-1970s, but some of the mines' output continues to be trucked to the railhead at Alice Springs (315 miles [507 km] south) via Stuart Highway. Beef cattle graze the countryside, and an abattoir was

opened at Tennant Creek in 1980; there are also deposits of tin, mica, and wolfram (tungsten) in the vicinity. Pop. (2001 prelim.) 3,065.

**Tenneco Automotive Inc.,** automotive parts manufacturer and, with packaging firm Pactiv Corporation, one of the last companies to be spun off by the former Tenneco, Inc., a diversified industrial conglomerate that had interests in natural-gas pipelines, petroleum production, and heavy equipment.

Tenneco was formed in 1943 as the Tennessee division of the Chicago Corporation to build a natural-gas pipeline from Texas to West Virginia. Shortly after World War II ended, the division was sold, and the new company was incorporated in 1947 as the Tennessee Gas & Transmission Company with founder Gardiner Symonds as its long-time president. With Symonds at the head, the company began to distribute its gasoline in the South—under such trade names as Tenneco and Red Diamond—and heating oil in the North. The company assumed the name Tenneco, Inc., in 1966.

Federal regulations on oil and gas pricing caused Symonds to expand into other business areas while retaining its large network of natural-gas pipelines. Among its other businesses were construction and farm equipment, shipbuilding, automotive equipment, packaging, and chemicals. Two-thirds of the company's shipbuilding business came from building and repairing nuclear-powered vessels for the U.S. Navy. In 1988 Tenneco sold its petroleum- and natural-gas-producing properties and continued to downsize its operations through the 1990s. Pactiv and Tenneco Automotive were formed in 1999.

**Tennent, Gilbert** (b. Feb. 5, 1703, County Armagh, Ire.—d. July 23, 1764, Philadelphia), Irish-born American Presbyterian clergyman, son and brother of three other Presbyterian clergymen. He was one of the leaders of the Great Awakening of religious feeling in colonial America, along with Jonathan Edwards and George Whitefield.

Like his three brothers, Tennent was educated at home by his father in Neshaminy, Pa. He was licensed to preach by the presbytery of Philadelphia in 1725 and took a pastorate in New Brunswick, N.J. He became a revivalist preacher along with George Whitefield, who called him "a son of thunder." He was known for his fiery exhortations to sinners to repent and also for his scorn of his critics among the more conservative Presbyterians. Tennent's attacks on the majority reached a peak in 1740 in his "Nottingham Sermon," in which he denounced his opponents as hypocrites. This led to a schism the following year, Tennent and other members of the New Brunswick Presbytery withdrawing from the church. In 1743 he moved to a church in Philadelphia, where he remained for the rest of his life. His preaching became less impassioned, and he worked to heal the breach in the Presbyterian Church.

**Tennessee,** constituent state of the United States of America, lying in the east south-central U.S. It is bounded on the north by Kentucky and Virginia, on the east by North Carolina, and on the south by Georgia, Alabama, and Mississippi; on the west it is separated by the Mississippi River from Arkansas and Missouri. The capital is Nashville.

A brief treatment of Tennessee follows. For full treatment, *see* MACROPAEDIA: United States of America: *Tennessee*.

Spanish, French, and English explorers and traders visited Tennessee frequently during the 16th and 17th centuries. In 1663 Charles II of England issued a charter that established Carolina, including Tennessee, as a proprietary colony. After the French and Indian Wars (1763), "longhunters" from Virginia and North Carolina entered the region, the most prominent being Daniel Boone. Great Britain acknowledged the region to be part of the United States following the American Revolution.

Tennessee was part of the state of North Carolina until 1785, when the area's settlers broke away and formed the temporary free state of Franklin. North Carolina relinquished its claim to the area in 1789, and Tennessee became the 16th state in 1796. During the War of 1812, thousands of Tennesseans volunteered for the army, and from that time onward Tennessee was known as the Volunteer State. Many native Tennesseans distinguished themselves in the war. Most notable were Andrew Jackson, David Crockett, and Sam Houston. Jackson went on to father a populist movement, known as Jacksonian democracy, that dominated the Tennessee and eventually the national political scene in the 1820s and '30s.

Most of Tennessee, except for the eastern part of the state, supported secession from the Union in 1861. Tennessee was the site of several hard-fought American Civil War battles including Shiloh, Chattanooga, Stone River, and Nashville. After the war's end, Tennessee became the first seceding state to be readmitted to the Union in 1866.

The state is divided into six physiographic regions: the Great Smoky Mountains along the North Carolina border, the generally flat Cumberland Plateau, the Inner Low Plateau in Middle Tennessee, the Eastern Gulf Coastal Plateau, and the Mississippi Alluvial Plain. The Tennessee River valley dominates the landscape of much of the state, as the river flows south in the eastern part of the state and subsequently flows north in the state's western part. The Mississippi River and several small tributaries drain the extreme western portion of Tennessee.

Tennessee has a moderate climate with cool, but not cold, winters and warm, but not hot, summers. The state receives about 50 inches (1,270 mm) of rainfall a year. About half of the state is forested with some 200 species of trees, a third of which have commercial value for timber and other products.

Tennessee's white residents are largely Protestants of Anglo-Saxon ancestry. Blacks comprise about one-sixth of Tennessee's total population. The trend of greater emigration than immigration was broken in the 1960s as Tennessee became the only east south-central state to have a greater inflow than outflow of people. In the same decade urbanization continued, especially for blacks. By the late 20th century about four-fifths of the state's black population resided in four of the largest metropolitan areas.

Tennessee's lack of productive agricultural land forced an economic transition to manufacturing in the 1940s. The creation of the Tennessee Valley Authority and the subsequent availability of relatively inexpensive electrical power helped stimulate this economic transformation. The major manufacturing industries are chemicals, food processing, electrical machinery, apparel, and textiles. The state is a leading producer of zinc.

Highways crisscross the state, and major airline service to the metropolitan areas is available.

Tennessee's rich folk culture is cultivated by the tourist industry. Much of the area's culture and tourism are centred on the state capital, Nashville. This city is the home of country and western music and is sometimes called the "Athens of the South" because of its re-creation of the Parthenon and its Greek Ionic state capitol. Opryland, outside Nashville and home of the "Grand Ole Opry," is a major tourist attraction. The homes of famous entertainers receive similar tourist attention, such as the home of Elvis Presley in Memphis. The Hermitage, home of Andrew Jackson, is a much-visited shrine, as are the many American Civil War battlefields. The Smoky Mountains National Park is the site of many mountain vacations. Symphonies and art galleries are found in the four major metropolitan areas. More than 75 public and private institutions of higher learning are located in the state. Quality major newspapers are circulated throughout the state from Nashville, Memphis, Chattanooga, and Knoxville. Network and educational television is available in every county. Area 42,144 square miles (109,152 square km). Pop. (2000) 5,689,283.

**Tennessee Gas and Transmission Company:** *see* Tenneco Inc.

**Tennessee River,** central component of one of the world's greatest irrigation and hydropower systems and a major waterway of the southeastern United States. It is formed by the confluence of the Holston and French Broad rivers, just east of Knoxville, Tenn., and flows south-southwest to Chattanooga, Tenn. Turning west through the Cumberland Plateau into northeastern Alabama, it continues across northern Alabama and bends north on the boundary between Alabama and Mississippi. Continuing north through Tennessee and then Kentucky, it joins the Ohio River at Paducah, Ky., after a U-shaped course of 652 miles (1,049 km). Its drainage basin covers about 40,910 square miles (105,960 square km).

The name of the river may have come from a Cherokee Indian village located on the Little Tennessee River and spelled variously Tanase, Tennassee, Tanasi, or Tinasse. The Tennessee was explored during the period of rivalry between the French and the English for the territory west of the Appalachians, and a few small forts and posts were established on its banks. Earlier, explorers and fur traders had entered the lower course of the river from the Ohio River. Although the Tennessee served as a route for settlers moving southwestward, its role as a westward passage was negligible compared to that of the Ohio.

Originally, the Tennessee could be navigated only by flatboats. Its upper course was shallow and filled with short rapids. Its middle course, through the Cumberlands, contained whirlpools and was interrupted by Muscle Shoals (rapids, now submerged by reservoirs) in Alabama. Only its lower course was easily navigable, but the advent of the railroads in the Tennessee River valley after the 1840s kept river traffic from assuming the significance it had on other western and more easily navigated rivers.

The river's north-flowing lower course was strategically important during the American Civil War, for its valley offered an invasion route into the western Confederacy. Part of the course downstream is paralleled by the Cumberland River. The Confederate forts Henry (on the Tennessee) and Donelson (on the Cumberland) were only 12 miles (19 km) apart. General Ulysses S. Grant's Federal army, accompanied by gunboats, struck southward in the Tennessee River valley in February 1862. The Confederate forces fell back to Corinth, Miss., and the Federal troops moved almost to Tennessee state's southern boundary, where the Battle of Shiloh (or of Pittsburgh Landing) was fought (April 6–7, 1862).

The development of the river system as an important inland waterway began in 1933 with the establishment of the Tennessee Valley Authority (TVA). The Tennessee now has a series of locks and reservoirs impounded by multipurpose dams for navigation, power, and flood control. The mainstream dams include the Kentucky (1944); Pickwick Landing (1938) in Tennessee; Wilson (1925), Wheeler (1936), and Guntersville (1939) in Alabama;

and Hales Bar (1913), Chickamauga (1940), Watts Bar (1942), and Fort Loudoun (1943) in Tennessee. Its chief tributaries, besides the Holston and French Broad, are the Little Tennessee, Hiwassee, Paint Rock, Duck, and Ocoee (Toccoa) rivers, all entering from a southerly direction; and Clinch, Flint, Sequatchie, and Elk rivers from a northerly direction. The main riparian cities are Chattanooga and Knoxville in Tennessee and Florence in Alabama.

**Tennessee-Tombigbee Waterway,** American waterway linking the Tennessee River in northeastern Mississippi with the Tombigbee River in western Alabama. The 234-mile (376-kilometre) system of locks and canals along the upper Tombigbee River south to Demopolis, Ala., gives access via the lower Tombigbee to the Gulf of Mexico at Mobile, Ala. The waterway was built (1971–84) to provide an alternate and shorter route to the Gulf than the Mississippi River for Appalachian coal and agricultural products from neighbouring Southern states, as well as to draw more businesses to the region. Barge traffic began moving along the system in January 1985.

**Tennessee Valley Authority** (TVA), U.S. government agency established in 1933 to control floods, improve navigation, improve the living standards of farmers, and produce electrical power along the Tennessee River and its tributaries. The Tennessee River was subject to severe periodic flooding, and navigation along the river's middle course was interrupted by a series of shoals at Muscle Shoals, Ala. In 1933 the U.S. Congress passed a bill establishing the TVA, thus consolidating all the activities of the various government agencies in the area and placing them under the control of a single one. A massive program of building dams, hydroelectric generating stations, and flood-control projects ensued. The fusion of a broad range of specific powers with a sense of social responsibility to the region made the TVA significant as a prototype of natural-resource planning. Its jurisdiction is generally limited to the drainage basin of the Tennessee River, which covers parts of seven states: Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia. The TVA is a public corporation governed by a board of three directors appointed by the president with the advice and consent of the Senate. The constitutionality of the TVA was immediately challenged upon the agency's establishment, but it was upheld by the Supreme Court in the case of *Ashwander* v. *Tennessee Valley Authority* (1936) and in later decisions.

All dams in the system are managed as a unit, with primary emphasis on flood control, which has proved extremely effective; no major flood damage has occurred on the Tennessee River since the system of dams was completed. The TVA has built navigation locks into each of its nine main dams, deepened and otherwise improved the channel, and encouraged the development of port facilities along the river. As a result, traffic on the river increased from 33,000,000 ton-miles in 1933 to several billion ton-miles by the late 20th century. The cheap electricity provided by the new dams spurred the industrial development of what had been a chronically depressed regional economy. The waters impounded by the dams created the "Great Lakes of the South," which the TVA helped develop into a prime boating, fishing, and recreational area. The TVA carried out a vigorous mosquito eradication program on its reservoirs, thus eliminating the endemic malaria that had previously been traceable to the river. The agency also improved forestry and land conservation practices in the region.

The most controversial activity of the TVA is the production and sale of electric power, which has been resisted by privately owned power companies. The TVA contracts with municipalities and cooperatives to supply wholesale power for distribution and has joined with them in purchasing the facilities of privately owned electric-utility companies in the region. These purchases have established an integrated power service area in which the TVA is the sole supplier of power. The TVA power system, which includes more than 50 dams, as well as coal-fired thermal plants and operable nuclear plants, possesses a huge generating capacity. Power is sold in bulk, about half to federal agencies and half to large industries and locally owned municipal and cooperative distribution systems; and electric rates in the Tennessee River valley are among the lowest in the nation. Because of critics' claims that the low rates are made possible by the TVA's tax exemption and lack of obligation to show a profit on its operations, a schedule of payments was worked out by which the TVA would refund to the national treasury over a period of years all federal electric-power investment in the valley. The TVA nuclear power plant program was seriously curtailed in the 1980s because of quality control problems and safety deficiencies in several plants already completed or under construction.

**Tennessee walking horse,** also called PLANTATION WALKING HORSE, breed of horse that derives its name from the state of Tennessee and from its distinctive gait—the running walk. In a broad sense, it originated from all the ancestors that could do a running walk. Allan F-I (foaled 1886), a Standardbred stallion with several crosses of Morgan breeding, had the greatest influence on the breed. The walking horse is heavier and stouter than, and lacks the refinement and style of, the American saddle horse. The head is usually carried low. Some are more sloping in the croup and more curved in the hocks than other riding horses. Tennessee walking horses average 15.2 hands (157 cm, or 62 inches) in height and weigh about 450 kg (1,000 pounds). The colours are black, chestnut, bay, brown, roan, gray, yellow, and pure white.

The running walk is a natural gait that may be improved but not acquired by a horse without the natural ability. The gait is faster than a flat-footed walk, with a speed of 10 to 13 km (6 to 8 miles) per hour. The front foot strikes the ground an instant before the diagonal hind foot. The horse has a low, gliding, reaching action, the hind foot overstepping the print of the forefoot by several inches. Official recognition as a distinct breed dates from 1935.

**Tenniel, Sir John** (b. Feb. 28, 1820, London, Eng.—d. Feb. 25, 1914, London), English illustrator and satirical artist, especially known for his work in *Punch* and his illustrations for *Alice's Adventures in Wonderland* (1865) and *Through the Looking-Glass* (1872).

Tenniel attended the Royal Academy schools and in 1836 sent his first picture to the exhibition of the Society of British Artists. In 1845 he contributed a 16-foot cartoon to the competition of designs for mural decoration of the new Palace of Westminster and received £100 and a commission for a fresco in the Upper Waiting Hall (or "Hall of Poets") in the House of Lords. In 1850 he was invited to succeed Richard Doyle as joint cartoonist with John Leech for *Punch,* a periodical Tenniel worked on for most of his life. Gradually he took over altogether the weekly drawing of the political "big cut." In his drawings for *Punch* Tenniel lent new dignity to the political cartoon. His most famous cartoon was probably "Dropping the Pilot" (1890), on the subject of Bismarck's resignation. Tenniel was knighted in 1893 and retired from *Punch* in 1901. He illustrated many books; his drawings for *Alice's Adventures in Wonderland* and *Through the Looking-Glass* are remarkably subtle and clever and are extremely well-suited to Lewis Carroll's text. These illustrations won him an international reputation and a continuing audience.



"Dropping the Pilot," cartoon by Sir John Tenniel commenting on the forced resignation of Otto von Bismarck from the government of Emperor William II (Kaiser Wilhelm) of Germany, 1890

By courtesy of the trustees of the British Museum; photograph J.R. Freeman & Co. Ltd.

**tennis,** original name LAWN TENNIS, game played on a rectangular court, in which two (singles) or four (doubles) players use strung rackets to hit a ball back and forth over a net at the centre of the court. The object is to hit the ball so that an opponent cannot reach or return it correctly.

A brief treatment of tennis follows. For full treatment, *see* MACROPAEDIA: Sports, Major Team and Individual.

Games of racket and ball (including real tennis in Great Britain, royal tennis in Australia, and court tennis in the United States, all of which are the same game and played indoors) originated from a 12th- and 13th-century French handball game called *jeu de paume* ("game of the palm"). In 1873 Major Walter Wingfield invented a game called Sphairistikè, from which modern outdoor tennis evolved. The game caught on quickly in Great Britain and spread throughout the British Empire. The All-England Croquet Club at Wimbledon later added the term Lawn Tennis to its title, and in 1877 it sponsored the first world tennis championship. Professional tennis in the United States began in 1927 with the formation of the U.S. Professional Lawn Tennis Association. In 1968 the International Tennis Federation, the governing body of tennis, sanctioned open tennis, which allowed amateur players to compete against professionals in the same tournament. The current major international team tournaments are the Davis Cup for men (begun 1900) and the Federation Cup (1963) for women's teams. The Wightman Cup (1923) between British and U.S. women's teams was discontinued after 1989. The major tournaments for individual players constitute the grand slam of tennis and consist of the national championships of Great Britain (Wimbledon), the United States, Australia, and France. *See* Sporting Record: *Tennis.*

The game is started by a player who serves the ball from behind the baseline so that it goes over the net and bounces in the opposite diagonal service court. Each player serves for an entire game, but service is alternated between players after each game. Points are scored as 15, 30, 40, and game. If a score is tied at 40–40, or deuce, play continues until one

competitor has achieved a two-point margin, although a one-point margin may be agreed to in some competitions. The first player to win six games, with a lead of two games, takes the set. In men's competition, depending on the tournament, the side that wins two out of three sets or three out of five takes the match; the best two out of three wins a match in women's competition. To accommodate the rise in television coverage, the tiebreaker was introduced in the early 1970s in some tournaments to limit the length of matches; it is usually employed when play is tied at 6–6 games. Most major tournaments use a 12-point tiebreaker in which the first player to reach 7 points by a 2-point margin wins.

**Tennis Court Oath,** French SERMENT DU JEU DE PAUME (June 20, 1789), dramatic act of defiance by representatives of the nonprivileged classes of the French nation (the Third Estate) during the meeting of the Estates-General (traditional assembly) at the beginning of the French Revolution. The deputies of the Third Estate, realizing that in any attempt at reform they would be outvoted by the two privileged orders, the clergy and the nobility, had formed, on June 17, a National Assembly. Finding themselves locked out of their usual meeting hall at Versailles on June 20 and thinking that the king was forcing them to disband, they moved to a nearby tennis court. There they took an oath never to separate until a written constitution had been established for France. In the face of the solidarity of the Third Estate, King Louis XVI relented and on June 27 ordered the clergy and the nobility to join with the Third Estate in the National Assembly.

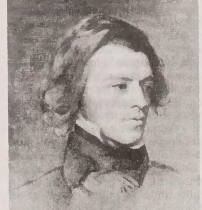
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**tennō** (Japanese: "heavenly emperor"), the title of Japan's chief of state, bestowed posthumously together with the reign name chosen by the emperor (*e.g.,* Meiji Tennō, the emperor Meiji). The term was first used at the beginning of the Nara period (710–784) as a translation of the Chinese *t'ien-huang,* or "heavenly emperor," and replaced the older title of *mikado,* or "imperial gate."

According to Japanese tradition, the imperial line was founded in 660 BC by the legendary emperor Jimmu, a direct descendant of the sun goddess Amaterasu. Around the 3rd century AD, the imperial clan defeated rival chieftains and first asserted suzerainty over central and western Japan. The imperial institution survived for 2,000 years despite the removal of individual emperors and murders resulting from court intrigues. From the 12th to 19th century, however, aristocratic and military clans held virtually all the emperor's power (*see* shogunate). In 1868 the leaders of the Meiji Restoration claimed the reestablishment of direct imperial rule and built a centralized nation-state with the emperor as the symbol of national unity; loyalty to the emperor was made a sacred duty and a patriotic obligation, though he was actually given few governmental responsibilities.

The high priest of the Shintō cult and of divine ancestry, the Japanese emperor had been invested with an aura of sacred inviolability. The defeat of Japan in World War II dealt a blow to the emperor cult and the ancient myths of divine origin; the postwar constitution referred to the emperor as a symbol of the state, without effective political power.

**Tennyson (of Aldworth and Freshwater), Alfred Tennyson, 1st Baron,** byname ALFRED, LORD TENNYSON (b. Aug. 6, 1809, Somersby, Lincolnshire, Eng.—d. Oct. 6, 1892, Aldworth, Surrey), English poet often regarded as the chief representative of the Victorian age in poetry. He was raised to the peerage in 1884.



Tennyson, detail of an oil painting by Samuel Laurence, *c.* 1840; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

*Early life and work.* Tennyson was the fourth of 12 children, born into an old Lincolnshire family, his father a rector. Alfred, with two of his brothers, Frederick and Charles, was sent in 1815 to Louth grammar school—where he was unhappy. He left in 1820, but, though home conditions were difficult, his father managed to give him a wide literary education. Alfred was precocious, and before his teens he had composed in the styles of Alexander Pope, Sir Walter Scott, and John Milton. To his youth also belongs *The Devil and the Lady* (a collection of previously unpublished poems published posthumously in 1930), which shows an astonishing understanding of Elizabethan dramatic verse. Lord Byron was a dominant influence on the young Tennyson.

At the lonely rectory in Somersby the children were thrown upon their own resources. All writers on Tennyson emphasize the influence of the Lincolnshire countryside on his poetry: the plain, the sea about his home, "the sand-built ridge of heaped hills that mound the sea," and "the waste enormous marsh."

In 1824 the health of Tennyson's father began to break down, and he took refuge in drink. Alfred, though depressed by unhappiness at home, continued to write, collaborating with Frederick and Charles in *Poems by Two Brothers* (1826; dated 1827). His contributions (more than half the volume) are mostly in fashionable styles of the day.

In 1827 Alfred and Charles joined Frederick at Trinity College, Cambridge. There Alfred made friends with Arthur Hallam, the gifted son of the historian Henry Hallam. This was the deepest friendship of Tennyson's life. The friends became members of the Apostles, an exclusive undergraduate club of earnest intellectual interests. Tennyson's reputation as a poet increased at Cambridge. In 1829 he won the chancellor's gold medal with a poem called *Timbuctoo.* In 1830 *Poems, Chiefly Lyrical* was published; and in the same year Tennyson, Hallam, and other Apostles went to Spain to help in the unsuccessful revolution against Ferdinand VII. In the meantime, Hallam had become attached to Tennyson's sister Emily but was forbidden by her father to correspond with her for a year.

In 1831 Tennyson's father died. Alfred's misery was increased by his grandfather's discovery of his father's debts. He left Cambridge without taking a degree, and his grandfather made financial arrangements for the family. In the same year, Hallam published a eulogistic article on *Poems, Chiefly Lyrical* in *The English-man's Magazine.* He went to Somersby in 1832 as the accepted suitor of Emily.

In 1832 Tennyson published another volume of his poems (dated 1833), including "The Lotos-Eaters," "The Palace of Art," and "The Lady of Shalott." Among them was a satirical epigram on the critic Christopher North (pseudonym of the Scottish writer John Wilson), who had attacked *Poems, Chiefly Lyrical* in *Blackwood's Magazine.* Tennyson's sally prompted a scathing attack on his new volume in the *Quarterly Review.* The attacks distressed Tennyson, but he continued to revise his old poems and compose new ones.

In 1833 Hallam's engagement was recognized by his family, but while on a visit to Vienna in September he died suddenly. The shock to Tennyson was severe. It came at a depressing time; three of his brothers, Edward, Charles, and Septimus, were suffering from mental illness, and the bad reception of his own work added to the gloom. Yet it was in this period that he wrote some of his most characteristic work: "The Two Voices" (of which the original title, significantly, was "Thoughts of a Suicide"), "Ulysses," "St. Simeon Stylites," and, probably, the first draft of "Morte d'Arthur." To this period also belong some of the poems that became constituent parts of *In Memoriam,* celebrating Hallam's death, and lyrics later worked into *Maud.*

In May 1836 his brother Charles married Louisa Sellwood of Horncastle, and at the wedding Alfred fell in love with her sister Emily. For some years the lovers corresponded, but Emily's father disapproved of Tennyson because of his bohemianism, addiction to port and tobacco, and liberal religious views; and in 1840 he forbade the correspondence. Meanwhile the Tennysons had left Somersby and were living a rather wandering life nearer London. It was in this period that Tennyson made friends with many famous men, including the politician William Ewart Gladstone, the historian Thomas Carlyle, and the poet Walter Savage Landor.

*Major literary work.* In 1842 Tennyson published *Poems,* in two volumes, one containing a revised selection from the volumes of 1830 and 1832, the other, new poems. The new poems included "Morte d'Arthur," "The Two Voices," "Locksley Hall," and "The Vision of Sin" and other poems that reveal a strange naïveté, such as "The May Queen," "Lady Clara Vere de Vere," and "The Lord of Burleigh." The new volume was not on the whole well received. But the grant to him at this time, by the prime minister, Sir Robert Peel, of a pension of £200 helped to alleviate his financial worries. In 1847 he published his first long poem, *The Princess,* a singular anti-feminist fantasia.

The year 1850 marked a turning point. Tennyson resumed his correspondence with Emily Sellwood, and their engagement was renewed and followed by marriage. Meanwhile, Edward Moxon offered to publish the elegies on Hallam that Tennyson had been composing over the years. They appeared, at first anonymously, as *In Memoriam* (1850), which had a great success with both reviewers and the public, won him the friendship of Queen Victoria, and helped bring about, in the same year, his appointment as poet laureate.

*In Memoriam* is a vast poem of 131 sections of varying length, with a prologue and epilogue. Inspired by the grief Tennyson felt at the untimely death of his friend Hallam, the poem touches on many intellectual issues of the Victorian Age as the author searches for the meaning of life and death and tries to come to terms with his sense of loss. Most notably, *In Memoriam* reflects the struggle to reconcile traditional religious faith and belief in immortality with the emerging theories of evolution and modern geology. The verses show the development over three years of the poet's acceptance and understanding of his friend's death and conclude with an epilogue, a happy marriage song on the occasion of the wedding of Tennyson's sister Cecilia.

After his marriage, which was happy, Ten-

nyson's life became more secure and outwardly uneventful. There were two sons: Hallam and Lionel. The times of wandering and unsettlement ended in 1853, when the Tennysons took a house, Farringford, in the Isle of Wight. Tennyson was to spend most of the rest of his life there and at Aldworth (near Haslemere, Surrey).

Tennyson's position as the national poet was confirmed by his *Ode on the Death of the Duke of Wellington* (1852)—though some critics at first thought it disappointing—and the famous poem on the charge of the Light Brigade at Balaklava, published in 1855 in *Maud and Other Poems*. *Maud* itself, a strange and turbulent "monodrama," provoked a storm of protest; many of the poet's admirers were shocked by the morbidity, hysteria, and bellicosity of the hero. Yet *Maud* was Tennyson's favourite among his poems.

A project that Tennyson had long considered at last issued in *Idylls of the King* (1859), a series of 12 connected poems broadly surveying the legend of King Arthur from his falling in love with Guinevere to the ultimate ruin of his kingdom. The poems concentrate on the introduction of evil to Camelot because of the adulterous love of Lancelot and Queen Guinevere, and on the consequent fading of the hope that had at first infused the Round Table fellowship. *Idylls of the King* had an immediate success, and Tennyson, who loathed publicity, had now acquired a sometimes embarrassing public fame. The *Enoch Arden* volume of 1864 perhaps represents the peak of his popularity. New Arthurian *Idylls* were published in *The Holy Grail, and Other Poems* in 1869 (dated 1870). These were again well received, though some readers were beginning to show discomfort at the "Victorian" moral atmosphere that Tennyson had introduced into his source material from Sir Thomas Malory.

In 1874 Tennyson decided to try his hand at poetic drama. *Queen Mary* appeared in 1875, and an abridged version was produced at the Lyceum in 1876 with only moderate success. It was followed by *Harold* (1876; dated 1877), *Becket* (not published in full until 1884), and the "village tragedy" *The Promise of May*, which proved a failure at the Globe in November 1882. This play—his only prose work—shows Tennyson's growing despondency and resentment at the religious, moral, and political tendencies of the age. He had already caused some sensation by publishing a poem called "Despair" in *The Nineteenth Century* (November 1881). A more positive indication of Tennyson's later beliefs appears in "The Ancient Sage," published in *Tiresias and Other Poems* (1885). Here the poet records his intimations of a life before and beyond this life.

Tennyson accepted a peerage (after some hesitation) in 1884. In 1886 he published a new volume containing "Locksley Hall Sixty Years After," consisting mainly of imprecations against modern decadence and liberalism and a retraction of the earlier poem's belief in inevitable human progress.

In 1889 Tennyson wrote the famous short poem "Crossing the Bar," during the crossing to the Isle of Wight. In the same year he published *Demeter and Other Poems*, which contains the charming retrospective "To Mary Boyle," "The Progress of Spring," a fine lyric written much earlier and rediscovered, and "Merlin and the Gleam," an allegorical summing-up of his poetic career. In 1892 his play *The Foresters* was successfully produced in New York City. Despite ill health, he was able to correct the proofs of his last volume, *The Death of Oenone, Akbar's Dream, and Other Poems* (1892).

*Assessment.* Alfred, Lord Tennyson was the leading poet of the Victorian Age in England and by the mid-19th century had come to occupy a position similar to that of Alexander Pope in the 18th. Tennyson was a consummate poetic artist, consolidating and refining the traditions bequeathed to him by his predecessors in the Romantic movement—especially Wordsworth, Byron, and Keats. His poetry is remarkable for its metrical variety, rich descriptive imagery, and exquisite verbal melodies. But Tennyson was also regarded as the preeminent spokesman for the educated middle-class Englishman, in moral and religious outlook and in political and social consciousness no less than in matters of taste and sentiment. His poetry dealt often with the doubts and difficulties of an age in which established Christian Faith and traditional assumptions about man's nature and destiny were increasingly called into question by science and modern progress. His poetry dealt with these misgivings, moreover, as the intimate personal problems of a sensitive and troubled individual inclined to melancholy. Yet through his poetic mastery—the spaciousness and nobility of his best verse, its classical aptness of phrase, its distinctive harmony—he conveyed to sympathetic readers a feeling of implicit reassurance, even serenity. Tennyson may be seen as the first great English poet to be fully aware of the new picture of man's place in the universe revealed by modern science. While the contemplation of this unprecedented human situation sometimes evoked his fears and forebodings, it also gave him a larger imaginative range than most of the poets of his time and added a greater depth and resonance to his art.

Tennyson's ascendancy among Victorian poets began to be questioned even during his lifetime, however, when Robert Browning and Algernon Charles Swinburne were serious rivals. And 20th-century criticism, influenced by the rise of a new school of poetry headed by T.S. Eliot (though Eliot himself was an admirer of Tennyson), has proposed some drastic devaluations of his work. Undoubtedly much in Tennyson that appealed to his contemporaries has ceased to appeal to many readers today. He can be mawkish and banal, pompous and orotund, offering little more than the mellifluous versifying of shallow or confused thoughts. The rediscovery of such earlier poets as John Donne or Gerard Manley Hopkins (a poet of Tennyson's own time who was then unknown to the public), together with the widespread acceptance of Eliot and W.B. Yeats as the leading modern poets, opened the ears of readers to a very different, and perhaps more varied, poetic music. A more balanced estimate of Tennyson has begun to prevail, however, with the recognition of the enduring greatness of "Ulysses," the unique poignancy of Tennyson's best lyric poems, and, above all, the stature of *In Memoriam* as the great representative poem of the Victorian Age. It is now also recognized that the realistic and comic aspects of Tennyson's work are more important than they were thought to be during the period of the reaction against him. Finally, the perception of the poet's awed sense of the mystery of life, which lies at the heart of his greatness, as in "Crossing the Bar" or "Flower in the Crannied Wall," unites his admirers in this century with those in the last. Though less of Tennyson's work may survive than appeared likely during his Victorian heyday, what does remain—and it is by no means small in quantity—seems likely to be imperishable. (W.W.R./Ed.)

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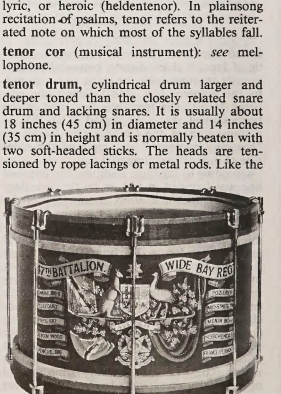
**tenor,** highest male vocal range, normally extending approximately from the second B below middle C to the G above; an extremely high voice, extending into the alto range, is usually termed a countertenor (*q.v.*). In instrument families, tenor refers to the instrument of more or less comparable range (*e.g.*, tenor horn).

In the polyphonic (multipart) music of the 13th–16th century, tenor referred to the part "holding" the cantus firmus, the plainsong, or other melody on which a composition was usually built. The highest line above was termed *superius* (the modern soprano), and the third added voice was termed *contratenor*. In the mid-15th century, writing in four parts became common, and the *contratenor* part gave rise to the *contratenor altus* (the modern alto) and *contratenor bassus* (the modern bass). The term tenor gradually lost its association with a cantus firmus and began to refer to the part between the alto and bass and to the corresponding vocal range.

Tenor voices are often classified as dramatic, lyric, or heroic (heldentenor). In plainsong recitation of psalms, tenor refers to the reiterated note on which most of the syllables fall.

**tenor cor** (musical instrument): *see* mellophone.

**tenor drum,** cylindrical drum larger and deeper toned than the closely related snare drum and lacking snares. It is usually about 18 inches (45 cm) in diameter and 14 inches (35 cm) in height and is normally beaten with two soft-headed sticks. The heads are tensioned by rope lacings or metal rods. Like the




Military tenor drum (rod-tensioned)
Messrs. H. Potter, Aldershot, Hampshire, Eng.

snare drum, the tenor drum descended from the medieval tabor. Though usually associated with military bands, especially since the early 19th century, it occasionally appears in orchestral scores, such as Benjamin Britten's opera *The Rape of Lucretia* (1946).

**tenor horn,** also called ALTHORN, or ALTO HORN, brass wind instrument derived from the cornet and the valved bugle, or flügelhorn. A saxhorn of tenor range and a tenor bugle are also sometimes called tenor horns.

The tenor horn was used in Prussian cavalry bands by 1829. It has three valves, a cup mouthpiece, and a narrow bore and medium

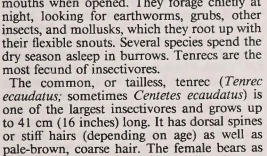
bell. Though usually pitched in B-flat, it is also built in A and C.

**tenorite,** copper oxide mineral (CuO) found as gray-to-black metallic crystals as a sublimation product on lavas. Melaconite, the massive variety, is common as earthy deposits in the oxidized zone of copper lodes. Crystals of tenorite have been identified at Mount Vesuvius and Mount Etna, Italy, and at Lostwithiel, Cornwall, Eng. Melaconite is abundant at Huerta de Arriba, Burgos, Spain, and at Bisbee, Ariz., where it was mined (1880–1902) as a copper ore. For detailed physical properties, *see* oxide mineral (table).

**tenpins** (game): *see* bowling.

**tenrec,** also spelled TANREC, any of the 23 varied species of mammals constituting the family Tenrecidae, order Insectivora. Except for the otter shrew, which is sometimes placed in a separate family, tenrecs are confined natively to Madagascar and the Comoro Islands. Typical tenrecs are round-bodied, bigheaded animals with pointed faces and very wide mouths when opened. They forage chiefly at night, looking for earthworms, grubs, other insects, and mollusks, which they root up with their flexible snouts. Several species spend the dry season asleep in burrows. Tenrecs are the most fecund of insectivores.

The common, or tailless, tenrec (*Tenrec ecaudatus;* sometimes *Centetes ecaudatus*) is one of the largest insectivores and grows up to 41 cm (16 inches) long. It has dorsal spines or stiff hairs (depending on age) as well as pale-brown, coarse hair. The female bears as many as 21 young (usually 12 to 16) at a time, which may be a record among mammals. The streaked, or banded, tenrec (*Hemicentetes semispinosus*), 18 cm (7 inches) long, has black-and-white bands along the body and at any age is prickly on the midback. The Madagascar hedgehog is the 18-centimetre-long spiny tenrec (*Setifer setosus;* sometimes *Ericulus setosus*); it is fully spined and looks almost like a true hedgehog.



Streaked tenrec (*Hemicentetes semispinosus*)
H. Uible—Photo Researchers

Other species of tenrecs may have soft fur. The three rice tenrecs (genus *Oryzorictes*) are molelike forms that burrow in rice fields for insects and do considerable damage to crops therein. An arboreal species is the long-tailed tenrec (*Microgale longicaudata*), whose tail is more than twice as long as its body. The web-footed tenrec (*Limnogale mergulus*) resembles a muskrat.

**Tenreiro, Francisco José (de Vasques)** (b. Jan. 20, 1921, São Tomé—d. Dec. 31, 1963, Lisbon), African poet writing in Portuguese, whose verse expresses the sufferings caused by colonialist exploitation of the indentured labourers of the island of São Tomé.

Tenreiro, the son of a Portuguese administrator and an African woman, spent much of his life in Portugal, where he earned a doctorate in geography from the University of Lisbon in 1961. Subsequently, he worked as a professor at the Higher Institute for Overseas Social and Political Sciences and became a deputy representing São Tomé and Príncipe in the Portuguese National Assembly.

Tenreiro's two volumes of poems, *Ilha do Nome Santo* (1942; "Island of a Holy Name") and the posthumous *Coração em Africa* (1964; "Courage in Africa"), record both a love of Africa as well as a fraternal bond with oppressed blacks throughout the world. A scholar of merit as well as a literary critic, he wrote *Panorama de Literatura Norte-Americana* (1945), which was inspired by reading black poets of the Harlem Renaissance. In 1958 he coedited, with Mário de Andrade, a major anthology of Lusophone African poetry, *Antologia de Poesia Negra de Expressão Portuguesa.*

*Where the same name may denote a person, place, or thing, the articles will be found in that order*

**Tenri,** city, Nara *ken* (prefecture), Honshu, Japan. It lies in the eastern part of the Nara basin. The area around the city contains many burial mounds and shrines dating from early historic times. Tenri became well-known in 1881, when the headquarters and main temple of Tenrikyō, a Shintō sect, were moved to the city. As a result, the city's population grew rapidly, and numerous religious and cultural facilities were established there. The city also houses Tenri University and a museum of Japanese folklore. In the western rural area of Tenri, rice and watermelons are cultivated. The city is connected with Nara by two railway lines. Pop. (1985 est.) 69,130.

**Tenrikyō** (Japanese: "Religion of Divine Wisdom"), largest and most successful of the modern Shintō sects in Japan. Though founded in the 19th century, it is often considered in connection with the evangelistic "new religions" of contemporary Japan.

Tenrikyō originated with Nakayama Miki (1798–1887), a charismatic peasant from Yamato Province (modern Nara Prefecture), who claimed she became possessed by a god called Tenri Ō no Mikoto ("Lord of Divine Wisdom") when she was 40 years old. She developed a worship characterized by ecstatic dancing and shamanistic practices, and a simple doctrine (based on the oracles transmitted through her) emphasizing charity and the healing of disease through mental acts of faith. The sect became popular in her lifetime, though it often met with persecution from state authorities. Her writings and her deeds were considered divine models, and she was widely venerated during her lifetime and since. The founder, Nakayama, was succeeded by Master Iburi (d. 1907); since his death, the leader of the sect has always been a member of the Nakayama family.

Tenrikyō was first considered a branch of the Yoshida sect of Shintō. In 1880 it changed its affiliation to Buddhism and from 1908 has been recognized as one of the 13 groups that compose Kyōha Shintō (*q.v.*). Tenrikyō was one of the most powerful religious movements in Japan immediately before World War II and has retained a large following. In 1980 its membership was about 2,500,000.

The goal of Tenrikyō is a happy life free from disease and suffering. The modern sect emphasizes modern medical care. The centre of religious activity is the *jiba,* a sacred recess in the sanctuary of the main temple in Tenri city (Nara Prefecture). The world is said to have been created here, and from the *jiba* salvation will finally be extended to the entire world. Every member of Tenrikyō is expected to carry on missionary work. In the propagation of its teaching, the sect has founded a radio station, a university, and an outstanding library. More than 200 churches have been established in other countries, including the United States, Brazil, Korea, China, the Philippines; they serve mainly Japanese living abroad.

**tense,** in grammar, a verbal category relating the time of a narrated event to the time of the speech event. In many languages the concept of time is expressed not by the verb but by other parts of speech (temporal adverbials or even nouns, for example).

Time is frequently perceived as a continuum with three main divisions: past, present, and future. The past and future times are defined in relation to the present time (now). Past tense refers to any time before the present time, and future tense refers to any time after the present. Not all languages perceive this relationship as a linear one, nor do these categories characterize all possible times. Tense, then, is a grammatical expression of time reference. The correlation between tense and time is not necessarily one-to-one; languages do not recognize as many oppositions of tense as they have conceptions of time. English has past, present, and future times, but only a past and a nonpast opposition of tense.

*past:* John ate lasagna.
*present:* John is eating lasagna.
*future:* John will eat lasagna.

Grammatical tense may not equal real time:

The flight is leaving at 5:00 PM.
That will be $5.00, please. [At a grocery checkout line.]

In the first sentence, the verb form that usually indicates present time is here used to indicate future time. In the second sentence, the verb form usually indicating future time is here used to indicate present time. The past form of the verb generally refers to past time, to a narrated event prior to the speech event.

In other languages the category of tense may express other oppositions, such as proximate versus nonproximate, now versus not now, etc. In English, however, the grammatical category of tense relates to the ontological concept of time in a binary opposition: past versus nonpast. Nonpast tense is considered "unmarked" for tense and thus can comprise present, future and even past times. With the exception of some problematic modal constructions—such as *would* in "John said he would go tomorrow," in which *would* is grammatically a past tense of *will* but is used to indicate future time—the past tense indicates only past time and is thus said to be "marked" with respect to tense. Other grammatical categories, such as mood and aspect, may add another dimension to the time reference, further specifying the action as definite or indefinite, completed or not completed, lasting or nonlasting.

**Tenshin:** *see* Okakura Kakuzō.

**Tenshō Kōtai Jingū-kyō** (Japanese: "Religion of the Shrine of the Heavenly Goddess"), also called ODORU SHŌKYŌ ("Dancing Religion"), one of the "new religions" of Japan that have emerged in the post-World War II period. It was founded by Kitamura Sayo (1900–67), a peasant of Yamaguchi Prefecture, whose charismatic preaching took the form of rhythmic singing and dancing. She had a revelation in 1945 that she was possessed by a Shintō deity, Tenshō-Kōtaijin (another name for the Shintō sun goddess Amaterasu Ōmikami). She traveled widely and won followers in Europe and the Americas. Her eccentric behaviour and forthright condemnation of organized institutions of religion and government, whom she characteristically referred to as "maggot beggars," won her an enthusiastic following, estimated at about 300,000 a few years after her death.

**Tenshō Shūbun:** *see* Shūbun.

**Tensift, Oued,** river in west-central Morocco. The Oued Tensift rises from several headstreams in the Haut (High) Atlas moun-

tains and flows westward for 160 miles (260 km) to the Atlantic Ocean south of Safi. The Tensift's river valley, the Haouz lowland, has been transformed from an arid wasteland into a fertile farming region by the construction of irrigation and hydroelectric dams along the river's course. Wheat, olives, fruit, vegetables, and grapes are grown. Chief tributaries of the Tensift include the Chichauoa and N'fis rivers. Marrakech is the agricultural market centre and largest town of the valley, while Safi serves as its port.

**tensile strength,** maximum load that a material can support without fracture when being stretched, divided by the original cross-sectional area of the material. Tensile strengths have dimensions of force per unit area and in the English system of measurement are commonly expressed in units of pounds per square inch, often abbreviated to psi. When stresses less than the tensile strength are removed, a material returns either completely or partially to its original shape and size. As the stress reaches the value of the tensile strength, however, a material, if ductile, that has already begun to flow plastically rapidly forms a constricted region called a neck, where it then fractures.

**Tenskwatawa** (Shawnee Indian leader): *see* Prophet, The.

**tensor analysis,** branch of mathematics concerned with relations or laws that remain valid regardless of the system of coordinates used to specify the quantities. Such relations are called covariant. Tensors were invented as an extension of vectors to formalize the manipulation of geometric entities arising in the study of mathematical manifolds.

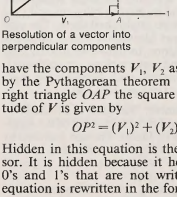
A brief treatment of tensor analysis follows. For full treatment, *see* MACROPAEDIA: Analysis (in Mathematics): *Vector and tensor analysis*.

A vector is an entity that has both magnitude and direction; it is representable by a drawing of an arrow, and it combines with similar entities according to the parallelogram law. Because of that law, a vector has components—a different set for each coordinate system. When the coordinate system is changed, the components of the vector change according to a mathematical law of transformation deducible from the parallelogram law. This law of transformation of the components has two important properties: first, if we start in a particular coordinate system and, after a sequence of changes, end up in the original system, the components of the vector will be the same as at the start. Second, relationships among vectors—for example, three vectors $U$, $V$, $W$ such that $2U + 5V = 4W$—will be present in the components regardless of the coordinate system.

A vector therefore may be regarded as an entity that, in $n$-dimensional space, has $n$ components that transform according to a specific law of transformation having the above properties. The vector itself is an objective entity independent of coordinates, but it is treated in terms of components with all coordinate systems on an equal footing.

Without insisting on a pictorial image, a tensor is defined as an objective entity having components that change according to a transformation law that is a generalization of the vectorial transformation law but that retains the two key properties of that law. For convenience the coordinates are usually numbered from 1 to $n$, and each component of a tensor is denoted by a letter having superscripts and subscripts, each of which independently takes on the values 1 to $n$. Thus a tensor represented by the components $T^{ab}_{c}$ would have $n^3$ components as the values of $a$, $b$, and $c$ run from 1 to $n$. Scalars and vectors constitute special cases of tensors, the former possessing only one component per coordinate system and the latter possessing $n$. Any linear relation between tensor components, such as $7R^{a}_{b.cd} + 2S^{a}_{b.cd} - 3T^{a}_{b.cd} = 0$, if valid in one coordinate system, is valid in all and thus represents a relationship that is objective and independent of coordinate systems in spite of the lack of a pictorial representation.

Two tensors, called the metrical tensor and the curvature tensor, are of particular interest. The metrical tensor is used, for example, in converting vector components into magnitudes of vectors. For simplicity, consider the two-dimensional case with simple perpendicular coordinates. Let vector $V$ in the Figure



Resolution of a vector into perpendicular components

have the components $V_1$, $V_2$ as shown. Then by the Pythagorean theorem applied to the right triangle $OAP$ the square of the magnitude of $V$ is given by

$$OP^2 = (V_1)^2 + (V_2)^2 .$$

Hidden in this equation is the metrical tensor. It is hidden because it here consists of 0's and 1's that are not written in. If the equation is rewritten in the form

$$OP^2 = 1(V_1)^2 + 0V_1V_2 + 0V_2V_1 + 1(V_2)^2 ,$$

the full set of components (1, 0, 0, 1) of the metrical tensor is apparent. If oblique coordinates are used, the formula for $OP^2$ takes the more general form

$$OP^2 = g_{11}(V_1)^2 + g_{12}V_1V_2 + g_{21}V_2V_1 + g_{22}(V_2)^2 ,$$

the quantities $g_{11}$, $g_{12}$, $g_{21}$, $g_{22}$ being the new components of the metrical tensor.

Out of the metrical tensor it is possible to construct a complicated tensor, called the curvature tensor, that represents the various aspects of the intrinsic curvature of the $n$-dimensional space to which it belongs.

Tensors have many applications in geometry and physics. In creating his general theory of relativity, Einstein argued that the laws of physics must be the same no matter what coordinate system one uses. This led him to express those laws in terms of tensor equations. It was already known from his special theory of relativity that time and space are so closely interrelated as to constitute an indivisible four-dimensional space-time. Einstein postulated that gravitation should be represented solely in terms of the metrical tensor of four-dimensional space-time. To express the relativistic law of gravitation, he had as building blocks the metrical tensor and the curvature tensor formed from it. Once he decided to confine himself to these building blocks, their very paucity led him to an essentially unique tensor equation for the law of gravitation, in which gravitation emerged not as a force but as a manifestation of the curvature of space-time.

While tensors had been studied earlier, it was the success of Einstein's general theory of relativity that gave rise to the current widespread interest of mathematicians and physicists in tensors and their applications.

**tent,** portable shelter, consisting of a rigid framework covered by some flexible substance. Tents are used for a wide variety of purposes, including recreation, exploration, military encampment, and public gatherings such as circuses, religious services, theatrical performances, and exhibitions of plants or livestock. Tents have also been the dwelling places of most of the nomadic peoples of the world, from ancient civilizations such as the Assyrian to the 20th-century Bedouins of North Africa and the Middle East. American Indians developed two types of tent, the conical tepee and the arched wigwam, the latter constructed of thin branches or poles covered with bark or animal hides.

The simplest form of tent is an extremely portable type carried by individual soldiers in the field. When erected, it consists of a low pyramid, formed by a short, diagonally set pole at either end supporting two lengths of cloth joined together at the top and pegged into the ground at the bottom. This is a primitive form of the popular pyramidal A-shaped tent. A long-common tent, the conical bell tent, has a single large vertical pole at its centre and is circular at ground level. The tepee (*q.v.*) is a variant of this design. Other kinds of tent include the wall tent, an A-shaped tent raised to accommodate straight, vertical walls beneath the slope of the pyramid; the Baker tent, which is a rectangular fabric lean-to with an open front protected by a projecting horizontal flap; the umbrella tent, which was originally made with internal supporting arms like an umbrella but which later became widely popular with external framing of hollow aluminum; and the cabin tent, resembling a wall tent with walls four to six feet high. Special tent designs include mountain tents, which are designed compactly for use in conditions of extreme cold and heavy snow, and back-packing tents, which use extremely lightweight synthetic fabrics and lightweight metal poles. "Pop" tents are designed with spring-loaded frames that erect the tent automatically when released; these are usually hemispheric in shape.

**tent caterpillar moth,** any member of the insect genus *Malacosoma* of the Lasiocampidae family of moths (order Lepidoptera) that


(Top) Tent moth (bottom) tent caterpillars
(Top) L. Hugh Newman and (bottom) G. E. Hyde from the Natural History Photographic Agency—EB Inc.

also includes the eggars, named for their egg-shaped cocoons, and the lappets, having lateral lobes, or lappets, on each segment of the larva. The tent caterpillars, which spin huge, tent-shaped communal webs in trees, are stout-bodied and usually yellowish brown, with a typical wingspan of 2.5 to 75 millimetres (1 to 3 inches). Many species have feathery antennae and hairy bodies and legs. The larvae are often brightly coloured and can defoliate forest, fruit, and ornamental trees.

The eastern tent caterpillar moth *Malacosoma americanum* of eastern North America deposits its eggs in a band on a tree in mid-summer. The following spring the eggs hatch, and the larvae migrate to a fork in the tree and construct a large silken tent. (Not all species form these communal webs.) The larvae leave the nest each day to feed until early summer when they are full grown. Pupation occurs in cocoons of silk mixed with a yellowish-white powder. The forest tent caterpillar moth *M. disstria* is common in the southern United States.

**tentacle worm,** also called TENTACLED TUBE WORM (*Thelepus*), any of a genus of tube-dwelling segmented worms of the class Polychaeta (phylum Annelida). They are sedentary forms that remain fixed to the sea bottom except as larvae. *T. cincinnatus,* 5 to 10 centimetres (about 2 to 4 inches) long and pale red, has lacelike markings on the backside and gills with many unbranched filaments in two separate rows. It remains attached to its underground tube along its entire length.

**tenure,** length and conditions of office in civil, judicial, academic, and similar services. Security of tenure, usually granted in the civil service and in academic appointments after a probationary period, is considered an essential condition of maintaining the independence and freedom of those services from political or partisan control. Judges in the permanent judiciary, for example, hold office during "good behaviour"—*i.e.,* for life.

Tenure, in services in which it is granted, can be terminated only on grounds of serious misconduct, incompetence, or misbehaviour. Such allegations have to be considered by a duly constituted body. In the civil service such bodies are usually disciplinary committees and tribunals; in academic appointments they are often collegial boards of peers or such overseeing bodies as trustees and university senates. The tenure of permanent judges can be terminated only by impeachment and conviction by legislatures.

The conditions as well as the duration of tenure and the manner of its guarantee vary. In the civil services of most countries, tenure is granted until a specified age of retirement, which generally ranges from age 50 to 60 years. Judges, in many instances, are appointed for life but may choose to retire from office. Professors may also have continuous or indefinite tenure. Protection of tenure for civil servants is afforded by administrative measures and for judges by means of constitutional and statutory provisions. Security of tenure and freedom from external control, particularly in the academic profession, are also ensured by a tradition of independence and an ethos of tolerance in addition to guarantees by law and regulation.

**Tenure of Office Act** (March 2, 1867), in the post-Civil War period of U.S. history, law forbidding the president to remove civil officers without senatorial consent. The law was passed over Pres. Andrew Johnson's veto by Radical Republicans in Congress in their struggle to wrest control of Reconstruction from Johnson. Vigorously opposing Johnson's conciliatory policy toward the defeated South, the Radicals gained enough strength in the congressional elections of 1866 to impose their military and civil program upon the defeated territory in the spring of 1867. At the same time, to further ensure the success of Radical Reconstruction, Congress passed the Tenure of Office Act. The act was often taken to have been aimed specifically at preventing President Johnson from removing from office Secretary of War Edwin Stanton, the Radicals' ally in the Cabinet, although during congressional debate on the bill some Republicans declared that Cabinet members would be exempt. Still, the President's attempt to thwart this law by dismissing Stanton led directly to his impeachment the following year. The Tenure of Office Act was repealed partly in 1869 and entirely in 1887 and was also declared by the U.S. Supreme Court in 1926 to have been unconstitutional.

**Tenzing Norgay** (Nepalese: "Wealthy-Fortunate Follower of Religion"), Norgay also spelled NORKEY OR NORKAY, original name NAMGYAL WANGDI (b. May 15, 1914, Tshechu, Tibet [now Tibet Autonomous Region, China]—d. May 9, 1986, Darjeeling [now Darjiling], West Bengal, India), Tibetan mountaineer who, with Edmund (later Sir Edmund) Hillary (*q.v.*) of New Zealand, was the first person to set foot on the summit of Mount Everest, the world's highest peak (29,035 feet [8,850 m]).



Tenzing Norgay
UPI—EB Inc.

It is not known exactly when, how, or under what conditions Tenzing came to live in Khumbu, Nepal, as a young boy. Among the ethnic Sherpas, immigrant Tibetans such as Tenzing are known as Khambas and have low status and little or no wealth. Tenzing worked for several years for an affluent family in Khumjung, and, as a teen, he ran away from difficult conditions and settled in Darjeeling, India. At age 19, having married an ethnic Sherpa, he was chosen as a porter for his first expedition; in 1935 he accompanied Eric Shipton's reconnaissance expedition of Everest. In the next few years he took part in more Everest expeditions than any other climber. After World War II he became a sirdar, or organizer of porters, and in this capacity accompanied a number of expeditions. In 1952 the Swiss made two attempts on the southern route up Everest, on both of which Tenzing was sirdar. He went as sirdar of the British Everest expedition of 1953 and formed the second summit pair with Hillary. From a tent at 27,900 feet (8,500 m) on the Southeast Ridge, they reached the summit at 11:30 AM on May 29.

After his feat he was regarded as a legendary hero by many Nepalese and Indians. His many honours included Britain's George Medal and the Star of Nepal (Nepal Tara). *Man of Everest* (1955; also published as *Tiger of the Snows*), written with James Ramsey Ullman, is an autobiography. *After Everest* (1978), with Malcolm Barnes, tells of his later life in Darjeeling. *Tenzing: Hero of Everest* (2003), is an excellent biography by mountaineer and journalist Ed Douglas.

**Teofilatto** (pope): *see* Benedict VIII; Benedict IX.

**Teófilo Otoni,** city, east-central Minas Gerais state, Brazil, on the Rio Todos os Santos in the Rio Mucuri Valley, 1,047 feet (319 m) above sea level. It was given city status in 1878. Teófilo Otoni is a trade centre for an agricultural hinterland in which coffee is the principal crop. Livestock raising is also of some importance, and the city has manufacturing and food-processing plants. Extensive mining and gem trading for aquamarines, topaz, brazilianite, and various forms of quartz take place there. It is situated on the Rio–Bahia Interstate Highway and is accessible by rail from Rio de Janeiro and from Belo Horizonte, the state capital, 413 miles (664 km) southwest. Pop. (2000 prelim.) 102,500.

**Teos** (Egyptian king): *see* Tachos.

**teosinte** (*Zea mexicana* or *Euchlaena mexicana*), tall, stout, annual grass of the family Poaceae, native to Mexico. Teosinte is related to corn (maize) and grows in large clumps, with tassels (staminate flowers) like those of corn. It usually branches at the base. The bundles of fruiting spikes, enclosed in husks, with the silk (long styles) hanging from the upper ends, are somewhat similar to the ears of corn. In the early 1980s botanists crossed species of corn with teosinte to produce a perennial variety of corn.

**Teotihuacán** (Nahuatl: "The City of the Gods"), the most important and largest city of pre-Aztec central Mexico, located about 30 miles (50 km) northeast of modern Mexico City. At its apogee (*c.* AD 500), it encompassed some 8 square miles (20 square km) and supported a population estimated at 125,000–200,000, making it, at the time, one of the largest cities in the world. It was the region's major economic as well as religious centre. Teotihuacán was designated a UNESCO World Heritage site in 1987.

The area was settled by 400 BC, but it did not experience large-scale urban growth until three centuries later, with the arrival of refugees from Cuicuilco, a city destroyed by volcanic activity. The basic urban plan may date to that time. About AD 750 central Teotihuacán burned. Although parts of the city were occupied after that event, much of it fell into ruin. Centuries later the area was revered by Aztec pilgrims. The culture of the Teotihuacanos spread throughout Mesoamerica, and the city carried on trade with distant regions.

In addition to some 2,000 single-story apartment compounds, the ruined city contains great plazas, temples, a canalized river, and palaces of nobles and priests. The main buildings are connected by a 130-foot- (40-m-) wide road, the Street of the Dead (Calle de los Muertos), that stretches 1.5 miles (2.4



Pyramid of the Sun, Teotihuacán
Shostal Assoc.—EB Inc.

km); oriented slightly east of true north, it points directly at the nearby sacred peak of Cerro Gordo. The Street of the Dead was once erroneously thought to have been lined with tombs, but the low buildings that flank

it appear to be palace residences. At the north end of the city is the Pyramid of the Moon, flanked by platforms and lesser pyramids; to the south the Temple of Quetzalcóatl, a huge courtyard compound covering 38 acres (15 hectares) called La Ciudadela (Citadel); to the east the great Pyramid of the Sun, constructed of about 1,000,000 cubic yards of material and measuring about 720 by 760 feet at the base and rising by five terraces to a present height of 216 feet. The pyramid is faced with hewn tezontle, a red, coarse volcanic rock of the region.

**Tepe Gawra,** ancient Mesopotamian settlement east of the Tigris River near Nineveh and the modern city of Mosul, northwestern Iraq. It was excavated from 1931 to 1938 by archaeologists from the University of Pennsylvania. The site, which apparently was continuously occupied from the Halaf Period (*c.* 5050–*c.* 4300 BC) to about the middle of the 2nd millennium BC, gave its name to the Gawra Period (*c.* 3500–*c.* 2900) of northern Mesopotamia. Prior to the Gawra Period, however, the site seems to have been influenced by the Ubaid culture (*c.* 5200–*c.* 3500) of southern Mesopotamia. That influence is seen, for example, in an Ubaidian-inspired temple at Gawra—the earliest example of a building with its walls decorated with pilasters and recesses—a Mesopotamian temple type that remained dominant throughout the following centuries. Tepe Gawra illustrates the transition from early Chalcolithic farming villages to complex settlements with mud-brick houses, stamp seals, the first metal objects, and monumental architecture. At the close of the Gawra Period, writing was invented in southern Mesopotamia; but Tepe Gawra shows that writing and advanced civilization did not reach the north until much later, the area remaining essentially the same until about 1700 BC, when non-Semites and Hurrians invaded the city.

**Tepe Yahya,** ancient Iranian site located northeast of Dowlatābād in southeastern Iran; it has yielded valuable information on the economic exchange patterns of the 3rd millennium BC. Excavations (1968–70) by the American School of Prehistoric Research have revealed that Tepe Yahya was almost continuously occupied from the middle of the 5th millennium to the end of the 3rd millennium BC. It was apparently abandoned during the 2nd millennium but was reoccupied from about 1000 BC to about AD 400. The excavated materials dating to the 3rd millennium were of particular interest and indicated that Tepe Yahya may have been a centre for the production and distribution of steatite (soapstone), a material used in making vessels, seals, and other objects. The trade, at first probably locally controlled, may later have come under Elamite influence. Design motifs on steatite bowls from Tepe Yahya parallel many motifs found in Mesopotamia and the Indus Valley and indicate that Tepe Yahya filled an important position in the economic and cultural relations between Mesopotamia, the Iranian Plateau, and the cultures to the east.

**tepee,** also spelled TIPI, tall tent dwelling of the Indians of the American Great Plains. Although it is often thought to be the dwelling used by all North American Indians, only the Plains tribes, representing about one-fifth of them, ever used the tepee, and they only for the last two or three hundred years. The introduction of horses, guns, and metal knives by the Spanish in the early 18th century enabled the Plains Indians to become swiftly moving nomads and enhanced their successful pursuit of the buffalo—whose hide offered shelter. They traded their stationary huts for the



Tepees in Banff, Alta., Can.
Alpha

portable tepee, which could be easily folded and dragged by a horse. Probably first used by the Arctic Indians as a summer home, the tepee thus became the year-round dwelling of the Plains Indians.

The tepee is made by stretching dressed and fitted buffalo skins over a skeleton of 20 to 30 wooden poles, all slanted in toward a central point and tied together a short distance from the top, giving the appearance of an inverted funnel. An adjustable flap is left open at the top to allow smoke to escape, and a flap at the bottom serves as a doorway. Tepees are usually from 12 to 20 feet (3.5 to 6 m) high.

The Indians devoted much of the nonhunting winter season to decorating their tepees with colourful paintings of animals and the hunt. The beauty and gracefulness of the tepee has made it the popular image of the home of all Indians, although such dwellings as the wigwam, wickiup, hogan, igloo, longhouse, and others were at least as important.

**Tepehuan,** Middle American Indians of southern Chihuahua, southern Durango, and northwestern Jalisco states in northwestern Mexico. The Tepehuan are divided into the Northern Tepehuan, of Chihuahua, and the Southern Tepehuan, of Durango. Both speak dialects of the same language, Tepehuan, a Uto-Aztecan language that is most closely related to Piman.

The habitat of both the Northern and the Southern Tepehuan is rugged and mountainous. The people are agricultural, growing corn (maize) and beans in small plots. The Northern Tepehuan keep a few chickens, turkeys, and goats and add to their diet a good deal of wild food. The Southern Tepehuan herd goats and eat a considerable amount of goat cheese and, occasionally, goat meat. Settlements are usually scattered, towns and villages being little more than governmental centres or mestizo population centres. Houses are stone or adobe for the Southern Tepehuan, log or plank among the Northern Tepehuan. Northern Tepehuan women weave blankets; otherwise, no traditional crafts are practiced. Clothing consists of white cotton jacket and pants for the men who do not wear commercially made clothing; women wear homemade but nontraditional printed cotton dresses or skirts and blouses.

Religion among both the Northern and Southern Tepehuan is a mixture of folk Roman Catholicism and native elements. Official Roman Catholic sacraments occur to some extent, particularly among the Southern Tepehuan; in the north not even these are important. God, Jesus, the Virgin Mary, and the saints are mixed in native pantheons in both regions, alongside such figures as the Deer God, mountain spirits, the Morning Star, and a culture hero resembling Quetzalcóatl of Aztec myth.

**tephillin** (Judaism): *see* phylactery.

**tephrochronology,** method of age determination that makes use of layers of ash (tephra). Tephra layers are excellent time-stratigraphic markers, but, to establish a chronology, it is necessary to identify and correlate as many tephra units as possible over the widest possible area. Because of the large number of violent volcanic explosions in Iceland, Sigurdur Thorarinsson, an Icelander who was the founder of the science of tephrochronology, was able to establish a detailed chronology of preoccupational and postoccupational geologic and archaeological events there. Tephrochronology enabled Thorarinsson to make a thorough study of the changes in climate in Iceland and the effect of agriculture on Icelandic ecology.

Japan is another fertile field for tephrochronological studies, and, not surprisingly, Japanese scientists have greatly contributed to the development of the science. In western North America, Pleistocene tephra (those from 10,000 to 1,600,000 years old) have been correlated over a distance greater than 1,600 km (1,000 miles). Tephra may be traced from the land areas into the ocean basins and, thus, may provide one of the most effective techniques for correlating terrigenous with marine stratigraphic deposits.

**tephroite,** olivine mineral found only in iron-manganese ore deposits and skarns and in metamorphosed manganese-rich sediments, such as those of Cornwall, Eng., and Franklin, N.J., in the United States. Tephroite (manganese silicate; $Mn_2SiO_4$) forms a solid solution series with the olivine fayalite in which iron completely replaces manganese in the molecular structure. Minerals intermediate in composition to these are called knebelite. For detailed physical properties, *see* olivine (table).

**Tepic,** city, capital of Nayarit *estado* ("state"), west-central Mexico, lying at 3,002 feet (915 m) above sea level along the Tepic River, at the foot of extinct Sangangüey volcano. Founded in 1542, much of the city retains its colonial atmosphere. The cathedral, municipal palace, and Amado Nervo Theatre especially reflect Spanish influence. Shops offer Indian handicrafts, and Huichol and Cora Indians attend market in their traditional costumes. The name is Nahuatl Indian for "hard stone." Its isolation limited growth until construction of the railroad in 1912. Since then Tepic has become a commercial and industrial as well as an agricultural centre. The surrounding farmlands yield various crops, including corn (maize), sugarcane, rice, coffee, and tobacco. In the city are refineries, rice mills, and other processing plants. The University of Nayarit (1969) was founded in 1930 as the Nayarit Institute of Science and Letters. Tepic can be reached by highway, railroad, and air. Pop. (2001 est.) 270,000.

**Teplice,** formerly TEPLICE-ŠANOV, German TEPLITZ-SCHÖNAU, city, Severočeský *kraj* (region), northwestern Czech Republic, on a rocky spur below the Ore Mountains (Krušné hory). Local radioactive springs (82°–115° F [28°–46° C]) were, according to archaeological evidence, known to the Romans and are mentioned in an 8th-century Bohemian legend. In 1156 a convent was founded there by Judith, queen of Bohemia; two ancient towers in the grounds of the 18th-century Clary-Aldringen Palace are thought to be remains of this foundation. Believing that gunshot wounds could be remedied by the Teplice waters, Austrian, Prussian, and Saxon authorities maintained spa establishments there for disabled men in the 19th century.

Industries developed in the 19th century; they include wood processing, metalworks, and the manufacture of glass, pottery, and textiles. Lignite and peat deposits are worked in the vicinity. In 1879, flooding of the lignite mines by the underground springs damaged industrial and spa activities. Later, Teplice was overshadowed by Karlovy Vary (German: Karlsbad) and other spas in western Bohemia. Since World War II the city has prospered

both industrially and as a health resort. Pop. (1999 est.) 52,938.

**Tequendama Falls,** Spanish SALTO DE TEQUENDAMA, waterfalls on the Bogotá (Funza) River, which is a tributary of the Magdalena River, in the Andean Cordillera (mountains) Oriental, central Colombia. One of the country's major tourist attractions, the falls are located in a forested area 20 miles (32 km) west of Bogotá. The river surges through a rocky gorge that narrows to about 60 feet (18 m) at the brink of the 515-foot- (157-metre-) high falls. The falls, once a common site for suicides, may be reached by road from Bogotá.

**tequila,** distilled liquor, usually clear in colour and unaged, that is made from the fermented juice of the Mexican agave plant, specifically several varieties of *Agave tequilana Weber.* Tequila contains 40–50 percent alcohol (80–100 U.S. proof). The beverage, which was developed soon after the Spaniards introduced distillation to Mexico, is named for the town of Tequila in the Mexican state of Jalisco where it is produced.

Upon maturity the pineapple-like agave plant's base fills with sweet sap, or *agua miel* ("honey water"). The bases are steamed to aid in extracting the sap; this juice is fermented and then distilled twice to achieve the desired purity. Some brands are aged in oak vats, which allows the distillate to mellow and take on a pale straw colour.

Tequila is mixed with lime juice to make the Margarita cocktail, which is served in a glass rimmed with salt. Mexicans usually prefer it unmixed, accompanied by salt and a lime slice. The drinker takes salt, tequila, and lime in rapid succession, thus combining all the flavours.

Mescal, a similar distilled beverage, is less expensive and stronger in flavour and is made from an agave plant that grows wild in the Oaxaca region.

**Tequistlatec,** Indian people centred in the Sierra Madre del Sur of Oaxaca *estado* ("state"), Mexico. Their subsistence is based on agriculture (staples are corn [maize], chilies, and beans), hunting, gathering, and animal husbandry. Towns and villages comprise one- and two-room houses, with a nuclear family generally occupying a single room. The communities are governed by adult males who serve in a council and in various civil and ceremonial offices.

**Teraina Island,** formerly called WASHINGTON ISLAND, PROSPECT ISLAND, or NEW YORK ISLAND, coral atoll of the Northern Line Islands, part of Kiribati, in the west-central Pacific Ocean. With a circumference of 9 miles (14 km), the atoll has a land area of 4 square miles (10 square km). It was sighted in 1798 by an American navigator, Edmund Fanning. Annexed by Britain in 1889, it was included in the Gilbert and Ellice Islands Colony in 1916. It became a part of independent Kiribati in 1979. The island is owned by Fanning Island Plantations, Ltd., a copra-processing firm. Pop. (1995) 978.

**Teramo,** city, capital of Teramo *provincia,* Abruzzi *regione,* central Italy. It lies at the confluence of the Tordino and Vezzola rivers, between the Adriatic Sea and the Gran Sasso d'Italia mountain group, northwest of Pescara. Teramo was built on the site of Interamna (Interamnia), a town of the ancient Praetuttii tribe, and was destroyed during the barbarian invasions. It was rebuilt in the 12th century and later passed to the Kingdom of Naples. Notable monuments in Teramo include the 12th- and 14th-century cathedral with a Gothic bell tower (1483), the remains of the Roman theatre, and the civic museum. There is an astronomical observatory just outside the city. Teramo is an agricultural centre, and its manufactures include woolen textiles, furniture, and ceramics. Pop. (1990 est.) mun., 52,501.

**teratology,** branch of the biological sciences dealing with the causes, development, description, and classification of congenital malformations in plants and animals and with the experimental production, in some instances, of these malformations. Congenital malformations arise from interruption in the early development of the organism. Malformations in human infants, for example, may occur because the infant's genotype contains mutant genes or includes an abnormal number of chromosomes; they also may occur if early in pregnancy the mother has had German measles (rubella), has taken some injurious drug, or has been exposed to an injurious dosage of radiation. Experimental studies suggest similar types of factors can cause malformations in animals and plants.

**Terauchi Masatake,** COUNT (Hakushaku) (b. July 12, 1852, Yamaguchi, Nagato province, Japan—d. Nov. 7, 1919, Ōiso), Japanese soldier and politician who served as Japanese prime minister (1916–18) during World War I.

He was born into a family of retainers of the Chōshū clan and originally was named Tada Jusaburō. Masatake changed his name when he was adopted into the Terauchi family during his youth. He entered the military at the age of 12 and became a protégé of Yamagata Aritomo, creator of the modern Japanese armed forces. In 1902 Terauchi was made army minister, a position he held for 10 years. In May 1910 he was concurrently appointed resident general of the Japanese colony in Korea, with orders to complete the annexation of Korea to Japan. He rapidly completed the Japanese military's control of the country, forcing the Korean government to accept an annexation treaty on Aug. 22, 1910.

In October 1916, at Yamagata's insistence, Terauchi became prime minister of a new Cabinet. At a time of growing party dominance over the government, the appointment of a nonpolitical figure was something of an anomaly, and Terauchi was able to govern only with the aid of an all-party Cabinet. Nevertheless, he pursued a forceful policy in foreign affairs, working to increase Japanese influence on the Chinese mainland by financially supporting pro-Japanese warlords in China. Further, Terauchi agreed to aid Great Britain and its allies during World War I only in exchange for secret agreements allowing for Japanese rights on the Chinese mainland; the agreements were later validated at the Treaty of Versailles in 1919. Terauchi's last official act was to propose Japanese intervention in Siberia, after the Russian Revolution, in the hope of gaining control of the Trans-Siberian Railway and consequently strengthening the Japanese position in Manchuria (Northeast). His government collapsed in 1918, when the Rikken Seiyūkai party withdrew its support as a result of rioting in Tokyo over a rice shortage.

**terbium** (Tb), chemical element, rare-earth metal of transition Group IIIb of the periodic table. One of the least abundant of the rare earths, terbium, when reduced to metallic form, is silvery white and is slowly oxidized by air at room temperatures and by cold water. The element was discovered in 1843 by Carl Gustaf Mosander in a heavy rare-earth fraction called yttria, but its existence was not confirmed for at least 30 years, and pure compounds were not prepared until 1905. Terbium occurs in many rare-earth minerals but is almost exclusively obtained as a by-product from monazite sands, which are a source of thorium. It is also found in the products of nuclear fission. Ion-exchange techniques are utilized for its commercial production. The metal is prepared in a highly pure form by thermoreduction of the anhydrous fluoride with calcium metal. At room temperature the atoms of the pure element adopt the hexagonal close-packed structure. The only isotope occurring in ores is terbium-159. About 20 radioactive artificial isotopes have been prepared, such as terbium-160 (73-day half-life). Sodium terbium borate as a laser material emits coherent light at 5,460 angstroms. In certain solid-state devices terbium is used to dope calcium fluoride, calcium tungstate, and strontium molybdate.

Terbium is one of a few rare earths that have a +4 as well as a +3 oxidation state. The brown oxide prepared by air ignition has the approximate formula $Tb_4O_7$; the oxide $TbO_2$ is obtained by using atomic oxygen. The tetrafluoride $TbF_4$ is prepared by fluorinating the trifluoride; the $Tb^{4+}$ ion is not known in solution. In other salts and in solution, terbium is trivalent and behaves as a typical rare earth. Its solutions are pale pink to colourless.

| | |
|---|---|
| atomic number | 65 |
| atomic weight | 158.925 |
| melting point | 1,360° C |
| boiling point | 3,041° C |
| specific gravity | 8.234 (25° C) |
| valence | 3 |
| electronic config. | 2-8-18-26(27)-9(8)-2 or $(Xe)4f^{8,9}5d^{1,0}6s^2$ |

**Terborch, Gerard,** Terborch also spelled TER BORCH, or TERBURG (b. 1617, Zwolle, Neth.—d. Dec. 8, 1681, Deventer), Dutch Baroque painter who developed his own distinctive type of interior genre in which he depicted with grace and fidelity the atmosphere of well-to-do, middle-class life in 17th-century Holland.

Terborch's father had been an artist and had visited Rome but from 1621 was employed as a tax collector. Surviving drawings made by the young Terborch in 1625 and 1626 are proudly inscribed and dated by his father. In 1632 Gerard was in Amsterdam, and in 1634 he was a pupil of Pieter de Molijn in Haarlem. He visited England in 1635, Rome in 1640, and from 1646 spent two or three years in



Terborch, self-portrait, oil on canvas, *c.* 1670; in the Mauritshuis, The Hague

By courtesy of the Foundation J.M. van Nassau, Mauritshuis, The Hague

Münster, Westphalia, where the peace congress was in session. The masterpiece of this period, "The Swearing of the Oath of Ratification of the Treaty of Münster" (1648), portrays the delegates of Holland and of Spain assembled to sign the peace treaty. After a stay in Madrid he finally returned to his own country at the end of 1650, and in 1655 he settled in Deventer.

Terborch's works consist almost equally of

portraits and genre pieces. His characteristically delicate technique can be appreciated in the portraits, which are painted on a small, almost miniature scale, though many of them are full-length. In colour they tend to be subdued, due largely to the sober costume of the times, but by subtlety of tonal gradations and mastery in rendering diverse surface textures he was able to achieve an extraordinary richness of effect. Particularly characteristic is his manner of rendering satin. His superb colour sense appears to greater advantage in genre subjects, though it is always employed with masterly restraint. In his earlier years he painted many guardroom subjects in the manner of Pieter Codde and Willem Duyster, but later, from about the time when he finally settled in Holland, he painted calm, exquisitely drawn groups, posed easily and naturally against shadowy backgrounds and imbued with an almost aristocratic elegance that is unique among Dutch painters of his time. Among many fine examples of Terborch's art are "The Letter," "The Concert," and "Fatherly Advice."

**Terbrugghen, Hendrik** (b. *c.* 1588, Deventer?, Neth.—buried Nov. 9, 1629, Utrecht), Dutch painter, among the earliest northern followers of the Italian painter Caravaggio.

In the early 1590s Terbrugghen's family moved to Utrecht, a strong Roman Catholic centre, where he studied with Abraham Bloemaert. Terbrugghen reportedly spent 10 years in Italy, having arrived in Rome about 1604,



"The Flute Player," oil painting by Terbrugghen, 1621; in the Staatliche Kunstsammlungen, Kassel, Ger.

By courtesy of the Staatliche Kunstsammlungen, Kassel, Ger.

and thus could have had direct contact with Caravaggio, who left Rome in 1606. Although no paintings are definitely known from Terbrugghen's Italian period, his work after his return to Utrecht in 1614 exhibits strong Caravaggesque influence. His two versions of the "Calling of St. Matthew" (*c.* 1617 and 1621) reflect a knowledge of Caravaggio's painting of the same subject at the Church of San Luigi dei Francesi, Rome.

Terbrugghen is most indebted to Caravaggio in his adoption of the master's chiaroscuro, or use of contrasting light and shade, although his light has a more atmospheric and silvery quality, as seen in his half-length "The Flute Player" (1621). Despite Terbrugghen's contact with the latest Italian developments, certain archaisms from 16th-century northern painting appear in such works as his "Crucifixion with the Virgin and St. John" (*c.* 1625). Terbrugghen's masterpiece, "St. Sebastian Tended by Irene and Her Maid" (1625), displays magnificent painterly qualities and restrained emotion. His work is considered superior to that of his Utrecht contemporaries Dirck van Baburen and Gerrit van Honthorst.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Terceira Island,** Portuguese ILHA TERCEIRA, island, part of the Portuguese Azores archipelago, in the North Atlantic Ocean. It occupies an area of 153 square miles (397 square km) and lies administratively within Angra do Heroísmo district. Terceira (The Third) was so called because it was the third island in the Azores to be discovered by the Portuguese. The chief town and port is Angra do Heroísmo, which was formerly capital of the Azores. The only other town of importance is Praia da Vitória, with a breakwater-protected bay, which handles supplies for a NATO air base at Lajes on the northeast coast of the island. Terceira's economy is basically agricultural, supplemented by a growing tourist trade.

**terefah,** also spelled TEREFA, TREF, or TREFA (from Hebrew *ṭaraf,* "to tear"), plural TEREFOTH, TEREFOT, or TREFOT, any food, food product, or utensil that, according to the Jewish dietary laws (kashruth, *q.v.*), is not ritually clean or prepared according to law and is thus prohibited as unfit for Jewish use. Terefah is thus the antithesis of kosher ("fit"). The broad connotation of terefah derives from a more specific prohibition against eating meat that has been "torn" by a wild animal (*e.g.,* Exodus 22:31).

Food may be terefah for any of several reasons. Shellfish and pork, for instance, are forbidden at all times. Malformed and sick animals are likewise excluded by the dietary laws. Animals improperly slaughtered or properly slaughtered animals that are found to be diseased upon examination are automatically classified terefah.

**Terek River,** river that rises in northern Georgia and flows north and then east through Russia to empty into the Caspian Sea. It is one of the main streams draining northward from the Caucasus mountain system. The Terek is 370 miles (600 km) long and drains a basin of 16,900 square miles (43,700 square km). It rises from the glaciers of Mount Kazbek in the main Caucasus range and cuts its way northward through a series of ranges in spectacular gorges. The river enters Russia upon emerging from the northern slopes of the Caucasus, runs northward past the city of Vladikavkaz (formerly Ordzhonikidze), and makes a loop to the northwest before running eastward for the rest of its course. The major city along the Terek's lower course is Grozny, after which the river forms the northern border of the Russian republic of Dagestan. The Terek empties into the Caspian Sea by a wide and complex delta. The river's chief tributaries are the Ardon, Urukh, and Malka rivers on the left bank and the Sunzha on the right. The Terek River represented the southern frontier of Russian settlement in the Caucasus for much of the 19th century.

**Terence,** Latin in full PUBLIUS TERENTIUS AFER (b. *c.* 195 BC, Carthage, North Africa [now in Tunisia]—d. 159? BC, in Greece or at sea), after Plautus the greatest Roman comic dramatist, the author of six verse comedies that were long regarded as models of pure Latin. Terence's plays form the basis of the modern comedy of manners.

Terence was taken to Rome as a slave by Terentius Lucanus, an otherwise unknown Roman senator who was impressed by his ability and gave him a liberal education and, subsequently, his freedom.

Reliable information about the life and dramatic career of Terence is defective. There are four sources of biographical information on him: a short, gossipy life by the Roman biographer Suetonius, written nearly three centuries later; a garbled version of a commentary on the plays by the 4th-century grammarian Aelius Donatus; production notices prefixed to the play texts recording details of first (and occasionally also of later) performances; and Terence's own prologues to the plays, which, despite polemic and distortion, reveal something of his literary career. Most of the available information about Terence relates to his career as a dramatist. During his short life he produced six plays, to which the production notices assign the following dates: *Andria* (*The Andrian Girl*), 166 BC; *Hecyra* (*The Mother-in-Law*), 165 BC; *Heauton timoroumenos* (*The Self-Tormentor*), 163 BC; *Eunuchus* (*The Eunuch*), 161 BC; *Phormio,* 161 BC; *Adelphi* (or *Adelphoe; The Brothers*), 160 BC; *Hecyra,* second production, 160 BC; *Hecyra,* third production, 160 BC. These dates, however, pose several problems. The *Eunuchus,* for example, was so successful that it achieved a repeat performance and record earnings for Terence, but the prologue that Terence wrote, presumably a year later, for the *Hecyra*'s third production gives the impression that he had not yet achieved any major success. Yet alternative date schemes are even less satisfactory.

From the beginning of his career, Terence was lucky to have the services of Lucius Ambivius Turpio, a leading actor who had promoted the career of Caecilius, the major comic playwright of the preceding generation. Now in old age, the actor did the same for Terence. Yet not all of Terence's productions enjoyed success. The *Hecyra* failed twice: its first production broke up in an uproar when rumours were circulated among its audience of alternative entertainment by a tightrope walker and some boxers; and the audience deserted its second production for a gladiatorial performance nearby.

Terence faced the hostility of jealous rivals, particularly one older playwright, Luscius Lanuvinus, who launched a series of accusations against the newcomer. The main source of contention was Terence's dramatic method. It was the custom for these Roman dramatists to draw their material from earlier Greek comedies about rich young men and the difficulties that attended their amours. The adaptations varied greatly in fidelity, ranging from the creative freedom of Plautus to the literal rendering of Luscius. Although Terence was apparently fairly faithful to his Greek models, Luscius alleged that Terence was guilty of "contamination"—*i.e.,* that he had incorporated material from secondary Greek sources into his plots, to their detriment. Terence sometimes did add extraneous material. In the *Andria,* which, like the *Eunuchus, Heauton timorourmenos,* and *Adelphi,* was adapted from a Greek play of the same title by Menander, he added material from another Menandrean play, the *Perinthia* (*The Perinthian Girl*). In the *Eunuchus* he added to Menander's *Eunuchos* two characters, a soldier and his "parasite"—a hanger-on whose flattery of and services to his patron were rewarded with free dinners—both of them from another play by Menander, the *Kolax* (*The Parasite*). In the *Adelphi,* he added an exciting scene from a play by Diphilus, a contemporary of Menander. Such conservative writers as Luscius objected to the freedom with which Terence used his models.

A further allegation was that Terence's plays were not his own work but were composed with the help of unnamed nobles. This malicious and implausible charge is left unanswered by Terence. Romans of a later period

assumed that Terence must have collaborated with the Scipionic circle, a coterie of admirers of Greek literature, named after its guiding spirit, the military commander and politician Scipio Africanus the Younger.

Terence died young. When he was 35, he visited Greece and never returned. He died either in Greece from illness or at sea by shipwreck on the return voyage. Of his family life, nothing is known, except that he left a daughter and a small but valuable estate just outside Rome on the Appian Way.

Modern scholars have been preoccupied with the question of the extent to which Terence was an original writer, as opposed to a mere translator of his Greek models. Positions on both sides have been vigorously maintained, but recent critical opinion seems to accept that, in the main, Terence was faithful to the plots, ethos, and characterization of his Greek originals; thus, his humanity, his individualized characters, and his sensitive approach to relationships and personal problems all may be traced to Menander, and his obsessive attention to detail in the plots of *Hecyra* and *Phormio* derives from the Greek models of those plays by Apollodorus of Carystus of the 3rd century BC. Nevertheless, in some important particulars he reveals himself as something more than a translator. First, he shows both originality and skill in the incorporation of material from secondary models, as well as occasionally perhaps in material of his own invention; he sews this material in with unobtrusive seams. Second, his Greek models probably had expository prologues, informing their audiences of vital facts, but Terence cut them out, leaving his audiences in the same ignorance as his characters. This omission increases the element of suspense, though the plot may become too difficult for an audience to follow, as in the *Hecyra.*

Striving for a refined but conventional realism, Terence eliminated or reduced such unrealistic devices as the actor's direct address to the audience. He preserved the atmosphere of his models with a nice appreciation of how much Greekness would be tolerated in Rome, omitting the unintelligible and clarifying the difficult. His language is a purer version of contemporary colloquial Latin, at times shaded subtly to emphasize a character's individual speech patterns. Because they are more realistic, his characters lack some of the vitality of Plautus' adaptations (Phormio here is a notable exception); but they are often developed in depth and with subtle psychology. Individual scenes retain their power today, especially those presenting brilliant narratives (*e.g.,* Chaerea's report of his rape of the girl in the *Eunuchus*), civilized emotion (*e.g.,* Micio's forgiveness of Aeschinus in the *Adelphi*), or clever theatrical strokes (*e.g.,* the double disclosure of Chremes' bigamy in the *Phormio*).

The influence of Terence on Roman education and on the later European theatre was very great. His language was accepted as a norm of pure Latin, and his work was studied and discussed throughout antiquity.

(W.G.A.)

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**Teresa,** BLESSED MOTHER, in full BLESSED MOTHER TERESA OF CALCUTTA, also known as BLESSED TERESA OF CALCUTTA, original name AGNES GONXHA BOJAXHIU (baptized Aug. 27, 1910, Skopje, Macedonia, Ottoman Empire [now in Republic of Macedonia]—d. Sept. 5, 1997, Kolkata [Calcutta], India; beatified Oct. 19, 2003), founder of the Order of the Missionaries of Charity, a Roman Catholic congregation of women dedicated to the poor, particularly to the destitute of India. She was the recipient of the 1979 Nobel Prize for Peace.



Mother Teresa, 1993
Chris Bacon—AP/Wide World Photos

The daughter of an ethnic Albanian grocer, she went to Ireland in 1928 to join the Sisters of Loretto at the Institute of the Blessed Virgin. She then sailed to India and taught for 17 years at the order's school in Calcutta (Kolkata).

In 1946 Sister Teresa experienced her "call within a call," which she considered divine inspiration to devote herself to caring for the sick and poor. She then moved into the slums she had observed while teaching. Municipal authorities, upon her petition, gave her the pilgrim hostel near the sacred Kālī's temple where she founded her order in 1948. Sympathetic companions soon flocked to her aid. Dispensaries and outdoor schools were organized. Mother Teresa adopted Indian citizenship, and her Indian nuns all donned the sari as their habit. In 1950 her order received canonical sanction from Pope Pius XII, and in 1965 it became a pontifical congregation (subject only to the pope). In 1952 she established the Nirmal Hriday ("Place for the Pure of Heart"), a hospice where the terminally ill could die with dignity. Her order also opened numerous centres serving the blind, the aged, lepers, and the disabled. Under Mother Teresa's guidance, the Missionaries of Charity built, near Asansol, India, a leper colony called Shanti Nagar ("Town of Peace").

In 1963 the Indian government awarded Mother Teresa the Padmashri ("Lord of the Lotus") for her services to the people of India. In 1964, on his trip to India, Pope Paul VI gave her his limousine, which she raffled to help finance her leper colony. In 1968 she was summoned to Rome to found a home there, staffed primarily with Indian nuns. In recognition of her apostolate, Pope Paul awarded her the first Pope John XXIII Peace Prize on Jan. 6, 1971. In 1979 she received the Nobel Peace Prize for her humanitarian work.

In her later years, Mother Teresa spoke out against divorce, contraception, and abortion. She also suffered ill health and had a heart attack in 1989. In 1990 she resigned as head of the order but was returned to office by a near unanimous vote—the lone dissenting voice was her own. A worsening heart condition forced her retirement, and the order chose the Indian-born Sister Nirmala as her successor in 1997. At the time of Mother Teresa's death, her order included hundreds of centres in more than 90 countries with some 4,000 nuns and hundreds of thousands of lay workers. Within two years of her death, the process to declare her a saint was begun, and Pope John Paul II issued a special dispensation to expedite the process of canonization. She was beatified on Oct. 19, 2003, reaching the ranks of the blessed in the shortest time in the history of the church.

**Teresa** BENEDICTA OF THE CROSS: *see* Stein, Edith.

*Consult the* INDEX *first*

**Teresa** OF ÁVILA, SAINT, also called SAINT TERESA OF JESUS, original name TERESA DE CEPEDA Y AHUMADA (b. March 28, 1515, Ávila, Spain—d. Oct. 4, 1582, Alba de Tormes; canonized 1622; feast day October 15), Spanish nun, one of the great mystics of the Roman Catholic church, and author of spiritual classics. She was the originator of the Carmelite Reform, which restored the austerity and contemplative character of primitive Carmelite life. St. Teresa was elevated to doctor of the church in 1970 by Pope Paul VI, the first woman to be so honoured.

Despite her father's opposition, Teresa entered, probably in 1535, the Carmelite Convent of the Incarnation at Ávila. Within two years her health collapsed, and she was an invalid for three years, during which time she developed a love for mental prayer. After her recovery, however, she stopped praying. She continued for 15 years in a state divided between a worldly and a divine spirit, until, in 1555, she underwent a religious awakening.

In 1558 Teresa began to consider the restoration of Carmelite life to its original observance of austerity, which had relaxed in the 14th and 15th centuries. Her reform required utter withdrawal so that the nuns could meditate on divine law and, through a prayerful life of penance, exercise what she termed "our vocation of reparation" for the sins of mankind. In 1562, with Pope Pius IV's authorization, she opened the first convent (St. Joseph's) of the Carmelite Reform. A storm of hostility came from municipal and religious personages, especially because the convent existed without endowment, but she staunchly insisted on poverty and subsistence only through alms.

John Baptist Rossi, the Carmelite prior general from Rome, went to Ávila in 1567 and approved the reform, directing Teresa to found more convents and to establish monasteries. In the same year, she met Juan de Yepes (later St. John of the Cross, the poet and mystic), who she realized could initiate the Carmelite Reform for men. A year later Juan opened the first monastery of the Primitive Rule at Duruelo, Spain.

Despite frail health and great difficulties, she spent the rest of her life establishing and nurturing 16 more convents throughout Spain. In 1575, while she was at the Seville convent, a dispute erupted between the friars of the restored Primitive Rule, known as the Discalced (or "Unshod") Carmelites, and the observants of the Mitigated Rule, the Calced (or "Shod") Carmelites. Although she had foreseen the trouble and endeavoured to prevent it, her attempts failed. The Carmelite general, to whom she had been misrepresented, ordered her to retire to a convent in Castile and to cease founding additional convents; Juan was subsequently imprisoned at Toledo in 1577.

In 1579, largely through the efforts of King Philip II of Spain, who knew and admired Teresa, a solution was effected whereby the Carmelites of the Primitive Rule were given independent jurisdiction, confirmed in 1580 by a rescript of Pope Gregory XIII. Teresa,

broken in health, was then directed to resume the reform. In journeys that covered hundreds of miles, she made exhausting missions and was fatally stricken en route to Avila from Burgos.

Teresa's ascetic doctrine has been accepted as the classical exposition of the contemplative life, and her spiritual writings are among the most widely read. Her *Life of the Mother Teresa of Jesus* (1611) is autobiographical; the *Book of the Foundations* (1610) describes the establishment of her convents. Her writings on the progress of the Christian soul toward God are recognized masterpieces: *The Way of Perfection* (1583), *The Interior Castle* (1588), *Spiritual Relations, Exclamations of the Soul to God* (1588), and *Conceptions on the Love of God.* Of her poems, 31 are extant; of her letters, 458.

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**Tereshkova, Valentina,** in full VALENTINA VLADIMIROVNA TERESHKOVA (b. March 6, 1937, Maslennikovo, Russia, U.S.S.R.), Soviet cosmonaut, the first woman to travel into space. On June 16, 1963, she was launched in the spacecraft *Vostok 6*, which completed 48 orbits in 71 hours. In space at the same time was Valery F. Bykovsky, who had been launched two days earlier in *Vostok 5;* both landed on June 19.

Although she had no pilot training, Tereshkova was an accomplished amateur parachutist and on this basis was accepted for the cosmonaut program when she volunteered in 1961. She left the program just after her flight, and on Nov. 3, 1963, she was married to Andriyan G. Nikolayev, another cosmonaut. From 1962 until 1990/91 she was an active member in the U.S.S.R. Supreme Soviet. She directed the Soviet Women's Committee in 1968, and from 1974 to 1990/91 she served as a member of the Supreme Soviet Presidium. Tereshkova was named a hero of the Soviet Union and was twice awarded the Order of Lenin.

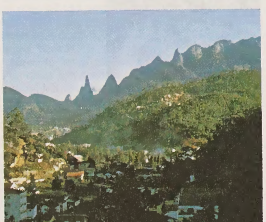
**Teresina,** city, capital of Piauí *estado* ("state"), northeastern Brazil. The city lies along the Parnaíba River (there bridged to Timon in Maranhão state), 220 miles (354 km) upstream from the Atlantic port of Parnaíba.



Open market, Teresina, Braz.
Peter L. Gould

Founded in 1852 as the new capital of Piauí, it was originally named Therezina after the Brazilian empress Teresa Cristina. Since then, it has become the chief commercial centre of the middle Parnaíba River valley and has textile plants, sugar refineries, distilleries, soap factories, and sawmills. The city exports cattle, hides, goat skins, carnauba wax, babassu palm oil, *feijão* (beans), rice, cotton, and cassava. To alleviate the area's annual six-month drought, the Brazilian government has dug wells and built dams to trap water during the rainy months to keep the waterways flowing during arid times. A highway and a railroad lead to São Luís, 200 miles (320 km) northwest. Shallow-draft riverboats navigate northward to Parnaíba, and the city has a commercial airport. Pop. (1996) 613,767.

**Teresópolis,** city, central Rio de Janeiro *estado* ("state"), Brazil. It lies in the Serra dos Órgãos at 2,959 feet (902 m) above sea level. Named after the Brazilian empress Teresa Cristina in 1890 and originally spelled Therezópolis, it was given city status in 1893. A cool climate and picturesque setting amid mountain peaks such as the Dedo de Deus ("Finger of God") make the city a popular summer resort. Flowers are grown in the re-



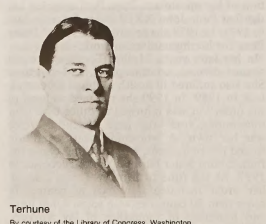
Teresópolis in the uplands of Serra dos Órgãos, Brazil
Ernst Jahn

gion, and vegetables are shipped to the city of Rio de Janeiro, 35 miles (56 km) southsouthwest. Furniture is manufactured in Teresópolis, which is also known for its bakeries. Pop. (1996) 104,977.

**Tereus,** in Greek legend, king of Thrace who married Procne, daughter of Pandion, king of Athens. Later Tereus seduced her sister Philomela, pretending that Procne was dead. In order to hide his guilt, he cut out Philomela's tongue. But she revealed the crime to her sister by working the details in embroidery. Procne sought revenge by serving up her son Itys for Tereus' supper. On learning what Procne had done, Tereus pursued the two sisters with an ax. But the gods took pity and changed them all into birds, Tereus into a hoopoe (or hawk), Procne into a nightingale (or swallow), and Philomela into a swallow (or nightingale).

**Terezín** (German Nazi concentration camp): *see* Theresienstadt.

**Terhune, Albert Payson** (b. Dec. 21, 1872, Newark, N.J., U.S.—d. Feb. 18, 1942, near Pompton Lakes, N.J.), American novelist and short-story writer who became famous for his popular stories about dogs.



Terhune
By courtesy of the Library of Congress, Washington, D.C.

After schooling in Europe, Terhune graduated from Columbia University in 1893, traveled in Egypt and Syria, and joined the staff of the *New York Evening World* in 1894. His first book was *Syria from the Saddle* (1896); his first novel, *Dr. Dale* (1900), was written in collaboration with his mother, herself a novelist. He published more than 12 books before he left the *Evening World* in 1916.

In 1919 appeared the first of his popular dog stories, *Lad, a Dog,* written at his farm near Pompton Lakes, where for the rest of his life he wrote, bred prize collies, fished, and hunted. He wrote more than 25 books after 1919, nearly all of them novels in which dogs played conspicuous parts, including *Bruce* (1920), *The Heart of a Dog* (1924), *Lad of Sunnybank* (1928), and *A Book of Famous Dogs* (1937).

**teriyaki** (Japanese: "glossy broil"), in Japanese cuisine, foods grilled with a highly flavoured glaze of soy sauce and sake or *mirin* (sweet wine). Garlic and fresh ginger are sometimes added to the mixture. In westernized Japanese cooking, the teriyaki sauce is frequently used as a marinade as well as a basting sauce. Beef, chicken, and fish are commonly prepared teriyaki style.

**term,** in logic, the subject or predicate of a categorical proposition (*q.v.*), or statement. Aristotle so used the Greek word *horos* ("limit"), apparently by an analogy between the terms of a proportion and those of a syllogism. *Terminus* is the Latin translation of this word, used, for example, by the 5th-century Roman philosopher Boethius. Hence in medieval logic the word came to be used also for common and proper names generally and even for what were called syncate-goremat ic terms—words such as *and, if, not, some, only, except,* which are incapable of being used for the subject or predicate of a proposition.

In mathematics, the terms of a fraction are the numerator and denominator. The terms of a proportion are the four numbers or expressions that enter into the proportion. Similarly, the terms of a sum are the numbers that are added together to constitute the sum or the numerical expressions denoting them. In this sense, an infinite series is thought of as a sum of an infinite number of terms; and a polynomial is a sum of a finite number of monomials, which are the terms of the polynomial. When the terms are quite complicated, they can be identified by the plus or minus signs by which they are demarcated.

**term,** in the visual arts, element consisting of a sculptured figure or bust at the top of a stone pillar or column that usually tapers downward to a quadrangular base. Often the pillar replaces the body of the figure, with feet sometimes indicated at its base. The pillar itself may be a separate object (*i.e.,* a pedestal for the head or other sculpture), in which case it is called a terminal pedestal.

The word term (an abbreviation of Terminus, the Roman name for the god of boundaries) has a long list of synonyms, including terminal figure, terminus, terminal, herma, hermes, and herm. In ancient Rome terms were placed along highways and used as boundary markers. The head or bust on a Roman term could be that of a human, an animal, or a mythical creature. The ancestor of the Roman term, the herm, was a sacred representation of the Greek god of travelers, Hermes: a sculptured bust of the god merging into the stone pillar supporting it. The most familiar form of term is that found in many Renaissance gardens, in which a detailed portrait head arises out of a simple, sculptured pillar.

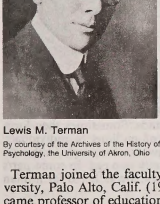
**Terman, Frederick Emmons** (b. June 7, 1900, English, Ind., U.S.—d. Dec. 19, 1982, Palo Alto, Calif.), American electrical engineer known for his contributions to electronics research and antiradar technology.

Terman, the son of the noted psychologist Lewis Madison Terman, earned his undergraduate degrees from Stanford University, Stanford, Calif., and a doctorate in electrical engineering from the Massachusetts Institute of Technology, Cambridge (1924). From 1925 to 1941 he designed a course of study and research in electronics at Stanford that focussed on work with vacuum tubes, circuits, and instrumentation.

During World War II Terman directed a staff of more than 850 persons at the Radio Research Laboratory at Harvard University; this organization was the source of Allied jammers to block enemy radar, tunable receivers to detect radar signals, and aluminum strips ("chaff") that produced spurious reflections on enemy radar receivers. These devices cut by 75 percent the effectiveness of radar-directed anti-aircraft fire.

After the war Terman was appointed dean of engineering at Stanford and from 1955 to 1965 served as provost of the university. His other scientific contributions include work on long-distance electrical transmission and resonant transmission lines. His publications include *Radio Engineers' Handbook* (1943) and *Electronic and Radio Engineering* (4th ed., 1955).

**Terman, Lewis M(adison)** (b. Jan. 15, 1877, Johnson County, Ind., U.S.—d. Dec. 21, 1956, Palo Alto, Calif.), U.S. psychologist who published the individual intelligence test widely used in the United States, the Stanford–Binet.



Lewis M. Terman
By courtesy of the Archives of the History of American Psychology, the University of Akron, Ohio

Terman joined the faculty of Stanford University, Palo Alto, Calif. (1910), where he became professor of education in 1916, the year he published *The Measurement of Intelligence*, a guide for his Stanford revision and enlargement of the earlier Binet–Simon intelligence scale developed in France. Scoring on the test was signified by the intelligence quotient, or IQ, which takes account of both chronological age and mental age so that the average child of any age has an IQ of 100.

During World War I Terman contributed to developing the first notable mass group intelligence testing in the U.S. Army Alpha and Beta programs. He became professor of psychology at Stanford in 1922, remaining there until he retired in 1942. In 1921 he launched a comprehensive, long-term program for study of the gifted. The subjects, 1,528 California children with IQ's exceeding 140, were examined medically, anthropologically, and psychologically and described otherwise in terms of interests, scholastic achievement, books read, and games known. He continued this research until his death 35 years later, by which time he had obtained definitive evidence that gifted children tend to be healthier and more stable than the average.

Findings from the study, which is projected to continue until about 2010, are reported in Terman *et al., Genetic Studies of Genius*, 5 vol. (1926–59). Terman's other investigations were reported in *Sex and Personality* (1936) and *Psychological Factors in Marital Happiness* (1938).

**Termez,** city and administrative centre of Surkhandarya *oblast* (province), Uzbekistan, and a port of the Amu Darya (river) on the frontier of Afghanistan. The ancient town of Termez, a little to the north, flourished in the 1st century BC and was finally destroyed at the end of the 17th century AD. The present city originated as a Russian fort built in 1897 beside the small settlement of Pattagissar. It has registered some extremely high temperatures, the highest having been a temperature of 122° F (50° C) in July 1914. Termez has cotton ginneries, as well as food-processing and other light industries. The city and its environs have remains of a Buddhist monastery, ruined forts, and medieval mausoleums. Pop. (1991 est.) 90,400.

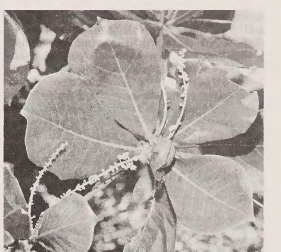
**Termier, Henri-François-Émile** (b. Dec. 13, 1897, Lyon), French geologist known for his studies of the stratigraphy (study of stratified rocks) and paleontology of North Africa and France.

Termier was a geologist for the Morocco Mine Service from 1925 until 1940, when he became head of the Morocco Geological Service; in 1945 he became a professor at the University of Algiers and in 1955 joined the Sorbonne, where he became the chairman of the department of geology in 1961. Termier wrote a number of books on his observations and findings including *Études géologiques sur le Maroc central et le Moyen Atlas septentrional* (1936; "Geological Studies of Central Morocco and the Northern Middle Atlas Mountains"), *Paléontologie marocaine* (1947–50; "Moroccan Paleontology"), *Traité de géologie* (1952–56; "Treatise on Geology"), *Traité de stratigraphie* (1964; "Treatise on Stratigraphy"), *Biologie des premiers fossiles* (1968; "Biology of the First Fossils"), *Les Animaux préhistoriques* (1977; "Prehistoric Animals"), and *Histoire de la Terre* (1979; "History of the Earth"). For his fundamental research Termier was named a chevalier in the Legion of Honour and was awarded the Croix de Guerre in 1978.

**terminal velocity,** steady speed achieved by an object freely falling through a gas or liquid. A typical terminal velocity for a parachutist who delays opening the chute is about 150 miles (240 kilometres) per hour. Raindrops fall at a much lower terminal velocity, and a mist of tiny oil droplets settles at an exceedingly small terminal velocity. An object dropped from rest will increase its speed until it reaches terminal velocity; an object forced to move faster than its terminal velocity will, upon release, slow down to this constant velocity.

Terminal velocity is achieved, therefore, when the speed of a moving object is no longer increasing or decreasing; the object's acceleration (or deceleration) is zero. The force of air resistance is approximately proportional to the speed of the falling object, so that air resistance increases for an object that is accelerating, having been dropped from rest until terminal velocity is reached. At terminal velocity, air resistance equals in magnitude the weight of the falling object. Because the two are oppositely directed forces, the total force on the object is zero, and the speed of the object has become constant.

**Terminalia,** genus of about 200 species of trees of the family Combretaceae. Some species are commercially important for products such as gums, resins, and tanning extracts. *T. arjuna,* of Southeast Asia; *T. hilariana,* of tropical America; *T. obovata,* of the West Indies and South America; and *T. superba,* of West Africa yield woods used for cabinetwork, tools, and boat construction. *T. catappa,* the Indian,



Indian almond (*Terminalia catappa*)
Douglas David Dawn

or tropical, almond, is commonly cultivated for ornament, particularly along streets in the tropics.

**Termini Imerese,** Latin THERMAE HIMERENSES, town, Palermo province, northern Sicily, Italy, on the Golfo (gulf) di Termini Imerese (an inlet of the Tyrrhenian Sea), southeast of Palermo city. It was possibly a Phoenician seaport or trading station, and its well-known thermal saline springs were praised by the 6th–5th-century BC Greek poet Pindar. The Carthaginians called it Thermae Himerenses after their destruction of nearby Himera in 409 BC. The Syracusan tyrant Agathocles was born there in 361 BC. The town lies on two levels connected by steps and the Serpents' Road (Serpentina). There are some Roman remains and a civic museum.

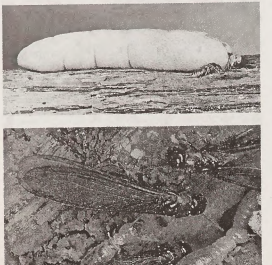
It is a flourishing tourist and health resort. Citrus fruits, vines, and olives are grown, pasta is manufactured, and there is some fishing. Pop. (1990 est.) mun., 27,033.

**Términos Lagoon,** Spanish LAGUNA DE TÉRMINOS, lagoon in southwestern Campeche state, at the base of the Yucatán Peninsula, eastern Mexico. An inlet of the Bay of Campeche on the Gulf of Mexico, it measures 45 mi (72 km) east–west and 12 to 15 mi north–south. Long, narrow Carmen Island stretches across its entrance. The lagoon is fed by the Palizada and Candelaria rivers. Shrimp, fish, and turtles are taken from Términos, and crocodiles are hunted in the smaller adjacent lagoons.

**Terminus** (Latin: Boundary Stone), originally, in Roman cult, a boundary stone or post fixed in the ground during a ceremony of sacrifice and anointment. Anyone who removed a boundary stone was accursed and might be slain; a fine was later substituted for the death penalty. From this sacred object evolved the god Terminus. On February 23 (the end of the old Roman year) the festival called the Terminalia was held. The owners of adjacent lands assembled at the common boundary stone, and each garlanded his own side of the stone. Offerings of cakes, grain, honey, and wine were made, and a lamb or pig was sacrificed.

**termite,** social, cellulose-eating insect of the order Isoptera, known also as the white ant, although it is not related to the true ants (order Hymenoptera). Most of the 1,900 species of termites are tropical in distribution, but the order has many representatives in temperate zones. In the Southern Hemisphere, termites reach the Cape Province of the Republic of South Africa, as well as Australia, New Zealand, and Tasmania; Northern Hemi-

sphere species are found as far north as Maine and Vancouver in North America, the Atlantic coast of France in Europe, and South Korea and northern Japan in Asia. Man has introduced various species to areas outside



(Top) King and queen fungus-growing termites (*Macrotermes natalensis*), (bottom) winged reproductive and worker dry-wood termites (*Kalotermes flavicollis*)
(Top) J.A.L. Cooke, (bottom) Papperfoto

their natural ranges by inadvertently carrying them in wooden articles.

A brief treatment of termites follows. For full treatment, *see* MACROPAEDIA: Insects.

Termites probably evolved from roachlike ancestors and share many characteristics with the most primitive of living roaches, those of the genus *Cryptocercus*. Although the earliest fossil termites known are from the early Cretaceous Period (some 130,000,000 years ago), it is likely that they appeared much earlier, perhaps in the late Permian Period (about 230,000,000 years ago).

Termites are small to medium-sized, usually soft-bodied insects that live in colonies with well-defined caste systems. Three castes are typical—reproductives, workers, and soldiers. Unlike hymenopterans, both sexes are present in equal numbers, although only the reproductives have fully developed sex organs. There is typically one pair of reproductives per colony, a queen and a king. These develop from winged dispersing individuals (alates) and have hard, pigmented bodies and compound eyes; after the dispersal flight the wings are shed. The king remains from 1 to 2 cm (0.4 to 0.8 inch) long, but once a queen starts laying eggs her abdomen enlarges, and she may eventually attain a length of 11 cm (more than 4 inches). Workers and soldiers are sterile. The workers constitute the most populous caste in most colonies. They are blind, pale, soft-bodied insects with mouthparts modified for chewing. The soldiers are also blind and, depending on species, use enlarged mandibles or chemical means to defend the nest.

Termites live in nests either within wood or under the soil; these nests are sealed from the outside air to maintain high humidity, although ventilation pores may be constructed to facilitate diffusion of air through the nest. The most prominent nests are the termite mounds present in savanna habitats around the world. These may be domelike or conical; in Africa the mounds of the fungus-growing *Macrotermes* species may reach 9 m (29.5 feet) in height. In Australia the termite *Amitermes meridionalis* constructs wedge-shaped nests; the long axis of these nests is always set in a north–south alignment. The outer wall of termites' large mounds is generally made of hardened soils; the internal galleries are constructed of carton, a combination of wood fragments and fecal matter that resembles cardboard. Some termites construct arboreal nests of carton; these nests are always connected to the soil by covered runways. Various invertebrates, as well as some lizards, snakes, and birds, may share a mound with the termite colony. Termitophiles, insects that cannot survive away from the nest of host termite species, are frequently found in termite nests. There are even certain termites, the inquilinous species, that can survive only within the nest of another termite species—their obligate host—and feed on the carton of the host species' nest; *Incolitermes* is even dependent on its host for exit holes during swarming.

Swarming is the method by which new colonies are established. The alates develop at a certain time of year and exit the nest through tunnels prepared by the workers. The alates swarm when a combination of environmental factors is favourable. Emergence occurs simultaneously from colonies within a geographic neighbourhood, which may ensure that individuals from different colonies will have the opportunity to interbreed. The alates are weak fliers and, if not carried by the wind, will not disperse more than a few hundred yards. They shed their wings soon after the flight and pair with a member of the opposite sex. The pair dig a small nest and seal themselves within this nuptial chamber; only after they are sealed in do they mate. The queen, once fully developed, may lay 36,000 eggs a day for as long as 50 years. Termites are quite long-lived; workers and soldiers survive 2 to 5 years, while the reproductive pair in many advanced species may live for 60 to 70 years. Termites are hemimetabolous, undergoing a gradual metamorphosis through a series of nymphal molts, rather than showing distinct larval, pupal, and adult stages. In the early stages of a colony the nymphs all develop into workers and soldiers; only when a colony is well-established do the winged alates appear.

Termites subsist on cellulose, a major structural material of plants. In order to digest this material they harbour various intestinal symbiotes. Primitive termites depend upon certain flagellate protozoans to break down the cellulose, while the more advanced termites (family Termitidae, comprising 1,413 species and some 75 percent of all termites) have a bacterial flora in the gut. Only the workers are able to feed themselves, and they are responsible for feeding the rest of the colony. Termites of the subfamily Macroterminae supplement their diet by farming the symbiotic fungus *Termitomyces*. They cultivate the fungus on combs of fecal material within the nest, and as the fungus grows it breaks down the combs into materials that the termites can utilize. These termites feed on both fungus and combs.

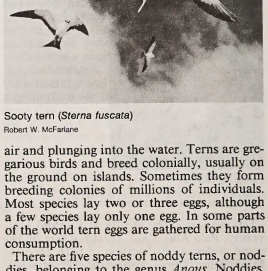
Termites are frequently classed as pests. Although only 10 percent of the known species have destructive habits, these species may do great damage. Subterranean termites—which enter wooden structures through the ground, as they need to maintain contact with the soil's moisture—are fairly easy to control; insecticides can be placed in trenches dug around the structure to be protected. Materials such as pressure-treated wood and reinforced concrete are impervious to termites and make safe foundations. Dry-wood termites (family Kalotermitidae), however, nest within the wood they feed on and are much more difficult to control; fumigation has proved to be the best technique.

**terms, distribution of** (syllogistic logic): *see* distribution.

**tern,** any of about 40 species of slender, graceful water birds that constitute the subfamily Sterninae, of the family Laridae, which also includes the gulls. Terns inhabit seacoasts and inland waters and are nearly worldwide in distribution. The largest number of species is found in the Pacific Ocean. Many terns are long-distance migrants, the most notable being the Arctic tern (*Sterna paradisaea*). The Arctic tern breeds in the southerly reaches of the Arctic and winters in Antarctic regions, thus making the longest annual migration of any bird.

Terns range in length from about 20 to 55 cm (8 to 22 inches). Compared with gulls, they are more slender, shorter legged, and longer winged. They range in colour from white to black and white to almost entirely black. The bill of various species may be black, red, or yellow, while the feet are red or black. Their feet are webbed. Most species have long and pointed wings, forked tails, and sharply pointed bills.

Terns sometimes eat insects, but the bulk of their diet consists of crustaceans and small fish, which they catch by diving through the



Sooty tern (*Sterna fuscata*)
Robert W. McFarlane

air and plunging into the water. Terns are gregarious birds and breed colonially, usually on the ground on islands. Sometimes they form breeding colonies of millions of individuals. Most species lay two or three eggs, although a few species lay only one egg. In some parts of the world tern eggs are gathered for human consumption.

There are five species of noddy terns, or noddies, belonging to the genus *Anous*. Noddies, named for their nodding displays, are tropical birds with wedge-shaped or only slightly forked tails. A distinct type of tern, the Inca tern (*Larosterna inca*), of Peru and northern Chile, bears distinctive white plumes on the side of the head.

The most typical terns are the approximately 30 species of the genus *Sterna*, with forked tail, black cap or crest, and pale body. The black tern, *S. nigra* (sometimes *Chlidonias niger*), about 25 cm (10 inches) long, with a black head and underparts (white below in winter) and gray wings and back, breeds in temperate Eurasia and North America and winters in tropical Africa and South America. It is called a marsh tern because it nests inland on freshwater marshes and around lakes. The common tern (*S. hirundo*) is about 35 cm (14 inches) long and has a black cap, red legs, and a red bill with a black tip. It breeds throughout northern temperate regions and winters on southern coasts. The least, or little, tern (*S. albifrons*), under 25 cm (10 inches) long, is the smallest tern. It breeds on sandy coasts and river sandbars in temperate to tropical regions worldwide except South America. The sooty tern (*S. fuscata*), about 40 cm (16 inches) long, has a white forehead and is otherwise black above and white below. It breeds

in huge, noisy colonies on oceanic islands in warm regions.

**ternary form,** musical form consisting of three sections, the last of which is a repeat of the first. The symmetrical construction of this scheme (*aba*) provides one of the basic shapes in music and may be found as a guiding principle in music from the Middle Ages (in Gregorian chant, for instance, the arrangement antiphon-verse-antiphon is common) to the 21st century (a well-known example being the "Minuet" and "Trio" from Arnold Schoenberg's *Piano Suite,* Opus 25).

Although any kind of *aba* pattern may correctly be defined as ternary, the term most precisely denotes that form exemplified by the minuet and trio of the Classical symphony. Basic to the form in this strict definition is the requirement that each of its sections forms an intelligible musical entity, relatively complete within itself. Thus section *a* forms a logical whole, which is harmonically closed; *i.e.,* it ends in the key in which it begins. It is most frequently in binary form, a variety of two-section form. The same may be said about section *b,* which is placed in a key different than—though closely related to—that of section *a.* The origins of ternary form (still speaking in the strict sense) may be found in the Baroque instrumental suite, in which two dances (most often a minuet and trio) are performed in the standard *aba* pattern. It survived into the Classical era as the combination of minuet (or scherzo) and trio that serves as the third movement of the typical Classical symphony.

In his symphonies *No. 4 in B-flat Major* and *No. 7 in A Major* and his *String Quartet in E Minor,* Opus 59, No. 2, Ludwig van Beethoven modified the form by giving both the *a* and *b* sections an extra repeat, thus producing a five-part (*ababa*) form. The even more striking phenomenon of a second trio (*abaca*) may be seen in the symphonies *No. 1 in B-flat Major* and *No. 2 in C Major* of Robert Schumann and in Anton Bruckner's *Symphony No. 7 in E Major.*

**Ternate Island,** Indonesian PULAU TERNATE, one of the northernmost of a line of Indonesian islands stretching southward along the western coast of the island of Halmahera to the Bacan Islands east of the Molucca Sea. Ternate Island, which lies within North Maluku *propinsi* (province), is situated 14 miles (23 km) west of Halmahera. The island is dominated by a volcano (5,646 feet [1,721 m]) with three peaks. It has suffered from frequent volcanic activity since the 15th century, the worst eruption occurring in 1763. The southern and eastern coasts of Ternate Island have forests and luxuriant vegetation. Rice, corn (maize), sage, coffee, pepper, nutmeg, and fruit are grown. Ternate town, which is the capital and main commercial centre of North Maluku *propinsi,* includes about half of the population of Ternate Island.

The people are ethnically mixed but probably of largely Malay ancestry. Most are Muslims, though some are Christians; the island has a language of its own, written in Arabic script. Although once a leading centre of clove cultivation, the island now trades principally in nutmeg and copra.

Ternate was the first part of the Moluccas to accept Islām, and it was an important sultanate from the 12th to the 17th century. The initial Western visitor, a Portuguese, came in 1512; other Portuguese followed to ship cloves and construct a fort (1522). In time the Ternate people conquered the fort and expelled the Portuguese (1574), and in 1606 the sultan signed a treaty with the Dutch and granted them a spice monopoly. Restriction of production to maintain high prices led to revolts in 1650 and 1679 and the end of clove production in the northern Moluccas. The sultan became a vassal of the Dutch East India Company, and the Dutch assumed executive power on the island until the establishment of the Republic of Indonesia after World War II. In the late 1990s violence erupted between Muslims and Christians in the region, causing tens of thousands of Christians to flee Ternate. Their former communities were occupied, in turn, by large numbers of Muslims who had fled similar violence on Halmahera Island. Area 41 square miles (106 square km). Pop. (2000 est.) 155,000.

**terneplate,** steel sheet with a coating of terne metal, an alloy of lead and tin applied by dipping the steel in molten metal. The alloy has a dull appearance resulting from the high lead content. The composition of terne metal ranges from 50–50 mixtures of lead and tin to as low as 12 percent tin and 88 percent lead. The tin serves to wet the steel, making possible the union of lead and iron, which would otherwise not alloy. Terneplate is made by a process similar to galvanizing or tinplating—*i.e.,* by dipping the sheets into a series of heated baths, the first of a zinc chloride flux, followed by the molten terne metal, and finally one of palm oil. Terneplate has the strength and formability of steel and the noncorrosive surface and solderability of terne metal. While it is still used for roofing, gutters and downspouts, and casket linings and in the manufacture of gasoline tanks for automobiles, oil cans, and containers for paints, solvents, resins, and so on, it has largely been replaced by other, more durable steel products that are easier to manufacture.

**Terni,** city, capital of Terni *provincia,* Umbria *regione,* central Italy. It lies along the Nera River, north of Rome. The city was founded on the site of the ancient city of Interamna Nahars and in the 14th century became a dominion of the papacy. Terni's important archaeological remains include a Neolithic village, cisterns of the Villanovan period, and a Roman amphitheatre and walls. Its 12th-century cathedral, built on an earlier site, was extensively remodeled in the 17th century. The 5th-century round Church of San Salvatore, with a 12th-century chapel, was erected over a Roman building, possibly a temple of the Sun. The city's other medieval churches include San Francesco, with a bell tower of 1345. A notable secular monument is the Renaissance-style Spada Palace, the last work of Antonio da Sangallo the Younger, who died at Terni in 1546. The chief local attraction is the Cascata delle Marmore, a waterfall created by the Roman consul Manius Curius Dentatus (271 BC) by diverting the waters of the Velino River into the Nera. The waters now provide hydroelectric power.

Although half of Terni was destroyed in World War II, it reemerged larger and more active, with modern industrial plants and a growing service sector. Metallurgy and the manufacture of arms, machinery, textiles, and food products are important. Pop. (2000 est.) mun., 222,859.

**Ternopil,** Russian TERNOPOL, formerly TARNOPOL, *oblast* (province), western Ukraine. It occupies an area on the Volyn-Podilsk Upland. Its southern boundary runs along the Dniester River, to which the greater part of the *oblast* drains. The entire *oblast* lies in the forest-steppe transition zone and has fertile soils, most of which have been plowed; only small, scattered groves of oak survive. The intensive cultivation has brought about severe, widespread soil erosion and gullying. Ternopil *oblast*'s economy is overwhelmingly agricultural, and the density of its rural population is remarkably high. Grains, chiefly rye, wheat, and corn (maize), occupy a large portion of the arable land. Sugar beets lead the industrial crops, especially in the east. Sunflowers are grown in the west and some tobacco in the south, while hops are generally important. The *oblast*'s abundant potato crops are used for human and animal consumption and for distilling. Approximately one-quarter of the population lives in small towns, which are engaged chiefly in processing farm produce, especially sugar refining. Ternopil city is the administrative centre. Area 5,300 square miles (13,800 square km). Pop. (1998 est.) 1,168,400.

**Ternopil,** Russian TERNOPOL, formerly TARNOPOL, city and administrative centre of Ternopil *oblast* (province), western Ukraine. It lies along the upper Seret River, 70 miles (115 km) east of Lviv. Although its date of foundation is unknown, the first known reference to Ternopil occurs in 1524, when as a Polish town it was sacked by the Tatars. Taken by Austria in 1772 and returned to Poland in 1920, Ternopil was annexed by the U.S.S.R. in 1939. World War II inflicted exceptionally heavy damage on the city. Modern Ternopil is an important railway junction and has light engineering, food-processing, and consumer-goods industries. The 16th-century Nativity and 18th-century Dominican churches survive. A medical institute is also located there. Pop. (1998 est.) 235,100.

**Terpander** (fl. *c.* 647 BC, Lesbos, Asia Minor [Greece]), Greek poet and musician of the Aegean island of Lesbos.

Terpander was proverbially famous as a singer to the accompaniment of the kithara, a seven-stringed instrument resembling a lyre, which he was said to have invented, and from the name of which the word "guitar" derives. He was also credited with important developments in music for that instrument and is said to have won a prize for music at the 26th Olympiad held in Sparta (676/672).

**terpene,** any of a class of hydrocarbons occurring widely in plants and animals and empirically regarded as built up from isoprene, a hydrocarbon consisting of five carbon atoms attached to eight hydrogen atoms ($C_5H_8$). The term is often extended to the terpenoids, which are oxygenated derivatives of these hydrocarbons.

Biological formation of the terpenes occurs by the combination of two molecules of acetic acid to give mevalonic acid ($C_6H_{12}O_4$) and conversion of the latter to isopentenyl pyrophosphate, which contains the five-carbon isoprene skeleton. Further transformations of the isopentenyl compound yield the true terpenes and the terpenoids.

The true terpenes are usually grouped according to the number of isoprene ($C_5H_8$) units in the molecule: monoterpenes ($C_{10}H_{16}$) contain two such units; sesquiterpenes ($C_{15}H_{24}$), three; diterpenes ($C_{20}H_{32}$), four; triterpenes ($C_{30}H_{48}$), six; and tetraterpenes ($C_{40}H_{64}$), eight. Rubber and gutta-percha are polyterpenes in which 1,000–5,000 isoprene units are joined in a long chain. Monoterpenes, sesquiterpenes, and diterpenes are abundant in the essential oils of plants: turpentine contains several monoterpenes, and the rosin acids are diterpenes. Vitamin A is another important diterpene. The triterpene squalene, obtainable from shark-liver oil, may be converted to cholesterol and many other steroids. The carotenoid pigments are the best known tetraterpenes.

**Terpsichore,** in Greek religion, one of the nine Muses, patron of lyric poetry and dancing (in some versions, flute playing). She is perhaps the most widely known Muse, her name having entered general English as the adjective terpsichorean ("pertaining to dancing"). In some accounts she was the mother of the half-bird, half-woman Sirens, whose father was the sea god Achelous or the river god Phorcys.

**terra-cotta** (Italian: "baked earth"), literally, any kind of fired clay but, in general usage, a kind of object—*e.g.*, vessel, figure, or structural form—made from fairly coarse, porous clay that when fired assumes a colour ranging from dull ochre to red and usually is left unglazed. Most terra-cotta has been of a utilitarian kind because of its cheapness, versatility, and durability. Limitations in the basic materials often cause a superficial similarity between simply made works as far separated by time and distance as early Greece and the modern cultures of Latin America.





*Early Renaissance terra-cottas*
(Top) "Madonna and Child," glazed terra-cotta relief from the workshop of Andrea Della Robbia (1435–1525), Florence and (bottom) "Virgin and Child," polychromed and gilded terra-cotta relief by Andrea del Verrocchio, *c.* 1470; both in the Metropolitan Museum of Art, New York City
By courtesy of the Metropolitan Museum of Art, New York, (top) The Jules S. Bache Collection, 1949, (bottom) Rogers Fund, 1909

Throughout the ancient world, one of the most common uses of terra-cotta was for building-brick, roof tiles, and sarcophagi, the last often decorated with paintings. Small terra-cotta figures from the Early Bronze Age, as early as 3000 BC, have been found in Greece, and larger objects dating from the 7th century BC have also been found. Greek artists carried the craft to Etruria, whence both Etruscan and Greek sculptors moved to work in Rome. Most Greek terra-cotta statuary, commoner than once thought, was used to decorate temples. The modelled Etruscan statues, at times very Greek in style but often with a gayer or fiercer flavour, were admired widely in antiquity. Figures on Etruscan sarcophagi often were of terra-cotta. Few Roman terra-cotta statues have been found.

Molded statuettes six to seven inches (15–18 centimetres) in height are common throughout the ancient world, among them very early primitive figures from Cyprus and painted, glazed human figures from Minoan Crete. The Cypriot figures often comprise groups of dancers or warriors, the Cretan, lively poses of women, horsemen, or animals. After the 7th century BC, styles became less hieratic, the subjects more mundane—*e.g.*, a nurse with child, a teacher and pupils, an actor in costume. The Tanagra figurines, found in Tanagra in central Greece (Boeotia), are the best known of this kind (*see* Tanagra figurine). In the Hellenistic period, from the 4th century BC, centres of statuette production moved to Asia Minor and westward, being found throughout the Roman Empire as far as Britain. Styles in the East became more ornate and influenced by Oriental values in design and subject.

Architectural relief, especially where wood or clay was used for building, used floral or more abstract designs and such figured representations as chariot races or animal or female heads; examples have been found in Asia Minor, Greece, and Etruscanized southern Italy. Votive reliefs also were common, notably those of the local divinities and heroes rendered broadly and smoothly in Tarentum (Taranto), southern Italy, and the small, meticulous reliefs of local cults found at Locris in central Greece. The fine 5th-century reliefs from the island of Melos, in which mythological scenes predominate, decorated chests. Much Roman architecture is decorated with relief themes from mythology, especially of Dionysus and his revellers.

The use of terra-cotta for all purposes virtually died out between the end of the Roman Empire and the 14th century; in 15th-century Italy and Germany it appeared again, either molded or carved, and in its natural colour as friezes, moldings, or inset medallions decorating buildings. A new use of terra-cotta was in the highly glazed and coloured sculpture introduced in Florence early in the 15th century by the Della Robbia family. The effect, adding a freshness of accent especially to marble and stone, was imitated widely, and the use of terra-cotta, glazed or unglazed, spread throughout Europe. Free sculpture in terra-cotta also was revived in the 15th century by such artists as Donatello, Verrocchio, and especially Guido Mazzoni and Antonio Begarelli working in Modena; often it was painted in natural colours or to imitate marble or bronze.

During the following centuries most terra-cotta figures were executed as preliminary studies, though the works of such 18th-century French artists as Jean-Baptiste Lemoyne and Jean-Antoine Houdon display a personal immediacy of subject that is not transferable to the harder material.

In the same period such pottery centres as Sèvres in France introduced finely wrought small groups with allegorical and mythological themes. Terra-cotta was used both architecturally and for figures during the 19th century, but its modern revival dates from the 20th century, when both potters and architects again became interested in the aesthetic properties of the material.

**Terra Mater** (Roman goddess): *see* Tellus.

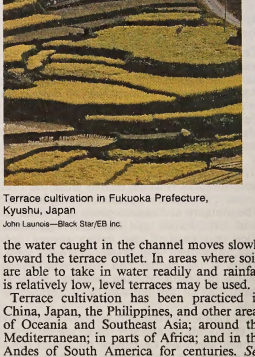
**terra sigillata ware,** bright-red, polished pottery used throughout the Roman Empire from the 1st century BC to the 3rd century AD. The term means literally ware made of clay impressed with designs. Other names for the ware are Samian ware (a misnomer, since it has nothing to do with the island of Samos) and Arretine ware (which, properly speaking, should be restricted to that produced at Arretium—modern Arezzo, Italy—the original centre of production and source of the best examples). After the decline of Arretium production, terra sigillata was made in Gaul from the 1st century AD at La Graufesenque (now Millau, Fr.) and later at other Gallic centres, whence it was exported in large quantities to outlying parts of the Roman Empire, including Britain. The body of the ware was generally cast in a mold. Relief designs, taken from a wide repertory of patterns and figurative scenes, were also cast in molds (which had been impressed with stamps in the desired pattern) and then applied to the vessels. Such are the fluctuations of style in these ornaments, and so frequently are potter's marks stamped on the vessels, that the wares provide a valuable means of dating the other archaeological material found with them. The quality of the pottery was at the outset high, considering that it was so mass-produced. There was, however, a gradual coarsening both of forms and of the decoration over the four centuries of production.

**terrace, marine,** a rock terrace formed where a sea cliff, with a wave-cut platform (*q.v.*) before it, is raised above sea level.

**terrace, river:** *see* river terrace.

**terrace cultivation,** method of growing crops on sides of hills or mountains by planting on graduated terraces built into the slope. Though labour-intensive, the method has been employed effectively to maximize arable land area in variable terrains and to reduce soil erosion and water loss.

In most systems the terrace is a low, flat ridge of earth built across the slope, with a channel for runoff water just above the ridge. Usually terraces are built on a slight grade so that the water caught in the channel moves slowly toward the terrace outlet. In areas where soils are able to take in water readily and rainfall is relatively low, level terraces may be used.



Terrace cultivation in Fukuoka Prefecture, Kyushu, Japan
John Launois—Black Star/EB Inc.

Terrace cultivation has been practiced in China, Japan, the Philippines, and other areas of Oceania and Southeast Asia; around the Mediterranean; in parts of Africa; and in the Andes of South America for centuries. *See also* paddy.

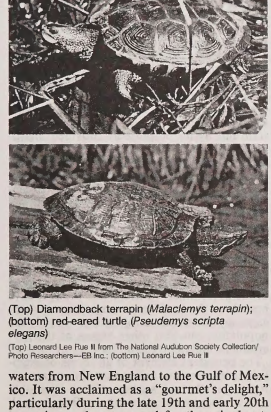
**Terracina,** Latin TARRACINA, town and episcopal see, Latina province, Lazio (Latium) region, south central Italy, on the Golfo (gulf) di Gaeta (an inlet of the Tyrrhenian Sea) at the foot of the Monti Ausoni, southeast of Rome. Originating as the Anxur of the Volsci tribe, it passed under Roman domination *c.* 400 BC and became known as Tarracina. An important city on the Appian Way, it assumed great importance as a resort, as witnessed by the remains of the forum, sumptuous temples, baths, and theatres and villas of the emperors Tiberius, Galba, and Vitellius.

Dominating the town are the ruins of the temple of Jupiter Anxur and the ancient

Anxur wall on the slopes overlooking the modern town and port. The cathedral of S. Cesario (consecrated 1074) stands over the ancient temple of Rome and Augustus, remains of which can be seen in the outer walls. In the modern town are municipal parks, a town hall (1958), and a museum.

Now a popular seaside resort, Terracina's principal economic activities are fishing, food preserving, and the manufacture of floor coverings and electrical appliances. The muscatel grapes of the district are exported. Pop. (1999 est.) mun., 38,662.

**terrapin,** any aquatic turtle of the family Emydidae, especially the diamondback terrapin (*Malaclemys terrapin*). The diamondback terrapin inhabits salt marshes and coastal



(Top) Diamondback terrapin (*Malaclemys terrapin*); (bottom) red-eared turtle (*Pseudemys scripta elegans*)

(Top) Leonard Lee Rue III from The National Audubon Society Collection/ Photo Researchers—EB Inc.; (bottom) Leonard Lee Rue III

waters from New England to the Gulf of Mexico. It was acclaimed as a "gourmet's delight," particularly during the late 19th and early 20th centuries, and was named for the raised patterns on the plates of its brownish or black upper shell (carapace). It has spots on its head and legs and a raised, sometimes saw-edged, ridge along the centre of the upper shell. The female, attaining a shell length of about 23 centimetres (9 inches), is considerably larger than the male, which grows to about 14 cm (5.5 in.). The diet of the diamondback terrapin includes small animals and some vegetation.

The turtles of the genus *Pseudemys* (or *Chrysemys* according to some zoologists)—the cooters, sliders, red-bellied and yellow-bellied turtles, and others—are sometimes referred to collectively as terrapins. Members of this genus range from the northeastern United States to Argentina. They feed on both animal and vegetable material and usually inhabit rivers, ponds, and other bodies of fresh water. The females, larger than the males, attain carapace lengths of about 15–40 cm (6–16 in.), depending on species.

The eight species of *Pseudemys* are found in the southeastern United States. Several members of the genus are of economic importance. Large numbers of infant red-eared turtles, or sliders (*P. scripta elegans*), are sold in pet shops. These turtles are found in the central and southeastern United States and are distinguished by a large red spot behind each eye. The suwannee cooter, *P. floridana* (or *concinna*), is a large, blackish turtle of the rivers and coastal waters of the Gulf of Mexico. It is known as suwannee chicken and is considered the tastiest member of the genus.

**Terre Haute,** city, seat (1818) of Vigo County, western Indiana, U.S., on a 10-mi (16-km) square plateau above the Wabash River (whence its French name meaning "high ground"), 70 mi west-southwest of Indianapolis. The site was once a place of rendezvous for Indian tribes, and nearby Ft. Harrison, built in 1811, was frequently attacked by Tecumseh's Shawnees. Laid out in 1816, it became an important community on the Cumberland (National) Road (1835), the Wabash and Erie Canal (1849), and the Richmond Railroad (1852). Development of local bituminous coal deposits in 1875 plus several oil wells stimulated industrial growth. Miners organized early, and the city is remembered in labour history for militant union activity. The home of Eugene V. Debs, who organized the country's first industrial union (American Railway Union) in 1893, still stands. The city subsequently acquired highly diversified industries including the manufacture of chemicals, paper products, beverages, and phonograph records. Terre Haute is the seat of Indiana State University (1870) and Rose-Hulman Institute of Technology (1874). St. Mary-of-the-Woods College (1840) is 15 mi north. Author Theodore Dreiser (*q.v.; An American Tragedy*) and his brother, the composer Paul Dresser ("On the Banks of the Wabash"), were born in Terre Haute; the latter's birthplace is preserved as a state shrine and memorial. Inc. 1853. Pop. (2000) city, 59,614; Terre Haute MSA, 149,192.

**Terres Australes et Antarctiques Françaises,** English FRENCH SOUTHERN AND ANTARCTIC LANDS, territory of the French community, consisting of the islands of Saint-Paul and Nouvelle Amsterdam (*qq.v.*) and the island groups of Kerguelen and Crozet (*qq.v.*) in the south Indian Ocean, as well as the Adélie Coast (*q.v.*) on the Antarctic continent. The barren and for the most part uninhabited lands were linked for administrative purposes with Madagascar from 1924 until 1955, when they became a French territory governed under a special statute by a senior administrator who is partially resident in Paris. It was not until the arrival of scientific personnel in 1949–50 that they were effectively occupied.

**terrestrial locomotion,** any of several forms of animal movement such as walking and running, jumping (saltation), and crawling. Walking and running, in which the body is carried well off the surface on which the animal is moving (substrate), occur only in arthropods and vertebrates. Running (cursorial) vertebrates are characterized by elongated lower legs and feet and by reduction and fusion of toes.

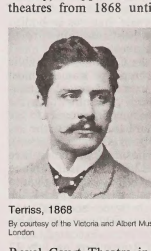
Saltatory locomotion, movement by leaping, hopping, or jumping, is found in a number of insects (*e.g.,* fleas, grasshoppers) and vertebrates (frogs, kangaroos, rabbits and hares, some rodents). Specializations in mammalian saltators include, to varying degrees, enlargement of the hind legs and reduction of the forelegs; elongation of the midregion (metatarsals) of the hind feet; and elongation of the tail as a balancing organ.

Crawling differs from other forms of terrestrial locomotion in that the body touches or nearly touches the substrate. Many aquatic vertebrates, whose limbs are often short and poorly adapted for terrestrial movement, are restricted to crawling when on land. Snakes and other limbless vertebrates are highly adapted crawlers, using a variety of methods for gaining adhesion against the substrate.

**Terricus** CARNOTENSIS: *see* Thierry de Chartres.

**Terriss, William,** original name WILLIAM CHARLES JAMES LEWIN (b. Feb. 20, 1847, London—d. Dec. 16, 1897, London), one of England's leading actors of the later Victorian stage.

After scoring his first success as Doricourt in *The Belle's Stratagem,* a comedy by Hannah Cowley, he appeared at the principal London theatres from 1868 until his death. At the



Terriss, 1868

By courtesy of the Victoria and Albert Museum, London

Royal Court Theatre in 1878, Terriss acted opposite Ellen Terry, later playing Romeo to Adelaide Neilson's Juliet. In 1880 he joined Sir Henry Irving, the great Victorian actor-manager, at the Lyceum Theatre, performing such Shakespearean parts as Cassio (in *Othello*), Mercutio (in *Romeo and Juliet*), and Henry VIII. He remained with the Lyceum until 1883, when he joined the Adelphi Theatre, of which he became the leading man and where, as the hero of a famous series of melodramas, he became a public idol. His gusto and debonair style had great appeal and earned him the affectionate nickname "Breezy Bill." At the height of his career he was stabbed to death by a madman, Richard Prince, while entering the Adelphi.

Terriss' daughter Ellaline (b. April 13, 1871—d. June 16, 1971) became a great star in music halls and in both straight and musical plays from the 1890s to the 1920s. After making her debut in 1888, she formed a team with her husband, the actor-manager and dramatist Sir Seymour Hicks (1871–1949).

**Territoire de Wallis and Futuna:** *see* Wallis and Futuna.

**territory,** in ecology, any area defended by an organism or a group of similar organisms for such purposes as mating, nesting, roosting, or feeding. Most vertebrates and some invertebrates, such as arthropods, including insects, exhibit territorial behaviour. Possession of a territory involves aggressive behaviour and thus contrasts with the home range, which is the area in which the animal normally lives. Home range is not associated with aggressive behaviour, although parts of the home range may be defended: in this case the defended part is the territory. The type of territory varies with the social behaviour and environmental and resource requirements of the particular species and often serves more than one function, but whatever the type, the territory acts as a spacing mechanism and a means of allocating resources among a segment of the population and denying it to others. Some authorities also consider plants or animals that secrete repulsive chemicals into their immediate environments to be territorial, because the substances space individuals of the species apart from one another.

**Terror, Reign of,** also called THE TERROR, French LA TERREUR, the period of the French Revolution from Sept. 5, 1793, to July 27, 1794 (9 Thermidor, year II). Caught up in civil and foreign war, the Revolutionary government decided to make "Terror" the order of the day (September 5 decree) and to take harsh measures against those suspected of being enemies of the Revolution (nobles, priests, hoarders). In Paris a wave of executions followed. In the provinces, representatives on

mission and surveillance committees instituted local terrors. The Terror had an economic side embodied in the Maximum, a price-control measure demanded by the lower classes of Paris, and a religious side that was embodied in the program of de-Christianization pursued by the followers of Jacques Hébert.

During the Terror, the Committee of Public Safety (of which Robespierre was the most prominent member) exercised virtual dictatorial control over French government. In the spring of 1794, it eliminated its enemies to the left (the Hébertists) and to the right (the Indulgents, or followers of Georges Danton). Still uncertain of its position, the committee obtained the Law of 22 Prairial, year II (June 10, 1794), which suspended a suspect's right to public trial and to legal assistance and left the jury only a choice between acquittal and death. The Terror that followed, in which about 1,400 persons were executed, contributed to the fall of Robespierre on July 27 (9 Thermidor).

During the Reign of Terror, at least 300,000 suspects were arrested; 17,000 were officially executed, and many died in prison or without trial.

**terrorism,** the systematic use of violence to create a general climate of fear in a population and thereby to bring about a particular political objective. Terrorism has been practiced by political organizations with both rightist and leftist objectives, by nationalistic and religious groups, by revolutionaries, and even by state institutions such as armies, intelligence services, and police.

*Definitions of terrorism.* Definitions of terrorism are usually complex and controversial, and, because of the inherent ferocity and violence of terrorism, the term in its popular usage has developed an intense stigma. It was first coined in the 1790s to refer to the terror used during the French Revolution by the revolutionaries against their opponents. The Jacobin party of Maximilien Robespierre and its Reign of Terror used mass executions and the guillotine to enforce its authority. Although terrorism in this usage implied an act of violence by a state against its domestic enemies, since the 20th century the term has been applied most frequently to violence aimed, either directly or indirectly, at governments in an effort to influence policy or topple an existing regime.

Terrorism is not legally defined in all jurisdictions; the statutes that do exist, however, generally share some common elements. Terrorism involves the use or threat of violence and seeks to create fear, not just within the direct victims but among a wide audience. The degree to which it relies on fear distinguishes terrorism from both conventional and guerrilla warfare. Although conventional military forces invariably engage in psychological warfare against the enemy, their principal means of victory is strength of arms. Similarly, guerrilla forces, which often rely on acts of terror and other forms of propaganda, aim at military victory and occasionally succeed (*e.g.,* the Viet Cong in Vietnam and the Khmer Rouge in Cambodia). Terrorism proper is thus the systematic use of violence to generate fear, and thereby to achieve political goals, when direct military victory is not possible. This has led some social scientists to refer to guerrilla warfare as the "weapon of the weak" and terrorism as the "weapon of the weakest."

In order to attract and maintain the publicity necessary to generate widespread fear, terrorists must engage in increasingly dramatic, violent, and high-profile attacks. These have included hijackings, hostage takings, kidnappings, car bombings, and, frequently, suicide bombings. Although apparently random, the victims and locations of terrorist attacks often are carefully selected for their shock value. Schools, shopping centres, bus and train stations, and restaurants and nightclubs have been targeted both because they attract large crowds and because they are places with which members of the civilian population are familiar and in which they feel at ease. The goal of terrorism generally is to destroy the public's sense of security in the places most familiar to them. Major targets sometimes also include buildings or other locations that are important economic or political symbols, such as embassies or military installations. The hope of the terrorist is that the sense of terror these acts engender will induce the population to pressure political leaders toward a specific political end.

Some definitions treat all acts of terrorism, regardless of their political motivations, as simple criminal activity. For example, in the United States the standard definition used by the Federal Bureau of Investigation (FBI) describes terrorism as "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives." The element of criminality, however, is problematic, because it does not distinguish among different political and legal systems and thus cannot account for cases in which violent attacks against a government may be legitimate. A frequently mentioned example is the African National Congress (ANC) of South Africa, which committed violent actions against that country's apartheid government but commanded broad sympathy throughout the world. Another example is the Resistance movement against the Nazi occupation of France during World War II.

Since the 20th century, ideology and political opportunism have led a number of countries to engage in transnational terrorism, often under the guise of supporting movements of national liberation. (Hence, it became a common saying that "one man's terrorist is another man's freedom fighter.") The distinction between terrorism and other forms of political violence became blurred—particularly as many guerrilla groups often employed terrorist tactics—and issues of jurisdiction and legality were similarly obscured.

These problems have led some social scientists to adopt a definition of terrorism based not on criminality but on the fact that the victims of terrorist violence are most often innocent civilians. For example, the U.S. government eventually accepted the view that terrorism was premeditated, politically motivated violence perpetrated against noncombatant targets. Even this definition is flexible, however, and on occasions it has been expanded to include various other factors, such as that terrorist acts are clandestine or surreptitious, that terrorists choose their victims randomly, and that terrorist acts are intended to create an overwhelming sense of fear.

*Types of terrorism.* Various attempts have been made to distinguish among types of terrorist activities. It is vital to bear in mind, however, that there are many kinds of terrorist movements, and no single theory can cover them all. Not only are the aims, members, beliefs, and resources of groups engaged in terrorism extremely diverse, but so are the political contexts of their campaigns. One popular typology identifies three broad classes of terrorism: revolutionary, subrevolutionary, and establishment terrorism. Although this typology has been criticized as inexhaustive, it provides a useful framework for understanding and evaluating terrorist activities.

Revolutionary terrorism is arguably the most common form. Practitioners of this type of terrorism seek the complete abolition of a political system and its replacement with new structures. Modern instances of such activity include campaigns by the Italian Red Brigades, the German Red Army Faction (Baader-Meinhof Gang), the Basque separatist group ETA, and the Peruvian Sendero Luminoso (Shining Path), each of which attempted to topple national regimes. Subrevolutionary terror is rather less common. It is used not to overthrow an existing regime but to modify the existing sociopolitical structure. Since this modification is often accomplished through the threat of deposing the existing regime, subrevolutionary groups are somewhat more difficult to identify. An example can be seen in the ANC and its campaign to end apartheid in South Africa.

Establishment terrorism, often called state or state-sponsored terrorism, is employed by governments—or more often by factions within governments—against that government's citizens, against factions within the government, or against foreign governments or groups. This type of terrorism is very common but difficult to identify, mainly because the state's support is always clandestine. The Soviet Union and its allies allegedly engaged in widespread support of international terrorism during the Cold War; in the 1980s the United States supported rebel groups in Africa that allegedly engaged in acts of terrorism, such as the National Union for the Total Independence of Angola (UNITA); and various Muslim countries (*e.g.,* Iran and Syria) purportedly provided logistical and financial aid to Islāmic revolutionary groups engaged in campaigns against Israel, the United States, and conservative Muslim countries in the late 20th and early 21st centuries.

The military dictatorships in Chile (1973–90) and Argentina (1976–83) committed acts of state terrorism against their own populations. The violent police states of Joseph Stalin in the Soviet Union and Saddam Hussein in Iraq are examples of countries in which one organ of the government—often either the executive branch or the intelligence establishment—engages in widespread terror against not only the population but also other organs of the government, including the military.

The persistent element of all forms of establishment terrorism, unlike that of nonstate terrorism, is that of secrecy. States invariably seek to disavow their active complicity in such acts, both to evade international censure and to avoid political and military retribution by those they target.

*Group structure.* There is no one structure that is typical of terrorist organizations, and, in fact, there have been few groups in the modern period purely devoted to the use of terrorism. As mentioned above, governments, departments of governments, and guerrilla organizations have frequently engaged in or supported terrorism, as have para-state organizations and political parties in regions of the world where centralized governments are weak. Because of this ambiguity—not to mention the intense stigma attached to the term "terrorism"—it is therefore perhaps best not to use the term "terrorist groups" but to refer to "groups that engage in terrorism," irrespective of their structure or political commitments.

*History.* Terror has been practiced by state and nonstate actors throughout history and throughout the world. The ancient Greek historian Xenophon (*c.* 431–*c.* 350 BC) wrote of the effectiveness of psychological warfare against enemy populations. Roman emperors such as Tiberius (reigned AD 14–37) and Caligula (reigned AD 37–41) used banishment, expropriation of property, and execution as means to discourage opposition to their rule.

The most commonly cited example of early terror, however, was the activity of the Jewish Zealots, often known as the Sicarii (Hebrew: "Daggers"), who engaged in frequent violent attacks on fellow Hebrews suspected of collusion with the Roman authorities. Likewise, the use of terror was openly advocated by Robes-

pierre during the French Revolution, and the Spanish Inquisition used arbitrary arrest, torture, and execution to punish what it viewed as religious heresy. After the American Civil War (1861–65), defiant Southerners formed the Ku Klux Klan to intimidate supporters of Reconstruction (1865–77) and the newly freed former slaves. In the latter half of the 19th century, terror was adopted in western Europe, Russia, and the United States by adherents of anarchism, who believed that the best way to effect revolutionary political and social change was to assassinate persons in positions of power. From 1865 to 1905 a number of kings, presidents, prime ministers, and other government officials were killed by anarchists.

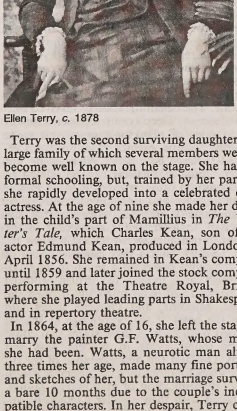
The 20th century witnessed great changes in the use and practice of terror. It became the hallmark of a number of political movements stretching from the extreme right to the extreme left of the political spectrum. Technological advances, such as automatic weapons and compact, electrically detonated explosives, gave terrorists a new mobility and lethality, and the growth of air travel provided new methods and opportunities. Terrorism was virtually a state policy in totalitarian states such as Nazi Germany under Adolf Hitler and the Soviet Union under Stalin. In these states arrest, imprisonment, torture, and execution were applied without legal guidance or restraints to create a climate of fear and to encourage adherence to the national ideology and the declared economic, social, and political goals of the state.

Terror has been used by one or both sides in anticolonial conflicts (*e.g.,* Ireland and the United Kingdom, Algeria and France, and Vietnam and France and the United States), in disputes between different national groups over possession of a contested homeland (*e.g.,* Palestinians and Israelis), in conflicts between different religious denominations (*e.g.,* Catholics and Protestants in Northern Ireland), and in internal conflicts between revolutionary forces and established governments (*e.g.,* in the successor states of the former Yugoslavia, Indonesia, the Philippines, Nicaragua, El Salvador, and Peru). In the late 20th and early 21st centuries some of the most extreme and destructive organizations that engaged in terrorism possessed a fundamentalist religious ideology (*e.g.,* Ḥamās and al-Qaeda, *qq.v.*). Some groups, including the Liberation Tigers of Tamil Eelam and Ḥamās, adopted the tactic of suicide bombing, in which the perpetrator would attempt to destroy an important economic, military, political, or symbolic target by detonating a bomb on or near his person. In the latter half of the 20th century the most prominent groups using terrorist tactics were the Red Army Faction, the Japanese Red Army, the Red Brigades, the Puerto Rican FALN, Fatah and other groups related to the Palestine Liberation Organization (PLO), the Sendero Luminoso, and the Liberation Tigers.

In the late 20th century the United States suffered several acts of terrorist violence by Puerto Rican nationalists (such as the FALN), antiabortion groups, and foreign-based organizations. The 1990s witnessed some of the deadliest attacks on American soil, including the bombing of the World Trade Center in New York City in 1993 and the Oklahoma City bombing, which killed 168 people, two years later. In addition, there were several major terrorist attacks on U.S. government targets overseas, including military bases in Saudi Arabia (1996) and the U.S. embassies in Kenya and Tanzania (1998). In 2000 an explosion triggered by suicide bombers caused the deaths of 17 sailors aboard a U.S. naval ship, the USS *Cole,* in the Yemeni port of Aden. The deadliest terrorist strikes to date were the September 11 attacks (*q.v.*; 2001), in which suicide terrorists associated with al-Qaeda hijacked four commercial airplanes, crashing two of them into the twin towers of the World Trade Center complex in New York City and one into the Pentagon building near Washington, D.C.; the fourth plane crashed near Pittsburgh, Pennsylvania. The crashes destroyed much of the World Trade Center complex and a large portion of one side of the Pentagon and killed some 3,000 people.

Even prior to the September 11 attacks, there was widespread concern that terrorists might escalate their destructive power to vastly greater proportions by using weapons of mass destruction—including biological, chemical, or nuclear weapons—as was done by the Japanese doomsday cult AUM Shinrikyo (*q.v.*) in 1995. These fears were intensified after September 11, when a number of letters laced with the anthrax (*q.v.*) bacterium were delivered to political leaders and journalists in the United States, leading to several deaths. President George W. Bush made a broad war against terrorism the centrepiece of U.S. foreign policy at the beginning of the 21st century. (J.P.J./Ed.)

**Terry, (Alice) Ellen** (b. Feb. 27, 1847, Coventry, Warwickshire, Eng.—d. July 21, 1928, Small Hythe, Kent), English actress who became one of the most popular stage performers in both Great Britain and North America. For 24 years (1878–1902) she worked as the leading lady of Sir Henry Irving (*q.v.*) in one of the most famous partnerships in the theatre. In the 1890s she began her famous "paper courtship" with George Bernard Shaw, one of the most brilliant correspondences in the history of English letter writing.



Ellen Terry, *c.* 1878

Terry was the second surviving daughter in a large family of which several members were to become well known on the stage. She had no formal schooling, but, trained by her parents, she rapidly developed into a celebrated child actress. At the age of nine she made her debut in the child's part of Mamillius in *The Winter's Tale,* which Charles Kean, son of the actor Edmund Kean, produced in London in April 1856. She remained in Kean's company until 1859 and later joined the stock company performing at the Theatre Royal, Bristol, where she played leading parts in Shakespeare and in repertory theatre.

In 1864, at the age of 16, she left the stage to marry the painter G.F. Watts, whose model she had been. Watts, a neurotic man almost three times her age, made many fine portraits and sketches of her, but the marriage survived a bare 10 months due to the couple's incompatible characters. In her despair, Terry could scarcely be induced to return to the stage but eventually did so, though playing with little of her former distinction. It was in 1867 that she first appeared with Irving, playing Katherine in *The Taming of the Shrew.*

The following year she left the stage abruptly to live for six years in Hertfordshire with the architect and theatrical designer Edward Godwin (1833–86), whom she had met in Bristol and who became the father of her children, Edith and Edward Gordon Craig (1872–1966), who was to become a renowned actor, stage designer, and producer. When her association with Godwin began to fail, it was the author, dramatist, and producer Charles Reade who found her and brought her back to the stage. In the role of Portia she showed new maturity in a striking production of *The Merchant of Venice* (1875), designed by Godwin. On parting from Godwin, she became responsible for rearing their children. Before joining Irving at the Lyceum Theatre in 1878, she completed a successful season at the Court Theatre. In 1877 she received a divorce from Watts and married an actor, Charles Kelly, mainly to give her children a "name." They soon separated, and Kelly died in 1885.

When Terry joined Irving, she was 31 and he 40. It was the beginning of a close association with a man whose life and resources were to be dedicated to the theatre and who was to make the Lyceum a centre for new, striking interpretations—of Shakespeare in particular. His approach to sponsorship of new plays was that of a great stage visualizer and star actor who required a scenarist to assemble a script that would give him a framework for compelling performance and spectacular stage effects. As part of his mise-en-scène, he needed a beautiful woman to lend her own glamour to his productions. Terry responded to his needs with selfless dedication, playing many great Shakespearean parts—Portia (1879), Juliet and Beatrice (1882), Lady Macbeth (1888), Queen Katharine (1892), Imogen (1896), Volumnia (1901), Ophelia (1878), Desdemona (1881), and Cordelia (1892). She also willingly undertook such humble roles as Rosamund in Tennyson's *Becket* (1893).

Whether in London or on arduous provincial tours, in New York City or on exhausting excursions across North America, Ellen Terry acted as Irving's leading lady until she had grown too old for most of the parts in his repertory. They severed their partnership in 1902, three years before his death. Their relationship was as close in private as in public life, but when his affection began to wane in the 1890s Terry entered into her famous correspondence with Bernard Shaw. In 1907 she married the American actor James Carew, some 30 years her junior; although they soon parted, he remained her friend.

It was in comedy and in plays of tender sentiment, as well as in Shakespeare, that Terry's talent shone. When she left Irving it was to appear with Sir Herbert Beerbohm Tree in *The Merry Wives of Windsor* (1902), and Shaw eventually persuaded her to appear as Lady Cecily Waynefleet in *Captain Brassbound's Conversion* (1906), one of several parts he wrote with her in mind. When she celebrated her golden jubilee in 1906 at the Theatre Royal, Drury Lane, all the theatrical personalities of the day shared the stage with her.

Shaw saw Terry as a shining example of a modern, intelligent actress, capable of both naturalistic and intellectual performance. During the 1890s he constantly urged her to leave Irving, whom he regarded as reactionary, and to dedicate herself to promoting modern drama, represented in the works of Ibsen and himself. But unlike Sarah Siddons, her 18th-century predecessor as undisputed queen of the English theatre for a whole generation, Terry was ill suited by temperament to become a theatrical leader in her own right. Her particular, instinctual genius flowered only through her long service with Irving.

Although Irving had paid her £200 a work-

ing week for most of 20 years, she still had to earn a living in her later years. She worked in the theatre, last appearing on stage in 1925; in films; and as a Shakespearean lecturer-recitalist, reinterpreting her successes on tours in the United States, Great Britain, and Australia. Her warm, generous personality made her a favourite wherever she went, but eyesight and memory began to fail. Belatedly, in 1925, she was made a Dame Grand Cross of the British Empire. She died three years later at her cottage, Small Hythe, in Kent, which became the Ellen Terry Memorial Museum and in 1939 was given to the National Trust by her daughter, Edith Craig. (R.M.)

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**Terry, Samuel** (b. 1776?, England—d. Feb. 22, 1838, New South Wales, Australia), pioneer Australian landowner and merchant, known as "the Rothschild of New South Wales."

Terry was transported to Australia after having been convicted of stealing 400 pairs of stockings. Even before his sentence expired in 1807, he had opened a shop in Parramutta; and in 1810 he moved to Sydney, opening an inn and a store and marrying a widow. Within 10 years he became amazingly prosperous, speculating in urban and rural properties, acquiring mortgages, and becoming one of the largest shareholders in the Bank of New South Wales. In the 1820s and '30s he also became a philanthropist and a sometime politician, espousing the causes of the emancipists. He was the first of a politically and financially influential Australian family, which intermarried with other successful families.

*Consult the* INDEX *first*

**Terry, Sonny,** original name SAUNDERS TERRELL (b. Oct. 24, 1911, Greensboro, Ga., U.S.—d. March 11, 1986, Hempstead, N.Y.), American blues singer and harmonica player who became the touring and recording partner of guitarist Brownie McGhee in 1941.

Blinded in childhood accidents, Terry was raised by musical parents and developed a harmonica style that imitated sounds ranging from moving trains to barnyard animals, often using his voice while playing these effects. He was influenced by the harmonica player DeFord Bailey, who broadcast nationally on the radio program *Grand Ole Opry*. Terry traveled as an itinerant musician from 1929 through the 1930s, working with Blind Boy Fuller and recording with him in 1937–40.

Terry first met McGhee in 1939 and in 1940 performed with him and the singer Paul Robeson in Washington, D.C. Terry and McGhee first recorded together in 1941. Subsequently they recorded extensively and toured internationally, becoming a popular nightclub, concert, and folk, blues, and heritage festival attraction. During his long career, Terry also performed with such bluesmen as Blind Gary Davis, Mississippi John Hurt, and Big Bill Broonzy. Terry appeared in the Broadway musical *Finian's Rainbow* (1947–48) and the play *Cat on a Hot Tin Roof* (1955–57).

**Tertiary Period,** interval of geologic time lasting from 66.4 to 1.6 million years ago. It constitutes the first of two periods of the Cenozoic Era, the second being the Quaternary. The Tertiary has five subdivisions, which from oldest to youngest are the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs. Some authorities prefer not to use the term Tertiary and instead divide the time interval encompassed by it into two periods, the Paleogene Period (66.4 to 23.7 million years ago) and the Neogene Period (23.7 to 1.6 million years ago).

A brief treatment of the Tertiary Period follows. For full treatment, *see* MACROPAEDIA: Geochronology.

During most of the Tertiary Period the spatial distribution of the major continents was to a large extent similar to that of today. Emergence and submergence of land bridges between continents, particularly between North and South America, Eurasia and Africa, and Asia and North America, critically affected the migration of both continental and marine faunas and floras. The most important Tertiary geologic events, however, were those that influenced the topography of the continents. Virtually all the major existing mountain belts and ranges, notably the Andes, the Rockies, the Alps, the Himalayas, and the Atlas Mountains, were formed either partly or wholly during episodes of mountain building during the Tertiary.

In the early Tertiary, climatic conditions were generally considerably warmer than today. Evidence from deep-sea cores shows that these conditions were terminated by a sharp, global episode of cooling at the end of the Eocene. During the Oligocene and particularly the Miocene, glacier ice built up in the Antarctic, eventually forming a massive ice sheet that greatly affected oceanic and atmospheric circulation patterns. The Miocene and Pliocene were characterized by relatively weak oscillations between warmer and cooler global conditions that gradually became more pronounced until an episode of major cooling about 1.6 million years ago marked the effective beginning of the Quaternary Period and its glacial-interglacial cycles.

The beginning of the Tertiary marked the onset of the Cenozoic Era, the era of recent life. A major worldwide faunal change took place at the end of the Cretaceous Period that preceded the Tertiary. On land the dinosaurs and pterosaurs became extinct, as did the giant marine reptiles, such as the ichthyosaurs, mosasaurs, and plesiosaurs, of the oceans and inland seas. Ammonites and several other groups of marine invertebrates also died out at this time. The belemnites barely survived into the Paleocene. Deep-ocean sediments reveal that a series of planktonic organisms quite suddenly became extinct close to the Cretaceous-Tertiary boundary. Whether or not these multiple extinctions can be related to some common cause or event is still a matter of considerable and unresolved controversy, though there is growing evidence that the impact of an asteroid (or meteorite) in the Caribbean region triggered the extinctions.

The Tertiary faunas that replaced those of the Cretaceous possessed a much more modern aspect, and, indeed, the British geologist Sir Charles Lyell, who originally defined the Eocene, Miocene, and Pliocene stages, did so on the basis of the percentage of species recorded from each of these stages that could still be found living in modern seas and oceans. On land the disappearance of the dinosaurs was followed by a considerable evolutionary diversification of mammalian faunas. Compared with their smaller Cretaceous ancestors, many groups of mammals demonstrated a definite trend toward larger size. Tertiary land vegetation was certainly richer and more varied than that of the Cretaceous. Angiosperms, predominantly woody trees and shrubs, had already become the principal constituents of the vegetation over large areas by the Late Cretaceous, and during the mid-Tertiary many low-growing herbaceous taxa, including grasses, evolved. This led directly to the development of grazing in several different lineages of mammals and to an expansion of other herbivorous groups, such as the land mollusks. At the same time, a very important diversification of insects, particularly such orders as Lepidoptera (butterflies and moths), Coleoptera (beetles), and Hymenoptera (ants, bees, and wasps), was taking place in which coevolution with particular species or genera of angiosperms clearly occurred. The Tertiary was also the period of expansion and diversification of the Primates, which evolved from the Insectivora. The earliest generally accepted hominid fossils, those of *Australopithecus,* come from rocks of Pliocene age (5.3 to 1.6 million years old) in Eastern Africa. An australopithecine species is thought to be ancestral to modern human beings.

Among marine organisms, gastropod mollusks and bony fishes evolved rapidly and are often associated with increasing specialization of ecological niches and feeding habits. Planktonic Foraminifera, because of their rapid evolution and wide dispersal, are of particular importance in the understanding of Tertiary marine stratigraphy and climate. Paleontologic, paleomagnetic, and isotopic studies of deep-sea sediment cores containing foraminiferans provide a reasonably accurate correlation and dating of Tertiary marine sediments both at the continental margins and in the deep oceans.

**Terts, Abram:** *see* Sinyavsky, Andrey Donatovich.

**Tertullian,** Latin in full QUINTUS SEPTIMUS FLORENS TERTULLIANUS (b. *c.* 155/160, Carthage [now in Tunisia]—d. after 220, Carthage), important early Christian theologian, polemicist, and moralist who, as the initiator of ecclesiastical Latin, was instrumental in shaping the vocabulary and thought of Western Christianity.

*Life.* Knowledge of the life of Tertullian is based almost wholly on documents written by men living more than a century after him and from obscure references in his own works. On this basis a general outline of his life has been constructed, but most of the details have been continually disputed by modern scholars.

He was born in Carthage, which, at that time (approximately AD 155–160), was second only to Rome as a cultural and educational centre in the West. Tertullian received an exceptional education in grammar, rhetoric, literature, philosophy, and law. Little is known of his early life. His parents were pagan, and his father may have been a centurion (*i.e.,* a noncommissioned officer) in an African-based legion assigned to the governor of the province. After completing his education in Carthage, he went to Rome, probably in his late teens or early 20s, to study further and perhaps begin work as a lawyer. He is most likely not the jurist Tertullian mentioned in the Digest, a collection of Roman legal opinion compiled under the aegis of the 6th-century Byzantine emperor Justinian, though this is disputed.

While in Rome, he became interested in the Christian movement, but not until he returned to Carthage toward the end of the 2nd century was he converted to the Christian faith. He left no account of his conversion experience, but in his early works, *Ad martyras* ("To the Martyrs"), *Ad nationes* ("To the Nations"), and *Apologeticum* ("Defense"), he indicated that he was impressed by certain Christian attitudes and beliefs: the courage and determination of martyrs, moral rigorism, and an uncompromising belief in one God. By the end of the 2nd century the church in Carthage had become large, firmly established, and well organized and was rapidly becoming a pow-

erful force in North Africa. By the year 225 there were approximately 70 bishops in Numidia and Proconsularis, the two provinces of Roman Africa. Tertullian emerged as a leading member of the African church, using his talents as a teacher in instructing the unbaptized seekers and the faithful and as a literary defender (apologist) of Christian beliefs and practices. According to Jerome, a 4th-century biblical scholar, Tertullian was ordained a priest. This view, however, has been challenged by some modern scholars.

*Literary activities.* During the next 20 to 25 years—*i.e.*, from his early 40s to mid-60s—Tertullian devoted himself almost entirely to literary pursuits. Developing an original Latin style, the fiery and tempestuous Tertullian became a lively and pungent propagandist though not the most profound writer in Christian antiquity. His works abound with arresting and memorable phrases, ingenious aphorisms, bold and ironic puns, wit, sarcasm, countless words of his own coinage, and a constant stream of invective against his opponents. Yet, he could be gentle and sensitive, as in a treatise to his wife (*Ad uxorem*), and he could be self-critical and reflective, as in his treatise on patience (*De patientia*), a virtue that he admitted was conspicuously absent from his life.

As a historical personage Tertullian is known less for what he did than for what he wrote. The range of his interests and the vigour with which he pursued them, however, encouraged other Christians to explore previously unInvestigated areas of life and thought. Like his contemporaries, he wrote works in defense of the faith (*e.g., Apologeticum*) and treatises on theological problems against specific opponents: *Adversus Marcionem* ("Against Marcion," an Anatolian heretic who believed that the world was created by the evil god of the Jews), *Adversus Hermogenem* ("Against Hermogenes," a Carthaginian painter who claimed that God created the world out of preexisting matter), *Adversus Valentinianos* ("Against Valentinus," an Alexandrian Gnostic, or religious dualist), and *De resurrectione carnis* ("Concerning the Resurrection of the Flesh"). He also wrote the first Christian book on Baptism, *De Baptismo*; a book on the Christian doctrine of man, *De anima* ("Concerning the Soul"); essays on prayer and devotion, *De oratione* ("Concerning Prayer"); and a treatise directed against all heresy, *De praescriptione haereticorum* ("Concerning the Prescription of Heretics"). In addition to apologetical and polemical works, he addressed himself to a whole range of moral and practical problems on issues facing Christians of his day: what is appropriate dress; the wearing of cosmetics, *De cultu feminarum* ("Concerning the Dress of Women"); service in the military, *De corona* ("Concerning the Crown"—a military decoration); whether one should flee under persecution, *De fuga in persecutione* ("Concerning Flight in Persecution"); on marriage and remarriage, *De exhortatione castitatis* ("Concerning the Exhortation to Chastity") and *De monogamia* ("Concerning Monogamy"); on the arts, theatre, and civic festivals, *De spectaculis* ("Concerning Spectacles"); *De idolatria* ("Concerning Idolatry"); on repentance after Baptism, *De poenitentia* ("Concerning Repentance"); and others.

*Tertullian as a Montanist.* Sometime before 210 Tertullian left the orthodox church to join a new prophetic sectarian movement known as Montanism (founded by the 2nd-century Phrygian prophet Montanus), which had spread from Asia Minor to Africa. His own dissatisfaction with the laxity of contemporary Christians was congenial with the Montanist message of the imminent end of the world combined with a stringent and demanding moralism. Montanism stood in judgment on any compromise with the ways of the world, and Tertullian gave himself fully to the defense of the new movement as its most articulate spokesman. Even the Montanists, however, were not rigorous enough for Tertullian. He eventually broke with them to found his own sect, a group that existed until the 5th century in Africa. According to tradition, he lived to be an old man. His last writings date from approximately 220, but the date of his death is unknown.

*Assessment.* In antiquity most Christians never forgave him for his apostasy (rejection of his earlier faith) to Montanism. Later Christian writers mention him only infrequently, and then mostly unfavourably. Somewhat grudgingly, however, they acknowledged his literary gifts and acute intelligence. Modern scholars, however, do not share this earlier view. In the 19th and 20th centuries Tertullian has been widely read and studied and is considered one of the formative figures in the development of Christian life and thought in the West.

Tertullian is usually considered the outstanding exponent of the outlook that Christianity must stand uncompromisingly against its surrounding culture. Recent scholarship has tended to qualify this interpretation, however. Because he was a moralist rather than a philosopher by temperament—which probably precipitated his famous question, "What has Athens to do with Jerusalem?"—Tertullian's practical and legal bent of mind expressed what would later be taken as the unique genius of Latin Christianity. Like most educated Christians of his day, he recognized and appreciated the values of the Greco-Roman culture, discriminating between those he could accept and those he had to reject. (Ro.W.)

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**Tertz, Abram:** *see* Sinyavsky, Andrey Donatovich.

**Teruel,** province, in the autonomous community (region) of Aragon, northeastern central Spain. It has an area of 5,715 sq mi (14,803 sq km), three-quarters of which is covered by mountains belonging to the Sistema Ibérico. The remainder, principally in the northeast, is a broad plain known as Alcañiz. Marble and chalk are quarried; and the chief products include corn (maize), wine, oil, cheese, fruits, timber, flax, hemp, silk, and wool. Apart from the provincial capital, Teruel town, the main centres are Alcañiz, Castellote, and Híjar (the last two are noted for their Easter and Whitsun festivals). Pop. (1982 est.) 133,068.

**Teruel,** town, capital of Teruel province, in the autonomous community (region) of Aragon, northeastern Spain, at the confluence of the Guadalaviar and Turia rivers, northwest of Valencia. It originated as the Iberian settlement of Turba, which was destroyed by the Romans in retaliation for the destruction of nearby coastal Saguntum by the Carthaginian general Hannibal. It became a Moorish stronghold after the 8th century. Large numbers of Moors remained in the city after its conquest by Alfonso II of Aragon in 1171; this resulted in a mixed, or Mudéjar, style in architecture still visible today. In the cloisters of the Gothic church of San Pedro were buried the celebrated "Lovers of Teruel," Diego Juan Martínez de Marcilla and Isabel de Segura (13th century). Their story is the subject of works by Tirso de Molina (real name Gabriel Téllez), Juan Pérez de Montalbán, Juan Eugenio Hartzenbusch, and—in an Italian setting—by Giovanni Boccaccio. Structures from the 16th century include the cathedral (begun 1248 but altered 1596–1614) and an aqueduct built by Pierre Bedel.

Although the economy is basically agricultural, tourism is also important, and a national parador (inn) was inaugurated just outside Teruel in the 1970s to accommodate the increasing number of tourists. Pop. (1982 est.) 25,932.

**terza rima,** Italian verse form consisting of stanzas of three lines (tercets); the first and third lines rhyming with one another and the second rhyming with the first and third of the following tercet. The series ends with a line that rhymes with the second line of the last stanza, so that the rhyme scheme is *aba, bcb, cdc, . . . , yzy, z.* The metre is often iambic pentameter.

Dante, in his *Divine Comedy* (written *c.* 1310–14), was the first to use terza rima for a long poem, though a similar form had been previously used by the troubadours. After Dante, terza rima was favoured in 14th-century Italy, especially for allegorical and didactic poetry, by Petrarch and Boccaccio, and in the 16th century for satire and burlesque, notably by Ariosto. A demanding form, terza rima has not been widely adopted in languages less rich in rhymes than Italian. It was introduced in England by Sir Thomas Wyat in the 16th century. Many 19th-century Romantic poets such as Shelley ("Ode to the West Wind"), Byron, Elizabeth and Robert Browning, and Longfellow experimented with it. In the 20th century, W.H. Auden used terza rima for *The Sea and the Mirror,* and Archibald MacLeish in "Conquistador," but with many deviations from the strict form.

**Terzaghi, Karl (Anton von)** (b. Oct. 2, 1883, Prague—d. Oct. 25, 1963, Winchester, Mass., U.S.), civil engineer who founded the branch of civil engineering science known as soil mechanics, the study of the properties of soil under stresses and under the action of flowing water.

He studied mechanical engineering at the Technical University in Graz, graduating in 1904, then worked as an engineer for several years; he was awarded a doctorate in engineering by the same institution in 1911. After visiting the United States, he served in the Austrian Air Force during World War I, but in 1916 he accepted a position with the Imperial School of Engineers, Istanbul. When the war was over, he took a post (1918–25) with Robert College, a U.S. institution, also in Istanbul. Much research had been done on foundations, earth pressure, and stability of slopes, but Terzaghi set out to organize the results and, through research, to provide unifying concepts. The results were published in his most noted work, *Erdbaumechanik* (1925; *Introduction to Soil Mechanics,* 1943–44).

In 1925 he went to the United States, where—as a member of the faculty of the Massachusetts Institute of Technology, Cambridge—he worked unceasingly for the acceptance of his ideas, serving also as consulting engineer for many construction projects.

In 1929 he accepted the newly created chair of soil mechanics at Vienna Technical University. He returned to the United States in 1938 and served as professor of civil engineering at Harvard University from 1946 until his retirement in 1956. His consulting practice grew to encompass the world, including the

chairmanship of the Board of Consultants of Egypt's Aswān High Dam project until 1959.

**Teschen,** Polish CIESZYN, Czech TĚŠINA, eastern European duchy centred on the town of Teschen (Cieszyn; *q.v.*) that was contested and then divided by Poland and Czechoslovakia after World War I.

Originally a principality linked to the Polish duchy of Silesia, Teschen was attached with Silesia to the Bohemian crown in 1335; in 1526 it passed with that crown to Habsburg control. Although most of Silesia was seized by Prussia in 1742, Teschen remained under Habsburg rule until Austria-Hungary collapsed at the end of World War I.

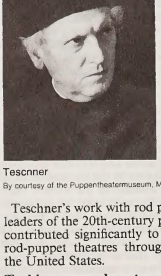
Having been one of the richest and most industrialized regions in Austria-Hungary, Teschen was claimed after the war by Poland on the grounds that its prewar population had been 55 percent Polish, as well as by Czechoslovakia, which based its claims on historic arguments. A bitter conflict that erupted into violence when the Czechs forcibly occupied a large portion of Teschen (January 1919) was resolved only when the Allies' Conference of Ambassadors divided Teschen along the Olše River, giving Poland the eastern districts, including the city of Teschen, while granting Czechoslovakia a larger part of the region, which included a sizable Polish population, the city of Karviná, and the coal-mining basin and major railroad line (July 28, 1920).

Although Poland, which in July 1920 was facing a threatening Soviet military offensive, accepted this division, it remained dissatisfied, and, as a result of the Teschen dispute, relations between Poland and Czechoslovakia remained strained for almost 20 years. Consequently, Poland took advantage of Czechoslovakia's weakened position at the time of the Munich Conference and, on Sept. 29, 1938, demanded the cession of Teschen, which it occupied by early October. After World War II, however, when Poland tried to retain all of Teschen (June 1945), the Soviet Union intervened and forced the restoration of the 1920–38 border.

**teschenite,** coarse- to fine-grained, rather dark-coloured, intrusive igneous rock that occurs in sills (tabular bodies inserted while molten between other rocks), dikes (tabular bodies injected in fissures), and irregular masses and is always altered to some extent. It consists primarily of plagioclase feldspar, analcime, and titaniferous augite, with barkevikite, nepheline, and olivine usually in lesser amounts. The plagioclase crystals often are encased in the augite to give teschenite an ophitic texture. The rock is named for its occurrence near Teschen (now Cieszyn, Pol.); in central Scotland it is abundant in thick sills. Teschenite grades into picrite when the olivine content increases.

**Teschner, Richard** (b. March 22, 1879, Carlsbad, Bohemia, Austria-Hungary—d. July 4, 1948, Vienna), puppeteer who developed the artistic potentialities of the Javanese rod puppet for western puppet theatre.

Teschner studied art in Prague and was already an accomplished puppeteer and stage designer when, in 1906, he established his own marionette company in Prague. Five years later, while travelling in The Netherlands, he became interested in the rod-puppet figures brought by Dutch explorers from Java. Returning to Vienna, he opened a small rod-puppet theatre called Figuren Spiegel (Figure Mirror). Teschner variations on the Javanese figure resulted in such figures as the woman whose chalk-white face changes into a skull and the gorilla whose lower and upper lips retract to bare fangs. The puppets were controlled by a central rod and had a network of internal strings to manipulate hand and leg movements, bending to the front or back, and sensitive facial expressions.



Teschner
By courtesy of the Puppentheatermuseum, Munich

Teschner's work with rod puppets influenced leaders of the 20th-century puppet revival and contributed significantly to the popularity of rod-puppet theatres throughout Europe and the United States.

**Teshio-sammyaku,** also called TESHIO-SANCHI (Japanese: Teshio Range, or Teshio Mountain Country), range, northwestern Hokkaido, Japan, extending southward for nearly 125 mi (200 km) from Sōya-misaki (Cape Sōya), across the transverse gorge of the Ishikari-gawa (Ishikari River), to the Yūbari-sammyaku. The mountains consist of Cretaceous formations in the east and coal-bearing Tertiary formations in the west, both of which are zonally arranged from north to south. The interior of the range is characterized by parallel ridges and valleys. A group of peaks in the interior attains an altitude of 3,386 ft (1,032 m), while the rest of the mountains lie below 2,625 ft.

**Teshub,** in the religions of Asia Minor, the Hurrian weather god, assimilated by the Hittites to their own weather god, Tarhun (*q.v.*). Several myths about Teshub survive in Hittite versions. One, called the "Theogony," relates that Teshub achieved supremacy in the pantheon after the gods Alalu, Anu, and Kumarbi had successively been deposed and banished to the netherworld. Another myth, the "Song of Ullikummi," describes the struggle between Teshub and a stone monster that grew out of the sea. Teshub's consort was Hebat (Queen of Heaven), and they had a son, Sharruma. In art, unless identified by name or associated with Hebat, Teshub is often indistinguishable from the Hittite Tarhun. At the rock sanctuary of Yazılıkaya near the ancient Hittite capital, the leading god is named Teshub and is represented treading on the bowed necks of two mountain gods. In other representations he is shown as a standing figure carrying a *lituus* (a long crook) or driving a chariot drawn by bulls. He reappears in the Kingdom of Urartu as Tesheba, one of the chief gods, and in Urartian art he is depicted standing on a bull.

**Těšín** (Poland): *see* Cieszyn.

**Těšína** (duchy, eastern Europe): *see* Teschen.

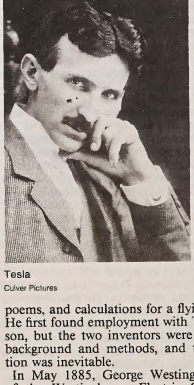
**tesla,** unit of magnetic induction or magnetic flux density in the metre–kilogram–second system (SI) of physical units. One tesla equals one weber per square metre, corresponding to $10^4$ gauss.

It is named for Nikola Tesla (*q.v.*). It is used in all work involving strong magnetic fields, while the gauss is more useful with small magnets. *See* flux density, magnetic.

**Tesla, Nikola** (b. July 9/10, 1856, Smiljan, Croatia—d. Jan. 7, 1943, New York City), Serbian-American inventor and researcher who discovered the rotating magnetic field, the basis of most alternating-current machinery. He emigrated to the United States in 1884 and sold the patent rights to his system of alternating-current dynamos, transformers, and motors to George Westinghouse the following year. In 1891 he invented the Tesla coil, an induction coil widely used in radio technology.

Tesla was from a family of Serbian origin. His father was an Orthodox priest; his mother was unschooled but highly intelligent. A dreamer with a poetic touch, as he matured Tesla added to these earlier qualities those of self-discipline and a desire for precision.

Training for an engineering career, he attended the Technical University at Graz, Austria, and the University of Prague. At Graz he first saw the Gramme dynamo, which operated as a generator and, when reversed, became an electric motor, and he conceived a way to use alternating current to advantage. Later, at Budapest, he visualized the principle of the rotating magnetic field and developed plans for an induction motor that would become his first step toward the successful utilization of alternating current. In 1882 Tesla went to work in Paris for the Continental Edison Company, and, while on assignment to Strassburg in 1883, he constructed, in after-work hours, his first induction motor. Tesla sailed for America in 1884, arriving in New York, with four cents in his pocket, a few of his own



Tesla
Culver Pictures

poems, and calculations for a flying machine. He first found employment with Thomas Edison, but the two inventors were far apart in background and methods, and their separation was inevitable.

In May 1885, George Westinghouse, head of the Westinghouse Electric Company in Pittsburgh, bought the patent rights to Tesla's polyphase system of alternating-current dynamos, transformers, and motors. The transaction precipitated a titanic power struggle between Edison's direct-current systems and the Tesla–Westinghouse alternating-current approach, which eventually won out.

Tesla soon established his own laboratory, where his inventive mind could be given free rein. He experimented with shadowgraphs similar to those that later were to be used by Wilhelm Röntgen when he discovered X-rays in 1895. Tesla's countless experiments included work on a carbon button lamp, on the power of electrical resonance, and on various types of lighting.

Tesla gave exhibitions in his laboratory in which he lighted lamps without wires by allowing electricity to flow through his body, to allay fears of alternating current. He was often invited to lecture at home and abroad. The Tesla coil, which he invented in 1891, is widely used today in radio and television sets and other electronic equipment. That year also marked the date of Tesla's United States citizenship.

Westinghouse used Tesla's system to light the World's Columbian Exposition at Chicago in 1893. His success was a factor in winning him the contract to install the first power machinery at Niagara Falls, which bore Tesla's name and patent numbers. The project carried power to Buffalo by 1896.

In 1898 Tesla announced his invention of a teleautomatic boat guided by remote control. When skepticism was voiced, Tesla proved his claims for it before a crowd in Madison Square Garden.

In Colorado Springs, Colo., where he stayed from May 1899 until early 1900, Tesla made what he regarded as his most important discovery—terrestrial stationary waves. By this discovery he proved that the Earth could be used as a conductor and would be as responsive as a tuning fork to electrical vibrations of a certain frequency. He also lighted 200 lamps without wires from a distance of 25 miles (40 kilometres) and created man-made lightning, producing flashes measuring 135 feet (41 metres). At one time he was certain he had received signals from another planet in his Colorado laboratory, a claim that was met with derision in some scientific journals.

Returning to New York in 1900, Tesla began construction on Long Island of a wireless world broadcasting tower, with $150,000 capital from the American financier J. Pierpont Morgan. Tesla claimed he secured the loan by assigning 51 percent of his patent rights of telephony and telegraphy to Morgan. He expected to provide worldwide communication and to furnish facilities for sending pictures, messages, weather warnings, and stock reports. The project was abandoned because of a financial panic, labour troubles, and Morgan's withdrawal of support. It was Tesla's greatest defeat.

Tesla's work then shifted to turbines and other projects. Because of a lack of funds, his ideas remained in his notebooks, which are still examined by engineers for unexploited clues. In 1915 he was severely disappointed when a report that he and Edison were to share the Nobel Prize proved erroneous. Tesla was the recipient of the Edison Medal in 1917, the highest honour that the American Institute of Electrical Engineers could bestow.

Tesla allowed himself only a few close friends. Among them were the writers Robert Underwood Johnson, Mark Twain, and Francis Marion Crawford. He was quite impractical in financial matters and an eccentric, driven by compulsions and a progressive germ phobia. But he had a way of intuitively sensing hidden scientific secrets and employing his inventive talent to prove his hypotheses. Tesla was a godsend to reporters who sought sensational copy but a problem to editors who were uncertain how seriously his futuristic prophecies should be regarded. Caustic criticism greeted his speculations concerning communication with other planets, his assertions that he could split the Earth like an apple, and his claim of having invented a death ray capable of destroying 10,000 airplanes at a distance of 250 miles (400 kilometres).

After Tesla's death the custodian of alien property impounded his trunks, which held his papers, his diplomas and other honours, his letters, and his laboratory notes. These were eventually inherited by Tesla's nephew, Sava Kosanovich, and later housed in the Nikola Tesla Museum in Belgrade. Hundreds filed into New York City's Cathedral of St. John the Divine for his funeral services, and a flood of messages acknowledged the loss of a great genius. Three Nobel Prize recipients addressed their tribute to "one of the outstanding intellects of the world who paved the way for many of the technological developments of modern times." (I.W.H.)

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**Teso,** also called ITESO, or ATESO, people of central Uganda who speak an Eastern Sudanic language of the Chari-Nile branch of the Nilo-Saharan family. They are counted among the most progressive farmers of Uganda; they quickly took to ox plows when they began cultivating cotton in the early 1900s. Millet is the major staple crop; cotton, the main economic crop.

Much of the traditional culture and organization of the Teso were lost when they were conquered by the Ganda under Kakunguru at the end of the 19th century. The age-grade system and the clan lost their importance, and much of the indigenous territorial organization was destroyed. Almost all indigenous religion has been replaced by Christianity; previously the Teso believed in an omnipotent but remote god, Akuj, and in a god of calamity, Edeke.

**tessellated pavement,** also called FLOOR MOSAIC, or MOSAIC PAVEMENT, interior or exterior floor covering composed of stone tesserae (Latin: "dice"), cubes, or other regular shapes closely fitted together in simple or complex designs with a durable and waterproof cement, mortar, clay, or grout. Deriving from Greek pebble mosaic (*q.v.*) pavings of the 8th or 7th century BC, tessellated pavement appeared in the Hellenistic Age and by the 1st century AD had come into popular use in public and private buildings throughout the Roman Empire. The technique was ideally suited to paving baths, courtyards, and building interiors; early black-and-white pavements were arranged in simple figure scenes or geometrical designs. By the 1st century AD the use of tesseraei (*see* tessera) had enabled such precise design and colour gradation that original artworks and reproductions of paintings in tessellated pavements were common.

As the art form became more popular and a greater range of colour was desired, semiprecious and precious stones, as well as alabaster and brightly coloured glass, were used. One of the most noted examples of floor mosaic—a 1st-century AD representation of the *Battle of Issus*—was unearthed at Pompeii in the Faun House and is now in the National Archeological Museum at Naples.

**tessellatum, opus** (mosaic): *see* opus tessellatum.

**tessera** (Latin: "cube," or "die"), plural TESSERAE, in mosaic work, a small piece of stone, glass, ceramic, or other hard material cut in a cubical or some other regular shape. The earliest tesserae, which by 200 BC had replaced natural pebbles in Hellenistic mosaics, were cut from marble and limestone. Stone tesserae remained dominant in mosaics into Roman times, but between the 3rd and 1st centuries BC tesserae of *smalto,* or coloured glass, also began to be produced, cut from large slabs of glass that ranged from lightly tinted to opaque. These relatively fragile glass tesserae were used sparingly in floor mosaics to provide pure blues, reds, and greens that could not be found in the more durable natural stone; with the advent of wall mosaic between the 1st and 3rd centuries AD, however, glass tesserae of every hue were produced to constitute the major part of this decoration, stone being mainly reserved for floors. Glass was the major material for wall and vault mosaics of Early Christian and Byzantine churches, and marble and limestone tesserae were frequently used in the depiction of faces, woolen garments, rocks, and other objects that required a soft or rough appearance.

An important variety of glass tesserae, appearing first in Roman mosaics of the 4th century AD, were those made with gold and silver leaf. Thin plates of gold or silver were sandwiched between two slabs of molten glass, one thicker than the other, to produce a mirrorlike piece that was then cut into tesserae. These gold and silver tesserae were used in Roman and the earliest Christian mosaics simply to depict gold and silver objects; in later mosaics of the Early Christian period and in Byzantine mosaics, solid fields of gold tesserae formed the gold background that appeared in almost every decoration.

Another important class of tesserae is ceramic tesserae, used occasionally in antiquity and the Middle Ages but rivaling glass as a major material in modern mosaics. Tesserae of shell, mother-of-pearl, enamel, painted stone, and painted terra-cotta have also been used.

**Tessin** (Switzerland): *see* Ticino.

**Tessin, Carl Gustaf, Greve** (Count) (b. Sept. 5, 1695, Stockholm—d. Jan. 7, 1770, Åkerö, Swed.), Swedish court official, statesman, and writer who was a founder of the 18th-century parliamentary Hat Party and an



Carl Tessin, detail from a portrait by Jacques-André-Joseph (Camelot) Aved; in the Nationalmuseum, Stockholm
By courtesy of the Svenska Portrattarkivet, Stockholm

influential adviser to the court of Adolf Frederick.

Carl Tessin was the son of the architect and court superintendent Nicodemus Tessin the Younger. He was educated in France and Italy and in the 1720s entered the Swedish diplomatic service. In 1728 he succeeded his father as court superintendent.

A founder of the anti-Russian Hat Party, he wanted to regain the provinces lost to Russia during the Great Northern War (1700–21). In 1738 his party gained a parliamentary majority, and he was elected speaker of the noble chamber and, thus, of the whole parliament. He attempted unsuccessfully to prevent a disastrous war with Russia in 1741.

In 1744 he gained the favour of the future king Adolf Frederick (reigned 1751–71) and his wife Louisa Ulrica; he persuaded Adolf to renounce his hereditary claims in Schleswig and Holstein and thus eased Sweden's relations with Denmark. In 1746 he was appointed tutor to the future king Gustav III and head of the state chancellery. In the early 1750s, however, he lost the Queen's favour and left public life. Tessin was also an accomplished poet and writer of fables and letters.

**Tessin, Nicodemus,** THE ELDER (b. Dec. 7, 1615, Stralsund, Pomerania—d. May 24, 1681, Stockholm), most eminent Swedish architect of his period, whose principal work is the Drottningholm palace.

Early in his career Tessin worked under the Swedish Royal Architect Simon de la Vallee, whose style remained an important influence.

He was named de la Vallee's successor in 1646 and spent several years after 1651 traveling in Germany, France, and Italy. His most significant building in Sweden, the palace at Drottningholm (1662–86), was commissioned by the dowager queen Hedvig Eleonora. It shows French Baroque influences in its plan, gardens, and interior, but it also has Italian Classical elements and is capped by the peculiarly Nordic *sateri* roof. Tessin's other principal works are the cathedral at Kalmar, Swed. (1660–70), the Caroline Mausoleum (1672) at the Riddarholm Church in Stockholm, and several country houses for the Swedish nobility. He became city architect to Stockholm in 1661. His son was the architect Nicodemus Tessin the Younger.

**Tessin, Nicodemus,** THE YOUNGER (b. May 23, 1654, Nyköping, Swed.—d. April 10, 1728, Stockholm), notable Swedish Baroque architect.

The son of the architect Nicodemus Tessin the Elder, he took over his father's position as Stockholm's city architect after studying in Paris and Rome during the 1670s. He completed his father's Drottningholm palace and then futilely tried to interest the French king Louis XIV in his proposals for building the New Louvre and a temple of Apollo at Versailles. His main achievement was the Royal Palace at Stockholm, built to replace an older brick structure that was destroyed by fire in 1697. The rebuilt palace is a huge block-like structure with a severe Classical facade but having richly Baroque interior decorations and furniture. Nicodemus the Younger's son, the noted Swedish statesman Carl Gustaf Tessin, enlarged his father's large collection of architectural drawings, which are now in the National Museum in Stockholm.

**tessitura** (Italian: "texture"), in music, the general range of pitches found in a melody or vocal part. It differs from the compass of a piece to the extent that it does not take into account the extremes of the piece's range but is concerned with the way in which the vocal line is arranged or situated. The tessitura of a piece, therefore, is not determined by a few isolated notes of extraordinarily high or low pitch but rather by which part of the range is most consistently used; for example, the role of Siegfried in Wagner's *Ring* operas extends from c♯ to c‴, but its tessitura would be considered extremely high (and consequently very demanding) because the tenor is frequently required to sing long phrases in the range c′ to a′. Added to the strain of singing in such a high tessitura is the full volume and dramatic intensity often required for such parts.

**test,** in zoology, a protective, loose-fitting shell secreted by some protozoans (especially foraminiferans and radiolarians). In most species the organic test contains inorganic materials that may be foreign objects (*e.g.,* sand grains, shell fragments) or substances secreted by the organism (calcium carbonate or silica plates). Properties of the test (*e.g.,* light transmitting qualities, wall structure) vary with test form.

Tests are diverse in structure and can include external ridges and spines and internal partitions, structural supports, wall laminations, and canal systems. Some tests have a single opening through which cytoplasm can emerge; others have several openings, and some are penetrated by small pores for cytoplasmic extensions. The taxonomy of the protozoan order Foraminiferida is based on the structure of the test, as is that of the ciliate order Tintinnida, in which the test is usually called a lorica (*q.v.*).

**test act,** in England, Scotland, and Ireland, any law that made a person's eligibility for public office depend upon his profession of the established religion. In Scotland, the principle was adopted immediately after the Reformation, and an act of 1567 made profession of the reformed faith a condition of public office. Such a law was not at first necessary in England, where penal laws against those who failed to conform to the established church were so severe as automatically to exclude such persons from public life. In the more tolerant climate of the late 17th and 18th centuries, Roman Catholics and Protestant dissenters were normally able to practice their religion unmolested; but the Anglican majority's fear of subversion led to their being precluded from officeholding. The form that the test took in England was to make the receiving of Holy Communion according to the rites of the Church of England a condition precedent to the acceptance of office. It was first embodied in legislation in 1661 as a requisite for membership of a town corporation and was extended to cover all public offices by the Test Act of 1673. During the 18th century the tests were, on the whole, less strenuously applied; in Scotland, only those engaged in education were required to make profession, while in England some known Protestant dissenters openly practiced "occasional conformity." Roman Catholics could not do that and, accordingly, were still excluded from office until an act of 1828 removed the test and the Roman Catholic Emancipation Act of 1829 abolished other legal disabilities imposed on them. The test acts themselves were formally repealed in the 1860s and '70s, and religious tests were abolished in the universities except in connection with degrees and professorships in divinity. Scottish tests were abolished in 1889.

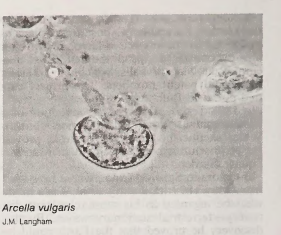
In Ireland, the Anglican sacramental test was introduced in 1704, and English legislation on oaths of allegiance and religious declarations became valid there in 1782. All of these provisions were abolished in 1871.

Article VI of the Constitution of the United States prescribes that "no religious test shall ever be required as qualification to any office or public trust under the United States." A similar provision is written into the constitutions of most U.S. states.

**test-tube conception:** *see* in vitro fertilization.

**Test Valley,** district (borough), county of Hampshire, England, occupying an area of 246 square miles (637 square km) in the northwestern part of the county. Situated directly north of the port of Southampton, Test Valley district embraces nearly the entire north–south length of the River Test before extending into low-lying chalk uplands in the north. The valley's fertile agricultural land is interspersed with groves and forests (especially in the south). The locality of Andover in the northern part of the district has become its most populous centre by absorbing people from the Greater London area as part of a resettlement program. In the 14th century Andover produced woolen goods, parchments, and silks. Contemporary Andover has paper milling and printing industries. Romsey, in the south, is an ancient parish known for its abbey founded by Saxons in 907. Broadlands, the home of the lords Palmerston (1784–1865) and Mountbatten (1900–79), is nearby. A British army training base is located west of Andover at Tidworth, on the border of Test Valley district and the county of Wiltshire. Pop. (1986 est.) 99,300.

**testacean,** any member of the protozoan order Arcellinida (formerly Testacida) of the class Rhizopodea. Testaceans are usually encased in one-chambered tests, or shells, and usually found in fresh water, although sometimes they occur in salt water and in mossy soil. The test has an underlying membrane of



*Arcella vulgaris*
J.M. Langham

chitinous material that is similar to an insect's exoskeleton. The outer layer may be a brownish chitinoid shell secreted by the inner layer (as in *Arcella*), sand or solid particles glued together (as in *Difflugia*), or siliceous plates that are secreted by cytoplasm, pushed out, and cemented in place (as in *Euglypha*). The genus *Nebela* forms its pear-shaped shell from the plates of other testaceans ingested as food. *Arcella,* a soil and freshwater genus, resembles an amoeba enclosed in a one-chambered, umbrella-shaped test. Reproduction is asexual, by division or budding, or sexual.

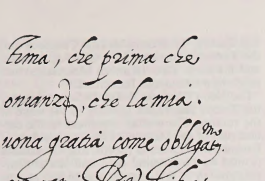
**testament** (law): *see* will.

**Testamentum Domini,** English TESTAMENT OF THE LORD, one of a series of writings (including the *Apostolic Constitutions* and the *Apostolic Tradition* of Hippolytus) that claim to set forth the fundamental rules of the early Christian Church. Originally written in Greek, probably in the 4th–5th century, it survives in a 7th-century Syriac translation.

According to the work, the author was Jesus Christ, and thus it claims a higher authority than those works that were ascribed to the Apostles. It has a highly ascetic tone and imposes strict regulations on Christians, who are pictured as set in the midst of wolves, despised and slighted by the careless and worldly. There is frequent mention of the persecuted and of the duty of bearing the cross. Great stress is laid upon virginity (although there is no sign of monasticism), fasting, and regular attendance at prayer of the entire clerical body and the more perfect of the laity.

**testcross,** the mating of an organism whose genetic constitution is unknown with an organism whose entire genetic makeup for a trait is known, to determine which genes are carried by the former. In a breed of dog, for example, in which the gene for black coat colour is dominant over (suppresses the effect of) the gene for red coat colour, a dog with a black-coloured coat may be either pure breeding, with two genes for black coat colour, or hybrid, with one gene for black coat colour and one for red coat colour. To determine which genetic endowment the dog has, it is mated to a red-coated dog, which invariably has two genes for red coat colour only. If all the offspring are black, the black-coated parent must be pure breeding and have both genes for black coat colour; if some of the young are red, the parent must be hybrid and have one gene for black coat colour and one for red coat colour.

**testegiatta,** in calligraphy, the headed ascenders or plumelike terminals on *b, d, h,* and *l,* in particular, which became an ornamental feature of the 16th-century italic *bastarda* script. Vespasiano Amphiareo published at Venice, in 1554, models that combined an overdisciplined *cancellaresca* script with black-letter mercantile script mannerisms such as loops and running ligatures. From this hybrid the Vatican scriptor Gianfrancesco Cresci developed a highly cursive, free-flowing hand. His italic *bastarda* is topped off with accents at the end of ascenders made by doubling back at



Letter written in the *testegiatta* style of italic *bastarda* script by Gianfrancesco Cresci, 1572 (Vatican Library, MS. Vat. Lat. 6185, fol. 135r)
By courtesy of the Biblioteca Apostolica Vaticana

the start of the stroke and exerting a bit of pressure at that point on a rather flexible nib.

**tester,** canopy, usually of carved or cloth-draped wood, over a bed, tomb, pulpit, or throne. It dates from the 14th century and is usually made of the same material as the object it covers. It can be supported either by four posts, by two posts at the foot and a headpiece at the back, or by suspension from the ceiling. The edges may overhang and in some cases are decorated with incised work or a fabric valance. The word, derived from the late Latin *testa* ("head"), came into use in the Middle Ages, originally referring only to the vertical headpiece.

Perhaps the most notable and widespread use of the tester was in bed design. Sixteenth- and 17th-century testers were frequently massive in construction and featured elaborate carving of the canopy over the bed and of its supporting posts. In the 18th century, testers over beds became lighter and more purely decorative, in part because of the development of smaller, more intimate rooms in northern European residences. Popular in 19th-century England, the characteristic full tester bed featured detailed front posts on a vase-turned section resting on block supports. Also popular in America at the beginning of the 19th century was the closely related field bed, with an arched tester over a light, plain framework. A half tester is supported only at the head of the bed.



Carved oak bedstead with tester, English, *c.* 1610; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

**testis,** plural TESTES, also called TESTICLE, in animals, the organ that produces sperm (*q.v.*), the male reproductive cell. In humans the testis is either of the paired, oval-shaped organs that produce sperm and the male hormones, the androgens. They are contained within the scrotal sac, which is located directly behind the penis and in front of the anus. Each testis weighs about 25 grams (0.875 ounce) and is 4 to 5 centimetres (1.6 to 2.0 inches) long and 2 to 3 centimetres (0.8 to 1.2 inches) in diameter. Each is covered by a fibrous capsule called the tunica albuginea and is divided by partitions of fibrous tissue from the tunica albuginea into 200 to 400 wedge-shaped sections, or lobes. Within each lobe are 3 to 10 coiled tubules, called seminiferous tubules, which produce the sperm cells. Both the partitions between lobes and the seminiferous tubules converge in one area near the anal side of each testis to form what is called the mediastinum testis. Sperm cells produced in the seminiferous tubules migrate, by short contractions of the tubules, to the mediastinum testis; they are then transported through a complex network of canals (rete testis and efferent ductules) to the epididymis (*see* epididyme) for temporary storage. The epididymis partially surrounds the top and anal side of each testis.

In the embryo, the testes originate in the lower body cavity near the kidneys. They migrate to their position within the scrotum (*q.v.*) in about the seventh or eighth month of development in the unborn child. Descent is controlled by the androgen testosterone. The production of testosterone by the fetal testes is stimulated by chorionic gonadatropin, a hormone secreted by the placenta. Testosterone secretion ceases a few weeks after birth, and the cells within the testes remain undeveloped during early childhood; during adolescence, gonadotropic hormones from the pituitary gland at the base of the brain stimulate the development of tissue, so that it becomes capable of producing sperm and androgens.

The seminiferous tubules, in which the sperm are produced, comprise about 90 percent of the testicular mass. In the young male, the tubules are simple and composed of undeveloped sperm-producing cells (spermatogonia) and the Sertoli cells. In the older male, the tubules become branched, and spermatogonia are changed into the fertile sperm cells after a series of transformations called spermatogenesis (*q.v.*). The Sertoli cells found in both young and adult males mechanically support and protect the spermatogonia.

Cells known as interstitial cells, or Leydig cells, located beneath the tunica albuginea, in the septal walls, and between the seminiferous tubules, are thought to secrete androgens. The Leydig cells are irregularly shaped and commonly have more than one nucleus. Frequently they contain fat droplets, pigment granules, and crystalline structures; the Leydig cells vary greatly in number and appearance among the various animal species. They are surrounded by numerous blood and lymphatic vessels, as well as by nerve fibres. The secretion of androgens is controlled by the pituitary hormones.

In animals that breed seasonally, such as sheep and goats, the testes regress completely during the nonbreeding season and the spermatogonia return to the state found in the young, sexually immature males. Frequently in these animals the testes are drawn back into the body cavity except in the breeding season, when they again descend and mature; this process is known as recrudescence.

**testosterone,** an organic compound belonging to the steroid family and occurring as the androgenic, or masculinizing, hormone produced by the testis. Testosterone is responsible for development of the male sex organs and such masculine characteristics as facial hair and deepening of the voice. The hormone was isolated from testicular extracts in 1935, after it had been shown that they contain an androgen more potent than androsterone, which had been obtained from urine in 1931. Androsterone was later shown to be a biochemical product (a metabolite) of testosterone. Testosterone can be manufactured by chemical and microbiological modification of inexpensive steroids, such as diosgenin. It is used clinically for treatment of testicular insufficiency, the suppression of lactation, the therapy of certain types of breast cancer, and the treatment of frigidity in women.

**Testudinidae,** family of terrestrial turtles, or tortoises (order Chelonia). The group is closely related to turtles in the family Emydidae. The approximately 40 species are characterized by heavy domed shells, elephantine limbs, and slow-moving, herbivorous habits. The family is widespread in South America and Africa, and representatives occur in warm regions of North America, Europe, and Asia. The best known members of the family are the giant tortoises of the Galápagos Islands and the gopher tortoises of the American south and west.

**tetanus,** also called LOCKJAW, acute infectious disease of humans and other animals, caused by toxins elaborated by the anaerobic (living without free oxygen) bacillus *Clostridium tetani* and characterized by rigidity and spasms of the voluntary muscles. The almost constant involvement of the jaw muscles accounts for the popular name of the disease.

Spores of *Clostridium* are distributed widely in nature, especially in topsoil, and may enter the body through any wound, even a superficial abrasion; puncture wounds and deep lacerations are particularly dangerous because they provide the oxygen-free environment needed for growth of the microorganism.

Both the occurrence and severity of tetanus are determined by the amount of toxin produced and the resistance of the host. The neurotoxic component, tetanospasmin, is one of the deadliest poisons known. It is excreted by the bacterial cells and transported via the bloodstream from the local focus of infection to the ganglion cells of the anterior horn of the spinal cord, which are then stimulated. The neurotoxin is believed to act on the synthesis and liberation of acetylcholine, a substance having a key role in the synaptic transmission of nerve impulses throughout the body. The clinical expression of central nervous system stimulation consists of fairly constant rigidity of muscle groups, frequently and unpredictably punctuated by tonic spasms. Local tetanus, confined approximately to the area of injury, may occur as the only symptom or as a precursor to generalized affection.

The incubation period is quite variable in length—from two days to two weeks in most cases but sometimes up to three months. In general, the longer the incubation period, the milder will be the disease. The use of tetanus antitoxin prevents or delays the development of symptoms but is of limited value in therapy. Treatment usually includes administration of antibiotics, sedatives, and muscle relaxants. In very severe cases, curare is used. This drug paralyzes all the skeletal muscles so that they can no longer contract and thus ends the painful tonic spasms and convulsions. Because curare also paralyzes the breathing muscles, artificial ventilation becomes necessary, by means either of an iron lung or a positive-pressure machine, which blows air into the lungs through a tube inserted into the trachea. After a few weeks, when the disease is curtailed, the curare treatment is stopped and the patient begins to breathe on his own again.

Passive protection with tetanus antitoxin should be administered in all cases of injuries that may be contaminated by clostridial spores. Active immunization with tetanus toxoid (prepared by chemical modification of toxin) is a relatively slow process, requiring

weeks or months to become effective, and must be renewed at least every four years. A first dose should be given to every accident victim, followed by two more doses several months later. This applies also to persons who have recovered from tetanus, for an attack of the disease does not confer immunity.

**tetany,** a type of cramp that is a symptom of metabolic imbalance. The muscles of the hands and feet cramp rhythmically, and there may be spasms of the larynx with difficulty in breathing, nausea, vomiting, convulsions, and considerable pain. Tetany may be caused by too little calcium, potassium, or magnesium in the circulation or by an over-acid or over-alkaline condition of the body. These conditions may accompany poorly controlled hypoparathyroidism, hypophosphatemia, osteomalacia, renal disorders, or malabsorption syndromes. Treatment is directed at restoring metabolic balance, as by intravenous administration of calcium in cases of hypocalcemia (calcium deficiency).

**Tete,** port city, west-central Mozambique. Tete is situated on the right bank of the Zambezi River near the rich coal mines of Moatize. Under Portuguese influence Tete had become a market centre for ivory and gold by the mid-17th century. Given a town charter in 1761, it became a city in 1959. It is connected to the Indian Ocean by railway to the port of Beira and by the Zambezi River.

About 80 miles (125 km) northwest of Tete is the Cabora Bassa dam and hydroelectric-power project on the Zambezi River; Lake Cabora Bassa, created by the dam, extends about 150 miles (240 km) west to the Zambian border. The Cabora Bassa project supplies power to South Africa, Maputo city, Tete, and the coal mines at Moatize. The climate and soils of the Angonia Highlands favour some cattle raising and the cultivation of cassava and sorghum. Pop. (1991 est.) 112,221.

**Tetens, Johannes Nikolaus** (b. Sept. 16, 1736, Tetenbüll, South Schleswig [Germany]—d. Aug. 15/19, 1807, Copenhagen, Den.), German psychologist, mathematician, economist, educator, and empiricist philosopher who strongly influenced the work of Immanuel Kant.

Tetens became professor of physics at Bützow University in 1760 and five years later was made director of the Pädagogium ("Academy") there. In 1776 he was appointed professor of philosophy at the University of Kiel, where he later held the chair of mathematics. He gave up teaching in 1789 to enter public service, becoming assessor and then councillor of state and deputy in the Danish Ministry of Finance in Copenhagen.

Tetens' major work, *Philosophische Versuche über die menschliche Natur und ihre Entwickelung* (1777; "Philosophical Experiments on Human Nature and Its Development"), shows the influence of Kant's *Dissertation* (1770). The *Philosophische Versuche* is essentially an investigation of the origin and structure of human knowledge and was the most important philosophical work written in Germany during the period immediately prior to the publication of the *Critique of Pure Reason* (1781) by Kant, who valued Tetens' work highly. Kant reiterated Tetens' emphasis on the importance of empirical foundations for philosophical studies. He was also influenced in the construction of his own theory of human knowledge by Tetens' threefold division of consciousness into the faculties of feeling, will, and understanding. By the last category he referred to the faculty of forming and combining ideas.

Tetens subsequently became the only major German thinker to embrace, with some modifications, the empirical psychology then in style in Great Britain and France, particularly as found in the work of David Hume. Tetens also wrote *Über die allgemeine spekulativische Philosophie* (1775; "On General Speculative Philosophy").

**Tethys,** one of the eight large, regular satellites of Saturn. Essentially composed of pure water ice, Tethys has a diameter of 1,060 km (657 miles). It orbits Saturn at a distance of 294,660 km (182,689 miles) and is involved in an orbital resonance with Mimas such that it completes precisely one orbit for every two of Mimas' orbits. Tethys possesses two noteworthy features. The first of these is a long crack extending along three-quarters of the satellite's circumference and forming 5 to 10 percent of its surface. It is theorized that the crack was produced by freezing and expansion of the water that composes the satellite's interior. The second notable feature is a crater that measures 400 km (250 miles) in diameter and has a large central peak.

**Tethys,** former equatorial ocean that is believed to have separated the former supercontinent of Laurasia in the north from Gondwana, or Gondwanaland, in the south during much of the Mesozoic Era (245 to 66.4 million years ago). Laurasia consisted of North America and Eurasia north of the Alpine-Himalayan mountain ranges, while Gondwana consisted of South America, Africa, peninsular India, Australia, Antarctica, and those Eurasian regions south of the Alpine-Himalayan chain. The continental convergences and collisions that eventually eliminated Tethys created the Alpine-Himalayan mountain belt. Tethys was named in 1893 by the Austrian geologist Eduard Suess after the sister and consort of Oceanus, the ancient Greek god of the ocean.

The presence of a former Mesozoic marine realm in the place of the present Alpine-Himalayan chain of mountain systems was recognized late in the 19th century by the German geologist Melchior Neumayr on the basis of the distribution of large thicknesses of marine (and in places fully oceanic) sedimentary rocks and common faunal affinities of their fossils from the Alps and Carpathians through Turkey and Iran all the way to the Himalayas and Burma (Myanmar). Suess interpreted this marine realm as a former ocean in 1893. Later, in the first half of the 20th century, this marine realm was mistakenly interpreted as a long-lived geosyncline—*i.e.,* a narrow, elongate, subsident trough in the Earth's crust—that had become subject to orogenic (mountain-building) phases since the middle Mesozoic and the remnants of which now form the Mediterranean Sea. With the rise of the theory of plate tectonics and its application to historical geology, it was recognized that the concept of the geosyncline was incorrect, that Tethys must have been an ocean rather than a trough, and that it can only have existed since the formation of Pangaea (by the collision of Laurasia and Gondwana) during Permian-Triassic times.

Studies in the late 20th century revealed that at least two Tethyan oceans may have successively occupied the area between Laurasia and Gondwana during the Mesozoic Era. The earlier, called the Paleo ("Old") Tethys Sea, came into existence along with Pangaea late in the Paleozoic Era (about 320 million years ago). During the Permian and Triassic periods (286 to 208 million years ago), Paleo Tethys formed an enormous, eastward-opening, oceanic embayment of Pangaea. This ocean was eliminated by the detachment (from northern Gondwana) and northward rotation of a strip of continental material called the Cimmerian continent that eventually collided with the southern margin of Laurasia in the Early Jurassic Period (208 to 187 million years ago). The vestiges of the Paleo Tethys Sea are now preserved in the mountain ranges of northern Turkey, Transcaucasia (the Caucasus and the Pamirs), northern Iran and Afghanistan, and northern Tibet (Kunlun Mountains) and reach into China and Indochina.

The Neo ("Younger") Tethys Sea, or simply the Tethys Sea, began forming in the wake of the rotating Cimmerian continent in the earliest part of the Mesozoic Era. The breakup of Pangaea into Laurasia (north) and Gondwana (south) by continental drift and the concurrent growth of the Atlantic and Indian oceans resulted in the gradual elimination of Tethys by the convergence and eventual collision of the fragments of former Gondwana with Eurasia. Tethys was finally closed in the Cenozoic Era (66.4 million years ago to the present) when India, Arabia, and Apulia (consisting of parts of Italy, the Balkan states, Greece, and Turkey) finally collided with the rest of Eurasia to erect the modern Alpine-Himalayan ranges, which extend from Spain (the Pyrenees) and northwest Africa (the Atlas) along the northern margin of the Mediterranean Sea (the Alps, Carpathians) into southern Asia (the Himalayas) and reach Indonesia. The eastern part of the Mediterranean Sea is a remnant of the Tethys Sea.

The discovery of the closure of the Tethys Sea had so severely defaced those of earlier closures that the prior existence of the Paleo Tethys Sea was not recognized by geologists until the 1980s. Another important effect of the evolution of the Tethys Sea was the formation of the giant hydrocarbon-bearing basins of North Africa and the Middle East.

**Tetley, Glen** (b. Feb. 3, 1926, Cleveland, Ohio, U.S.), American dancer, choreographer, and ballet director.

Tetley began dancing in 1945, training with Hanya Holm, Helen Platova, and others. He performed in Broadway musicals as well as with companies as diverse as the American Ballet Theatre and the Martha Graham Company. His first choreography was for *Pierrot Lunaire,* and it gained him a position as guest artist with the Netherlands Dance Theatre (1962), of which he soon became the artistic codirector.

In 1969 he formed his own company, only to return to the Netherlands Dance Theatre as director. From 1974 to 1976 Tetley served as director of the Stuttgart Ballet. Some of his best-known works are *Mutations* (1970), *Le Sacre du Printemps* (1974), *Daphnis and Chloe* (1975), *The Tempest* (1979), *Contredances* (1979), *Summer's End* (1980), *Dances of Albion, Dark Night: Glad Day* (1980), *Murderer Hope of Women* (1983), and *Revelation and Fall* (1984).

**Tetmajer (Przerwa), Kazimierz** (b. Feb. 11, 1865, Ludźmierz, Galicia [now in Poland]—d. Jan. 18, 1940, Warsaw), poet and short-story writer who was a member of the Young Poland movement.

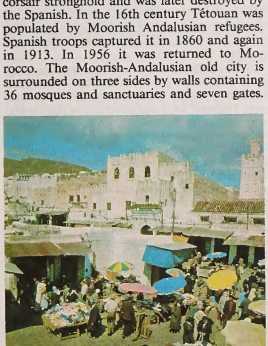
Much of his lyric poetry received publication in the Kraków periodical *Życie* ("Life"). His nostalgic and pessimistic *Poezje* ("Poetry"), published in eight series between 1891 and 1924, shows the influence of the Romantic poet and playwright Juliusz Słowacki and of French and Belgian verse. His five volumes of sketches and tales, *Na skalnym Podhalu* (1903–10; *Tales of the Tatras*), are considered his best work. Based in part on ancient legends of the area of the Tatras mountains, these colourful stories describe the mountaineers, their violent lives, and their intense love of freedom.

**Teton Range,** segment of the northern Rocky Mountains in the United States, extending southward for 40 miles (64 km) across northwestern Wyoming, from the southern boundary of Yellowstone National Park to Teton Pass. Some foothills reach into southeastern Idaho. Many peaks exceed 12,000 feet (3,700 m); Grand Teton (13,766 feet

[4,196 m]) is the highest point, towering 7,000 feet (2,130 m) above Jackson Hole, a fertile valley and noted ski-resort area at its eastern base. The range serves as a source for the Teton River, and much of it lies within the Grand Teton National Park and the Teton and Targhee national forests.

The first recorded exploration of the mountains, in 1808 by John Colter of the Lewis and Clark Expedition, was followed by an era of fur trapping in the vicinity. On July 29, 1872, the first ascent of Grand Teton was made by Nathaniel P. Langford and James Stevenson. Early 19th-century French fur trappers referred to the South, Middle, and Grand (higher) eminences as *les trois tétons* ("the three breasts"), hence the name.

**Tétouan,** also spelled TETUÁN, city, north-central Morocco. It lies along the Wadi Martin, 7 miles (11 km) from the Mediterranean Sea. The city stands on a rocky plateau detached from the southern flank of Mount Dersa. The Roman settlement of Tamuda stood immediately above the present-day city. Tétouan was inhabited in the 9th century by the Idrīsids and in the 14th century was fortified by the Marinids. Its fortress became a corsair stronghold and was later destroyed by the Spanish. In the 16th century Tétouan was populated by Moorish Andalusian refugees. Spanish troops captured it in 1860 and again in 1913. In 1956 it was returned to Morocco. The Moorish-Andalusian old city is surrounded on three sides by walls containing 36 mosques and sanctuaries and seven gates.



The marketplace at Tétouan, Mor.
Picturepoint, London

It is a commercial centre with an economy based on crafts and light manufacturing. It is known as a cultural centre with a school of music, several artisan schools, national museums of archaeology and traditional arts, and an archival library. It is connected by road with Tangier (Tanger), al-Hoceïma, and Ouezzane. Cereals (primarily wheat), citrus fruits, tea, sheep, goats, and cattle are raised in the surrounding area, and cork and olive trees are also cultivated. Pop. (1982) city, 199,615.

**tetra,** any of numerous attractively coloured freshwater fishes of the characin family, Characidae, often kept in home aquariums. Tetras are characteristically small, lively, hardy, and unaggressive. They are native to South America and Africa. Tetras are egg layers and breed, as do most other characins, by scattering their eggs among aquatic plants. The name tetra was derived from a genus name, *Tetragonopterus,* once applied to a large number of characins. The tetras found in pet shops are now placed in several genera, such as *Hemigrammus, Hyphessobrycon,* and *Mimagoniates,* but the term tetra, though of no scientific significance, continues as a convenient popular name. Well-known species of tetras include the following:



Glowlight tetras (*Hemigrammus erythrozonus*)
Jane Burton—Bruce Coleman Ltd.

The black tetra (*Gymnocorymbus ternetzi*), also called blackamoor, or petticoat fish, is a deep-bodied fish that is 4–7.5 cm (1.5–3 inches) long. When small, it is marked with black on its hind parts and dorsal and anal fins; the black fades to gray as the fish increases in size.

The glowlight tetra (*Hemigrammus erythrozonus*) is a hardy fish that grows up to 4.5 cm long and has a shining red stripe along each side of its body.

The neon tetra (*Paracheirodon,* or *Hyphessobrycon, innesi*) is a slender fish that is very popular with aquarium owners. It grows to a length of 4 cm, its hind parts are coloured a gleaming red, and its sides have a neonlike blue-green stripe. The cardinal tetra (*Cheirodon axelrodi*) of Brazil is similar but with more red on its body.

The silver tetra (*Ctenobrycon spilurus*) is a deep-bodied fish that is flattened sidewise; it grows to 9 cm and is silvery in colour.

The Buenos Aires tetra (*Hemigrammus caudovittatus*) grows to 9 cm; it has reddish fins and a dark, lengthwise stripe on each side that widens to a diamond-shaped spot on each side of the tail root.

**tetrachloroethane,** either of two isomeric colourless, dense, water-insoluble liquids belonging to the family of organic halogen compounds. One isomer, 1,1,2,2-tetrachloroethane, also called acetylene tetrachloride, is highly toxic. Almost the entire production of the compound is consumed in manufacturing chlorinated solvents, especially trichloroethylene and tetrachloroethylene; it has minor uses as a solvent and as an insecticide, particularly against the greenhouse white fly. It is made by the reaction of acetylene and chlorine. The other isomer, 1,1,1,2-tetrachloroethane, has no commercial application.

**tetrachloroethylene,** also called PERCHLOROETHYLENE, a colourless, dense, nonflammable, highly stable liquid belonging to the family of organic halogen compounds. Tetrachloroethylene is a powerful solvent for many organic substances. By the mid-20th century it had become the most widely used solvent in dry cleaning (displacing carbon tetrachloride and trichloroethylene) and was also commonly used for cleaning metal objects in vapour-degreasing apparatuses. Its broad acceptance was been based upon its nonflammability and low toxicity. Small quantities are also employed as a vermifuge, particularly against hookworm.

Tetrachloroethylene was first prepared in 1821 by the English physicist Michael Faraday; it has been commercially manufactured since about 1910, mostly from trichloroethylene. Tetrachloroethylene is denser than water and practically insoluble in it.

**tetrachloromethane:** *see* carbon tetrachloride.

**tetrachord,** musical scale of four notes, bounded by the interval of a perfect fourth (an interval the size of two and one-half steps, *e.g.,* c–f ). In ancient Greek music the descending tetrachord was the basic unit of analysis, and scale systems (called the Greater Perfect System and the Lesser Perfect System) were formed by joining successive tetrachords. Only the outer notes of each tetrachord were fixed; the position of the inner pitches determined the genus of the tetrachord. The basic form was the diatonic genus (*e.g.,* a–g–f–e); its modifications formed the chromatic (a–f♯–f–e) and enharmonic (a–f–e+–e♮, with e+ being a pitch between e♮ and f ) genera. The Greek theorist Cleonides (*c.* 2nd century AD) discusses the tetrachord and its genera.

In Western music, the tetrachord is an ascending series of four notes. Two disjunct tetrachords (those without a common tone), each with the interval arrangement of tone, tone, semitone, combine to form the major scale. Thus the tetrachords c–d–e–f and g–a–b–c′ form the scale built on c.

**tetracycline,** any of a group of antibiotic compounds that have a common basic structure and are either isolated directly from several species of *Streptomyces* bacteria or produced semisynthetically from those isolated compounds. These drugs, which include chlortetracycline, oxytetracycline, tetracycline, demeclocycline, methacycline, doxycycline, and minocycline, are "broad spectrum" antibiotics, meaning they are effective against many different bacterial species as well as other types of microorganisms. They act by interfering with a microorganism's ability to produce certain vital proteins; thus they are inhibitors of growth (bacteriostatic) rather than killers of the infectious agent (bacteriocidal) and are only effective against multiplying microorganisms. These drugs are used against a variety of infectious diseases, including those caused by *Rickettsia, Chlamydia,* and *Mycoplasma,* as well as respiratory and urinary tract infections. By the late 20th century, concerns arose that the widespread use of tetracyclines was contributing to an increase in the number of tetracycline-resistant organisms, which in turn had rendered certain infections more resilient to treatment. The use of tetracyclines in livestock feed to promote growth was also called into question.

**tetradymite,** a sulfide mineral of bismuth and tellurium ($Bi_2Te_2S$). It is commonly found in gold-quartz veins and contact-metamorphic deposits, as in Idu, Japan; Sorata, Bolivia; Boliden, Sweden; and Boulder county, Colo., U.S. Tetradymite is classified in a group of metallike sulfide minerals closely resembling each other in physical properties and in the hexagonal symmetry of their crystals. For detailed physical properties, *see* sulfide mineral (table).

**tetraethyl lead,** organometallic compound that is the chief antiknock agent for automotive fuels. Manufactured by the action of ethyl chloride on a powdered alloy of lead and sodium, the compound is a dense, colourless liquid that is quite volatile, boiling at about 200° C (400° F). As an antidetonant (*i.e.,* antiknock agent), tetraethyl lead is added to gasoline in quantities not exceeding 3 cubic cm (0.2 cubic inch) per gallon; a small quantity of ethylene dibromide and sometimes ethylene dichloride is added to prevent accumulation of lead deposits in the engine. Tetraethyl lead can cause acute or chronic lead poisoning if inhaled or absorbed through the skin. Its use declined markedly during the 1970s because the products of its combustion are toxic and detrimental to catalytic devices that were introduced to nullify other objectionable components of the exhaust gases of engines.

**tetrafluoroethylene,** a colourless, odourless, faintly toxic gas belonging to the family of

organic halogen compounds; it is the starting material in the manufacture of polytetrafluoroethylene (*q.v.*), a valuable synthetic resin.

Tetrafluoroethylene is produced by heating chlorodifluoromethane, which is made from chloroform by its reaction with hydrogen fluoride in the presence of antimony pentachloride; chlorodifluoromethane (known by several trade names, of which the oldest is Freon 22) is used as a refrigerant in small air conditioners. Tetrafluoroethylene is flammable and, under certain conditions, explosive. It is practically insoluble in water but is appreciably soluble in acetone.

**tetragonal system,** one of the structural categories to which crystalline solids can be assigned. Crystals in this system are referred to three mutually perpendicular axes, two of which are equal in length. If the atoms or atom groups in the solid are represented by points and the points are connected, the resulting lattice will consist of an orderly stacking of blocks, or unit cells. The tetragonal unit cell is distinguished by an axis of fourfold symmetry, about which a rotation of the cell through an angle of 90° brings the atoms into coincidence with their initial positions. Betatin (white tin), rutile, calomel, cassiterite, zircon, chalcopyrite, and wulfenite crystallize in the tetragonal system.

**Tetragrammaton,** the four Hebrew letters, YHWH, in the name of God. *See* Yahweh.

**tetrahedrite,** common sulfosalt mineral, an antimony sulfide of copper, iron, zinc, and silver $[(Cu,Fe,Zn,Ag)_{12}Sb_4S_{13}]$, that is an important ore of copper and sometimes of silver. It forms gray to black metallic crystals or masses



Tetrahedrite with pyrite from Zacatecas, Mex.
By courtesy of the Field Museum of Natural History, Chicago; photograph, John H. Gerard

in metalliferous hydrothermal veins. Tetrahedrite forms a solid solution series with the similar mineral tennantite, in which arsenic replaces antimony in the molecular structure. It is found in important quantities in Switzerland, Germany, Romania, the Czech Republic, France, Peru, and Chile, and both minerals occur in large amounts in Colorado, Idaho, and other localities in the western United States. For detailed physical properties, *see* sulfosalt (table).

**tetrahydrocannabinol** (THC), active constituent of marijuana and hashish that was first isolated from the Indian hemp plant (*Cannabis sativa*) and synthesized in 1965. For the effects of the drug, *see* marijuana.

**tetralogy of Fallot:** *see* Fallot, tetralogy of.

**tetrameter,** line of poetic verse that consists of four metrical feet. In English versification, the feet are usually iambs (an unstressed syllable followed by a stressed one, as in the word be|cause), trochees (a stressed syllable followed by an unstressed one, as in the word ti|ger), or a combination of the two. Iambic tetrameter is, next to iambic pentameter, the most common metre in English poetry; it is used in the English and Scottish traditional ballads, which are usually composed of four-line stanzas of alternating iambic tetrameter and trimeter.

**tetraodontiform,** any member of the order Tetraodontiformes, a group of bony, primarily tropical, marine fishes containing about 320 species in 11 families. Included within the order are the triggerfishes, puffers, and porcupine fishes.

A brief treatment of tetraodontiforms follows. For full treatment, *see* MACROPAEDIA: Fishes.

Most tetraodontiforms, which constitute about 5 percent of all tropical fish, are bottom dwellers, and they have developed a number of specializations for acquiring food. Teeth, for example, are well developed and in some species form parrotlike beaks with which to scrape at rock and corals or to crush mollusks and crustaceans. Boxfishes blow jets of water onto the bottom floor to expose burrowing worms and other invertebrates. Members of the superfamily Triacanthodidae (spikefishes and triple spines) have long snouts, with which to poke into holes and crevices, and rudimentary teeth, probably as a result of feeding on the scales of other bottom-dwelling fishes. Some species eat spiny sea urchins, clams, and even oysters. The huge ocean sunfish, which has massive teeth, feeds extensively on jellyfishes and other soft-bodied invertebrates.

Tetraodontiforms are distinguished by a small gill slit on the side of the head, a small mouth, and massive teeth. Their scales may be overlapping (triacanthoids and balistoids), sutured (ostracionтoids), or developed as sharp spines (puffers and diodontoids). The skin is sometimes thick and hard. Tetraodontiforms swim by rowing their soft dorsal and anal fins; their pectoral fins vibrate constantly, giving them great control.

Tetraodontiforms have little commercial value, although their flesh may be esteemed by local groups. Many species are poisonous during certain times of the year. These fishes have to be carefully cleaned prior to cooking. Of the nonpoisonous varieties, the flesh of certain triggerfishes and trunkfishes is considered particularly delectable. The skins of boxfishes and puffers are often dried as curios.

**Tetraonidae,** the grouse family, a bird family (order Galliformes) that includes the grouse and the ptarmigan (*qq.v.*).

**tetrarch** (Greek: "ruler of a quarter"), in Greco-Roman antiquity, the ruler of a principality; originally the ruler of one-quarter of a region or province. The term was first used to denote the governor of any of the four tetrarchies into which Philip II of Macedon divided Thessaly in 342 BC—namely, Thessaliotis, Hestiaeotis, Pelasgiotis, and Phthiotis. (These may, however, have constituted a revival of a division of earlier origin.) Later, the term tetrarchy was applied to the four divisions of Galatia (in Anatolia) before its conquest by the Romans (169 BC).

Even later, "tetrarch" became familiar as the title of certain Hellenized rulers of petty dynasties in Syria and Palestine, whom the Romans allowed a measure of independent sovereignty. In this usage it lost its original precise sense and meant only the ruler of a divided kingdom or of a district too minor to justify a higher title. After the death of Herod the Great (4 BC), his realm was shared among his three sons: the chief part, including Judaea, Samaria, and Idumaea, fell to Archelaus, with the title of ethnarch; Philip received the northeast of the realm and was called tetrarch; and Galilee was given to Herod Antipas, who also was called tetrarch. These three sovereignties were reunited under Herod Agrippa from AD 41 to 44.

**Tetrazzini, Luisa** (b. June 29, 1871, Florence, Italy—d. April 28, 1940, Milan), Italian coloratura soprano, one of the finest of her time.

In Florence, Tetrazzini studied with her sister Eva, a successful dramatic soprano, and at the conservatory, making her debut in 1895 as Inez in Giacomo Meyerbeer's opera *L'Africaine.* After her well-received debut, Tetrazzini sang in Rome and other Italian cities with a success that led to tours as far away as Russia, Mexico, and South America. She first sang at Covent Garden in London in 1907, as Violetta in Giuseppe Verdi's *La traviata.* Her New York City debut was at the Manhattan Opera House in 1908, and she sang with the Chicago Opera in 1913–14. The greatest period of her career was before World War I, although she appeared in recitals after the war and taught singing in Milan.

Tetrazzini's voice was light in quality. Critics held that she was a poor actress, a characteristic shared by most Italian singers of her time. Her vocal technique, however, was stunning and remained so very nearly until her death. She described her career in *My Life of Song* (1921) and published another book, *How to Sing,* in 1923. The dish chicken tetrazzini was named in her honour.

**Tetricus, Gaius Pius Esuvius** (fl. 3rd century), rival Roman emperor in Gaul from 270 to 274.

He was a Gallic noble related to the usurping ruler of Gaul, Victorinus, and to Victorinus' mother, Victoria. Upon the murder of Victorinus, Tetricus, who was governor of Aquitania, was proclaimed emperor, apparently backed by the influence and money of Victoria. During his short and nominal reign, the monetary inflation of the 3rd century reached its peak. Gaul experienced extensive invasions by Germanic tribes, and Tetricus was threatened by successive mutinies. When the emperor Aurelian (reigned 270–275) appeared in Gaul with an army, Tetricus concluded a private treaty with him, then deserted to him during the battle. Pardoned by Aurelian, Tetricus was appointed governor of southern Italy.

**tetrode,** electronic vacuum tube with four electrodes. In addition to the cathode, anode, and control grid, as in the triode (*q.v.*), an additional grid, the screen grid, is placed between the control grid and plate. The screen grid acts as an electrostatic shield to protect the control grid from the influence of the plate when its potential changes. Although the pentode replaced the tetrode in most vacuum tube functions, a specially designed tetrode, called the beam-power tube, found extensive use in power amplification. A special form of tetrode was the dynatron, a vacuum tube that was operated with screen grid voltage higher than plate voltage so that the tube exhibited negative resistance (*i.e.,* plate current decreased when plate voltage increased), a useful characteristic in oscillator circuits.

**Tetschen** (Czech Republic): *see* Děčín.

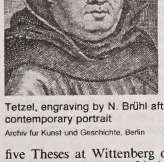
**Tetuán** (Morocco): *see* Tétouan.

**Tetzel, Johann,** Tetzel also spelled TEZEL (b. *c.* 1465, Pirna, Saxony [Germany]—d. Aug. 11, 1519, Leipzig), German Dominican friar whose preaching on indulgences, considered by many of his contemporaries to be an abuse of the sacrament of penance, sparked Martin Luther's revolt.

After entering the Dominican order at Leipzig, Tetzel was appointed inquisitor for Poland (1509) and later for Saxony. His experiences as a preacher of indulgences, especially between 1503 and 1510, led to his appointment as commissary by Albert, archbishop of Mainz, who, deeply in debt to pay for a large accumulation of benefices, had to contribute a considerable sum toward the rebuilding of St. Peter's Basilica in Rome. Albert obtained per-

mission from Pope Leo X to conduct the sale of a special plenary indulgence (*i.e.*, remission of all temporal punishment of sin), half of the proceeds of which Albert was to claim to pay the fees of his benefices. In effect, Tetzel became a salesman whose product was to cause a scandal in Germany that evolved into the greatest crisis (the Reformation) in the history of the Western church.

Tetzel preached for the indulgence in the German dioceses of Meissen (1516), Magdeburg, and Halberstadt (1517), but he was forbidden to do so in Wittenberg by the elector Frederick III the Wise of Saxony. Tetzel's preaching at Jüterbog, near Wittenberg, in the spring of 1517 provoked Martin Luther's Ninety-



Tetzel, engraving by N. Brühl after a contemporary portrait
Archiv fur Kunst und Geschichte, Berlin

five Theses at Wittenberg on Oct. 31, 1517, attacking the system of indulgences. In reply, an uncompromising 50 theses under Tetzel's name (but composed by the theologian Konrad Wimpina) were published in May 1518. At the end of 1518 Tetzel withdrew to Leipzig priory, where he died.

Tetzel was not a profound theologian and was severely criticized for his unorthodox teaching on indulgences for the dead. His view that gifts secured this indulgence, together with the financial transactions surrounding the preaching of it, was symptomatic of the abuses that provoked the Reformation.

**Teutates,** also spelled TOUTATES (Celtic: "God of the People"), important Celtic deity, one of three mentioned by the Roman poet Lucan in the 1st century AD, the other two being Esus ("Lord") and Taranis ("Thunderer"). According to later commentators, victims sacrificed to Teutates were killed by being plunged headfirst into a vat filled with an unspecified liquid, which may have been ale, a favourite drink of the Celts. Teutates was identified with both the Roman Mercury (Greek Hermes) and Mars (Greek Ares). He is also known from dedications in Britain, where his name was written Toutates. The Irish Tuathal Techtmar, one of the legendary conquerors of Ireland, has a name that comes from an earlier form, Teuto-valos ("Ruler of the People"); he may have been an eponymous deity of the district that he is reputed to have conquered, but he was probably just another manifestation of the great god Teutates.

**Teutoburg Forest,** German TEUTOBURGER WALD, westernmost escarpment of the Weser Hills (Weserbergland) in northeastern North Rhine-Westphalia *Land* (state), northern Germany. Its wooded limestone and sandstone ridges curve from the Ems River valley southeastward in an arc approximately 60 miles (100 km) long and 4 to 6 miles (6.5 to 9.5 km) wide around the north and northeast sides of the Münsterland basin. The highest point in the Teutoburg Forest, the Velmerstot, rises to an elevation of 1,535 feet (468 m) at the southeastern end where the range meets the Egge Mountains. The city of Bielefeld, a diversified industrial centre most famous for its linen textiles, is situated at an important pass through the hills. The Hermannsdenkmal, a colossal metal statue built in the 19th century to commemorate the Battle of the Teutoburg Forest (fought AD 9), stands outside Detmold on the northeastern slope. Numerous health and holiday resorts are established in the small hill towns situated among beech and spruce forests.

**Teutonic Order,** also called TEUTONIC KNIGHTS, formally HOUSE OF THE HOSPITALERS OF SAINT MARY OF THE TEUTONS IN JERUSALEM, German DEUTSCHER ORDEN, OF DEUTSCHER RITTER-ORDEN, OF HAUS DER RITTER DES HOSPITALS SANKT MARIEN DER DEUTSCHEN ZU JERUSALEM, Latin DOMUS SANCTAE MARIAE THEUTONICORUM IN JERUSALEM, religious order that played a major role in eastern Europe in the late Middle Ages and that underwent various changes in organization and residence from its founding in 1189/90 to the present. Its major residences, marking its major states of development, were: (1) Acre, Palestine (modern 'Akko, Israel), its original home beginning with the Third Crusade (1189/90–*c.* 1291); (2) Marienburg, Prussia (modern Malbork, Pol.), the centre of its rule as a military principality (1309–1525); (3) Mergentheim, Württemberg, Ger., to which it moved after its loss of Prussia (1525–1809); and (4) Vienna, where the order gathered the remains of its revenues and survives as a purely hospital order (from 1834).

*Origin.* In 1189–90, when crusading forces were besieging Acre, some German merchants from Bremen and Lübeck formed a fraternity to nurse the sick there. After the capture of Acre (1191), this fraternity took over a hospital in the town and began to describe itself as the Hospital of St. Mary of the German House in Jerusalem. Pope Clement III approved it, and it adopted a rule like that of the original Hospital of St. John of Jerusalem (*i.e.,* the Knights of Malta).

The death of the Hohenstaufen emperor Henry VI in 1197, when he was planning a great expedition to Palestine, caused an important change: a number of German crusaders who had arrived in Palestine decided to return home. In order to fill the gap, the German princes and bishops, together with King Amalric II of Jerusalem, in 1198 militarized the fraternity, making it a religious order of knights. The new order was put under a monastic and military rule like that of the Templars. It received privileges from Popes Celestine III and Innocent III and extensive grants of land, not only in the kingdom of Jerusalem but also in Germany and elsewhere. Innocent III in 1205 granted the Teutonic knights the use of the white habit with a black cross.

The knights left Palestine forever toward the end of the Crusades, with the final fall of the country to Islām (1291).

*Eastern Europe and Prussia.* Meanwhile, under the leadership of the grand master Hermann von Salza (reigned 1210–39), the Teutonic knights had already begun transferring their main centre of activity from the Middle East to eastern Europe. The order's first European enterprise started in Hungary in 1211, when King Andrew II invited a group of the Teutonic Knights to protect his Transylvanian borderland against the Cumans by colonizing it and by converting its people to Christianity. The order was then granted extensive rights of autonomy; but the knights' demands became so excessive that they were expelled from Hungary in 1225. By that time, however, a new opportunity was opening: a Polish duke, Conrad of Mazovia, with lands on the lower reaches of the Vistula River, needed help against the pagan Prussians.

Hermann von Salza proceeded carefully, in order to avoid a repetition of what the order had experienced in Transylvania. He already enjoyed the confidence of the Hohenstaufen emperor Frederick II, whom he had served as a diplomat. So, when Conrad made his offer, Hermann in 1226 obtained from Frederick the so-called Golden Bull of Rimini as a legal basis for the settlement. By this charter, Frederick confirmed to Hermann and to the order not only the lands to be granted by Conrad but also those that the knights were to conquer from the Prussians. Later (1234), Hermann also secured privileges from Pope Gregory IX, which can be regarded as the second foundation charter of the order's Prussian state: the papacy was ready to accept the order's current and future conquests as the property of the Holy See and to grant them back to the order in perpetual tenure.

In 1233, led by the *Landmeister* (provincial leader) Hermann Balk and using an army of volunteer laymen recruited mainly from central Germany, the Teutonic Knights began the conquest of Prussia. During the next 50 years, having advanced from the lower Vistula River to the lower Neman (Niemen, Nemunas) River and having exterminated most of the native Prussian population (especially during the major rebellion of 1261–83), the order firmly established its control over Prussia.

Although the order gave one-third of the conquered territory to the church and granted a large degree of autonomy to the newly developing towns in the area, it easily became the dominant power in Prussia. It worked to develop the region by building castles, by importing German peasants to settle in depopulated areas, by bestowing substantial estates on German and Polish nobles who became vassals of the order, and by monopolizing the lucrative Prussian grain trade, particularly after 1263, when the pope allowed the knights, who had previously been bound by a vow of poverty, to engage directly in trading activities.

In 1237, less than two years before Hermann von Salza's death, the Order of the Brothers of the Sword (Schwertbrüderorden), also known as the Knights of the Sword, or the Livonian Order (founded 1202), was made a branch of the Teutonic Order, its head becoming *Landmeister* of Livonia. The Teutonic Order, however, never established such effective control over these northern provinces as it did over Prussia.

By 1309, when the order's grand master established his residence at Marienburg, the order had created a strong feudal state that governed not only Prussia but also the eastern Baltic lands of the Livonian Knights (*i.e.,* Courland, Livonia, and, after 1346, Estonia); Pomerelia, or Eastern Pomerania, including the city of Danzig (Gdańsk); and lands in central and southern Germany. During the following century the order demonstrated its power by continually, although unsuccessfully, trying to conquer and convert Lithuania; by actively protecting the merchant cities of the Hanseatic League; and by expanding its territories through purchase and conquest.

The order's expansion and increasing power, however, aroused the hostility of both Poland, whose access to the Baltic Sea had been cut off, and Lithuania, whose territory the knights continued to menace despite Lithuania's conversion to Christianity in 1387. Consequently, when a rebellion broke out against the order in Samogitia (1408), Poland and Lithuania joined forces and decisively defeated the knights at Grunwald (1410). Although the order was compelled to give up only Samogitia and the Dobrzyń land (Treaty of Torún, 1411), its military might was broken. Subsequently, its authority and financial position also rapidly declined; it was unable to withstand the wars that Poland continued to wage, and when its own vassals joined the Poles in the Thirteen Years' War (1454–66), the order

was finally defeated. In 1466 it ceded Pomerelia, both banks of the Vistula, and the bishopric of Warmia (Ermland) to Poland (Treaty of Torún, 1466). The order retained the rest of Prussia, but its grand master became a vassal of the Polish king for that territory. Furthermore, the formerly exclusively German order was obliged to accept Polish members.

*Decline and fall of the knights.* The Teutonic Order's rule in Prussia came to an end in 1525, when the grand master Albert, under Protestant influence, dissolved the order there and accepted its territory as a secular duchy for himself under Polish suzerainty. In 1526 a new grand master, Walter of Cronenberg (Kronenberg), fixed his residence at Mergentheim in Franconia (Württemberg). After the loss of Prussia the order still retained in Europe several territories. But in 1558 the Livonian territory was lost, partitioned between Russia, Sweden, and Poland-Lithuania. In 1580 the secession of Utrecht meant the loss of territory in the Low Countries. In the late 17th century Louis XIV secularized its possessions in France. In 1801 the Treaty of Luneville stripped the order of its German possession on the left bank of the Rhine. In 1809 the emperor Napoleon, at war with Austria, declared the order to be dissolved and distributed most of its remaining lands among other principalities.

*The Austrian revival.* By the end of the Napoleonic wars the Teutonic Order retained only small territories in the Austrian domains and the Tyrol. In 1834 the Austrian emperor reestablished the order in Vienna, as an ecclesiastical institution, reserving the dignity of grand master for an archduke of his house. New statutes in 1839–40 limited the knights to charitable and pastoral activities and limited the order's sisters to nursing. In 1871 Pope Pius IX approved new rules for the priests of the order. When the Habsburg empire collapsed in 1918, the last imperial grand master, Archduke Maximilian, gave way to a priest as grand master for the first time. A new rule of Nov. 27, 1929, emphasized religious discipline.

Currently the headquarters of the order are in Vienna (Singerstrasse 7), where it maintains a church and an archives of the order. Branch houses also exist in Bavaria, Hesse, and the Italian Tyrol.

**Tevere, Fiume** (Italy): *see* Tiber River.

**Teverone** (river, Italy): *see* Aniene River.

**Teveryа** (Israel): *see* Tiberias.

**Tevfik Fikret,** pseudonym of MEHMED TEVFİK, also called TEVFİK NAZMI (b. Dec. 24, 1867, Constantinople, Ottoman Empire [now Istanbul, Tur.]—d. Aug. 18, 1915, Constantinople), poet who is considered the founder of the modern school of Turkish poetry.

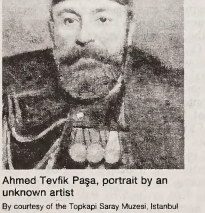
The son of an Ottoman government official, Tevfik Fikret was educated at Galatasaray Lycée, where he later became principal. As a young writer he became editor of the avant-garde periodical *Servet-i Fünun* ("The Wealth of Knowledge") in 1896. Together with a group of the most talented young authors of the day, he published Turkish works and translations of European (particularly French) poems and stories until the publication was temporarily censored by the government in 1901, after which it failed to regain its impetus.

In attempting to define a new literature, Tevfik Fikret and his contemporaries often wrote in an obscure style and in language containing many Arabic and Persian words not easily accessible to the average reader. Greatly influenced by the French Symbolist poets, he sought to adapt Turkish poetry to Western themes and verse forms. A lover of freedom, he became outraged at what he considered an oppressive government and finally took a teaching position at Robert College, then a U.S. institution. Afterwards he settled in his home on the Bosphorus, where he devoted the rest of his life to writing poetry and teaching.

Among his most important works are two collections of poems, *Rübbab-i Shikeste* (1896 1957; "The Broken Lute") and *Haluk'un Defteri* (1911, 1957; "Haluk's Notebook"), the latter dedicated to his son; his famous anti-government polemic *Sis* ("Mist") appeared in 1902.

**Tevfik Paşa, Ahmed** (b. Feb. 11, 1845, Üsqüdar, near Constantinople, Ottoman Empire [now Istanbul, Tur.]—d. 1936, Istanbul), last Ottoman grand vizier (chief minister); he was sympathetic to the nationalist movement of Mustafa Kemal (later known as Atatürk), which resisted the Allied occupation of Anatolia after World War I.

He served in a number of advisory and diplomatic posts, including the ambassadorship in Berlin and the foreign ministry. After



Ahmed Tevfik Paşa, portrait by an unknown artist

By courtesy of the Topkapi Saray Muzesi, Istanbul

the Young Turk Revolution of 1908, Ahmed Tevfik became grand vizier, but he resigned following Sultan Abdulhamid II's deposition (1909) and was appointed ambassador to London. In 1918 he was again made grand vizier, and again he resigned, becoming a member of the Ottoman Senate. In 1919 he headed the Ottoman delegation to the Paris Peace Conference, where he refused to sign the Treaty of Sèvres (May 1920), which aimed at total dismemberment of the Ottoman Empire.

In October 1920, Ahmed Tevfik became grand vizier for the third time, openly declaring his support for the Turkish nationalist government at Ankara. In 1922, however, when the last Ottoman sultan, Mehmed VI, fled and the sultanate was abolished, Ahmed Tevfik ceased to be grand vizier.

**Teviot, River,** tributary of the River Tweed, southern Scotland. Its valley, Teviotdale, constitutes a large part of the district of Roxburgh. The river, rich in trout, flows northeast past Hawick to join the Tweed at Kelso. The alluvial haughs and gravel terraces of the valley floor are improved farmland, but much of the basin consists of steep, rounded hills used for rough sheep grazing.

**Tewfik Pasha, Mohammed:** *see* Tawfiq Pasha, Muḥammad.

**Tewkesbury,** district (borough), county of Gloucestershire, England, north of the city of Gloucester. It comprises 174 square miles (450 square km) of low-lying land along the River Severn. It is predominantly rural and has 54 parishes, among which Tewkesbury town is the only one with town status. The district adjoins and very nearly surrounds both Gloucester and the borough of Cheltenham. The M5 motorway passes through the district. Pop. (1989 est.) 88,100.

**Tewkesbury,** town ("parish"), Tewkesbury district (borough), county of Gloucestershire, England, at the confluence of the Severn and Warwickshire Avon rivers. A small Benedictine abbey was founded in 715 on the site of the present Abbey Church of St. Mary's. The later medieval abbey was consecrated in 1123 and was rebuilt after a fire in 1178; in the 15th century considerable additions were made. At the time of the dissolution of the monasteries (1536–39), the choir, transepts, and square Norman tower of the abbey were purchased by the townsfolk, but much of the remainder of the building was destroyed.

The feudal earls of Gloucester made Tewkesbury a free borough in the 12th century, and the royal charter of liberties granted in 1698 remains in force. In 1471, during the Wars of the Roses, the Battle of Tewkesbury was an important Yorkist victory. Among buildings of architectural interest is the Black Bear (1308), perhaps the oldest inn in Gloucestershire; another inn, the Hop Pole, is mentioned in *The Pickwick Papers* by the 19th-century novelist Charles Dickens.

Tewkesbury, reputedly famous for mustard in William Shakespeare's day, is a centre for boating and angling, especially on the slow-flowing Avon. The town's main industries are flour milling, engineering, and boatbuilding. Pop. (1981) 9,568.

**Tewkesbury, Battle of** (May 4, 1471), in the English Wars of the Roses, the Yorkist king Edward IV's final victory over his Lancastrian opponents. Edward, who had displaced the Lancastrian Henry VI in 1461, later quarreled with his powerful subject Richard Neville, Earl of Warwick, and Warwick in 1470 restored Henry to the throne. In March 1471 Edward returned from Holland, defeating and killing Warwick at the Battle of Barnet on April 14. On that day King Henry's queen, Margaret of Anjou, who had been in France with her son Prince Edward since 1462, landed at Weymouth, in Dorset, and moved northward to rally Lancastrian support in Wales. King Edward intercepted her army just south of Tewkesbury in Gloucestershire on May 3. Battle was joined the following day, each side numbering about 3,000 men. The Lancastrians had a strong defensive position, but a surprise Lancastrian attack on the Yorkist left miscarried, and the Yorkists broke the main Lancastrian position. About 1,000 men were killed, including Prince Edward and other Lancastrian leaders. The murder of Henry VI in the Tower of London (May 21–22) secured Edward's position.

**Tewodros II,** English THEODORE II, original name KASSA (b. *c.* 1818—d. April 13, 1868, Magdela, Eth.), emperor of Ethiopia (1855–68) who has been called Ethiopia's first modern ruler. Not only did he reunify the various Ethiopian kingdoms into one empire, but he also attempted to focus loyalty around the government rather than the Ethiopian church, which he sought to bring under royal control. He also worked to abolish the feudal system and create a new nobility of merit, dependent on the ruler alone. Although he failed in these aims, while alienating the church and important elements of the nobility, his example was followed by his successors.

Not of noble birth, Tewodros came to the throne through warfare against the feudal chiefs. One of his first acts as emperor was to break up the provinces into smaller districts with personally appointed governors, a move that angered many provincial nobles who saw their status diminished. He also wanted to reorganize and modernize the army. To get the necessary weapons, he demanded first that

European missionaries and adventurers then living in Ethiopia build him a cannon (successful after much trial and error), and then he brought in artisans, especially arms makers, from England. Contemporary European accounts portray him as an Ethiopian Peter the Great, both for his hot temper and cruelty and for his courage, ambition, military genius, and interest in technology.

His modernization program, however, failed. Several incidents in the 1860s, including a letter to Queen Victoria that remained unanswered, led Tewodros to feel insulted by England. When he imprisoned several British missionaries and envoys, accusing them of plotting against him, Great Britain sent the Napier expedition (1867–68) to rescue the prisoners. Aided by rebellious nobles along the way, the British force attacked Tewodros' forces at Magdela on April 10, 1868. The emperor, realizing the hopelessness of his position, committed suicide three days later.

**Tewson, Sir Vincent,** in full SIR HAROLD VINCENT TEWSON (b. Feb. 4, 1898, Bradford, Yorkshire, Eng.—d. May 1, 1981, Letchworth, Hertfordshire), English trade union leader and general secretary of the Trades Union Congress (TUC) from 1946 to 1960.

Tewson acquired his early organizing experience with the Amalgamated Society of Dyers in Bradford. After distinguished service in World War I, Tewson returned to work for the Dyers until he joined the TUC in 1925, when he was chosen to head a new organizing unit. In 1931 he became assistant general secretary to Walter Citrine and then succeeded Citrine in 1946 as general secretary.

During his tenure as general secretary of the TUC, Tewson actively supported the postwar economic-recovery program in Europe and helped to create a trade union advisory committee for the Marshall Plan. In 1949 he acted as secretary to the Geneva conference at which the International Confederation of Free Trade Unions (ICFTU) was created, and he was its president from 1951 to 1953. Tewson was made a Commander of the British Empire in 1942 and was knighted in 1950.

**Texaco Inc.,** American-based oil and petrochemical corporation, founded in 1902 (as The Texas Company) and, by the late 20th century, one of the world's largest petroleum companies in sales. The current name was adopted in 1959.

Though it is now headquartered in White Plains, N.Y., the company originally conducted its business ventures wholly within Texas and still has major operations there. Its operations have expanded, however, to all states of the United States and to countries on all continents. Texaco is primarily engaged in the production, refining, marketing, and shipping of petroleum and natural gas.

The Texas Company was founded by Joseph S. Cullinan (1860–1937), a former Standard Oil field-worker, and Arnold Schlaet (1859–1946), a New York investment manager. Their original design was to buy and refine oil in Texas and sell it to Standard Oil Company interests in the North at a profit, but very soon they expanded into oil production in the giant Spindletop field. By 1910 the company was operating tankers out of New York and by 1911 had established its first refinery outside Texas, in Illinois. In 1928 it became the first company to market in all 48 states, and in the 1930s it began operations in Canada, Colombia, and Venezuela. It joined with Standard Oil of California in half ownership of ventures in the Middle East and Indonesia—such as the "Caltex" group of companies in Bahrain, the Arabian American Oil Company (Aramco) in Saudi Arabia, and holding companies in Sumatra and Java.

In 1984 Texaco purchased the Getty Oil Company but was sued for contract interference by the Pennzoil Company, whose own imminent acquisition of Getty had been derailed by Texaco's successful bid. Texaco retained control of Getty, but Pennzoil won punitive damages after a five-year court battle, being awarded the sum of $10,530,000,000 (of which Texaco eventually paid $3,000,000,-000).

The Getty Oil Company, formerly headquartered in Los Angeles, had been incorporated in 1928 as the Pacific Western Oil Corporation, holding properties owned by Edward L. Doherty and family. It came under the control of J. Paul Getty (*q.v.*), and the name Getty Oil Company was adopted in 1956.

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**Texarkana,** dual municipality astride the Texas-Arkansas boundary, U.S., and also near the Louisiana and Oklahoma state lines. First settled in 1874 at the junction of the Cairo and Fulton and the Texas and Pacific railways, it derived its name from *Tex*as, *Ark*ansas, and Louisi*ana*. The two cities—Texarkana, Texas (in Bowie county, incorporated 1874), and Texarkana, Ark. (seat of Miller county, incorporated 1880)—are divided by State Line Avenue; they have separate municipal governments but are integrated economically and socially. A marketing and distribution point for the surrounding agricultural area, Texarkana has diversified industry (including the manufacture of wood products, tank cars, tires, paper, and food) and is a railroad and bus terminal. The Red River Army (ordnance) Depot is located nearby. Texarkana College was established in 1927 and East Texas State University at Texarkana in 1971. Pop. (1993 est.) Texarkana, Texas, 32,754; Texarkana, Ark., 22,959; Texarkana-Texarkana MSA, 123,027.

**Texas,** constituent state of the United States of America, lying in the south-central United States. It is bounded on the north by Oklahoma, on the east by Arkansas and Louisiana, on the southeast by the Gulf of Mexico, on the southwest by Mexico, and on the west by New Mexico. The capital is Austin.

A brief treatment of Texas follows. For full treatment, *see* MACROPAEDIA: United States of America.

Spanish explorations into Texas, previously sparsely settled by American Indians, began in 1528, but not until 1685, when the French attempted to establish a colony at Matagorda Bay, did the Spanish take settlement in Texas seriously. The number of missions increased, and San Antonio (founded 1718) became the main settlement of Spanish Texas. In 1820 Moses Austin of Virginia secured permission to begin a colony in Texas. When Mexico became independent of Spain in 1821, it consented to the colonial venture under the leadership of Austin's son, Stephen. This colony was the beginning of the Anglo-American settlement of Texas. Texans, both Anglo-Americans and Mexicans, became disgruntled with Mexican rule, particularly after General Antonio López de Santa Anna assumed the Mexican presidency in 1833. The Texans declared independence as the Republic of Texas in 1836 and defeated a Mexican military effort to retain the territory. After a 10-year struggle to remain a viable independent nation, Texas entered the United States in 1845 as the 28th state. Like other Southern states, Texas seceded in 1861 at the beginning of the American Civil War, forcing the ouster of its unionist governor, Sam Houston. Readmission to the Union came in 1869. The discovery of oil in 1901 transformed the state's economy.

Texas is the largest of the U.S. states except for Alaska. The Coastal Plains stretch inland from the Gulf Coast and encompass about two-fifths of the state's land area. These flat, low prairies form a fertile crescent varying in width from 50 to 200 miles (80 to 320 km). At the Balcones Escarpment farther north, the Coastal Plains merge into the Great Plains, and there is hill country and tableland varying in elevation from 750 to 2,500 feet (230 to 775 m) above sea level. The North Central Plains in northern Texas are bordered on the west, in the Panhandle, by the High Plains, a flat, dry area with frequent sandstorms. The Trans-Pecos region, west of the Pecos River, contains the state's most rugged terrain and its highest peak, Guadalupe, 8,750 feet (2,667 m) above sea level.

Generalizations about Texas weather on a statewide basis are almost meaningless. The Gulf Coast around Houston has an average annual temperature of 70° F (21° C) and rainfall of 45 inches (1,145 mm), whereas the Panhandle averages about 60° F (16° C) and about 20 inches (510 mm) of rainfall. The driest region is the Trans-Pecos country, and the wettest is the southeast. Southern areas have freezing weather only rarely. In Brownsville, the southernmost city, no measurable snow has fallen in the 20th century, but the northwestern corner of the state averages 23 inches (584 mm) of snowfall annually.

Texas has a diverse population. Some 67,-000 American Indians live in Texas, but this figure fails to account for the many families in the state who have some Indian ancestry. By far the largest minority group in the state is the Hispanic: more than one-fourth of the population is of Hispanic origin, nearly all of whom are Mexican-Americans. Blacks, who have been in Texas since the earliest European penetration, constitute about one-eighth of the population. Texas remains one of the fastest-growing states in the country. Between 1970 and 1990, its population growth rate was about two and a half times the national average.

Texas is rich in natural resources. It is the leading cotton-producing state, and in total value of farm-crop production it consistently ranks high among the states. The state leads all others in the raising of beef cattle and sheep. Texas also has more than one-fourth of the nation's proved oil reserves, leads all other states in oil and natural-gas production, and is first in petroleum-refining capacity. Sulfur is also an important resource. The petrochemical industrial complex along the Gulf Coast is one of the largest in the country. The electronic and electrical-machinery industry, however, is the largest manufacturing employer. The manufacture of nonelectrical machinery and finished consumer products continues to grow.

Improvements in water transportation have made Houston an international port, one of the largest in the nation in tonnage moved. The western part of the Gulf Intracoastal Waterway runs from New Orleans (via Orange, Port Arthur, Galveston, and Corpus Christi) to Brownsville. Texas leads the nation in both road and rail mileage, and the Dallas–Fort Worth airport is one of the largest in the country.

Both Dallas and Houston have well-known symphony orchestras and theatres. The Houston Grand Opera Association is world famous, and the city has a major ballet company. The University of Texas at Austin houses the presidential library containing the papers of former president Lyndon B. Johnson. Texas has approximately 150 colleges and universities, about one-fourth of which are private or church-supported. Area 266,807 square miles (691,027 square km). Pop. (1994 est.) 18,291,-000.

**Texas and Pacific Railway Company,** Texas railroad merged into the Missouri Pacific in 1976. Chartered in 1871, it absorbed

several other Texas railroads and extended service to El Paso in the west and New Orleans, La., in the east. Under Thomas A. Scott, who was simultaneously president of the Pennsylvania Railroad, the line attempted to build to New Mexico and Arizona, where it could obtain a land grant for further expansion, but this plan was eventually abandoned.

In 1880 the railroad, along with several others, was acquired by Jay Gould, who made them into feeder lines for the Missouri Pacific, which he also controlled. The Texas and Pacific was officially merged into the Missouri Pacific in 1976, together with the Chicago and Eastern Illinois Railroad.

**Texas City,** city, Galveston County, Texas, U.S., and part of the Galveston–Texas City complex on Galveston Bay. The city is a deep-water port on channels to the Gulf, and its industrial activities have considerably expanded since World War II; they include the produc-



Petroleum complex, Texas City, Texas
By courtesy of the Texas Highway Department

tion of petrochemicals, tin smelting, and oil refining. Development of the area was begun in 1893 by shippers from the Great Lakes who recognized the potential advantages of a port terminal. The city has suffered several major disasters, including a severe hurricane that swept over Galveston Island in 1915 and the explosion of the French freighter "Grandcamp," loaded with ammonium nitrate fertilizer, in the harbour in 1947, which killed nearly 600. A protective seawall was completed in 1963. College of the Mainland (1967) is in Texas City. Inc. 1911. Pop. (1999 est.) city, 42,701; Galveston–Texas City PMSA, 248,469.

**Texas Instruments Incorporated (TI),** American manufacturer of calculators, microprocessors, and digital signal processors with its headquarters in Dallas, Texas.

The direct antecedent to the company was founded May 16, 1930, by John Karcher and Eugene McDermott to provide seismographic data for the petroleum industry. Incorporated as Geophysical Service Inc. (GSI) in 1938, the company was renamed Coronado Corporation the next year, and GSI was turned into a subsidiary. On December 6, 1941, Eugene McDermott, Cecil Green, Erik Jonsson, and H.B. Peacock bought GSI.

GSI developed submarine detection devices for the U.S. Navy during World War II, applying technologies used to locate oil before the war. The navy assigned Lt. Patrick Haggerty to monitor and manage GSI's contract, and at war's end he accepted a position as head of GSI's new laboratory and manufacturing division.

In 1951 the company changed its name to Texas Instruments Incorporated (TI) and the following year purchased a license from Western Electric to manufacture transistors. Haggerty established the TI semiconductor division and oversaw the development and production of the world's first transistor radio, the Regency, which was a best-seller for the 1954 Christmas season. Profits were considerable, and TI was established as a major electronics firm. From 1954 to 1958 TI was the only firm capable of producing silicon transistors in quantity.

In 1958 Jack Kilby, a researcher at TI, co-invented the integrated circuit (IC). (Robert Noyce of Fairchild Semiconductor Corporation independently invented the IC later that same year.) Haggerty, who had just become TI's president, recognized that developing the IC would demand resources far beyond his company's funding capabilities. Fortuitously for TI, the U.S. Air Force began a major program to close the "missile gap" and TI, already a prime supplier of semiconductor circuits for the military, received funding to develop ICs for use in ballistic missile guidance systems. The Minuteman missile, which became the principal American land-based nuclear missile following its deployment in 1962, relied on ICs made by TI. In 1964 the first consumer product containing an IC appeared, a hearing aid designed and manufactured in collaboration with Zenith Radio Corporation.

In 1965 Haggerty commissioned Kilby to design an affordable electronic pocket calculator. By 1967, the same year that Haggerty became TI's chairman, Kilby succeeded in inventing the basic design for hand-held calculators. In 1972 the TI Datamath pocket calculator was introduced. TI had reduced the number of ICs in this calculator to one—drastically reducing the manufacturing cost—and the success of the Datamath and subsequent TI scientific calculators transformed the company into a major consumer electronics firm.

The 1970s saw continued growth in TI's semiconductor business, particularly after 1973, when the company began manufacturing dynamic random-access memory (DRAM, commonly shortened to RAM) chips for use in computers. In 1978 TI introduced the first single-chip speech synthesizer; it was used in the company's Speak & Spell™ learning toy for young children.

Innovations continued in the 1980s and '90s at TI. In 1982 TI introduced the first single-chip digital signal processor (DSP), a market that the company went on to dominate. By 1997 TI's revenue from DSPs—the control units in digital cellular telephones, automobile brake systems, stereophonic sound systems, and computer modems—exceeded $1.4 billion.

**Texas Rangers,** a loosely organized military force that policed Texas from the time of their initial organization in the 1830s to their merger with the state highway patrol in 1935. The first Texas Rangers were minutemen hired by American settlers as protection against Indian attacks. During the Texas war for independence and its years as an independent republic, the Rangers, headquartered in Austin, also served as a border patrol. The Rangers, who provided their own horses and arms, refused to wear standard uniforms or to salute their officers, but they were noted as much for their highly disciplined esprit de corps as for their deadly marksmanship. They made the six-shooter (the Colt revolver) the weapon of the West, and at their peak in the 1870s they effectively brought law and order to hundreds of miles of Texas frontier. Although their importance declined in the 20th century, the Rangers have assumed a prominent position in Texas legend and American lore.

**Texas v. White** (1869), U.S. Supreme Court case in which it was held that the United States is "an indestructible union" from which no state can secede. In 1850 the state of Texas received $10,000,000 in federal government bonds in settlement of boundary claims. In 1861 the state seceded from the Union and joined the Confederacy. In 1862 the confederationist government of the state transferred the bonds to several private individuals in payment for Confederate military supplies. After the Civil War the Reconstruction state government filed a suit in the Supreme Court seeking to recover the bonds, then held by citizens of various states.

The suit contended that the transfer of the bonds was illegal because the bonds were not signed by the governor, as required by federal law. The defendants contended that, while a state may bring a suit in the Supreme Court, Texas had no such right in this case because it had seceded and, therefore, the federal law was not applicable at the time the bonds were transferred. The Supreme Court held that the intention of the Confederate States to secede meant that they had only temporarily lost privileges of Union membership but had not lost membership itself. Writing for the court, Chief Justice Salmon P. Chase commented that the federal Constitution "in all its provisions looks to an indestructible Union, composed of indestructible States." Thus, the Supreme Court decreed by law what the Union's Civil War victory had effected by force, namely, the principle that no state may secede from the Union.

**Texcoco,** city built in the present-day Valley of Mexico by the Acolhuas, a pre-Columbian people of the Nahuatl-speaking group of tribes, which gained mastery of the valley after the collapse of the Toltec hegemony in the mid-12th century AD. The rulers of Texcoco were the first among Nahuatl tribal leaders to establish their rule over Anáhuac (the Valley of Mexico). By the turn of the 15th century, Texcoco fell into tributary status to the-Tepanec rulers of Azcapotzalco, until that city was destroyed in 1428. The revival of Texcoco independence was accompanied by the formation of a triple alliance between the Acolhua city and its neighbours, Tacuba and Tenochtitlán. In the later 15th century the Aztec rulers of the latter overshadowed their allies and established an empire over most of central and southern Mexico. The Alcolhuas were responsible for the preservation of remnants of Toltec culture after the destruction of the Toltec centre at Tollán. Lake Texcoco, now drained, was located in the area of present-day Mexico City; along its shores were located Texcoco and other cities, and on the islands in the lake the Aztecs built Tenochtitlán.

**Texcoco, Lake,** Spanish LAGO DE TEXCOCO, lake in central Mexico. Originally one of the five lakes contained in Anáhuac, or the Valley of Mexico, Texcoco has been drained via channels and a tunnel to the Pánuco River since the early 17th century, until it now occupies only a small area surrounded by salt marshes 2½ mi (4 km) east of Mexico City. Tenochtitlán, the Aztec capital, captured in 1521 by the Spanish conquistador Hernán Cortés, stood on islands in old Texcoco, connected to the mainland by causeways. It was hoped that vast areas of rich farmlands would be made available by draining the lake, but the soils proved too saline for cultivation. In addition, the surface of the lake bed has dropped and the buildings on it have settled, and clouds of dust are occasionally blown over the urban area, contributing to the extreme air pollution of Mexico City.

**textile,** any filament, fibre, or yarn that can be made into fabric or cloth, and the resulting material itself. The word—derived from the Latin *textilis* and the French *texere,* meaning "to weave"—originally referred only to woven fabrics but now includes knitted, bonded, felted, and tufted fabrics as well.

A brief treatment of textiles and textile production follows. For full treatment, *see* MACROPAEDIA: Industries, Textile.

The fundamental raw materials used in textile production are fibres, either those obtained from natural sources, such as wool from sheep, or those produced from chemical substances. They are evaluated for strength, fineness, length, elasticity, flexibility, absorption, reaction to heat and light, and ability to withstand laundering or dry-cleaning.

Before they are converted into yarn, natural fibres are treated to remove impurities or undesirable constituents (such as wool fat), and some are blended to obtain uniform length, diameter, density, and moisture content. Another preparatory process is carding, by which a thin sheet of fibres is condensed to form a thick, continuous, untwisted strand called sliver. The spinning process draws out and twists fibres or slivers into a continuous yarn or thread. This product is then classified by any of several methods. One method is based on the number of strands and describes a yarn as one-ply, plied, or cord. One-ply yarns can be single strands composed of fibres twisted together; filaments with or without twist; narrow strips of material; or single, thick, man-made filaments (monofilaments). Plied yarns are composed of two or more yarns twisted into a single strand, and cord is formed by twisting plied yarns together. Among other systems of classification are those based on the use for which a yarn is intended or on the relationship of its length to its weight.

The most common method for converting yarn into fabric is by weaving, that is, by the interlacing of threads or yarns into a bound system. Woven fabrics are usually composed of lengthwise threads called warp, and shorter, widthwise threads called weft. The two are interwoven on a device known as a loom, which may have been used as early as the 5th century BC.

Fabric is also produced by means of knitting, the interlocking of a series of loops from one or more yarns. Hand knitting, an age-old practice, is still a highly regarded craft. The role of knitting in the textile industry was greatly expanded by the introduction of the knitting machine.

Other techniques for the production of fabric include lace-making, net-making, braiding, and processes that yield nonwoven materials. In the latter operation, known as felting, fibres are interlocked or matted in a random fashion by the application of heat, moisture, or mechanical action. Fibres can also be bonded by application of an adhesive.

In addition to widespread industrial use, textiles are used for wearing apparel, household linens and bedding, upholstery, draperies and curtains, wall coverings, rugs and carpets, and bookbindings.

**textual criticism,** the study of a literary or other work for the purpose of establishing the original form or a single definitive form of its text. By text is meant the literary forms preserved in autograph or in transmitted form. Transmission may be as close as the immediate copy of an autograph or may be as distant as copies of copies to any degree; moreover, texts may be transmitted in written or in printed form (each generally defined) or in both. "Transmitted" texts share only one characteristic: their preserved forms were not written out by the author in any manner. When there is mixture, the transmitted and autograph parts are to be distinguished. In some few cases the problem of oral transmission will arise to complicate the usual written or printed line of transmission.

A brief treatment of textual criticism follows. For full treatment, *see* MACROPAEDIA: History, Study of.

Textual criticism encompasses not only classical, biblical, and medieval manuscripts and books but also modern works. Even authorial supervision and the most modern composition methods are not enough to assure an error-free text, and the author's real intention may be difficult to determine. One example is the many printer's errors in William Faulkner's novel *Absalom, Absalom!* (1936) owing to the complex typography used to represent narrative levels. Occasionally deliberate correction or censorship must be undone, as in the case of novels by Stephen Crane and Theodore Dreiser and the published journals of Nathaniel Hawthorne. Lack of knowledge of language or subject matter and accidental damage or omission are other causes of variation in texts.

Variation occurs any time a text is transmitted, whether in print, in manuscript, or orally. In the case of early printed books, variation occurs because printers did not emphasize textual accuracy.

The problems with the study of manuscript transmission lie in establishing the genealogy of what may be a large number of handwritten versions, each textually unique. The variations that occur are not regarded as error; variation is a value-free term and describes only a difference between two readings. Whether texts have been copied many times over short or long periods, close in time to the original text or very long after it, from a lost or an extant original—all these are factors in reconstructing an authoritative original. When a text was originally transmitted orally—as were texts of Homer or the Provençal poets—critics often cannot reconstruct an "original" but must assume a common source.

Because of all these possibilities, textual criticism remains an art of knowledgeable intuition and conjecture despite the contributions of technology. It proceeds in three steps—recension, examination, and emendation.

Recension is the reconstruction, from surviving evidence, of the earliest form or forms of the text. The critic identifies and describes all the extant copies or editions as well as secondary versions and citations—together called "witnesses"—and collates them, comparing them with a selected version, such as a standard printed edition. He uses either the genealogical or the textual approach to solve the problem of variant forms of the text.

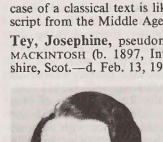
Critics using the genealogical or "stemmatic" approach treat the text (an abstract concept that they are attempting to reconstruct) and the vehicle of transmission (the book itself) as identical and draw up a family tree showing how the witnesses are related. They eliminate all variants that cannot be shown to descend from the "archetype," or lost copy of the earliest surmised text. This method works conclusively only in "vertical" transmission (called a "closed" tradition), when each copyist has followed only one model and produced only his own variants. When the copyist either used more than one source or copied one which incorporated variants from other models—"horizontal" transmission resulting in an "open" or "contaminated" tradition—the family tree, or *stemma,* may be impossible to reconstruct.

In the case of the existence of thousands of variants or the impossibility of determining the correctness of readings, the textual or "distributional" approach may be utilized. Here the text and vehicle are considered separately, and the distribution of the variations in the vehicles is analyzed without regard to the character of the text.

The next step, examination, is necessary to determine if any of the transmitted variants is authentic (what the author intended). The critic evaluates the smaller number of "authoritative" texts obtained through recension according to historical knowledge, his taste, and considerations of period and genre.

Finally, emendation is what the critic does to restore the established text to a state approximating an authorial fair copy, which frequently requires conjecture to close the gap between the archetype and the original—which in the case of a classical text is likely to be a manuscript from the Middle Ages.

**Tey, Josephine,** pseudonym of ELIZABETH MACKINTOSH (b. 1897, Inverness, Inverness-shire, Scot.—d. Feb. 13, 1952, London, Eng.),



Josephine Tey, 1934
BBC Hulton Picture Library

Scottish playwright and author of popular detective novels praised for their warm and readable style.

A physical education teacher for eight years, Tey became a full-time writer with the successful publication of her first book, *The Man in the Queue* (1929). She wrote some novels and the majority of her plays under the pseudonym Gordon Daviot. Among the plays is *Richard of Bordeaux* (produced 1933), a stage success in London and New York.

Her detective fiction, written under the pen name Josephine Tey and frequently featuring the fictional investigator Inspector Grant, includes *Miss Pym Disposes* (1947); *The Franchise Affair* (1949), based on a real case from the 18th century; *The Daughter of Time* (1951), a historical novel dealing with Richard III's implication in the murder of his two young nephews; and *The Singing Sands* (1952).

*Consult the* INDEX *first*

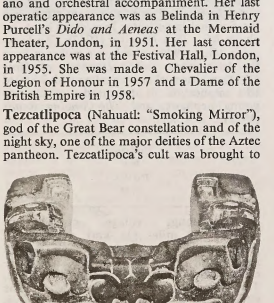
**Teyateyaneng,** village, northwestern Lesotho, 19 miles (31 km) northeast of Maseru, on the country's main north-south road. Named after the Teja-Tejane ("Quicksands") River that flows south of the village, Teyateyaneng is often abbreviated as TY. The village is on a hilltop, the site of a camp established in 1886 following the resolution of a dispute between the British resident commissioner, Marshall Clark, and Chief Masopha, third son of the legendary Mshweshwe, founder and paramount chief of the Sotho nation. Masopha agreed to pay taxes to the resident commissioner, who allowed the chief to set up his own district headquarters with police recruited from his own people. From its hilltop the village affords a spectacular view of the lowlands to the northwest and the Maloti (Maluti or Front Range) Mountains to the southeast. Teyateyaneng is a market centre and is known for the production of finely woven mohair rugs and other textiles and for stoneware pottery. Numerous specimens of Khoisan art in several rock shelters in the area, and the Cannibal Cave, a notorious hideout for cannibals during the *lifaqane* (migratory wars) in the early 19th century, are in the vicinity. Berea Mission (named for a Greek town where St. Paul found converts of remarkable zeal), which was maintained for 50 years by an Anglican missionary, William Wrenford, is a historical monument southwest of the village. Pop. (1986) 14,251.

**Teyte, Dame Maggie,** original name MARGARET TATE (b. April 17, 1888, Wolverhampton, Staffordshire, Eng.—d. May 26, 1976, London), English soprano, a well-known opera, concert, and recording artist who was considered one of the 20th century's foremost interpreters of French song.

Teyte studied at the Royal College of Music in London as a child, and in 1903 she moved to Paris to study voice with Jean de Reszke. She made her concert debut in 1906 in a W.A. Mozart festival organized by Reynaldo Hahn and her operatic debut in 1907 in Monte-Carlo. Her first great opportunity came in 1908, when Claude Debussy chose her to succeed Mary Garden as Mélisande in the original production of his *Pelléas et Mélisande* in Paris. She was an immediate success and was considered by many to be superior to Garden in the role. Debussy later performed with Teyte in a number of concerts in Paris. Among the opera companies with which she performed were the Chicago Opera Company, the Boston Opera Company, the Metropolitan Opera in New York City, the Opéra-Comique in Paris, and several British organizations, including the Beecham Opera Company, the British National Opera Company, and Covent Garden in London.

The 1937 release of Teyte's recording of a Debussy recital with Alfred Cortot at the piano brought her into international prominence as an interpreter of French song. In 1940 this was followed by an album of French song from Hector Berlioz to Debussy with both piano and orchestral accompaniment. Her last operatic appearance was as Belinda in Henry Purcell's *Dido and Aeneas* at the Mermaid Theater, London, in 1951. Her last concert appearance was at the Festival Hall, London, in 1955. She was made a Chevalier of the Legion of Honour in 1957 and a Dame of the British Empire in 1958.

**Tezcatlipoca** (Nahuatl: "Smoking Mirror"), god of the Great Bear constellation and of the night sky, one of the major deities of the Aztec pantheon. Tezcatlipoca's cult was brought to



Tezcatlipoca in the form of a jaguar, carved on a granite ball player's yoke, AD 650–1000; in the National Museum of Anthropology, Mexico City
Giraudon—Art Resource

central Mexico by the Toltecs, Nahua-speaking warriors from the north, about the end of the 10th century AD. Numerous myths relate how Tezcatlipoca expelled the priest-king Quetzalcóatl, the Feathered Serpent, from his centre at Tula. A protean wizard, he caused the death of many Toltecs by his black magic and induced the virtuous Quetzalcóatl to sin, drunkenness, and carnal love, thus putting an end to the Toltec golden age. Under his influence the practice of human sacrifice was introduced into central Mexico. Tezcatlipoca's nagual, or animal disguise, was the jaguar, the spotted skin of which was compared to the starry sky. A creator god, Tezcatlipoca ruled over Ocelotonatiuh ("Jaguar-Sun"), the first of the four worlds that were created and destroyed before the present universe.

Tezcatlipoca was generally represented with a stripe of black paint across his face and an obsidian mirror in place of one of his feet. The post-Classic (after 900) Maya-Quiché people of Guatemala revered him as a lightning god under the name Hurakan ("One Foot"). Other representations show Tezcatlipoca with his mirror on his chest. In it he saw everything; invisible and omnipresent, he knew all the deeds and thoughts of men.

In Aztec times (14th–16th century AD), Tezcatlipoca's manifold attributes and functions brought him to the summit of the divine hierarchy, where he ruled together with Huitzilopochtli, Tlaloc, and Quetzalcóatl. Called Yoalli Ehécatl ("Night Wind"), Yaotl ("Warrior"), and Telpochtli ("Young Man"), he was said to appear at crossroads at night to challenge warriors. He presided over the *telpochcalli* ("young men's houses"), district schools in which the sons of the common people received an elementary education and military training. He was the protector of slaves and severely punished masters who ill-treated "Tezcatlipoca's beloved children." He rewarded virtue by bestowing riches and fame, and he chastised wrongdoers by sending them sickness (*e.g.,* leprosy) or by reducing them to poverty and slavery.

The main rite of Tezcatlipoca's cult took place during the fifth ritual month, Toxcatl. Every year at that time, the priest selected a young and handsome war prisoner. For one year he lived in princely luxury, impersonating the god. Four beautiful girls dressed as goddesses were chosen as his companions. On the appointed feast day, he climbed the steps of a small temple while breaking flutes that he had played. At the top he was sacrificed by the removal of his heart.

Outside of the Aztec capital, Tenochtitlán, Tezcatlipoca was especially revered at Texcoco and in the Mixteca-Puebla region between Oaxaca and Tlaxcala.

**Tezel, Johann:** *see* Tetzel, Johann.

**Tezpur,** city, north-central Assam state, northeastern India. Situated along the Brahmaputra River, it is a trade centre for tea, rice, and other crops grown in the surrounding agricultural area. There is also some tea processing. The city is served by a rail line and nearby Salani airport. In World War II Tezpur was the western terminus of an Allied airlift to Kunming, China, over the "hump" of the Himalayas in the China-Burma-India theatre of war. Darrang College and a law school, both affiliated with Gauhāti University, and a government industrial and technical school are located in Tezpur. The capital of part of the ancient Pāla kingdom about the 9th century AD, the city contains carvings and ruined temples from that period. Pop. (1991 prelim.) 54,999.

**tfillin** (Judaism): *see* phylactery.

**Tha River,** river in northwestern Laos, one of the 12 principal tributaries of the Mekong River. The Tha River rises on the Chinese frontier and flows generally southwestward in deep, narrow valleys for about 134 miles (215 km) to join the Mekong River at a point some 20 miles (32 km) southeast of Ban Houayxay. Navigable only by small craft, the Tha is nonetheless the principal stream of extreme northwestern Laos. Near it lie copper, alluvial gold, sapphire, and zircon deposits.

**Thaba Bosiu,** also spelled THABA BOSIGO, site and sandstone plateau (elevation 5,919 feet [1,804 m]) in the foothills of the southern African state of Lesotho. It is located about 15 miles (24 km) east of Maseru, capital of Lesotho. Forming a natural fortress nearly 400 feet (120 m) above the surrounding plain, the plateau was used by the 19th-century chief and founder of the Sotho nation, Mshweshwe, as his headquarters and to protect his people from other African, British, or Boer intrusions. Only in times of real danger did the Sotho nation gather atop the approximately 0.75 square mile (2 square km) area of Thaba Bosiu. Today it is uninhabited, but remains of the villages and graves of Sotho chiefs are still there.

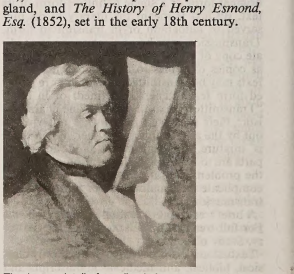
**Thabana Ntlenyana,** also called THADENTSONYANE, or THABANTSHONYANA, mountain peak (11,425 feet [3,482 m]) in the Drakensberg and the highest in Africa south of Mount Kilimanjaro. The peak lies in Lesotho, an independent country entirely within South Africa, just west of the border with the province of KwaZulu/Natal. Nearby are the headwaters of the Orange River, which flows west to the Atlantic Ocean.

**Thabazimbi,** iron ore mine and town, Northern province, South Africa, near the Botswana border. The name means "mountain of iron." Thabazimbi is situated in remote, semiarid country, and its superior-grade hematite was first discovered in 1919 and mined in 1931. Owned by Iscor (the Iron and Steel Corporation of South Africa), its iron-ore deposits are estimated at 100,000,000 tons. The area surrounding Thabazimbi is also well known for cattle ranching. Thabazimbi is connected by rail to the steelworks at Pretoria. Pop. (1985) 7,527.

**Thābit ibn Qurrah** (b. *c.* 836, Syria—d. 901, Baghdad, Iraq), Arab mathematician, physician, and philosopher, and a representative of the flourishing Arab-Islāmic culture of the 9th century.

Thābit was a scion of a prominent family settled in Harrān, a city noted as the seat of an enduring Hellenistic astronomical cult. Some sources describe him as a money changer; it is known that he inherited a large fortune that enabled him to go to Baghdad and obtain a thorough mathematical and philosophical training. When he returned to his native town, he found that his liberal philosophical ideas aroused much antagonism on the part of his coreligionists, the late Hellenistic pagan community. He recanted his philosophical heresies after being required to appear before the local religious court and only escaped further persecution by leaving Harrān. Through the influence of several men who were trusted advisers of the 'Abbāsid caliph al-Mu'tadid, Thābit secured appointment as a court astronomer in Baghdad, where he spent the remainder of his life writing mathematical, philosophical, and medical works and translating and teaching the works of Greek mathematicians.

**Thackeray, William Makepeace** (b. July 18, 1811, Calcutta, India—d. Dec. 24, 1863, London, Eng.), English novelist whose reputation rests chiefly on *Vanity Fair* (1847–48), a novel of the Napoleonic period in England, and *The History of Henry Esmond, Esq.* (1852), set in the early 18th century.



Thackeray, detail of an oil painting by Samuel Laurence; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

*Life.* Thackeray was the only son of Richmond Thackeray, an administrator in the East India Company. His father died in 1815, and in 1816 Thackeray was sent home to England. His mother joined him in 1820, having married (1817) an engineering officer with whom she had been in love before she met Richmond Thackeray. After attending several grammar schools Thackeray went in 1822 to Charterhouse, the London public (private) school, where he led a rather lonely and miserable existence.

He was happier while studying at Trinity College, Cambridge (1828–30). In 1830 he left Cambridge without taking a degree, and during 1831–33 he studied law at the Middle Temple, London. He then considered painting as a profession; his artistic gifts are seen in his letters and many of his early writings, which are amusingly and energetically illustrated. All his efforts at this time have a dilettante air, understandable in a young man who, on coming of age in 1832, had inherited £20,000 from his father. He soon lost his fortune, however, through gambling and unlucky speculations and investments. In 1836, while studying art in Paris, he married a penniless Irish girl, and his stepfather bought a newspaper so that he could remain there as its correspondent. After the paper's failure (1837) he took his wife back to Bloomsbury, London, and became a hardworking and prolific professional journalist.

Of Thackeray's three daughters, one died in infancy (1839); and in 1840, after her last confinement, Mrs. Thackeray became insane. She never recovered and long survived her husband, living with friends in the country. Thackeray was, in effect, a widower, relying much on club life and gradually giving more and more attention to his daughters, for whom he established a home in London in 1846. The serial publication in 1847–48 of his novel *Vanity Fair* brought Thackeray both fame and prosperity, and from then on he was an established author on the English scene.

Thackeray's one serious romantic attachment in his later life, to Jane Brookfield, can be traced in his letters. She was the wife of a friend of his Cambridge days, and during Thackeray's "widowerhood," when his life lacked an emotional centre, he found one in the Brookfield home. Henry Brookfield's insistence in 1851 that his wife's passionate but platonic friendship with Thackeray should end was a grief greater than any the author had known since his wife's descent into insanity.

Thackeray tried to find consolation in travel, lecturing in the United States on *The English Humorists of the 18th Century* (1852–53; published 1853) and on *The Four Georges* (1855–56; published 1860). But after 1856 he settled in London. He stood unsuccessfully for Parliament in 1857, quarreled with Dickens, formerly a friendly rival, in the so-called "Garrick Club Affair" (1858), and in 1860 founded *The Cornhill Magazine,* becoming its editor. After he died in 1863, a commemorative bust of him was placed in Westminster Abbey.

*Early writings.* The 19th century was the age of the magazine, which had been developed to meet the demand for family reading among the growing middle class. In the late 1830s Thackeray became a notable contributor of articles on varied topics to *Fraser's Magazine, The New Monthly Magazine,* and, later, to *Punch.* His work was unsigned or written under such pen names as Mr. Michael Angelo Titmarsh, Fitz-Boodle, The Fat Contributor, or Ikey Solomons. He collected the best of these early writings in *Miscellanies,* 4 vol. (1855–57). These include *The Yellowplush Correspondence,* the memoirs and diary of a young cockney footman written in his own vocabulary and style; *Major Gahagan* (1838–39), a fantasy of soldiering in India; *Catherine* (1839–40), a burlesque of the popular "Newgate novels" of romanticized crime and low life, and itself a good realistic crime story; *The History of Samuel Titmarsh and the Great Hoggarty Diamond* (1841), which was an earlier version of the young married life described in *Philip;* and *The Luck of Barry Lyndon* (1844; revised as *The Memoirs of Barry Lyndon,* 1856), which is a historical novel and his first full-length work. *Barry Lyndon* is an excellent, speedy, satirical narrative until the final sadistic scenes and was a trial run for the great historical novels, especially *Vanity Fair. The Book of Snobs* (1848) is a collection of articles that had appeared successfully in *Punch* (as "The Snobs of England, by One of Themselves," 1846–47). It consists of sketches of London characters and displays Thackeray's virtuosity in quick character-drawing. *The Rose and the Ring,* Thackeray's Christmas book for 1855, remains excellent entertainment, as do some of his verses; like many good prose writers, he had a facility in writing light verse and ballads.

*Mature writings.* With *Vanity Fair* (1847–48), the first work published under his own name, Thackeray adopted the system of publishing a novel serially in monthly parts that had been so successfully used by Dickens. Set in the second decade of the 19th century, the period of the Regency, the novel deals mainly with the interwoven fortunes of two contrasting women, Amelia Sedley and Becky Sharp. The latter, an unprincipled adventuress, is the leading personage and is perhaps the most memorable character Thackeray created. Subtitled "A Novel Without a Hero," the novel is deliberately antiheroic: Thackeray states that in this novel his object is to "indicate . . . that we are for the most part . . . foolish and selfish people . . . all eager after vanities."

The wealthy, wellborn, passive Amelia Sedley and the ambitious, energetic, scheming, provocative, and essentially amoral Becky Sharp, daughter of a poor drawing master, are contrasted in their fortunes and reactions to life, but the contrast of their characters is not the simple one between moral good and evil—both are presented with dispassionate sympathy. Becky is the character around whom all the men play their parts in an upper middle-class and aristocratic background. Amelia marries George Osborne, but George, just before he is killed at the Battle of Waterloo, is ready to desert his young wife for Becky, who has fought her way up through society to marriage with Rawdon Crawley, a young officer of good family. Crawley, disillusioned, finally leaves Becky, and in the end virtue apparently triumphs, Amelia marries her lifelong admirer, Colonel Dobbin, and Becky settles down to genteel living and charitable works.

The rich movement and colour of this panorama of early 19th-century society make *Vanity Fair* Thackeray's greatest achievement; the narrative skill, subtle characterization, and descriptive power make it one of the outstanding novels of its period. But *Vanity Fair* is more than a portrayal and imaginative analysis of a particular society. Throughout we are made subtly aware of the ambivalence of human motives, and so are prepared for Thackeray's conclusion: "Ah! *Vanitas Vanitatum!* Which of us is happy in this world? Which of us has his desire, or having it, is satisfied?" It is its tragic irony that makes *Vanity Fair* a lasting and insightful evaluation of human ambition and experience.

Successful and famous, Thackeray went on to exploit two lines of development opened up in *Vanity Fair,* a gift for evoking the London scene and for writing historical novels that demonstrate the connections between past and present. He began with the first, writing *The History of Pendennis* (1848–50), which is partly fictionalized autobiography. In it, Thackeray traces the youthful career of Arthur Pendennis—his first love affair, his experiences at "Oxbridge University," his working as a London journalist, and so on—achieving a convincing portrait of a much-tempted young man.

Turning to the historical novel, Thackeray chose the reign of Queen Anne for the period of *The History of Henry Esmond, Esq.,* 3 vol. (1852). Some critics had thought that *Pendennis* was a formless, rambling book. In response, Thackeray constructed *Henry Esmond* with great care, giving it a much more formal plot structure. The story, narrated by Esmond, begins when he is 12, in 1691, and ends in 1718. Its complexity of incident is given unity by Beatrix and Esmond, who stand out against a background of London society and the political life of the time. Beatrix dominates the book. Seen first as a charming child, she develops beauty combined with a power that is fatal to the men she loves. One of Thackeray's great creations, she is a heroine of a new type, emotionally complex and compelling, but not a pattern of virtue. Esmond, a sensitive, brave, aristocratic soldier, falls in love with her but is finally disillusioned. Befriended as an orphan by Beatrix' parents, Lord and Lady Castlewood, Henry initially adores Lady Castlewood as a mother and eventually, in his maturity, marries her.

Written in a pastiche of 18th-century prose, the novel is one of the best evocations in English of the atmosphere of a past age. It was not well received, however—Esmond's marriage to Lady Castlewood was criticized. George Eliot called it "the most uncomfortable book you can imagine." But it has come to be accepted as a notable English historical novel.

Thackeray returned to the contemporary scene in his novel *The Newcomes* (1853–55). This work is essentially a detailed study of prosperous middle-class society and is centred upon the family of the title. Col. Thomas Newcome returns to London from India to be with his son Clive. The unheroic but attractive Clive falls in love with his cousin Ethel, but the love Clive and Ethel have for each other is fated to be unhappily thwarted for years because of worldly considerations. Clive marries Rose Mackenzie; the selfish, greedy, cold-hearted Barnes Newcome, Ethel's father and head of the family, intrigues against Clive and the Colonel; and the Colonel invests his fortune imprudently and ends as a pensioner in an almshouse. Rose dies in childbirth, and the narrative ends with the Colonel's death. This deathbed scene, described with deep feeling that avoids sentimentality, is one of the most famous in Victorian fiction. In a short epilogue Thackeray tells us that Clive and Ethel eventually marry—but this, he says, is a fable.

*The Virginians* (1857–59), Thackeray's next novel, is set partly in America and partly in England in the latter half of the 18th century and is concerned mostly with the vicissitudes in the lives of two brothers, George and Henry Warrington, who are the grandsons of Henry Esmond, the hero of his earlier novel. Thackeray wrote two other serial novels, *Lovel the Widower* (1860) and *The Adventures of Philip* (1861–62). He died after having begun writing the novel *Denis Duval.*

*Assessment.* In his own time Thackeray was regarded as the only possible rival to Dickens. His pictures of contemporary life were obviously real and were accepted as such by the middle classes. A great professional, he provided novels, stories, essays, and verses for his audience, and he toured as a nationally known lecturer. He wrote to be read aloud in the long Victorian family evenings, and his prose has the lucidity, spontaneity, and pace of good reading material. Throughout his works, Thackeray analyzed and deplored snobbery and frequently gave his opinions on

human behaviour and the shortcomings of society, though usually prompted by his narrative to do so. He examined such subjects as hypocrisy, secret emotions, the sorrows sometimes attendant on love, remembrance of things past, and the vanity of much of life—such moralizing being, in his opinion, an important function of the novelist. He had little time for such favourite devices of Victorian novelists as exaggerated characterization and melodramatic plots, preferring in his own work to be more true to life, subtly depicting various moods and plunging the reader into a stream of entertaining narrative, description, dialogue, and comment.

Thackeray's high reputation as a novelist continued unchallenged to the end of the 19th century but then began to decline. *Vanity Fair* is still his most interesting and readable work and has retained its place among the great historical novels in the English language.

(La.B./Ed.)

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**Thaddaeus,** SAINT: *see* Judas, Saint.

**Thai language,** also called SIAMESE, the standard spoken and literary language of Thailand, belonging to the Tai language family of Southeast Asia. It is based largely on the dialect of Bangkok and its environs in the central region of the country but retains certain consonant distinctions (such as *l* versus *r, kl* versus *k*), which are usually merged in the spoken language but preserved in the orthography. Other dialects, differing mostly in their tones and to some degree their consonants, are spoken in other major regions of the country. These are Northeastern (*e.g.,* in Ubon Ratchathani, Khon Kaen), Northern (around Chiang Mai, Chiang Rai), and Southern (Songkhla, Nakhon Si Thammarat). The Northeastern dialects are similar to those of Laos.

Thai words are predominantly monosyllabic, but many are polysyllabic. The language makes use of tones to distinguish between otherwise identical words. There are five distinct tones in Thai: mid, low, falling, high, and rising. There are 21 consonant sounds and 9 distinguishable vowel qualities. Inflection is completely lacking in Thai, but word-compounding occurs widely—*e.g., khamnam* 'preface' (literally, 'word-leading'), and *khâwcaj* 'understand' (literally, 'enter-heart'). Synonym compounds like *hàanklaj* 'far distant' and alliterative compounds like *ramâdrawan* 'cautious' add greatly to the expressiveness of the language. Thai word order is quite rigid. The typical sentence contains subject, verb, and object in that order—*e.g., khâw*[1] *rian*[2] *khanítdtasàad*[3] 'he[1] studies[2] mathematics[3].' Modifiers follow the words they modify, as in *phaasăa*[1] *thaj*[2] 'Thai[2] language[1]' or *wîn*[1] *rew*[2] 'run[1] fast[2].'

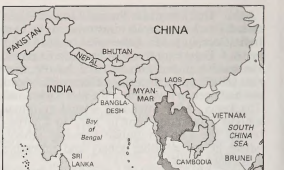
Thai freely incorporates foreign words. Perhaps the oldest are Chinese, but recent Chinese loanwords also occur. Hundreds of elegant and literary words are taken from Pāli and Sanskrit, and new words are also coined from Sanskrit roots. There are also loanwords from Khmer (the official language of Cambodia), from 16th-century Portuguese, from Austronesian, and in modern times increasingly from English. The Thai alphabet (instituted in the 13th century AD) derives ultimately from the southern type of Indic script. Writing proceeds from left to right, and spaces indicate punctuation but not word division. The alphabet has 42 consonant signs, 4 tone markers, and many vowel markers.

**Thai literature,** body of writings of the Thai (Siamese) people, historically fostered by the kings, who themselves often produced outstanding literary works. The earliest literature, that of the Sukhothai period (13th to mid-14th century), survives chiefly in inscriptions, which provide vivid accounts of contemporary life. The golden age of Thai literature occurred from 1351 to 1767 (particularly from the mid-15th century), when Ayutthaya (Ayudhya) was the capital. Outstanding writing of the period includes an abundance of poetry, dance-dramas, and prose narratives influenced by Hindu sources. *Great Existence,* later rewritten as the *Royal Version of Mahajati* (a poem exalting the virtue of charity), *Phra Lo* (a tragic romance), and *Defeat of the Yuan* (a history) are three influential works of the Ayutthayan period. The court of Narai (reigned 1656–88) included most of the Thai writers of the time, and the epic romance (concerning the lives of Thai heroes) flourished. Much literature was lost in the sack of Ayutthaya by Myanmar (Burma) in 1767. After the restoration of Thai sovereignty, and with the capital established at Bangkok, many law codes, religious works, and literary texts were rewritten. From about 1850, Western influences came to bear on Thai literature. Prose replaced poetry as the dominant form of literature, and fiction developed rapidly.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Thai Nguyen,** city, north-central Vietnam. The city is located on the right bank of the Cau River, which flows southeastward into the Gulf of Tonkin, and is connected with Haiphong by river steamers and with Hanoi by road. The population includes a high proportion of Tai. Iron-ore deposits are located nearby, and a metallurgical manufacturing centre has been established. Pop. (1992 est.) 127,643.

**Thailand,** officially KINGDOM OF THAILAND, formerly (1856–1939) SIAM, Thai PRATHET, OR PRADES, THAI ("Thailand"), RAJANAJAK THAI ("Thai Kingdom"), or SAYAM ("Siam"), byname MUANG THAI ("Land of the Free"), country situated in the west of the Indochinese Peninsula of Southeast Asia. Extending about 930 miles (1,500 km) from north to south and about 500 miles (800 km) from east to west, Thailand is bordered on the northwest by Myanmar (Burma), on the northeast by Laos, on the southeast by Cambodia and the Gulf of Thailand, on the south by Malaysia, and on the southwest by the Andaman Sea. The capital is Bangkok. Area 198,115 square miles (513,115 square km). Pop. (1996 est.) 60,003,000.




Thailand

A brief treatment of Thailand follows. For full treatment, *see* MACROPAEDIA: Southeast Asia.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*The land.* The country can be divided into four physiographic regions. In the mountainous north is a series of parallel and longitudinal mountain ranges (average elevation 3,900 feet [1,200 m] above sea level) incised by steep valleys of the Ping, Wang, Yom, and Nan rivers; these ranges are thickly covered with tropical monsoon forests yielding valuable timber. Mount Inthanon (8,481 feet [2,585 m]), the highest point in the country, is located in the extreme northwest. The central plain region, forming the Thai heartland, is the largest region of the country, chiefly consisting of the Chao Phraya River delta. This fertile and densely populated central plain, with a vast complex of canals and small irrigation projects, is the centre of the country's economic life. In the northeast is the Khorat Plateau, a sandstone tableland of low elevations. Its soils are poor and sandy, and it is largely covered with savanna-type grasses and shrubs. The densely forested southern region, occupying the northern half of the Malay Peninsula, is of rolling to mountainous topography with little flat land; much of Thailand's mineral wealth (tin) and rubber cultivation are concentrated there. The Chao Phraya River is—along with its tributaries—of the greatest importance to Thailand's economic life.

Thailand has a subtropical monsoonal climate with three distinct seasons: the hot season (March–April), the rainy season (May–October), and the cool season (November–February). Annual average temperatures range between 77° and 84° F (25° and 29° C); annual precipitation varies from (east to west) 35 inches (900 mm) on the Khorat Plateau, to more than 40 inches (1,016 mm) in the Chao Phraya floodplains, and up to 160 inches (4,000 mm) on the west coast of the Malay Peninsula. Forests cover about one-fourth of the total land area and consist chiefly of hardwood and resin-producing trees; bamboo, palm, banyan, and rattan are also found. Wildlife includes the elephant, gibbon, tiger, leopard, wild pig, python, king cobra, green turtle, and crocodile; silkworms are raised for the prosperous silk industry.

Thailand's most important mineral resource is tin, and its reserves amount to about 10 percent of the world's total. The country also has substantial natural-gas reserves.

*The people.* People speaking Tai languages, including Thai (Siamese) and Lao, account for nearly four-fifths of the total population. The Thai are the predominant ethnolinguistic group. The Chinese, the Khmer, and Malays also constitute a significant portion of the population. Indigenous minorities include the hill-dwelling Karen; the Semang, who live by hunting with blowpipes and spears; and the Lawa, who are believed to be the original dwellers of the delta plain. The Kuay (Souei, Kuy) and Indians make up notable immigrant groups. By the mid-1980s there

were some 380,000 refugees in Thailand from Myanmar, Vietnam, Laos, and Cambodia.

Buddhism is the national religion and is widespread. Minorities include Muslims, Hindus, Sikhs, and a few Christians. Most of the tribal groups are animists.

Birth and death rates in Thailand have declined since World War II but are still relatively high. Almost one-fifth of the population lives in urban areas. Population is concentrated in the Chao Phraya delta, especially in Bangkok. Other population centres are usually located beside rivers or on the coast. Another area of high density is the west coast, where tin mining and shipping industries operate. More than one-third of the population is younger than 15 years.

*The economy.* Thailand has a predominantly market economy based largely on services, light industries, and agriculture. The gross national product (GNP) is increasing much more rapidly than the population.

Agriculture accounts for about one-eighth of the gross domestic product (GDP) but employs more than one-half of the workforce. Small landholders predominate through most of the country. Rice is the chief staple, and export duties on it are high to prevent domestic shortages. Corn (maize) is widely grown in the uplands around the central plain. Cassava, rubber, sugarcane, bananas, pineapples, and kenaf (a fibre used as a substitute for jute) are important cash crops.

Cattle and buffalo are used for several years as draft animals and then slaughtered for meat. Pig and poultry raising have become increasingly large-scale specialized endeavours. Fish are the main source of protein, and landings increased sharply when trawlers were introduced after 1960. Forests have been overcut, and production of roundwood must be supplemented by imports.

Mineral industries are dominated by the production and export of tin, of which Thailand is one of the world's major producers. The government requires that Thais own a controlling interest in offshore tin mines opened after 1980. Significant quantities of lignite, zinc, iron ore, and manganese ore are also mined. Increased consumption of natural gas, which is produced offshore, has helped to reduce imports of petroleum.

Manufacturing industries account for one-fourth of the GDP but employ only one-tenth of the work force. Light industries predominate and are concentrated around Bangkok. Most factories are small-scale and centre on the processing of domestic raw materials. Chief manufactures include clothing, canned goods, electrical circuits, beer, refined sugar, cement, chemicals, and motorcycles. Electricity is generated primarily from imported and domestic fuels; about one-tenth is hydroelectric.

Thailand continued to have a trade deficit during the 1980s and into the '90s. Chief trading partners include Japan, the United States, Singapore, Germany, The Netherlands, and the United Kingdom. Major exports consist of electrical-power equipment and machinery, textiles and apparel, fish and fish preparations, and precious stones. Machines and transport equipment, mineral fuels, iron and steel, and chemicals are imported.

*Government and social conditions.* Thailand is a constitutional monarchy with a parliamentary government that, since 1932, has largely been dominated by the military. The hereditary king is head of state and commander in chief of the armed forces. Legislative power resides in a bicameral National Assembly, consisting of the 270-member Senate and the 360-member House of Representatives. Senators are appointed to six-year terms on the recommendation of the incumbent prime minister, and members of the House are directly elected to four-year terms. The head of government is the prime minister, who is required by a 1992 constitutional amendment to be an elected member of the House of Representatives. The prime minister names a Council of Ministers (cabinet) for appointment by the king. A multiparty system operates, and there is no dominant party or coalition other than the military.

Social-welfare programs are meagre but include assistance to children, families, and the old and indigent and disaster relief. Although far from adequate, health conditions compare favourably to those of most other Southeast Asian countries. Malaria and gastrointestinal and respiratory diseases are major health problems. The average life expectancy is relatively good, at about 66 years.

Education is free and compulsory between the ages of 7 and 15, but some rural areas lack schools. The educational system includes six-year elementary and five- or six-year secondary schools, as well as universities, military academies, and teacher-training institutes.

Broadcasting is controlled by the government. The military owns most radio and many television stations.

*Cultural life.* Prominent Thai arts include architecture, painting, music, drama, literature, and the crafting of porcelain and pottery. The Thai architectural style is seen in Buddhist temples, usually constructed of wood. Thai painting, mostly religious, probably derived from India and Sri Lanka. Poetry is traditionally important; the realistic novel and the short story have become popular in contemporary literature.

*History.* Archaeological evidence indicates almost continuous human occupation of Thailand for the last 20,000 years. Tai-speaking peoples migrated southward and westward from China around the 10th century AD. During the 13th century two Tai states emerged. The Sukhothai kingdom was founded about 1220 after a successful revolt against the Khmer kingdom. Chiang Mai was founded in 1296 after the Tai people defeated the Mon state of Haripunjaya. In 1350 the Tai kingdom of Ayutthaya (Ayudhya) succeeded the state of Sukhothai. By the early 15th century it had absorbed Sukhothai and devastated the declining Khmer kingdom.

The Myanmar (Burmans) were the most powerful rival of the Ayutthaya kingdom, and in 1569 they defeated Ayutthayan forces, occupied their capital, and ruled the kingdom for 15 years. In 1767 the Myanmar again occupied the Tai capital and ended the Ayutthayan rule.

The Chakri (Chakkri) dynasty came to power in 1782 under the leadership of Chao Phraya Chakri (Rama I). In the early years of the new dynasty the capital city was moved across the river to Bangkok. The Chakri ruler Rama III (1824–51) extended the Tai empire south along the Malay Peninsula, north into Laos, and southeast into Cambodia. During the 19th century Western influence increased in the country as Tai (Siamese) rulers granted concessions and political relations to European countries. In 1867 Siam relinquished its claim on Cambodia to France. During the reign of King Chulalongkorn (1886–1910) a policy of Western internal reform was implemented. Siam ceded its vassal state in Laos and Cambodia to France in the late 19th and early 20th centuries. In 1917 Siam entered World War I on the side of the Allies.

During the reign of King Prajadhipok (1925–35) a coup d'état put an end to the absolute monarchy and established a constitutional regime with the king's support. In 1939 the country was officially renamed Thailand instead of Siam. During World War II Thailand reluctantly became an ally of Japan. The dominance of the military carried over from the 1932 coup into the 1950s and beyond, as Thailand's stability was successively undermined by the Indochina and Vietnam wars and Vietnam's postwar incursions into Cambodia. From 1932 on, there were a series of governments that were either overtly military or strongly influenced by the military. The role of the monarchy was limited.

**Thailand, Gulf of,** formerly GULF OF SIAM, inlet of the South China Sea bordering Thailand (southwest through north), Cambodia, and southern Vietnam (northeast). The Gulf of Thailand is 300 to 350 miles (500 to 560 km) wide and 450 miles (725 km) long. The Chao Phraya and Nakhon Chai Si rivers enter the gulf near its head. The main harbours in Thailand are located along the Gulf of Thailand at Bangkok, Pattani, Songkhla (Singgora), Pak Phanang (port for Nakhon Si Thammarat), and Chanthaburi; in Cambodia at Rām, Kāmpōt, and Kep; and in Vietnam at Rach Gia. The shallow waters along the gulf's coast provide economically important fishing grounds.

**Thais** (fl. late 4th century BC), Athenian courtesan who traveled with the army of Alexander the Great in its invasion of Persia. She is chiefly known from the story that represents her as having persuaded Alexander to set fire to the Achaemenian capital of Persepolis in the course of a drunken revel. The authenticity of this anecdote, which forms the subject of John Dryden's *Alexander's Feast* (1697), is doubtful, since it is based upon the authority of Cleitarchus, one of the least trustworthy of the historians of Alexander. Persepolis was probably set afire for political reasons.

Courtesans in Greek and Roman comedy were often named Thais. There is also a Christian saint called Thais, a reformed prostitute, but her story is probably fictitious; it was used by Anatole France for his *Thaïs* (1890) and thence for Jules Massenet's opera of the same name (1894).

**Thakin** (Myanmar title): *see under* proper name (*e.g.,* Than Tun, Thakin).

**Thal,** central section of the Sindh Sāgar Doāb (tract), Punjab province, Pakistan, lying between the Indus and the Jhelum and Chenāb rivers. Formerly desert, it is now irrigated by canals from the Jinnah Barrage (Kālābāgh Barrage) on the Indus. The Thal Project, under the Agriculture Development Corporation, is one of the most important development projects in the world, with plans for extension of agriculture, industry, and village and town construction. Cultivation of wheat, cotton, rice, and sugarcane has increased. Forests also have been planted and cattle farms set up. New towns—Jawharābād, Qāidābād, and Liāqatābād—have been built with woollen and sugar mills and textile and cement factories.

**thalamus,** plural THALAMI, either of a pair of large, ovoid organs that form most of the lateral (side) walls of the third ventricle of the brain. It is a major structure of the diencephalon (the interbrain; one of the five sections of the brain). Located between the brain stem and the forebrain, the thalamus is associated with the epithalamus (containing the habenula and the pineal body) and the hypothalamus (associated with the autonomic nervous system).

The thalamus has two important functions. It translates neural impulses from various receptors to the cerebral cortex, where they are experienced as the appropriate sensations of touch, pain, and temperature during the waking state; and it regulates synaptic transmissions (*i.e.,* incoming impulses) during resting states. The latter activity consists of interspersing burst discharges with long periods of neuronal inactivity, or silence.

**thalassemia,** also called COOLEY'S ANEMIA, MEDITERRANEAN ANEMIA, OF HEREDITARY LEPTOCYTOSIS, group of blood disorders characterized by a deficiency of hemoglobin, the

blood protein that transports oxygen to the tissues. Thalassemia is caused by genetically determined abnormalities in the synthesis of one or more of the polypeptide chains that make up the globin part of hemoglobin. The various forms of the disorder are distinguished by different combinations of three variables: the particular polypeptide chain or chains that are affected; whether the affected chains are synthesized in sharply reduced quantities or not synthesized at all; and whether the disorder is inherited from one parent (heterozygous) or from both parents (homozygous).

The five different polypeptide chains are named after the first five Greek letters: alpha, $\alpha$; beta, $\beta$; gamma, $\gamma$; delta, $\delta$; and epsilon, $\varepsilon$. No thalassemic disorder is known to involve the $\varepsilon$-chain. Involvement of the $\gamma$-chain or $\delta$-chain is rare. Of the 19 variations of thalassemic inheritance, a few (such as the two heterozygous $\alpha$-thalassemias) are benign and generally exhibit no clinical symptoms. Other forms exhibit mild anemia, while the most severe form (homozygous $\alpha$-thalassemia 1) usually causes premature birth, either stillborn or with death following within a few hours. Thalassemia major (homozygous $\beta$-thalassemia) shows clinical characteristics a few months following birth: anemia, splenomegaly, and often enlarged liver. Infections commonly develop. At about the age of four, stunted physical growth becomes apparent. Many patients develop abnormally protruding upper jaws, prominent cheekbones, and marrow expansion in the long bones, ribs, or vertebrae, which fracture easily. With blood transfusion therapy and antibiotic therapy, many live into their 20s.

Thalassemia minor (heterozygous $\beta$-thalassemia) is characterized by mild anemia, often presenting no symptoms, but occasionally complicated with slight enlargement of the spleen.

It is believed that the potentially lethal thalassemia gene is retained in the population because it provides some protection from malaria in the heterozygous state. Thalassemia genes are widely distributed in the world but are found most often among people with ancestors from the Mediterranean, the Middle East, and southern Asia. Thalassemia has also been found in some northern Europeans and American Indians. Among blacks, the disease is unusually mild.

**Thalberg, Irving G.** (b. May 30, 1899, Brooklyn, N.Y., U.S.—d. Sept. 14, 1936, Santa Monica, Calif.), American motion-picture executive called the "boy wonder of Hollywood" who, as the production manager of Metro-Goldwyn-Mayer (MGM), was responsible for that studio's reputation for the consistently high artistic quality of its films.

Thalberg worked in the New York offices of Universal Pictures Co. for two years before going to Hollywood as the secretary to Carl Laemmle, who was then the head of the company. At 21 Thalberg became Universal's studio manager.

When MGM was formed four years later, he was hired as the head of production with full authority to reedit any film. He shrewdly ascertained public taste and tightly controlled the studio's output by supervising the selection of scripts, their revision, and the final editing of the films. The literary flavour of MGM's products, *e.g., The Barretts of Wimpole Street* (1934), *Mutiny on the Bounty* (1935), and *Romeo and Juliet* (1936), stemmed mainly from his influence. With *Naughty Marietta* (1935) he initiated a long series of successful musicals starring Jeanette MacDonald and Nelson Eddy. Thalberg also acted as a liaison between the businessmen who controlled MGM's finances and the studio's directors. He supported the star system and discovered and developed many of MGM's popular screen personalities.

**Thalberg, Sigismond (Fortuné François)** (b. Jan. 8, 1812, Geneva, Switz.—d. April 27, 1871, Posillipo, Italy), the leading rival of Franz Liszt as a virtuoso pianist.

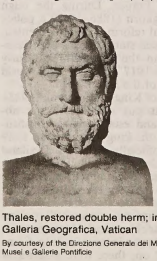
Thalberg began performing at the age of 14 in Viennese salons. In 1830 he toured Germany and England, and in 1834 he assumed the post of court pianist in Vienna. In 1836 he moved to Paris, where a famous rivalry developed with Liszt. His many tours included concerts in Brazil and the United States.

Like most 19th-century virtuosos, Thalberg primarily played his own compositions. His technique was praised for its legato, and his specialty was playing a melody in the middle of the keyboard and surrounding it with rapid figuration. His many compositions were mainly for piano and in a virtuosic vein, including a considerable number of fantasies based on operatic themes.

**Thales** OF MILETUS (fl. 6th century BC), philosopher remembered for his cosmology based on water as the essence of all matter. According to the Greek thinker Apollodorus, he was born in 624; the Greek historian Diogenes Laërtius placed his death in the 58th Olympiad (548–545) at the age of 78.

No writings by Thales survive, and no contemporary sources exist; thus, his achievements are difficult to assess. Inclusion of his name in the canon of the legendary Seven Wise Men led to his idealization, and numerous acts and sayings, many of them no doubt spurious, were attributed to him. According to Herodotus, Thales was a practical statesman who advocated the federation of the Ionian cities of the Aegean region. The Greek scholar Callimachus recorded a traditional belief that Thales advised navigators to steer by the Little Bear (Ursa Minor) rather than by the Great Bear (Ursa Major), both prominent constellations in the north. He is also said to have used his knowledge of geometry to measure the Egyptian pyramids and to calculate the distance from shore of ships at sea. Although such stories are probably apocryphal, they illustrate Thales' reputation. The Greek writer Xenophanes claimed that Thales predicted the solar eclipse that stopped the battle between the Lydian Alyattes and the Median Cyaxares, evidently on May 28, 585. Modern scholars believe, however, that he could not possibly have had the knowledge to predict accurately either the locality or the character of an eclipse. Thus, his feat was apparently isolated and only approximate; Herodotus spoke of his foretelling the year only. That the eclipse was nearly total and occurred during a crucial battle probably contributed considerably to his exaggerated reputation as an astronomer.

In geometry Thales has been credited with the discovery of five theorems: (1) that a circle is bisected by its diameter, (2) that angles at the base of a triangle having two sides of equal length are equal, (3) that opposite angles of intersecting straight lines are equal, (4) that the angle inscribed in a semicircle is a right angle, and (5) that a triangle is determined if its base and the angles relative to the base are given. His mathematical achievements are difficult to assess, however, because of the ancient practice of crediting particular discoveries to men with a general reputation for wisdom.



Thales, restored double herm; in the Galleria Geografica, Vatican

By courtesy of the Direzione Generale dei Monumenti Musei e Gallerie Pontificie

The claim that Thales was the founder of European philosophy rests primarily on Aristotle, who wrote that Thales was the first to suggest a single material substratum for the universe—namely, water, or moisture. Even though Thales as a philosopher renounced mythology, his choice of water as the fundamental building block of matter had its precedent in tradition. A likely consideration in this choice was the seeming motion that water exhibits, as seen in its ability to become vapour; for what changes or moves itself was thought by the Greeks to be close to life itself. To Thales the entire universe is a living organism, nourished by exhalations from water.

Thales' significance lies less in his choice of water as the essential substance than in his attempt to explain nature by the simplification of phenomena and in his search for causes within nature itself rather than in the caprices of anthropomorphic gods. Like his successors Anaximander and Anaximenes, Thales is important in bridging the worlds of myth and reason.

**Thalia,** in Greek religion, one of the nine Muses, patron of comedy; also, according to the Greek poet Hesiod, a Grace (one of a group of goddesses of fertility). She is the mother of the Corybantes, celebrants of the Great Mother of the Gods, Cybele, the father being Apollo, a god related to music and dance. In her hands she carried the comic mask and the shepherd's staff.

**thalidomide,** compound formerly used in medicine as a sedative and antiemetic drug until the discovery that it caused fetal malformations. Thalidomide was found to produce phocomelia ("seal limbs") and other deformities (as absence or malformation of the external ear, fusion defects of the eye, and absence of the normal openings of the gastrointestinal tract) in infants born of mothers who had taken the drug during early pregnancy. Between 2,000 and 3,000 such deformed babies were born in West Germany and 500 in Great Britain between 1959 and the beginning of 1962. In the United States, thalidomide was never distributed for clinical use.

Before the thalidomide tragedies, the fetus was believed to be adequately protected from the effects of drugs given to the mother during pregnancy. Since that time thalidomide sometimes has been used to treat leprosy, and researchers have suggested that it may aid in transplantation.

**thallium** (Tl), chemical element, metal of main Group IIIa, or boron group, of the periodic table, poisonous, chiefly univalent, and of limited commercial value. Like lead, thallium is a soft, low-melting element of low tensile strength. Freshly cut thallium has a metallic lustre that dulls to bluish gray upon exposure to air. The metal continues to oxidize upon prolonged contact with air, generating a heavy nonprotective oxide crust. Thallium dissolves slowly in hydrochloric acid and dilute sulfuric acid and rapidly in nitric acid.

Rarer than tin, thallium is concentrated in only a few minerals that have no commercial value. Trace amounts of thallium are present in sulfide ores of zinc and lead; in the roasting of these ores, the thallium becomes concentrated in the flue dusts, from which it is recovered.

Sir William Crookes discovered (1861) thallium by observing the prominent green spectral line generated by selenium-bearing pyrites

that had been used in the manufacture of sulfuric acid. Crookes and Claude-Auguste Lamy independently isolated (1862) thallium, showing it to be a metal.

Soluble thallium compounds are toxic. The metal itself is changed to such compounds by contact with moist air or skin. Thallium poisoning, which may be fatal, causes nervous and gastrointestinal disorders and rapid loss of hair.

The heaviest of the boron group elements, thallium, unlike the others, is predominantly univalent instead of trivalent. In water the colourless, more stable thallium(I) or thallous ion, $Tl^+$, resembles the heavier alkali metal ions; the thallium(III) compounds are easily reduced to thallium(I) compounds.

Two crystalline forms of the element are known: close-packed hexagonal below about 230° C and body-centred cubic above. Natural thallium consists almost entirely of a mixture of two stable isotopes: thallium-203 (29.50 percent) and thallium-205 (70.50 percent). Traces of several short-lived isotopes occur as decay products in the three natural radioactive disintegration series: thallium-206 and thallium-210 (uranium series), thallium-208 (thorium series), and thallium-207 (actinium series).

Thallium metal has no commercial use, and thallium compounds have no major commercial application, since thallium(I) sulfate was largely replaced in the 1960s as a rodenticide and insecticide. Thallium(I) compounds have a few limited uses. For example mixed bromide-iodide crystals (TlBr and TlI) that transmit infrared light have been fabricated into lenses, windows, and prisms for infrared optical systems. The sulfide ($Tl_2S$) has been employed as the essential component in a highly sensitive photoelectric cell and the oxysulfide in an infrared-sensitive photocell (thallofide cell). Also, the oxide ($Tl_2O$) has been utilized as an ingredient in highly refractive optical glasses and as a colouring agent in artificial gems. Alkali halide crystals, such as sodium iodide, have been doped or activated by thallium compounds to produce inorganic phosphors for use in scintillation counters to detect radiation.

| | |
|---|---|
| atomic number | 81 |
| atomic weight | 204.37 |
| melting point | 303.5° C |
| boiling point | 1,457° C |
| specific gravity | 11.85 (20° C) |
| valence | 1, 3 |
| electronic config. | 2-8-18-32-18-3 or $(Xe)4f^{14}5d^{10}6s^26p^1$ |

**thallus,** plant body of algae, fungi, and other lower organisms formerly assigned to the obsolete group Thallophyta. A thallus is composed of filaments or plates of cells and ranges in size from a unicellular structure to a complex treelike form. It has a simple structure that lacks specialized tissues typical of higher plants, such as a stem, leaves, and conducting tissue.

**Thälmann, Ernst** (b. April 16, 1886, Hamburg, Ger.—d. Aug. 18/28, 1944, Buchenwald), German Communist leader and twice presidential candidate during the Weimar Republic (1919–33), who was chiefly responsible for molding the German Communist Party (KPD; Kommunistische Partei Deutschlands), the most powerful communist party outside the Soviet Union.

Thälmann, a labourer, joined the Social Democratic Party (SPD; Sozialdemokratische Partei Deutschlands) in 1903, served on the Western Front during World War I, and in 1920 entered the Communist Party. As a member of the left wing and leader of the powerful Wasserkante district (centred at Hamburg), he became a member of the party's central committee in 1923.

Thälmann's rise to national prominence began in 1925. With the Stalinization of the Soviet Union, the Comintern (Third International) chose him to carry out the same process in the German party. He viewed the Soviet Union as the fatherland of the proletariat and followed Moscow's orders unquestioningly. In 1925 and 1932 he ran for president; he was beaten both times by the candidate of the right, Paul von Hindenburg.

With the coming of the Depression and the subsequent rapid expansion of Nazi power, Thälmann's party, following the lead of the Comintern, continued to focus on social democracy as the main enemy. The party was almost completely unprepared when, in early 1933, Adolf Hitler ordered the mass arrests of communist functionaries; these arrests practically destroyed the party structure. Thälmann's arrest came on March 3, 1933. All efforts to obtain his release failed, and he remained imprisoned for more than a decade until he was finally executed at Buchenwald concentration camp.

**Thames, Battle of the,** also called BATTLE OF MORAVIANTOWN (Oct. 5, 1813), in the War of 1812, decisive U.S. victory over British and Indian forces in Ontario, Canada, enabling the United States to consolidate its control over the Northwest.

After the U.S. naval triumph in the Battle of Lake Erie in September 1813, the British commander at Detroit, Brigadier General Henry A. Procter, found his position untenable and began a hasty retreat across the Ontario peninsula. He was pursued by about 3,500 U.S. troops under Major General William Henry Harrison, who was supported by the U.S. fleet in command of Lake Erie. The forces met near Moraviantown on the Thames River, a few miles east of what is now Thamesville. The British, with about 600 regulars and 1,000 Indian allies under Tecumseh, the Shawnee intertribal leader, were greatly outnumbered and quickly defeated. Many British troops were captured and Tecumseh was killed, destroying his Indian alliance and breaking the Indian power in the Ohio and Indiana territories. After this battle, most of the tribes abandoned their association with the British.

After destroying Moraviantown, a village of Christian Indians, the U.S. troops returned to Detroit. The U.S. victory helped catapult Harrison into the national limelight and eventually the presidency.

**Thames, River,** principal river of England and the stream on the banks of which London was built. It rises in the Cotswolds of Gloucestershire and winds eastward through six of the country's southern counties, its estuary meeting the North Sea at The Nore (sandbank). The river's total length is approximately 210 miles (338 km). The river is tidal between Teddington and The Nore, a distance of some 65 miles. Tributaries of the Thames include the Churn, Coln, Windrush, Evenlode, Cherwell, Ock, Thame, Kennet, Loddon, Colne, Wey, and Mole rivers.

Floods have occasionally threatened the embanked stretches in the centre of London when high-river spates pour toward the estuary at the same time that strong spring tides are running from the sea. Fears that the city could be inundated by rare "surge tides" thrust up the estuary by North Sea gales led the London authorities to undertake the erection of downstream barriers, which first became operational in 1982. Because the Thames is the chief water supply for London and its western suburbs (and also for districts around Oxford and Faringdon), drought can also be a matter for serious concern.

The freshwater Thames has been controlled by the Thames Conservancy Board since 1857 and the tidal Thames below Teddington by the Port of London Authority since 1908. In 1974 the Thames Water Authority, one of 10 regional water authorities established under the Water Act of 1973, undertook the management of the entire water cycle in the Thames basin area. Its responsibilities included water supply, sewerage, sewage treatment and disposal, pollution control, and recreation.

The river became navigable by barges to Oxford and beyond by 1624 but with difficulty until locks were constructed above Staines in 1771. Locks between Staines and Teddington were added in 1810–15 by the London Corporation. Later improvements allowed boats drawing 3 feet (1 m) to reach Lechlade. Some barge traffic uses the river above Teddington, especially to Kingston. Passenger steamers ply daily in summer between Oxford and Kingston, also from Westminster in Greater London upstream to Kew, Richmond, and Hampton Court, and downstream from Tower Pier to Tilbury, Southend-on-Sea, and Margate. Water-buses run between Greenwich and Putney. Ferries cross the Thames at Woolwich–North Woolwich and Gravesend-Tilbury.

Some of the derelict canals that connect with the freshwater Thames were restored for pleasure boating in the 1960s; those off the tidal stretches are used commercially, including the Grand Union Canal to West Midlands and Derbyshire. The Thames below Tower Bridge is one of the world's most important commercial waterways, its traffic supervised by the Thames Navigational Service.

Called the Tamesis by Julius Caesar and, by early English chroniclers, variously the Tamis, Tamisa, or Tamensin, the river has been celebrated by bards throughout history. But in London after the mid-19th century it became more of an open sewer than a poetic stream. Starting in 1963 the freshwater and tidal authorities, aided by new regulations, began a highly successful battle against pollution.

**Thames River,** river in southern Ontario, Canada. The Thames is 160 miles (260 km) long. It rises north-northwest of Woodstock, in the uplands between Lakes Huron and Erie, and flows southwest past the towns of Woodstock, London, and Chatham to Lake Saint Clair. The river is navigable below Chatham. Originally called the La Tranche River, it received its present name in 1792. The Battle of the Thames (1813) was fought at Moraviantown, near Chatham.

**Thames Sword,** also called THAMES SCAMASAX, weapon inlaid with brass and silver wire and inscribed with runes, discovered in 1857 near London in the bed of the River Thames. Probably carved in the 8th or 9th century, the inscription contains one of the two earliest examples of complete Old English runic alphabets. The Thames Sword is housed in the British Museum.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Thames Tunnel,** also called WAPPING-ROTHERHITHE TUNNEL, tunnel designed by Marc Isambard Brunel and built under the River Thames at London, from Rotherhithe to Wapping, the first subaqueous tunnel in history. To drive his heading, Brunel invented the tunneling shield, one of the basic tools of modern civil engineering. It was completed in the early 1840s. The completed tunnel measured 1,506 feet (459 m) in length; its cross section measured 23 by 37 feet (7 by 11 m) and was for many years the largest of any soft-ground tunnel. The tunnel is in regular use today as part of the Metropolitan Line of the London Underground.

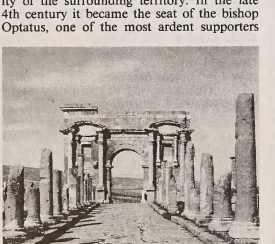
**Thamesdown,** district (borough), county of Wiltshire, southern England, occupying an

area of 89 square miles (230 square km) some 35 miles (55 km) east of Bristol in the northeastern part of the county. Thamesdown district consists of the railroad town of Swindon and its adjacent areas. Mostly a fertile clay valley, Thamesdown's northern boundary is defined by the upper reaches of the Thames River, and it is bordered on the south by the steep chalk escarpment of the Marlborough Downs. The district was renamed Swindon unitary authority in 1997. Pop. (1998 est.) 179,700.

**Thamūd,** in ancient Arabia, tribe or group of tribes that seem to have been prominent from about the 4th century BC to the first half of the 7th century AD. Although the Thamūd probably originated in southern Arabia, a large group apparently moved northward at an early date, traditionally settling on the slopes of Mount Athlab. Recent archaeological work has revealed numerous Thamūdic rock writings and pictures not only on Mount Athlab but also throughout central Arabia.

The Qur'ān mentions the Thamūd as examples of the transitoriness of worldly power. Traditionally, the Thamūd were warned by the prophet Ṣāliḥ to worship Allāh, but the Thamūd stubbornly refused and as a result were annihilated either by a thunderbolt or by an earthquake. Actually, they may have been destroyed by one of the many volcanic outbreaks that have formed the far-reaching Arabian lava fields.

**Thamugadi,** ancient Roman city, the site of which, at present-day Timgad, on the high plateau north of the Aurès Mountains in northeastern Algeria, offers the most extensive and best-preserved Roman remains in North Africa. Thamugadi, founded by the emperor Trajan in AD 100, proved to be of strategic importance in the defense of Numidia. Its long prosperity was derived from the fertility of the surrounding territory. In the late 4th century it became the seat of the bishop Optatus, one of the most ardent supporters



Roman ruins of the main street and the west gate, or triumphal arch, Thamugadi, Alg.
Robert Harding Picture Library, London

of Donatism, a heretical Christian movement, and the stronghold was sacked by Berbers in the early 6th century, toward the end of the Vandal supremacy in Africa.

The 10,000–15,000 inhabitants of Thamugadi lived in a classic Roman type of city, quasi-military in appearance, with all streets intersecting at right angles. That life there was comfortable is evidenced by the remains of a forum, a public library, a theatre holding about 4,000 people, and an exceptionally large number of public baths.

**Thamyris,** also spelled THAMYRAS, in Greek mythology, a Thracian poet who loved the beautiful youth Hyacinthus (*q.v.*). Thamyris' attentions, however, were rivaled by those of the god Apollo, who jealously reported to the Muses the boast by Thamyris that he could surpass them in song. Upon hearing the claim, the Muses immediately blinded Thamyris and robbed him of his voice and his talent.

**Than Tun, Thakin** (b. 1911, Kanyutkwin, Burma (Myanmar)—d. Sept. 24, 1968), leader of the Communist Party of Burma from 1945 until his death.

Than Tun was educated at Rangoon (Yangon) Teachers' Training School and taught at a high school in Rangoon. Influenced at an early age by Marxist writings, he joined in 1936 the nationalist Dobama Asi-ayone (We-Burmans Association). Than Tun helped form the alliance between Ba Maw's Sinyetha (Proletarian) Party and the Dobama Asi-ayone, which resulted in the "freedom bloc" of 1940. That same year he was imprisoned by the British for sedition. When Ba Maw's pro-Japanese government was established in 1942, Than Tun served as minister of land and agriculture. In 1943, however, he became a leader of the underground resistance movement. After the war he was general secretary of the Anti-Fascist People's Freedom League (AFPFL).

When Thakin Soe's Red Flag Communist Party left the Burma Communist Party in early 1946, Than Tun and the majority of Communists continued to cooperate with the AFPFL. In the face of increasing disagreements with the AFPFL, however, he was forced to revolt in March 1948, establishing his White Flag Party. He organized guerrilla forces in central Burma, but the government was largely successful in containing his insurgents.

In 1964 the Burmese communist movement was split by the Sino-Soviet rift. Than Tun took the side of Peking, accusing Thakin Soe's Red Flag Party of being Trotskyite, and he sent a number of party members to China to be trained by Chinese revolutionaries. In 1967 he carried out his own cultural revolution, purging the White Flag Party of "revisionists." The next year Than Tun was assassinated by one of his own subordinates.

**Thāna,** also spelled THĀNE, town, Mahārāshtra state, western India, at the mouth of the Thāna River and head of the Ulhās Estuary, northeast of Bombay. The town is primarily a residential suburb of Bombay, though it has a large industrial complex, including an industrial estate, with chemical, engineering, and textile industries, and is the divisional headquarters of the state road-transport service. There are a fort, two Christian churches, and many historical buildings.

The surrounding region is generally undulating, with spurs of the Ghāts reaching to the sea. The hills are interspersed with short, swift rivers, including the Ulhās and the Vaitarna. It receives the full impact of the southwest monsoon in summer and has reliable and heavy rains. The area is primarily an agricultural region for Bombay. Chief crops are rice, millet, and fruits and vegetables. Pop. (2001 prelim.) 1,261,517.

**thanatology,** the description or study of death and dying and the psychological mechanisms of dealing with them. Thanatology is concerned with the notion of death as popularly perceived and especially with the reactions of the dying, from whom it is felt much can be learned about dealing with death's approach. Thanatology (from Greek *thanatos,* "death") as a professional discipline gathered momentum following the publication of several subject-related books including *The Meaning of Death* (1959), edited by Herman Feifel, and *The Psychology of Death* (1972) by Robert Kastenbaum and Ruth Aisenberg. Generally, psychologists have agreed that there are two overall concepts concerning death that help in understanding the simultaneous processes of living and dying. The "my death versus your death" concept emphasizes the irrational belief that while "your death" is a certainty, an exemption may be made in "my case." The second concept, "partial deaths versus total extinction" stresses the belief that by experiencing the bereavement following the deaths of friends and relatives, a person is brought as close as possible to realizing "partial death." These experiences colour the individual's attitude toward greater personal losses, culminating with the ultimate loss, life itself.

In 1969 the Swiss-born psychiatrist Elisabeth Kübler-Ross conceptualized five stages in facing one's terminal illness: denial, anger, bargaining, depression, and acceptance. Although most thanatologists accept the Kübler-Ross stages, they also recognize that these stages occur neither with predictable regularity nor in any set order. Further, the five Kübler-Ross stages are but general reactions to many situations involving loss, not necessarily dying. Seldom does a dying person follow a regular, clearly identifiable series of responses. With some, acceptance may come first, then denial; others may cross over constantly from acceptance to denial.

Thanatology also examines attitudes toward death, the meaning and behaviours of bereavement and grief, and the moral and ethical questions of euthanasia, organ transplants, and life support.

**thane,** also spelled THEGN, in English history before the Norman Conquest (1066), a free retainer or lord, corresponding in its various grades to the post-Conquest baron and knight. The word is extant only once in the laws before the time of King Aethelstan (d. 939).

The thane became a member of a territorial nobility, and the dignity of thanehood was attainable by those who fulfilled certain conditions. In like manner a successful thane might hope to become an earl. There were others who were thanes because of their birth, and thus thanehood was partly inherited and partly acquired. The thane was inferior to members of a kingly family, but he was superior to the ceorl.

The increase in the number of thanes produced in time a subdivision of the order. There arose a class of king's thanes, corresponding to the earlier thanes, and a larger class of inferior thanes, some of them the thanes of bishops or of other thanes. A king's thane was a person of great importance, the contemporary idea being shown by the Latin translation of the word as *comes* (the Latin for what became "count"). He had certain special privileges. No one but the king had the right of jurisdiction over him.

The 12 senior thanes of the hundred (a territorial division) played some part in the development of the English system of justice. By a law of Ethelred II they seem to have acted as the judicial committee of the court for the purposes of accusation, and thus they have some connection with the grand jury of modern times.

The word thane was used in Scotland until the 15th century to describe a hereditary nonmilitary tenant of the crown.

**Thanet,** district, county of Kent, England, in the extreme northeast of the county. With an area of 40 square miles (103 square km), it roughly coincides with the historic Isle of Thanet, but the modern administrative district extends south of the Great Stour River almost to Sandwich. The district's agriculture, traditionally concentrated on grains, now specializes in green vegetables and potatoes.

Thanet has 26 miles (42 km) of coastline on the Thames Estuary and the Strait of Dover. The district has several seaside resorts, and more than one-third of the people living in Thanet are over 65 years of age. Increasing sea traffic between Ramsgate and Calais, Fr., in the second half of the 20th century, has

brought an expansion of related ground and air transportation facilities, warehousing, light industry, and hotels. Pop. (2001) 126,702.

**thang-ka,** also spelled TANKA (Tibetan: "something rolled up"), Tibetan religious painting or drawing on woven material, usually cotton; it has a bamboo-cane rod pasted on the bottom edge by which it can be rolled up.

*Thang-ka*s are essentially aids for meditation, though they may be hung in temples or at family altars, carried in religious processions,



Bhaiṣajyaguru, Tibetan *thang-ka*, c. 1750; in the Bodleian Library, Oxford, Eng. (MS. Tib. a. 18 R)
By courtesy of the curators of the Bodleian Library, Oxford, Eng.

or used to illustrate sermons. *Thang-ka*s are not free creations of art, in the Western sense, but are painted according to exact canonical rules. In their subject matter they provide a wealth of understanding of the Tibetan religion. They commonly depict the Buddha, surrounded by deities or lamas and scenes from his life; divinities assembled along the branches of a cosmic tree; the wheel of life (Sanskrit *bhava-cakra*), showing the different worlds of rebirth; the symbolic visions thought to occur during the intermediate state (Bar-do) between death and rebirth; *maṇḍala*s, symbolic representations of the universe; horoscopes; and Dalai and Paṇchen lamas, saints, and great teachers, such as the 84 *mahāsiddha*s ("great perfect ones").

The *thang-ka* is derived from Indian cloth paintings (*paṭa*s), from *maṇḍala*s originally drawn on the ground for each ritual use, and from scrolls used by storytellers. Its painting draws inspiration from Central Asian, Nepali, and Kashmiri schools and, in the treatment of landscape, from the Chinese. *Thang-ka*s are never signed and seldom dated but begin to appear about the 10th century. A precise chronology is made difficult by their close adherence to tradition in subject matter, gestures, and symbols.

*Thang-ka*s are generally rectangular, though the earlier ones tend to be square. The fabric is prepared by stretching muslin or linen on a frame and treating it with lime slaked in water and mixed with animal glue. The thickened and dried surface is then rubbed to make it smooth and shiny. The outlines of the figures are drawn in charcoal (in recent times they are often printed) and then filled in with colour, usually mineral, mixed with lime and gluten. The predominant colours are lime white, red, arsenic yellow, vitriol green, carmine vermilion, lapis lazuli blue, indigo, and gold used for backgrounds and ornaments. The painting is mounted on a brocaded silk border with a flat stick at the top and the roller at the bottom. Sometimes a thin silk dust curtain is added. A piece of silk invariably inset in the lower brocade border is known as the "door" of the *thang-ka* and represents the primeval makers, or source of all creation. Paintings are usually done by laymen under the supervision of lamas but have no religious value unless consecrated by a lama.

**Thānī, Shaykh Khalīfa ibn Ḥamad al-** (b. 1932, Doha, Qatar), *amīr* of Qatar (1972–95). Shaykh Khalīfa held several government posts, including chief of security forces, director of education, and minister of finance and petroleum affairs, in the 1950s and '60s. He became *amīr* in February 1972 by deposing his cousin Shaykh Aḥmad, whose profligate spending habits had aroused popular opposition. Khalīfa's family, including his sons and brothers, virtually controlled the government, holding 10 of 15 ministries in 1975.

As *amīr*, Khalīfa tried to direct and control the process of modernization stimulated by the boom in oil production. His economic policy was to diversify the economy by vastly expanding the agricultural sector and by building fertilizer plants and other new industries. Although political parties and labour unions were banned in 1976, Khalīfa ruled by decree within the framework of a written constitution and Islāmic law.

Following the First Persian Gulf War (1990–91), in which Qatari troops participated, Khalīfa left daily governing to his sons, one of whom, Shaykh Ḥamad ibn Khalīfa al-Thānī, installed himself as *amīr* in a peaceful coup in June 1995, while Khalīfa was traveling abroad.

**Thanjāvūr,** also called TANJORE, city, central Tamil Nādu state, southeastern India, in the Cauvery (Kaveri) River delta. An early Cōla capital (9th to 11th century), it was important during the Vijayanagar, Marāṭhā, and British periods. It is now a tourist centre; attractions are the Bṛhadīśvara Cōla temple, a Vijayanagar fort, and the palace of Sarfōjī, a Marāṭhā



Bṛhadīśvara Cōla temple, at Thanjāvūr, Tamil Nādu, India
Richard Abeles

prince. Industries include cotton mills, traditional handloom weaving, and the manufacture of *vīṇa*s (South Indian stringed instruments). The city has several colleges affiliated with the University of Madras.

The surrounding region occupies part of the flat, fertile Cauvery delta, one of the most important rice-growing areas in India. The delta is traversed by innumerable channels of the Cauvery, linked by irrigation canals, some of them used for at least 10 centuries. Chief crops are rice, sugar, and peanuts (groundnuts). Pop. (2001 prelim.) 215,725.

**Thanksgiving Day,** annual national holiday in the United States and Canada celebrating the harvest and other blessings of the past year.

Americans generally believe that their Thanksgiving is modeled on a 1621 harvest feast shared by the English colonists (Pilgrims) of Plymouth and the Wampanoag Indians. In fact, neither the standard Thanksgiving meal of turkey, cranberry sauce, and pumpkin pie nor the family orientation of the day reflects the Plymouth event.

Plymouth's Thanksgiving began with colonists going out "fowling," possibly for turkeys but more probably for the easier prey of geese and ducks. Next, about 90 Wampanoag appeared at the settlement's gate, doubtlessly unnerving the 50 or so colonists. Nevertheless, over the next few days the two groups socialized without incident. The Wampanoag contributed venison to the feast, which included the fowl and probably fish, eels, shellfish, and vegetables. The men fired guns and ran races. Although rather disorderly, the affair sealed a treaty between the two groups that lasted until King Philip's War (1675–76).

The New England colonists were accustomed to celebrating "Thanksgivings," days of prayer thanking God for blessings such as military victory or the end of a drought. Although the U.S. Continental Congress proclaimed a national Thanksgiving upon the enactment of the Constitution, after 1798 Congress left Thanksgiving declarations to the states—some objected to the national government's involvement in a religious observance, Southerners were slow to adopt a New England custom, and others took offense over the day's being used to hold partisan speeches and parades.

While sectional tensions prevailed in the mid-19th century, the editor of the magazine *Godey's Lady's Book*, Sarah Josepha Hale, campaigned for a national Thanksgiving Day to promote unity. After the Union victory at Gettysburg in 1863, Abraham Lincoln set aside August 6 as a national day of Thanksgiving. The public clamoured for an annual observance, and in 1867 the last Thursday in November was established as the date. Thanksgiving has been observed at that time in the United States ever since, except in 1870 and in 1939–41 when the date was moved.

As family members began to live farther apart, Thanksgiving became a time to gather together, and the holiday moved away from its religious roots. In the late 1800s parades of costumed revelers became common; in 1920 Gimbel's department store in Philadelphia staged a parade of about 50 people. In 1924 the first annual Macy's parade in New York City was held. The holiday came to symbolize intercultural peace, America's opportunity for newcomers, and the sanctity of family.

Days of Thanksgiving in Canada also originated in the colonial period, arising from the same European traditions, in gratitude for safe journeys, peace, and bountiful harvests. The earliest celebration was held in 1578, when Martin Frobisher held a ceremony in present-day Newfoundland to give thanks for a safe arrival in the New World. In 1879 Parliament established a national Thanksgiving day on November 6; the date has varied over the years. Since 1957 Thanksgiving Day has been celebrated in Canada on the second Monday in October. (D.J.Si.)

**Thanom Kittikachorn** (b. Aug. 11, 1911, Tak, Siam [Thai.]—d. June 16, 2004, Bangkok, Thai.), army general and prime minister of Thailand (1958, 1963–71, 1972–73).

Thanom entered the army from the royal military academy in 1931. He was a close associate of Sarit Thanarat, and, as commander of the important First Army in Bangkok, assisted him in overthrowing the government of Phibunsongkhram in 1957. In the ensuing caretaker government of Pote Sarasin he served first as minister of defense and then, briefly in 1958, as prime minister. When Sarit took over the government late that year, he stayed on as deputy prime minister and minister of defense. On the death of Sarit in December 1963, Thanom succeeded him as prime minister.

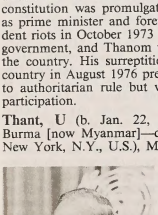
Thanom promised to restore parliamentary democracy and appointed a commission to write Thailand's eighth constitution since the revolution of June 1932. It was adopted in

June 1968, and elections were held in February 1969. Thanom's United Thai People's Party won a parliamentary majority, and Thanom continued as both prime minister and minister of defense.

Thanom's greatest problem was the growing threat of communist insurgency. Guerrillas, led by cadres trained in China and North Vietnam, became increasingly aggressive, particularly in the northeast, along the border with Laos. Thanom engaged U.S. pilots to fly Thai troops on counterinsurgency missions and employed U.S. "advisers" in a pattern similar to that adopted by South Vietnam in the early 1960s. A supporter of U.S. policies in Indochina, he sent Thai combat units to Vietnam and Laos and allowed the Americans use of six airbases on Thai soil for missions over Indochina.

In November 1971 Thanom dissolved the Cabinet and Parliament, suspended the constitution, and established a nine-man military directorate. In December 1972 an interim constitution was promulgated with Thanom as prime minister and foreign minister. Student riots in October 1973 brought down his government, and Thanom was forced to flee the country. His surreptitious return to the country in August 1976 precipitated a return to authoritarian rule but without his direct participation.

**Thant, U** (b. Jan. 22, 1909, Pantanaw, Burma [now Myanmar]—d. Nov. 25, 1974, New York, N.Y., U.S.), Myanmar educator,



U Thant, 1965
United Nations photograph

civil servant, and third secretary general of the United Nations (1962–71). Neutralist by inclination and in practice, he criticized both West and East for actions and attitudes that he considered threatening to world peace.

Thant was educated at the University of Yangôn (Rangoon) later the Arts and Science University, where he met Thakin Nu (afterward U Nu, who became prime minister of Myanmar in 1948). The death of Thant's father (1928) forced him to leave the university before graduation, and he returned to his hometown as a teacher at the National High School and later (from 1931) as headmaster. In 1942 he was secretary to the educational reorganization committee of the government of Japanese-occupied Burma. From 1943 to 1947 he once more was headmaster at Pantanaw.

After World War II Thant was recruited for government service by U Nu and General U Aung San, leader of the Anti-Fascist People's Freedom League. He was appointed press director (1947), director of broadcasting (1948), and secretary of the Ministry of Information (1949). In 1952–53 he was a Myanmar (Burmese) delegate to the UN, becoming his country's permanent UN representative in 1957. He was vice president of the UN General Assembly in 1959.

After the death of UN Secretary General Dag Hammarskjöld, the United States and the Soviet Union, failing to agree on a permanent successor, accepted U Thant as a compromise candidate for the acting secretaryship, to which he was elected on Nov. 3, 1961. On Nov. 30, 1962, he was elected permanent secretary general, and he was re-elected for five years on Dec. 2, 1966; he retired at the end of 1971. A devout Buddhist, he sought to apply the principles of detachment and concentration to the solving of international problems.

U Thant died in New York City of cancer, and his body was returned to Yangôn for burial. There it became involved in a bizarre tug of war between university students, who seized it on Dec. 5, 1974, and buried it in a hastily built mausoleum in the grounds of the Arts and Science University, and police, who retrieved it by force on December 11, buried it privately, and sealed the tomb in concrete. Subsequent rioting led to the military regime's declaration of martial law in the city and to several deaths.

Thant wrote (in Burmese) books on the history of cities, the League of Nations, and Myanmar education, as well as a three-volume history of post-World War II Myanmar (1961). A collection of his public addresses and essays from 1957 to 1963 was published as *Toward World Peace* (1964), and *View from the UN* (1978), an account of his years as secretary general, was published posthumously.

**Thap Muoi Plain,** also called PLAIN OF REEDS, Vietnamese DONG THAP MUOI, French PLAINE DES JONCS, low, basinlike, alluvial swampy region, a northwestern extension of the Mekong delta, in southern Vietnam and eastern Cambodia. It is bounded on the southeast by the Tien Giang River, the main channel of the Mekong River, and also drains to a lesser extent into the parallel Vam Co Tay River, on the northeast. The sparsely populated plain is essentially a vast hollow below the level of the Mekong, and it has been partially reclaimed by a levee and drainage system. In the 1950s the plain was chosen for intensive agricultural development with resettlement of refugees from the north, but the subsequent war in Vietnam contributed to postponement of the project. The old Mandarin Road from Saigon (Ho Chi Minh City) to Phnom Penh skirted the swamp on the north as does the more modern highway.

**Thapsus, Battle of** (Feb. 6, 46 BC), in ancient Roman history, battle during the civil war between the Caesarians and the Pompeians (49–46 BC). It was the final blow delivered by Julius Caesar's forces against the supporters of Pompey the Great. Thapsus was a North African seaport about 5 miles (8 km) east of present-day Teboulba, Tunisia. Quintus Metellus Scipio, Pompey's father-in-law, intending to relieve Caesar's siege of Thapsus, drew up his 14 legions and 15,000 cavalry on the corridor of land that formed the northern approach to the city.

Caesar's officers could not restrain their own forces, who surged forward and overwhelmed the enemy and, completely out of control, slaughtered about 10,000 of them. Within three weeks of his victory Caesar had conquered Roman Africa.

**Thar Desert,** also called GREAT INDIAN DESERT, a tract of rolling sand hills located partly in the Indian state of Rājasthān and partly in Pakistan. Covering 77,000 square miles (200,000 square km) of territory, it is bordered by the irrigated Indus plain to the west, the Arāvalli Range to the southeast, the Rann of Kutch to the south, and the Punjab plain to the north and northeast. The desert results from the dryness of the prevailing monsoon winds, which do not bring sufficient rain to keep the region moist. The name Thar is derived from *t'hul,* the general term for the region's sand ridges.

The desert sands cover early Precambrian gneiss (granitelike metamorphic rocks formed in the oldest geologic era, which began 3.8 billion years ago), sedimentary rocks from about 2.5 billion to 570 million years old, and more recent material deposited by rivers (alluvium). The surface sand is aeolian (wind-deposited) sand of the Quaternary Period (the most recent geologic period, which began about 1.6 million years ago).

The desert presents an undulating surface, with high and low sand dunes separated by sandy plains and low, barren hills, or *bhakars,* which rise abruptly from the surrounding plains. The dunes are in continual motion and take on varying shapes and sizes. Older dunes, however, are in a semistabilized or stabilized condition, and many rise to a height of almost 500 feet (150 m). Several playas (saline lakes), locally known as *dhands,* are scattered throughout the region.

The soils consist of seven main groups—desert soils, red desertic soils, sierozems (brownish gray soils), the red and yellow soils of the foothills, the saline soils of the depressions, and the lithosols (shallow, weathered soils) and regosols (soft, loose soils) found in the hills. All these soils are predominantly coarse-textured, well-drained, and calcareous (calcium-bearing). A thick accumulation of lime often occurs at varying depths. The soils are generally infertile and, because of severe wind erosion, are overblown with sand.

The amount of annual rainfall in the desert tract is generally low, ranging from about 4 inches (100 mm) or less in the west to about 20 inches (500 mm) in the east. Precipitation is highly erratic, and there are wide fluctuations in the amount from year to year. About 90 percent of the total annual rain occurs during the season of the southwest monsoon, from July to September. At other seasons the wind blows from the northeast. May and June are the hottest months of the year, with temperatures rising to 122° F (50° C). During January, the coldest month, the mean minimum temperature ranges between 41° and 50° F (5° and 10° C), and frost is frequent. Dust storms and dust-raising winds, often blowing with velocities of 87 to 93 miles per hour (140 to 150 km per hour), are common in May and June.

The desert vegetation is mostly herbaceous, or of stunted scrub; trees occasionally dot the landscape. On the hills, gum arabic acacia and euphorbia may be found. The *khajri* (*Prosopis cineraria*) tree grows throughout the plains.

The thinly populated grasslands support the black buck, the chikara (gazelle), and some feathered game, notably the francolin and quail. Among the migratory birds, sand grouse, ducks, and geese are common. The desert is also the home of the vanishing great bustard.

There are five major breeds of cattle in the Thar tract. Among these, the Tharparkar breed is the highest milk yielder, while the Kankre breed is good both as a beast of burden and as a milk producer. Sheep are bred for both medium-fine and rough wool. The camel is commonly used for transport, as well as for plowing the land and other agricultural purposes.

Most of the inhabitants reside in rural areas and are distributed in varying densities. Customs, rituals, and modes of dress are manifold. Both Islām and Hinduism are practiced, and the population is divided into complex economic and social groups. Many nomads are engaged in animal husbandry, crafts, or trade. They do not belong to a specific ethnic group, nor are they associated with a separate area; in general they are symbiotically related to the sedentary population and its economy.

The grasses form the main natural resources of the desert. They provide nutritive and palatable pasturage, as well as medicines used locally by the inhabitants. Alkaloids, used for making medicine, and oils for making soap are also extracted. Water is very scarce. What-



Hindu pilgrims gathering at Pushkar, in the Thar Desert, Rājasthān, India
© Brian A. Vikander/West Light

ever seasonal rain falls is collected in tanks and reservoirs and is used for drinking and domestic purposes. Most groundwater cannot be utilized because it lies deep underground and is often saline. Good aquifers have been detected in the central part of the desert.

Apart from wells and tanks, canals are the main sources of water throughout the desert. When water is available, crops such as wheat and cotton are grown. The Sukkur (Lloyd) Barrage on the Indus River, completed in 1932, irrigates the southern Thar region in Pakistan by means of canals, while the Gang Canal brings water from the Sutlej River to part of the northern region. The Rājasthān Canal irrigates a vast amount of land in that part of the Thar region in India. The canal begins at the Harike Barrage—at the confluence of the Sutlej and Bēas rivers in the Indian Punjab—and continues in a southwesterly direction for 292 miles (470 km).

Thermal-power-generating plants, fueled by coal and oil, are located only in the large towns and supply power only locally. Hydroelectric power is supplied by the Nangal power plant located on the Sutlej River in Punjab.

Roads and railways are few. One railway line serves the southern part of the region. In the Indian part of the desert, a second line goes from Merta Road to Sūratgarh via Bikaner, while another connects the towns of Jodhpur and Jaisalmer. In the Pakistani part of the desert, another railway line runs between Bahāwalpur and Hyderābād.

The partition of India and Pakistan in 1947 left most of the irrigation canals fed by the rivers of the Indus system in Pakistani territory, while a large desert region remained unirrigated on the Indian side of the border. The Indus Water Treaty of 1960 fixed and delimited the rights and obligations of both countries concerning the use of waters of the Indus River system. Under the agreement, waters of the Rāvi, Bēas, and Sutlej rivers are to be made available to the Rājasthān Canal to irrigate mainly the desertic tract covering parts of western Rajasthan in India.

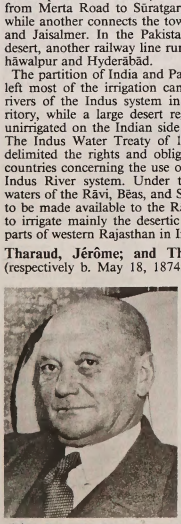
**Tharaud, Jérôme; and Tharaud, Jean** (respectively b. May 18, 1874, Saint-Junien, Fr.—d. Jan. 28, 1953, Varengeville-sur-Mer; b. May 9, 1877, Saint-Junien—d. April 9, 1952, Paris), French brothers noted for the extent and diversity of their literary production spanning 50 years of collaboration. Many of their early works were published in the periodical *Cahiers de la Quinzaine* ("Fortnight Account"), edited by Charles Péguy, and one of them, the novel *Dingley* (1902), earned them the esteemed Prix Goncourt in 1906.

Precise observers, the brothers Tharaud were among the first and greatest of French reporters, recording their travels in such works



Jean Tharaud
J.P. Ziolo

as *La Fête arabe* (1912; "The Arab Festival") and *Rabat, ou Les Heures marocaines* (1918; "Rabat; or, Moroccan Hours"). They also were concerned with the dynamics of current political events, particularly those of Jewish history, as seen in *Quand Israël est roi* (1921; "When Israel Is King") and *L'An prochain à Jérusalem* (1924; "Next Year in Jerusalem"). The brothers Tharaud were also the authors of numerous novels and reminiscences, including *La Randonné de Samba Diouf* (1922; *The Long Walk of Samba Diouf*) and *Notre cher Péguy* (1926; "Our Dear Péguy"). They were both elected to the French Academy—Jérôme in 1938, Jean in 1946.



Jérôme Tharaud, 1938
UPI/Bettmann Newsphotos

*Consult the* INDEX *first*

**Thargelia,** in Greek religion, one of the chief festivals of Apollo at Athens, celebrated on the sixth and seventh days of Thargelion (May-June). Basically a vegetation ritual upon which an expiatory rite was grafted, the festival was named after the first fruits, or the first bread from the new wheat.

On the first day of the festival, one or two men (or a man and a woman), representing the deity but also acting as scapegoats for community guilt, were first led through the city and then driven out. Occasionally, as in times of heavy calamity, they were sacrificed, being either thrown into the sea or burned on a funeral pyre. On the second day of the festival, there were a thanks offering, a procession, and the official registration of adopted persons.

**Tharp, Twyla** (b. July 1, 1942, Portland, Ind., U.S.), American dancer, director, and choreographer.

Tharp's childhood included comprehensive training in music and dance, though her college years were spent studying psychiatry in California and art history in New York City. While in the latter pursuit, she resumed her training as a dancer at several studios and at the American Ballet Theatre School. She joined the Paul Taylor Company in 1963.



Twyla Tharp
© Jack Mitchell

In 1965 she began to choreograph, demonstrating her diverse interests. *Tank Drive,* her first piece, was presented at Hunter College in 1965. Thereafter she created many works for various companies—notably *The Fugue* (1970), *Deuce Coupe* (1973), *Push Comes to Shove* (1976), and *Baker's Dozen* (1979)—and formed her own dance company, the Twyla Tharp Dance, which received international acclaim. She also directed television and film creations, working with Miloš Forman in 1983 on the film *Amadeus.* Her work *Fait Accompli,* which premiered in 1984, was typical in that it reflected the anxieties of an age of alienation and looming disaster. In 1988 she joined the American Ballet Theater as artistic associate and resident choreographer.

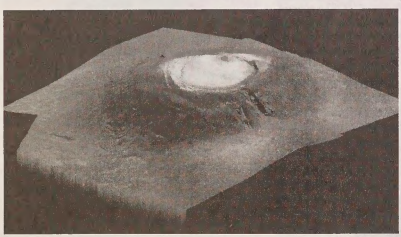
**Tharrawaddy** (d. October 1846), eighth king (reigned 1837–46) of the Alaungpaya, or Konbaung, dynasty of Myanmar (Burma), who repudiated the Treaty of Yandabo and nearly brought about a war with the British.

Tharrawaddy in 1837 deposed his brother Bagyidaw (reigned 1819–37), who had been obliged to sign the humiliating treaty that ceded the provinces of Arakan and Tenasserim to the British. Upon his accession, Tharrawaddy declared the treaty invalid and refused to negotiate with representatives of the government of India, demanding the right to deal directly with the British monarch. The British resident at Amarapura, the Myanmar capital, was forced to leave in June 1837, and Tharrawaddy refused to deal with his successor in 1838 because he too was merely a representative of the Indian governor-general. In 1840 the British suspended the residency, and diplomatic relations between Myanmar and the British remained broken for more than a decade.

Tharrawaddy nearly brought Myanmar to re-

newed war when, in 1841, he went to Yangôn (Rangoon) on a pilgrimage to the Shwe Dagon pagoda, bringing with him a large military escort. The British interpreted this as a warlike act and refrained from starting hostilities only because of their entanglements in Afghanistan. After 1841 Tharrawaddy became increasingly subject to fits of mental instability; he was dethroned and, on his death, succeeded by his son Pagan (reigned 1846–53).

**Tharsis,** extensive volcanic province on Mars that contains several of the planet's most massive volcanoes. The province is focused on a rise or dome that extends about 8,000 km (5,000 miles) in its widest dimension and stands 8 km (5 miles) high at the centre, as measured from Mars's mean radius. Much of Tharsis is covered with volcanic plains, collectively called Tharsis Planitia, that comprise numerous superposed lava flows. Near the top of the rise, three large volcanoes—Ascraeus



The Martian volcano Arsia Mons, the southernmost of the line of three volcanoes on Tharsis

By courtesy of the U.S. Geological Survey, Flagstaff, Arizona

Mons, Pavonis Mons, and Arsia Mons—form a line trending northeast to southwest. Together with Olympus Mons, which lies just off the rise to the west, these volcanoes are the largest known in the solar system. At the north end of Tharsis stands yet another large volcano, Alba Patera.

Tharsis is at the centre of a vast system of radial fractures that cover roughly one-third of the planet. The fractures probably formed as a result of stresses that were created in the crust by the presence of the huge dome. The ages of the lava flows, as estimated from the amount of cratering, are about one billion to three billion years, but some individual volcanic features may be younger. The Tharsis rise may have been formed by both uplift and the buildup of lava flows. Mathematical analyses of the motions of Mars suggest that the formation of the Tharsis rise altered the planet's axial tilt.

**Tharthār, Wadi,** Arabic WĀDI ATH-THARTHĀR, intermittent stream of north-central Iraq, rising from several headstreams in the Sinjār Mountains (west of Mosul) and flowing southward to Lake Tharthār, which is a reservoir 60 miles (100 km) long. The reservoir, formerly a playa lake that varied in size with the amount of rainfall, has been connected by regulators and channels to the Sāmarrā' Barrage on the Tigris River, keeping it at a constant level for the purpose of flood control and storage of irrigation water.

**Tharu,** people of the Tarai region of the Himalayan foothills located in southern Nepal and in the state of Uttar Pradesh in India. In the late 20th century the Tharu in Nepal numbered about 720,000, those in India about 10,000. They speak a language of the Indo-Aryan subgroup of the Indo-Iranian group of the Indo-European family, and they are largely Indian in culture. The Tharu of Uttar Pradesh practice agriculture, raise cattle, hunt, fish, and collect forest products. The five higher clans among them, which constitute about 80 percent of the population, claim to be of royal origin in Rājasthān. Although they are Hindu, the Tharu use alcoholic beverages and eat beef. Despite their patrilineal social system, women have property rights greatly exceeding those recognized in Hindu society. Each village is governed by a council and a headman.

**Thasos,** Modern Greek THÁSOS, Latin THASUS, large, wooded island of the northernmost Aegean Sea, Kavála *nomós* (department), Greece. It is located southwest of the delta of the Néstos River in Thrace and has an area of 146 square miles (379 square km) and a total coastline of 59 miles (95 km). Thasos is an outlier of the Macedonian crystalline massif, with intercalations of horizontally inclined white marble. The highest mountain, Mount Ipsárion (3,947 feet [1,203 m]), lies near the island's northeastern coast. The population is distributed in about 10 villages, mostly at some distance from the sea; the chief town, Thásos (formerly Limín), is on the north coast.

The ancient Greek historian Herodotus mentions an early Phoenician settlement that worked the island's gold mines. In the 7th century BC, Greeks from Páros colonized Thasos, exploited the gold mines, and founded a school of sculpture. In 465 Thasos seceded from the Delian League in a dispute over gold mines on the mainland, but, after a siege of two years by the Athenians, it was forced to demolish its walls, surrender its fleet and mainland possessions, and pay an indemnity and an annual contribution to the league. During the Peloponnesian War, Thasos revolted from 411 to 407, and, after Athens' defeat, the Spartan admiral Lysander seized the island (403). Thasos was again allied to Athens in 389 and was a permanent member of the Second Athenian League. It became a Macedonian dependency in 202 and passed to the Romans in 196. From AD 1204 it was under Latin rule until its capture by the Turks in 1455. The Turks ruled it almost continuously for the next three and a half centuries. From 1813 to 1902 it belonged to the Turkish governors of Egypt, and in 1913 it passed from the Turks to Greece following the Balkan Wars.

Excavations on the ancient settlements began in 1862–63 and were revived in 1911; much has been done since 1948 to uncover several monuments from the 7th to the 2nd century BC. The island's industries include boatbuilding, using local pine, as well as fishing and tourism. Zinc mining was revived there after World War I, creating the new centre of Limenária. Since the early 1970s Thasos has been the base for offshore oil exploration in the Aegean. Pop. (1991) 14,573.

**Thatch, Edward:** *see* Teach, Edward.

**Thatcher, Margaret,** in full MARGARET HILDA THATCHER, BARONESS THATCHER OF KESTEVEN, *née* ROBERTS (b. Oct. 13, 1925, Grantham, Lincolnshire, Eng.), British Conservative politician and prime minister (1979–90), Europe's first woman prime minister. She was the first British prime minister in the 20th century to win three consecutive terms, and at the time of her resignation she was Britain's longest-serving prime minister since 1827.

Thatcher was educated at Somerville College, Oxford (B.A., 1946; B.Sc., 1949; M.A., 1950), where she became the first woman president of the Oxford University Conservative Association. She subsequently worked as a research chemist. Her marriage to a prosperous businessman also enabled her to read for the bar, and she specialized in tax law. She first stood for Parliament in 1950 but was unsuccessful, despite increasing the local Conservative vote by 50 percent. Not until 1959, when she was selected to fight the relatively "safe" Conservative constituency of Finchley, in north London, did she enter Parliament. She was joint parliamentary secretary to the Ministry of Pensions and National Insurance (1961–64) and secretary of state for education and science (only the second woman ever to become a Conservative cabinet minister) under Prime Minister Edward Heath (1970–74). Thatcher succeeded Heath as Conservative leader in 1975 after the party's loss of two general elections in 1974. The Conservatives' decisive victory in the general elections of 1979, which elevated her to the prime ministry, was thought partly to have resulted from her denunciation of trade-union-induced chaos in the previous winter's strikes.

Thatcher was seen as belonging to the newly energetic right wing of the Conservative Party, who during her administration became known as "Dries," as opposed to the old-style, liberal Tories, known as "Wets." She advocated greater independence of the individual from the state, an end to allegedly excessive government interference in the economy, and reductions in both public expenditures (enabling personal taxes to be cut) and the printing of money (reflecting the policy known as monetarism). But unemployment, which had been rising mildly throughout the late 1970s,



Margaret Thatcher, 1983

AP/Wide World Photos

nearly tripled during her first two terms—from 1,100,000 to 3,000,000—and her term in office saw the growth of a substantial underclass. Moreover, business losses and bankruptcies increased during the austerity that accompanied her administration's policies for reducing inflation. Though the Conservative Party's parliamentary majority was large, it won with only a little over 40 percent of the vote in 1987; that figure reflected the lowest share of the vote for the Conservatives since 1922.

Abroad, Thatcher presided over the orderly establishment of an independent Zimbabwe (formerly Rhodesia) in 1980 after 15 years

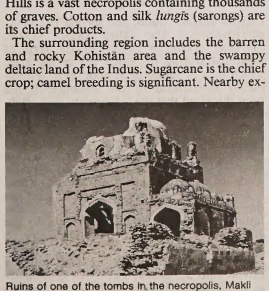
of illegal separation from British colonial rule under a white minority. In 1982 Britain successfully recaptured the Falkland Islands following a 10-week Argentine occupation. The electorate's memories of Thatcher's decisive leadership during the Falklands conflict helped give her a landslide victory in the general elections of June 1983.

Throughout her terms Thatcher pursued the policies that earned her the appellation of "Iron Lady": strict dominance over the ministers of her cabinet; pursuance of a strong monetarist policy; increased subjection of trade unions to legal constraints; and "privatization" of state-owned enterprises. In her later years she extended her "Thatcher revolution" from the economics of finance and industry into new areas of social policy, through the further privatization of education, health care, and housing. She affirmed Britain's strong commitment to NATO and Britain's independent nuclear deterrent, a stance that proved popular with the electorate, given the Labour Party's repudiation of Britain's traditional nuclear and defense policies. She also continued to support the retention of Northern Ireland within the United Kingdom, although a terrorist bombing in Brighton, Sussex, in 1984, allegedly the work of Irish separatists, nearly succeeded in killing her and several senior members of her administration. A split in Tory ranks over her policy regarding European monetary and political integration led to her resignation from party leadership late in 1990. In 1990 Thatcher received the Order of Merit, and in 1992 she was made a baroness.

**Thaton,** town, southern Myanmar (Burma), situated on the Tenasserim plains in the northern part of the narrow coastal strip known as Tenasserim. Once a lively seaport, Thaton, because of silting, is now 10 miles (16 km) from the Gulf of Martaban, an inlet of the Andaman Sea. The town was an early Talaing (Mon) capital and was subject to Indian influence from the time of Aśoka. With the growth of Pegu, 70 miles (110 km) northwest across the gulf, Thaton declined politically, but it remained a centre of Indian culture until the 11th century, when it fell to the Burmans under Anawrahta. The town has an airfield and is on the Yangôn- (Rangoon-) Ye railway line. It is the site of a laterite pagoda. Pop. (latest est.) 40,846.

**Thatta,** also TATTA, town, Sindh province, Pakistan, just west of the Indus River, inland from Karāchi and the Arabian Sea coast. During the 16th century it was the capital of the Sammā dynasty in Lower Sindh. Incorporated as a municipality in 1854, it has two mosques (notably Jāma Mosque [1647–49], built by the Mughal emperor Shāh Jahān), historic tombs, and a library. Nearby Makli Hills is a vast necropolis containing thousands of graves. Cotton and silk *lungīs* (sarongs) are its chief products.

The surrounding region includes the barren and rocky Kohistān area and the swampy deltaic land of the Indus. Sugarcane is the chief crop; camel breeding is significant. Nearby excavations reveal occupations dating from the 1st century BC. Pop. (1981) 21,524.



Ruins of one of the tombs in the necropolis, Makli Hills, Thatta, Pak.
J. Henry Stewart—Shostal

**Thayendanegea** (Mohawk Indian chief): *see* Brant, Joseph.

**THC** (drug): *see* tetrahydrocannabinol.

**The Dalles** (Oregon, U.S.): *see* Dalles, The.

**Theaceae,** the tea family of plants in the order Theales. The Theaceae comprises about 40 genera of trees or shrubs native to temperate and tropical regions of both hemispheres, including several ornamental plants, one that is the source of tea. Members of the family have evergreen leaves and flowers with five sepals (leaflike structures) and petals and numerous stamens inserted at the base of the ovary. The *Camellia* (*q.v.*; formerly *Thea*) genus includes the tea plant of commerce and many popular ornamental flowering shrubs. Plants of the genera *Franklinia, Gordonia,* and *Stewartia* bear camellia-like white blooms, often with purple or yellow-orange stamens.

Three members of the genus *Eurya,* from East Asia, are slow-growing, low foundation plants. They have small yellow-green flowers and glossy leaves with prominent, sunken veins. A similar species, *Cleyera japonica,* has fragrant, creamy-white blooms followed by dark red, puffy berries. *Ternstroemia japonica,* a small Asian tree, bears slightly fragrant flowers among bronze-coloured, red-stalked leaves.

**Theaetetus** (b. *c.* 417 BC, Athens [Greece]—d. 369 BC, Athens), Athenian mathematician who had a significant influence on the development of mathematics.

Theaetetus studied with Theodorus of Cyrene and at the Academy with Plato. He taught at some time in Heraclea. Plato made Theaetetus the chief subject of two dialogues—*Theaetetōs* (*Theaetetus*) and *Sophistēs* (*Sophist*)—the former of which is the major source from which scholars have derived the little that is known about Theaetetus' life.

Theaetetus contributed to the theory of irrational quantities (a theory that revolutionized Greek mathematics) and the construction of the regular solids; he is considered the inventor of solid geometry. He may also be the author of a general theory of proportion developed by Eudoxus and set forth in Euclid.

**Theales,** the tea order of flowering plants, belonging to the class called Magnoliopsida (dicotyledon; characterized by two seed leaves). The order comprises 18 families, approximately 175 genera, and 3,400 species. Its members are mostly tropical trees and shrubs. Prominent among them are the plant that produces tea and the camellia.

A brief treatment of Theales follows. For full treatment, *see* MACROPAEDIA: Angiosperms.

The Theales order is distributed worldwide, with the centre of its range in Southeast Asia. Some species extend into temperate regions, but most are native to rain forests or upland forests of the tropics. The order consists predominantly of evergreen trees or shrubs; some members are woody climbers, and a few are herbs. Tea cultivation is the most important economic activity associated with the group.

The tea family, Theaceae, ranges through the tropical and temperate regions of the world. Its members usually have evergreen leaves and showy flowers. The *Camellia* genus includes the tea plant (*C. sinensis*), a native of Assam in northeastern India, first cultivated in China. Today tea is grown commercially in India, Sri Lanka, China, Japan, Indonesia, and elsewhere. To produce tea, the leaves of the plant are picked and dried and may be fermented (for black tea), partially fermented (oolong tea), or unfermented (green tea).

The ornamental camellia shrub, *C. japonica,* belongs to the same family and genus as the tea plant and is widely cultivated in temperate areas for its roselike blossoms. The *Gordonia* and *Stewartia* genera of this family also include ornamental garden species.

The Dipterocarpaceae family consists of resinous trees that grow mainly in the Asian tropics. They form the characteristic high upper canopy of Malaysian rain forests, and many species are economically important for their timber or resins. As the demand for these timbers has increased, the trees have become endangered. The Hypericaceae family includes Saint-John's-wort (*Hypericum*), cultivated in temperate regions for its handsome flowers. Other families also contain fine horticultural plants, and members of some families produce edible nuts and fruits.

The Theales are generally woody plants with simple, often evergreen, leaves. Flowers are radially symmetrical, generally with five sepals and five petals; are usually not brightly coloured; and are bisexual (containing both male and female reproductive structures). Stamens (male) are numerous and may be united in a ring or in bundles, and the ovary (female) consists of several united carpels, or segments. Many members of the order contain resins. In the Dipterocarpaceae family the resins are distributed throughout the plant tissues; in the Hypericaceae and some smaller families, they occur in distinct glands.

Remarkable vegetative modifications appear in two families of the order. The Marcgraviaceae, which consists of South American tropical climbers, includes plants (especially in the genus *Marcgravia*) that give rise to two different types of shoots. The lower ones bear small leaves and produce aerial roots, enabling the shoots to climb; the upper shoots develop larger leaves and flower clusters, and they lack roots. In the Dioncophyllaceae family of west African scrambling shrubs, two or three types of leaves arise on the same plant, one type with hooks that enable the plant to scramble over other vegetation.

The Marcgraviaceae also displays a curious floral adaptation associated with pollination. The floral bracts (leaflike structures just below the flowers) are transformed into hollow, nectar-secreting organs. In *Marcgravia* the bracts enlarge to form erect nectar-filled pitchers that attract hummingbirds.

Seeds are dispersed in a variety of ways in the different members of the order, but the Dioncophyllaceae has a method unique among the flowering plants. In this group the fruits open before ripening, and the seeds are pushed out on a stalk, where they mature and drop off, leaving the fruit and stalk on the shrub. Some families adopt another unusual dispersal method, wherein two or more sepals enlarge above the fruit, forming a two-winged structure that is borne away by the wind.

**Theater of ——:** *see under* substantive word (*e.g.,* Absurd, Theatre of the).

**theatre,** also spelled THEATER, in architecture, building or space in which a performance may be given before an audience. The word is from the Greek *theatron,* "a place of seeing." A theatre usually has a stage area where the performance itself is given. Since ancient times the evolving design of theatres has been determined largely by the spectators' physical requirements for seeing and hearing the performers and by the changing nature of the activity presented.

A brief treatment of theatres follows. For full treatment, *see* MACROPAEDIA: Theatrical Production.

Asian drama has undergone relatively little change over time, and its stage arrangement has remained rather simple, with the audience usually grouped informally around an open space. The most notable exceptions are the nō and kabuki of Japan. Since the 14th century, nō has been performed on a temple-

like wooden stage approached from a bridge at the side, though today this is for the most part reconstructed in a modern auditorium. Kabuki, for which the revolving stage was invented, uses a stage similar to the Western-style proscenium-arch theatre, but with the addition of a runway (*hanamichi*).

In ancient Greece, where Western theatre began (5th century BC), the theatres of the classical period were constructed in natural hollows between two hills, so that the audience sat in a tiered semicircular arrangement facing the orchestra circle, in which most of the action took place. In the Hellenistic period the speaking actors stood on a raised platform behind the orchestra circle. The best-preserved Greek theatre, at Epidaurus, seats about 12,000 people and is still in use today. The Roman theatre, dating from the 1st century BC, improved the acoustics by reducing the orchestra to a half-circle and joining it to the auditorium. The single-level stage, though raised, was at a much lower level than in the Hellenistic theatre. An ambitious vaulting construction enabled the tiered auditorium to be built on flat ground.

After the collapse of the Roman Empire and the rise of Christianity, theatre as an organized entertainment vanished for nearly 1,000 years. New forms of theatre grew out of the Roman Catholic mass; simple dramas were first performed in the church as part of the mass to explain and elaborate on the liturgy. These precursors of the medieval mystery plays were later performed outside on church grounds and eventually on temporary stages erected in the marketplace or on movable pageant wagons. By the close of the European Middle Ages these plays had become elaborate spectacles that combined both secular and religious traditions.

Renewed interest in the classical world, generated by the Renaissance in the 16th century, gave rise to the permanent indoor theatre. The first of these, the Olimpico Theatre in Vicenza, Italy, was designed by Andrea Palladio and completed in 1585. It was a scaled-down version of the Roman theatre and featured, behind the stage, three-dimensional perspective views of street scenes. At the Farnese Theatre in Parma, built in 1618, the stage was framed by the first permanent proscenium arch (which separated the stage from the auditorium) and used movable scenery, the audience sitting in a horseshoe-shaped auditorium. The Farnese Theatre was the prototype of the modern theatre.

The public theatres of Elizabethan England developed independently of the Italian tradition. Although the exact design of these theatres is uncertain, it is known that they were open to the sky, with the audience looking down from tiered galleries or up from a courtyard. The most significant feature was the thrust rectangular stage, from which the actor was surrounded on three sides by the spectators.

The "Golden Age" of Spanish theatre in the late 16th century used a stage similar to the Elizabethan one. The popular tradition of the commedia dell'arte, spreading through Europe at this time from Italy, represented a return to medieval-style staging, with the actors performing on a raised platform in a public square.

During the Baroque period, from the middle of the 17th century, the European court theatres followed the principle of proscenium stage and horseshoe-shaped auditorium. They were built for the purpose of housing the early operas and played an important role in the development of classical ballet. They featured a sunken orchestra pit at the front of the stage and made extensive use of movable scenery. The rigid hierarchy of the court was reflected in the position of the royal box in the centre of the auditorium, with the tiered balconies above it. The court theatre at the Palace of Versailles in France, designed in 1769, is one of the best-preserved examples. When opera became more popular and spectacular in the 18th century, this kind of theatre was enlarged to provide public entertainment for the upper classes. La Scala in Milan, Italy, completed in 1778, can seat more than 2,000 people. During the 18th century richly detailed productions employed new, complicated mechanical devices and historically accurate costuming and props.

The Restoration playhouse in England followed the Baroque pattern, with the addition of an apron stage that extended in front of the proscenium arch and, like the Elizabethan stage, allowed greater intimacy with the audience. Illumination during this period was provided by candles and other wick-burning devices placed in the wings, at the front of the stage, and in the auditorium.

It was Richard Wagner's Festspielhaus, built at Bayreuth, Ger., in 1876, that first departed from the Baroque stratified auditorium and reintroduced classical principles of theatre design that are still in use. The Festspielhaus had a steep, fan-shaped seating plan, with the orchestra concealed in a deep, partially covered pit, and, for the first time, the auditorium was darkened during the performance. Everything in this austere theatre was geared to encourage the sharpest concentration on the action on stage. Late in the 19th century, electric lighting was introduced, which meant that the stage could be lit more brightly and without such a high risk of fire.

Most innovations in theatre design during the 20th century have derived from the greater flexibility in staging made possible first by machinery that can move more complicated sets and even alter the shape of the stage, and by the emergence of stage lighting as an art in its own right. One of the results has been the development of more plastic stage settings that have freed the theatre from the constrictions of the picture-frame proscenium arch.

Open, or thrust, stages, like that of the Guthrie Theatre (1963), Minneapolis, Minn., U.S., have come to be favoured in the 20th century, particularly for classical plays, because of the intimacy they afford. A more recent example is the Olivier Theatre (1976), part of London's National Theatre complex, which is strongly influenced by the Greek theatre at Epidaurus. Appreciation has also grown for smaller, more flexible theatre spaces (sometimes within large, multipurpose complexes) as an alternative to the impressive institutional buildings. Such theatres have proved particularly valuable as a forum for new writing or for the reassessment of classical works. Many theatre companies housed in large buildings also maintain "studio theatres," more intimate rooms in which less commercially viable works can be performed.

**theatre,** also spelled THEATER, in dramatic arts, an art concerned almost exclusively with live performances of actions planned to create a coherent and significant sense of drama, one of the predominant art forms in cultures worldwide. Although the script is the basic element of theatrical performance in many cultures, theatre is not primarily a literary art but relies in varying degrees on acting, singing, dancing, and spectacle, as well as on the technical aspects of production.

The art of theatre is treated in a number of articles in the MACROPAEDIA. For a general treatment of the origins, nature, and elements of theatre, *see* Theatre, The Art of the. For technical aspects, *see* Theatrical Production. For historical treatment of Western theatre, *see* Theatre, The History of Western. For a general survey of dramatic literature and its tragic and comic forms, *see* Literature, The Art of. Western dramatic literature is also treated in the articles on the literatures of particular languages, nations, or regions (*e.g.*, Belgian Literature; English Literature; Scandinavian Literature). For the relationship of theatre to music and to dance, *see* Musical Forms and Genres; Dance, The Art of. For treatment of the theatre of non-European peoples, *see* Islāmic Arts; East Asian Arts; South Asian Arts; Southeast Asian Arts; Central Asian Arts; African Arts.

For a description of the place of theatre in the circle of learning and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Six, Division II.

**Théâtre-Français, Le:** *see* Comédie-Française.

**Theatre Guild,** a theatrical society founded in New York City in 1918 for the production of high-quality, noncommercial American and foreign plays. The guild, founded by Lawrence Langner (1890–1962), departed from the usual theatre practice in that its board of directors shared the responsibility for choice of plays, management, and production. The first two seasons, which included plays by Jacinto Benavente, St. John Ervine, John Masefield, and August Strindberg, demonstrated the artistic soundness of the plan.

Following the world premiere of George Bernard Shaw's *Heartbreak House* in 1920, the guild became Shaw's American agent, producing 15 of his plays, including world premieres of *Back to Methuselah* and *Saint Joan*. Eugene O'Neill's long association with the guild began with its production of *Marco Millions* in 1928. Other American authors whose works were produced by the guild included Sidney Howard, William Saroyan, Maxwell Anderson, and Robert Sherwood—all Pulitzer Prize winners.

Many distinguished actors appeared in Theatre Guild productions, including Helen Hayes in *Caesar and Cleopatra* and Alla Nazimova in *Mourning Becomes Electra*. Lynn Fontanne and Alfred Lunt first acted as a team there in Ferenc Molnár's *Guardsman* and went on to act together in many other notable guild productions, such as *Arms and the Man* and *The Taming of the Shrew*.

The Theatre Guild contributed significantly to American musical theatre by producing George Gershwin and DuBose Heyward's *Porgy and Bess* and by bringing Richard Rodgers and Oscar Hammerstein II together for such collaborations as *Oklahoma!*

The "Theatre Guild of the Air" (1945–63) had a distinguished record of radio and television play productions, and the guild's subscription series enabled audiences in 23 cities from coast to coast to see its major attractions and those of other managers.

**theatre-in-the-round,** also spelled THEATER-IN-THE-ROUND, also called ARENA STAGE, CENTRAL STAGE, or ISLAND STAGE, form of theatrical staging in which the acting area, which may be raised or at floor level, is completely surrounded by the audience. It has been theorized that the informality thus established leads to increased rapport between the audience and the actors. Theatre-in-the-round has its roots in rituals such as those performed by the ancient Greeks, which evolved into classical Greek theatre. It was used again in medieval times, especially in England, where it gave way to the open stage of Elizabethan times. During the 17th century the proscenium stage, which limited audiences to the area directly in front of the stage, came to dominate theatre.

Beginning in about 1930, however, with the productions of Nikolay Pavlovich Okhlopkov at his Realistic Theatre in Moscow, theatre-in-the-round began to gain favour with stage designers who were dissatisfied with the limi-

tations of the proscenium. Advocates of the-atre-in-the-round maintain that it offers a wider range of stage size and activity and allows for a larger audience in a given space. In general, such a theatre requires less scenery and scenic space and fewer stage hands and storage rooms and is less expensive to build and maintain than a proscenium-stage theatre.

**Théâtre-Libre** (French: Free Theatre), independent, private theatre founded in Paris in 1887 by André Antoine, which became the proving ground for the new naturalistic drama. Antoine, an amateur actor, was influenced by the naturalistic novels of Émile Zola and by the theatrical realism of the Meiningen Company. Antoine believed that environment shaped character and behaviour, and he sought to create settings that would faithfully reflect every aspect of real life.

The Théâtre-Libre was instrumental in introducing into France the works of such foreign dramatists as Henrik Ibsen (*Ghosts*), Leo Tolstoy, August Strindberg (*Miss Julie*), B.M. Bjørnson, and Gerhart Hauptmann (*The Weavers*), as well as in bringing to the attention of Parisian audiences such French playwrights as Eugène Brieux and Georges de Porto-Riche.

Although the Théâtre-Libre failed financially, it produced more than 100 plays, by some 50 playwrights, and it established a model of realistic theatre that had a profound influence upon independent theatres throughout Europe. In 1894 Antoine, in severe financial debt, relinquished the Théâtre-Libre to another director, who ran it until 1896.

**Théâtre National Populaire** (TNP), French national theatre created in 1920 to bring theatre to the general public. Its first director, Firmin Gémier, had been the director of the Théâtre Antoine and had made a number of attempts to create a people's theatre. Initially the TNP offered productions from the other national companies in a large hall with inexpensive tickets. It had no acting company, could not produce its own plays, and was meagerly financed. Despite finding a permanent home at the Palais de Chaillot in 1937, the TNP was not really successful until some years after World War II.

Jean Vilar was made director in 1951 and was given enough financial support to establish a permanent company and produce at least 150 performances per year in and around Paris. Vilar formed an outstanding company, which included the popular film star Gérard Philipe. Vilar also divided his repertoire between French and foreign plays and established ticket prices competitive with the cinema. The troupe became enormously popular and in 1959 was given status equal to the Comédie-Français. Vilar resigned in 1963 and was replaced by Georges Wilson, a member of the acting company. In 1966 the TNP opened a Studio Theatre, the Salle Firmin Gémier, to stage experimental works. In 1972, as part of its attempt to decentralize French theatre, the government transferred the TNP's title to Roger Planchon's theatre in Villeurbanne, near Lyon.

**Theatre of ———:** *see under* substantive word (*e.g.,* Absurd, Theatre of the).

**theatres, war of the,** in English literary history, conflict involving the Elizabethan playwrights Ben Jonson, John Marston, and Thomas Dekker. It covered a period when Jonson was writing for one children's company of players and Marston for another, rival group. In 1599 Marston presented a mildly satirical portrait of Jonson in his *Histriomastix.* In 1599 Jonson replied in *Every Man Out of His Humour,* ridiculing Marston's style as "fustian." The same year, Marston's *Jack Drum's Entertainment* presented Jonson, thinly disguised, as a cuckold. The quarrel reached its height in about 1600: Jonson wrote *Cynthia's Revels* (performed *c.* 1600), satirizing Marston and Thomas Dekker; Marston satirized Jonson in *What You Will;* Jonson, anticipating Marston's attack, wrote *Poetaster,* representing Marston as a poetaster and plagiarist and Dekker as a playdresser and plagiarist; Dekker and Marston then lampooned Jonson as the laborious poet. The quarrel had been patched up by 1604, when Marston dedicated *The Malcontent* to Jonson.

Some scholars have seen the quarrel as based on a difference of opinion about the nature of drama; it was certainly sharpened by the intense competition that existed between children's companies at the time, which were so popular that in *Hamlet* Shakespeare refers to the fact that adult actors were forced to undertake provincial tours because of the boys' popularity.

*Consult the* INDEX *first*

**theatricalism,** in 20th-century Western theatre, the general movement away from the dominant 19th-century techniques of naturalism in acting, staging, and playwriting; it was especially directed against the illusion of reality that was the highest achievement of the naturalist theatre.

In the theatricalists' view, to turn one's back on naturalism was to draw inspiration from the spirit of the theatre itself. The then-current picture-frame stage called for passivity of response in audiences and their separation from the actors, lest the spell of illusion be broken. The theatricalists, on the contrary, favoured a platform projecting into the physical space of the audience in order to put the actor in direct, alert contact with the spectators and remove the psychological barriers between them. The theatricalists accepted the obvious truth that the playgoers were in a theatre and that actors were on a stage, carrying out dramatic action with the help of settings that were obviously scenic constructions illuminated by stage lights. They believed that the abolition of barriers between actors and audience was reestablishing full dramatic communication between them. In theatricalist stagings the spectators were expected to accept the frank scenic artifices and conventions laid before them.

Theatricalism attracted designers such as Gordon Craig in England and Robert Edmond Jones and Norman Bel Geddes in the United States. It appealed to such directors as Max Reinhardt and Leopold Jessner in Germany, Jacques Copeau, Louis Jouvet, A.M. Lugné-Poë, Charles Dullin, Gaston Baty, and Georges Pitoëff in France, and Vsevolod Meyerhold, Aleksandr Tairov, and Yevgeny Vakhtangov in the Soviet Union.

Even after the extreme stylization of acting and staging found in the Expressionist, Dadaist, and Surrealist drama of the early part of the century had subsided, theatricalism's frank acceptance of dramatic artifices remained a permanent part of the modern theatre. A basically naturalistic play—*e.g.,* Arthur Miller's *Death of a Salesman* (1949)—alternated scenes of strict realism with scenes of fantasy and was staged in an obviously unrealistic setting.

**Thebaud, Simon:** *see* Simon of Sudbury.

**Thebes,** ancient Egyptian WASE, WO'SE, or (from *c.* 22nd century BC) NOWE, or NUWE, one of the famed cities of antiquity, the capital of the ancient Egyptian empire at its heyday. Thebes lies on either side of the Nile River at approximately latitude 26° N. The modern town of Luxor, or al-Luxor, which occupies part of the site, is 419 miles (675 km) south of Cairo. Ancient Thebes was about six miles square; the main part of the city was situated along the Nile's east bank; along the west bank was "the city of the dead"—an area containing the Egyptian kings' mortuary temples and the houses of those priests, soldiers, craftsmen, and labourers who were devoted to their service.

*History.* The ancient name of Thebes was Wase, or Wo'se. The nome, or province, of Wase, the fourth of Upper Egypt, is known to have existed from the 4th dynasty onward. Although there are a number of tombs dating from the 3rd millennium BC on the west bank, the earliest monuments that have survived at Thebes itself date from the 11th dynasty (2081–1939 BC), when the local nomarchs (governors) united Egypt under their rule. From this time Thebes became the royal capital of Egypt and was called Nowe, or



The Colossi of Memnon, remains of the royal mortuary temple of Amenhotep III
J. Allan Cash

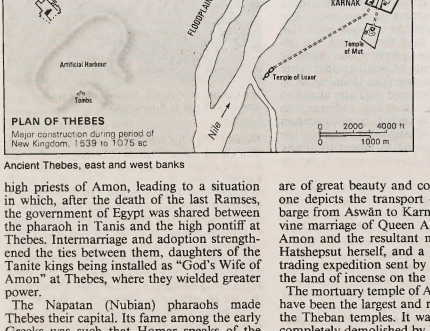
Nuwe ("City [of Amon]"), after its chief god. The Greek name Thebes (Thebai) was derived from Ta-ope, the ancient Egyptian name for Luxor.

During the 12th dynasty (1938–1756 BC), the royal residence was moved to the area of Memphis, but the kings of Egypt continued to honour Amon, their family god, and hence built temples at Thebes. The Hyksos invaders had little or no control over the area, and it was the kings of Thebes who finally drove the Hyksos out of Egypt (*c.* 1530–20). Then began the era of greatest prosperity for Thebes. The 18th-dynasty pharaohs rebuilt it and made it their capital, embellishing its temples with the spoils of Asia and the tribute of Nubia. During the 15th century BC great palaces rose on either bank of the river, brightly painted and surrounded with gardens. Noblemen had their estates round about, and in the crowded streets foreign traders and mercenaries mingled with the citizens. Although their seat of government soon moved north to Memphis, the pharaohs of the New Kingdom vied with each other in building great temples on the east bank and even larger mortuary temples on the west.

The height of Theban prosperity was reached in the 14th century BC in the reign of Amenhotep III, much of whose vast wealth from foreign tribute was poured into the temples of Amon. For a brief period in the reign of his son Akhenaton, Thebes fell on evil times; the city was abandoned by the court, and the worship of Amon was proscribed. With its restoration by Tutankhamen, however, Thebes soon re-

gained its revenues and prestige and retained both through the reigns of Seti I and Ramses II, who still resided in Thebes from time to time. The city continued to be richly endowed; according to ancient sources, Ramses III donated 86,486 slaves and vast estates to Amon's temples.

Under the later Ramessids, Thebes began to decline; the government fell, it seems, into grave economic difficulties. In the reign of Ramses IX, about 1111 BC, a series of investigations into the plundering of royal tombs in the necropolis of western Thebes uncovered proof of corruption in high places, following an accusation made by the mayor of the east bank against his colleague on the west. The plundered royal mummies were moved from place to place and at last deposited by the priests of Amon in the tomb of Amenhotep II and in a tomb-shaft in Dayr al-Bahri. (The finding of these two hiding places was one of the great events of modern archaeological discovery.) Such maladministration in Thebes led to unrest. Control of local affairs tended to come more and more into the hands of the




Ancient Thebes, east and west banks

high priests of Amon, leading to a situation in which, after the death of the last Ramses, the government of Egypt was shared between the pharaoh in Tanis and the high pontiff at Thebes. Intermarriage and adoption strengthened the ties between them, daughters of the Tanite kings being installed as "God's Wife of Amon" at Thebes, where they wielded greater power.

The Napatan (Nubian) pharaohs made Thebes their capital. Its fame among the early Greeks was such that Homer speaks of the wealth of "hundred-gated Thebes." In 663 BC, however, it was sacked by Ashurbanipal's Assyrians, and, although rebuilt by the Saites, it never fully recovered. In Strabo's time (*c.* 63 BC–*c.* AD 21), the city had dwindled to a mere village visited by tourists who came to see the ancient temples.

*Archaeology.* Four of the main complexes of ruins are discussed in separate articles. (*See* Karnak; Luxor; Kings, Valley of the; Queens, Valley of the.) Among the other chief sites of Thebes are the royal mortuary temples. In the New Kingdom, when the pharaohs hid their tombs in the secret Valley of the Kings, ostentation had to be concentrated in their mortuary temples, which rivaled each other in size and magnificence. Although they were designed for the performance of rites connected with the mortuary cult of the builder, they were all dedicated to Amon, the supreme god of Thebes, and had the character and essential form of a New Kingdom temple. They were built in western Thebes on the edge of the valley, in a sequence generally corresponding to a topographical arrangement from north to south. Only traces of most of the earlier ones remain. The most important will be mentioned here.

The temple of Hatshepsut at Dayr al-Bahri is the earliest large 18th-dynasty structure to survive and one of the most impressive. Here in the bay of cliffs, next to the pyramid-temple of Mentuhotep II, the queen's architect Senenmut in about 1473 BC designed a series of colonnades and courts on three levels. The approach from the valley led through an avenue of sphinxes, and in the forecourt was a garden planted with trees and vines. On either side of the sloping ramp leading to the next level, against the terrace face, was a gallery whose roof was supported on a double row of columns; a similar gallery ran along the westward side of the court on the next level, with side chapels dedicated to Anubis and Hathor. The top terrace contained a hall of columns, with further chapels on either side and a sanctuary dug into the cliff behind. Many of the series of reliefs in the colonnades and chapels are of great beauty and considerable interest: one depicts the transport of two obelisks by barge from Aswān to Karnak, another the divine marriage of Queen Ahmes with the god Amon and the resultant miraculous birth of Hatshepsut herself, and a third the maritime trading expedition sent by the queen to Punt, the land of incense on the Red Sea.

The mortuary temple of Amenhotep III must have been the largest and most splendid of all the Theban temples. It was, however, almost completely demolished by later pharaohs, and all that is left today are a few foundations, a huge stela 30 feet (9 m) high, and the two great statues known as the Colossi of Memnon, which once flanked the gateway in front of the temple pylon but now sit like lonely sentinels in the middle of cultivated fields. The statues represent Amenhotep III; with their crowns they were nearly 70 feet (21 m) high, each hewn from a single block of stone. The northern one was the "singing Memnon" celebrated in classical times because on certain days, shortly after sunrise, it emitted a curious high note; numerous Roman tourists, including the emperor Hadrian and his wife Sabina, came to Thebes to hear this marvel, but in the reign of Septimius Severus the statue was patched with masonry and never "sang" again.

The temple of Seti I at Qurnah survives only in part, the forecourt and pylon having disappeared. It was dedicated in part to the funerary cult of Ramses I, the father of Seti, and was completed by Seti's son Ramses II, who figures in the reliefs. The walls are decorated with scenes of purely religious content in which the pharaohs make offerings to various gods or are favoured by them.

The Ramesseum, or mortuary temple of Ramses II (Ramses the Great), though much ruined, retains some of its ancient grandeur. The wide outer pylon is decorated with vigorous scenes of the king's wars against the Hittites in Syria, and the inner pylon with episodes from the Battle of Kadesh and scenes from the festival of the harvest god, Min. Tall figures of the king in the guise of Osiris decorate the pillars of the inner court. In the first court stood a seated colossus of Ramses II; only fragments of it are left, but enough to show that it was of enormous size. It must have been more than 60 feet (18 m) high and weighed about 1,000 tons. The hypostyle hall beyond the second court is similar in design to that of the temple of Karnak; beyond were further pillared halls and a sanctuary that has now disappeared. Around the temple, within the high brick enclosure wall, are very extensive remains of vaulted buildings that must have been magazines, stables, workshops, and houses belonging to the temple staff. Diodorus Siculus describes the Ramesseum under the name of "the Tomb of Ozymandias" (i, 47–49).

The temple of Ramses III at Madīnat Habu is the latest and most southerly of the great New Kingdom mortuary temples. The general plan was modeled on that of the Ramesseum: a wide front pylon, an outer and an inner peristyle court separated by a second pylon, a large pillared hall and two smaller vestibules, and the sanctuary surrounded by smaller rooms. The hypostyle hall is partly ruined, the pillars having been dismantled to the level of the first or second drums, but the temple is otherwise well preserved. Scenes carved on the walls of the inner halls show the king performing acts of worship before the gods. There are also scenes of battle in which the king in his chariot mows down the Libyans, attacks an Amorite city, and leads Libyans, Asians, and sea raiders as prisoners before Amon and Mut. On the external wall of the temple, a great sea battle between Egyptians and the Peleset (Philistines) and other "peoples of the sea" is depicted with much lively detail. Another outstanding relief is that on the outer face of the great pylon, which shows the pharaoh hunting wild cattle in a reedy, marshy landscape. Adjoining the temple are the remains of a palace. The high gate in the eastern side of the perimeter wall of the temple area is battlemented like a fortress. Within the precinct are other, smaller temples: one dates from the reign of Thutmose III and Hatshepsut but was altered and added to in various reigns and during the Ptolemaic and Roman periods. There are also several mortuary chapels, a sacred lake, a well, and remains, as in the Ramesseum, of houses and vaulted magazines built of mud brick.

South of the temple of Madīnat Habu stand the ruins of what must have been one of the finest buildings in western Thebes: the palace of King Amenhotep III and Queen Tiy at Malkata. It is in fact four palaces, one of which was occupied by Tiy. There was also a vast artificial lake, still traceable by a line of mounds to the southeast of Malkata, which may have been a harbour for shipping connected with the Nile.

In ancient Egypt there were other great cities, but none that has left so great a legacy to posterity. The great temples of Thebes with their historical scenes and inscriptions, the tombs with their wealth of illustration of daily life and religious belief, and the countless antiquities that now fill the museums and private collections of the world, are all aspects of

that legacy. Few other sites have contributed more to the store of knowledge about early civilizations than that of ancient Thebes.

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**Thebes,** Modern Greek **THÍVAI,** major city of Boeotia *nomós* (department), northwest of Athens, Greece, and one of the chief cities and powers of ancient Greece. On the acropolis of the ancient city stands the present commercial and agricultural centre of Thebes. It is situated on a low ridge dividing the surrounding plain; the modern city is the seat of the Greek Orthodox bishop of Thebes and Levádhia. It has abundant springs of water, the most famous in antiquity being called Dirce, and the fertile plain in the vicinity is well irrigated.

Thebes was the seat of the legendary king Oedipus and the locale of most of the ancient Greek tragedies—notably Aeschylus' *Seven Against Thebes* and Sophocles' *Oedipus the King* and *Antigone*—and of other compilations about the fate of Oedipus, his wife-mother, and his children.

Said to have been occupied originally by Ectenians under the leadership of Ogyges (Ogygus), Thebes is called Ogygion by some classical poets. Greek legend attributes the founding of the ancient citadel, Cadmea, to the brother of Europa, Cadmus, who was aided by the Spartoi (a race of warriors sprung from dragon's teeth that Cadmus had sown). The building of the celebrated seven-gated wall of Thebes is usually attributed to Amphion, who is said to have charmed the stones into moving by the playing of his lyre. Archaeological evidence indicates that the site was inhabited in both the early and late Bronze ages. The ruined 15th-century-BC Minoan-style palace at Cadmea was adorned with frescoes of Theban women in Minoan dress; some Cretan vases also suggest contacts between Thebes and Knossos in the period 1450–1400 BC. In 1970 clay tablets confirming Mycenaean-Minoan links were found, while the discovery of Mesopotamian cylinder seals in 1964 strengthened the theory that Cadmus introduced writing to Greece.

Thebes rivaled Argolís as a centre of Mycenaean power until its palace and walls were destroyed shortly before the Trojan War (*c.* 1200 BC). According to tradition, the city was destroyed by the sons of the Seven about whom Aeschylus wrote. Knowledge of succeeding centuries is sparse. Immigration produced a Boeotian mixed stock, including the Aegeids, a Dorian clan, and an oligarchy of large estates was regulated by laws passed about 725. In the 6th century a league of Boeotian cities was formed; it was dominated by Thebes from the 5th century. Hostility to Athens over mutual interest in the Plataea district led in the 5th century to Theban collaboration with Persia and, later, with Sparta. A Theban suggestion at the end (404) of the Peloponnesian War that the Spartans annihilate the Athenians was rebuffed; the two powers clashed, and Sparta, winning, disbanded the Boeotian League (386) and occupied Cadmea (382).

Revolting after 379, Thebes reorganized the league along democratic lines and defeated Sparta at Tegyra (375) and Leuctra (371). For the next 10 years Thebes was the first military power in Greece; its commander Epaminondas invaded the Peloponnese (370–362) and died at the Battle of Mantineia (362). A rapid decline followed, and in 346 civil strife forced Thebes to admit Philip II of Macedon. Still fickle, Thebes broke confidence with Philip and in 338 was defeated at Chaeronea; the Boeotian League was again dissolved, and Thebes was garrisoned by Macedonian troops. After a massacre and almost total destruction in a fruitless uprising (336) against Alexander the Great, Cassander rebuilt Thebes in 316. The city's fortunes wavered between independence and subjugation. From about 280 it was once more part of the revived Boeotian League, forming regional alliances as required. For its participation in the Achaean revolt, the city eventually fell under Rome and was stripped of half its territory in 86 by the Roman general Sulla.

The historian Pausanias (2nd century AD) reported Cadmea still inhabited, but the town was overrun by a succession of conquerers and adventurers. In Byzantine and Frankish times it prospered as an administrative and commercial centre, particularly for silk weaving. It had a large Jewish colony in the 12th century. Throughout the Turkish occupation (1435–1829), it was only a poor village, and in the 19th century it was destroyed by an earthquake and rebuilt. Few artifacts of its earliest days survive.

The present city is the chief market town of a rich agricultural plain, trading in wheat, olive oil, wine, tobacco, and cotton, as well as silk manufacture. It is linked by rail to Athens. Among the few ancient ruins are remnants of the city walls, the palace of Cadmus (*c.* 1450–1350 BC), and the Ismeneion, or temple of Apollo Ismenius. Pop. (1991 prelim.) 18,191.

**thecodont,** any member of an order (Thecodontia) of primitive archosaurs ("ruling reptiles") that is thought to include the ancestral stock of all other archosaurs, including birds, all dinosaurs, pterosaurs (extinct flying reptiles), and crocodilians (members of the reptilian order that includes crocodiles, alligators, and caimans).

The name thecodont means "socket-toothed." The order has an extensive fossil record; thecodonts were distributed throughout the world during the Triassic Period (from 245 to 208 million years ago). There is a general trend toward a more upright stance. Some early thecodonts had four feet; others, however, had elongated hind legs, a modified hip structure, and other features that suggest they were becoming adapted to a bipedal mode of life.

**Theebaw** (king of Myanmar [Burma]): *see* Thibaw.

**theft,** in law, crime of taking another person's property without his consent. It is a general term covering the specific crimes of larceny, robbery, and burglary.

Larceny is the trespassory taking and carrying away of personal goods from the possession of another with intent to steal. There must be a trespassory taking; that is, the goods must be taken from the possession of another without his consent. And the goods must not only be taken but also "carried away." The latter requirement is highly formalistic and is satisfied by any movement of the entire object, however slight. Finally, there must be an intent to steal, which is ordinarily defined as an intent to deprive the owner permanently of his property. An unauthorized borrowing of another's property is not larceny if there is an intent to return the property. Moreover, one who takes goods erroneously believing them to be his own does not commit a criminal offense.

Robbery is an aggravated form of larceny involving violence or the threat of violence directed against the victim in his presence. The penalty for robbery is always more severe than that for larceny.

Burglary is defined as the breaking and entering of the premises of another with an intent to commit a felony within. Breaking consists not only in the breaking of some external portion of the building but also in the opening of a closed door or window. Any entry, however slight, is sufficient, including thrusting the hand or even an instrument into the building. Only the intent to commit a felony, not its actual consummation, is required. Possession of burglary tools with intent to commit burglary is a common statutory offense. Housebreaking originally covered daytime entries, whereas burglary was limited to nighttime thefts; but burglary has been extended to cover all hours of the day and to cover buildings other than houses, as well as automobiles.

Although many legal systems continue to separate thefts into categories, some jurisdictions, especially in the United States, have begun to consolidate them under the general title of theft, leaving for the court the chore of fitting an offense into the proper category.

Two types of offense usually distinguished from theft are embezzlement and fraud. In the former, the offender carries away goods the possession of which had been legally entrusted to him; in the latter, the possession of goods is obtained with the consent of the victim through misrepresentation.

**thegn** (Anglo-Saxon lord): *see* thane.

**Theiler, Max** (b. Jan. 30, 1899, Pretoria, S.Af.—d. Aug. 11, 1972, New Haven, Conn., U.S.), American microbiologist who won the 1951 Nobel Prize for Physiology or Medicine for his research on yellow fever. Theiler's discovery that mice are susceptible to yellow fever facilitated research and eventual development of a vaccine against the disease in humans.

Theiler received his medical training at St. Thomas' Hospital, London, and the London School of Hygiene and Tropical Medicine, graduating in 1922. In that year he joined the department of tropical medicine at the Harvard Medical School, Boston. There his studies of infectious diseases, among them yellow fever, led to development of the first attenuated strain of the virus. From 1930 to 1964 Theiler continued his research at the Rockefeller Institute for Medical Research (now Rockefeller University), New York City, where with his associates he developed the improved (17-D) vaccine, widely used for human immunization against yellow fever.

**theileriasis,** any of a group of livestock diseases caused by protozoan parasites of the genus *Theileria* (*Gonderia*), transmitted by tick bites. The most serious is East Coast fever of cattle, caused by *T. parva;* it has 90–100 percent mortality in Africa. Tropical theileriasis, from *T. annulata* (*T. dispar*), is a milder disease of cattle along the Mediterranean and in the Middle East. Theileriases of sheep and goats are mild diseases that occur in Africa, the Balkans, and the Caucasus. The elimination of ticks reduces the incidence of the disease. Infected animals are given drug therapy.

**theism,** the view that all limited, or finite, things, though fully real in their own right, are dependent in some way upon, yet distinct from, one supreme or ultimate being, of which one may also speak in personal terms. In religions, one speaks of this being as God, who is regarded as beyond human comprehension, perfect, and self-sustained but also peculiarly involved in the world and its events.

A brief treatment of theism follows. For full treatment, *see* MACROPAEDIA: Religious and Spiritual Belief, Systems of.

Theists characteristically seek support for their contentions in rational argument and ap-

peals to experience. In the history of Western thought, this has given rise to several types of arguments for the existence of God. The four primary types are the cosmological, teleological, ontological, and moral arguments. Frequently these arguments are propounded in combination.

Cosmological arguments begin with a recognition of particular features of the world, or of the fact of its existence, and then infer God as the ultimate cause. The world is seen as dependent upon some being beyond it for its intelligibility and existence. The classic statement of the cosmological argument was given by Thomas Aquinas in his *Summa Theologica* (Part I, Question ii, art. 3).

The teleological argument proceeds from an observation of the functional order of the universe whereby things in the world function toward ends or goals. One version of this argument is, strictly speaking, a form of cosmological argument since it depends upon a notion of final causality, holding that purposeful actions must be ultimately designed or directed by an intelligent purposive being. This argument received its clearest expression in David Hume's critical analysis of the argument from design, in which the universe is seen as an orderly machine.

The ontological argument attempts to show that the concept of God implies the necessity of God's existence. The classic statement of this argument is found in Anselm's *Proslogion,* which defines God as "that than which nothing greater can be conceived." One form of this argument is based on the claim that existence is a perfection among others and that, since God embraces all perfections, God must exist. This argument commonly falls under the criticism that existence is not a predicate that can be attributed or denied. Another form of ontological argument asserts that God can only be conceived as a necessary being and therefore cannot be conceived as nonexistent or merely possible.

The moral argument was developed by Immanuel Kant. This argument rests upon the experience of obligation or moral duty. Kant argued that for morality to be rationally justified and hold an influence over human actions, it must be assumed that obedience to obligation will coincide with happiness. Thus, a God must be postulated as the being who rewards worthiness and enables moral life to be rationally understood.

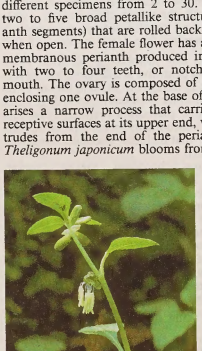
It is generally agreed that none of these arguments prove the existence of God in any strict sense. All depend upon certain disputable presuppositions. Such "proofs" are generally seen as means of examining the logical correlates of belief or disbelief.

Although conceptions of God vary greatly with cultural, religious, and historical circumstances, there are some features common to theistic claims. Theism commonly views God as somehow caringly related to the world. This has generally been expressed in some analogy of God to a personal being. Theism has also tended to affirm both the immanence and the transcendence of this ultimate being. Other attributes of God, such as infinity, eternity, omniscience, and omnipotence, are treated by theists in accordance with analogies drawn from human experience. A major problem is to understand how finite and imperfect characteristics can be understood as existing perfectly in God. Another central issue is that of reconciling the claims that God is both omnipotent and perfect with the existence of evil in the world. The problem of evil exists as such only upon the assumption that the universe is the expression of a divine ground and thus primarily concerns the divine nature and not God's existence.

While no doctrine of God is independent of the ideas and beliefs found in the historical religious traditions, theism represents a constructive philosophical position not to be identified with any particular religion. Frequently, a theistic line of thought has developed within a particular religion. Thus, for example, one can speak of Christian theism or of theistic interpretations of Hinduism. Theism thus appears both as a philosophico-theological position in its own right and as an identifiable strain of thought within institutional theologies.

Theists have responded quite variously to the questions regarding the nature and attributes of God. They have encountered criticism from those who deny the ability of reason beyond ordinary experience, those who reject the role of reason in favour of revelation alone, and those who accept the rational method but reject the theistic conclusions. Nevertheless, theists continue to use rational argument to support their contentions that a God exists who is creative and sustaining of the world and toward whom the world is directed in a purposeful manner.

**Theligonales,** problematic order of dicotyledonous flowering plants containing one family (Theligonaceae, sometimes called Cynocrambaceae) and one genus (*Theligonum*) with three species distributed in the Canary Islands, Mediterranean region, southwestern China, and Japan. The plants are somewhat succulent (fleshy) herbs with separate male and female flowers on the same plant. Male flowers usually have 7 to 12 stamens (pollen-producing structures), but the number may vary in different specimens from 2 to 30. There are two to five broad petallike structures (perianth segments) that are rolled back (revolute) when open. The female flower has an oblique membranous perianth produced into a tube with two to four teeth, or notches, at the mouth. The ovary is composed of one carpel enclosing one ovule. At the base of the ovary arises a narrow process that carries pollen-receptive surfaces at its upper end, which protrudes from the end of the perianth tube. *Theligonum japonicum* blooms from April to June in the woody, mountainous regions of Japan.



*Theligonum japonicum*
© Hiroshi Kihara/Nature Production, Tokyo

The order bears uncertain relationship to other orders. It has been placed near the orders Haloragales, Rubiales, and Caryophyllales by various authorities at various times.

**Thelodus,** extinct genus of early and primitive jawless vertebrates that is known from impressions on rocks of Silurian age in Europe and North America, although the genus persisted into the Early Devonian epoch (the Silurian period began 438 million years ago and ended 408 million years ago). The structure of *Thelodus* and its relatives, the coelolepids, is poorly known; but it is probable that the body was encased by tiny bony denticles. *Thelodus* was more agile than its contemporaries, who were encased in thick bony armour.

**Thelon River,** stream in eastern Fort Smith and central Keewatin regions, Northwest Territories, Canada, draining a major portion of the Barren Grounds (a sub-Arctic prairie region). Arising from several lakes, including Whitefish and Lynx, east of Great Slave Lake, the river flows through Thelon Game Sanctuary (where there are musk-oxen) in an easterly direction for 562 miles (904 km), draining Beverly, Aberdeen, Schultz, and Baker lakes before emptying into the west end of the 140-mile- (225-kilometre-) long Chesterfield Inlet, an arm of the Hudson Bay. The Canadian geologist Joseph B. Tyrrell and his brother James explored the river and its main tributaries, the Dubawnt and Kazan rivers, in 1893–98. The vast tundra region, inhabited by a dispersed Eskimo population and drained by the Thelon, is served by the Hudson's Bay Company trading posts of Baker Lake (known for its Inuit Eskimo tapestry) and Chesterfield Inlet.

**Themba, Can,** byname of DANIEL CANADOISE DORSAY THEMBA, also called CAN VON THEMBA (b. 1924, Pretoria, Transvaal, S.Af.—d. 1969, Manzini, Swaziland), South African journalist and short-story writer associated with a brilliant group of young South African writers in the 1950s that included Moses Motsisi, Arthur Maimane, Ezekiel Mphahlele, and Lewis Nkosi.

After graduating from the University of Fort Hare, S.Af., Themba worked as a reporter and later editor on the magazine *Drum* and the weekly *Golden City Post* in Johannesburg. His stories won several prizes, including the 1953 Drum Award. His journalistic viewpoint conditioned all his writing. His short stories are anecdotes and vignettes depicting the harsh and depressing conditions of African life in the Johannesburg townships. They have a lively and perceptive wit, but their jaunty tone cannot conceal the self-lacerating cynicism that was required in order to survive under the existing social conditions. Some critics saw his apparent flippancy as evidence of a lack of commitment. Mphahlele even accused him of writing "poor Hollywood imitations." Nevertheless, Themba's work has a lively force that illuminates the milieu in which he lived.

Themba left Johannesburg in the early 1960s to become a schoolteacher in Swaziland, where he died. His best pieces were posthumously collected in *The Will to Die* (1972).

**Thembu** (people): *see* Tembu.

**theme,** in music, short melody or melodic phrase developed in a musical composition. *See* melody.

**theme,** Greek THEMA, in the Byzantine Empire, originally, a military unit stationed in a provincial area; in the 7th century the name was applied to large military districts formed as buffer territories against Muslim encroachments in Anatolia.

The organization of territory into themes began under Emperor Heraclius (reigned 610–641), who stationed troops in three large districts under the command of military governors (*stratēgoi*). Soldiers were settled in the themes as farmers, helping to build a permanent citizen army.

In the 7th century there were four themes: Armeniakon (northeast Anatolia), Anatolikon (central Anatolia), Opsikion (northwest Anatolia), and Carabisiani (southwest Anatolia and adjacent islands). By the 9th century the system was extended to the whole empire, and there were five in Anatolia, four in Europe, and one maritime theme. By the 10th century they had been further subdivided into 29, and by the end of the 11th century there were 38 themes.

In the 11th century they began to lose their military character, as the farmer-soldiers were

allowed to commute their military service by paying a tax. The *stratēgoi* lost power as the empire weakened and the praetors, representatives of the civil power, grew in influence. The disintegration of the theme organization contributed to the collapse of the empire.

**Themis** (Greek: Order), in Greek religion, personification of justice, goddess of wisdom and good counsel, and the interpreter of the gods' will. According to some sources, she was



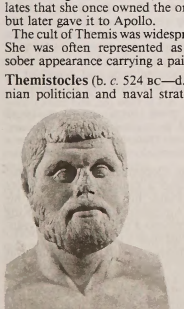
Themis, classical Greek sculpture; in the National Archaeological Museum, Athens

By courtesy of the National Archaeological Museum, Athens

the daughter of Uranus (Heaven) and Gaea (Earth), although at times she was apparently identified with Gaea. She was Zeus's second consort and by him the mother of the Horae (*q.v.*), the Moirai, and, in some traditions, the Hesperides (*q.v.*). On Olympus, Themis maintained order and supervised the ceremonial. She was a giver of oracles, and one legend relates that she once owned the oracle at Delphi but later gave it to Apollo.

The cult of Themis was widespread in Greece. She was often represented as a woman of sober appearance carrying a pair of scales.

**Themistocles** (b. *c.* 524 BC—d. *c.* 460), Athenian politician and naval strategist who was



Themistocles, Roman copy of a Greek herm, possibly *c.* 465–460 BC; in the Scavi di Ostia Museum

By courtesy of the Gabinetto Fotografico Nazionale del Ministero Della Pubblica Instruzione, Rome

the creator of Athenian sea power and the chief saviour of Greece from subjection to the Persian Empire at the Battle of Salamis in 480 BC.

*Early life.* Themistocles' father, Neocles, came of the aristocratic Lycomid family and was not poor, but his mother was a concubine, non-Athenian, possibly non-Greek. He thus owed his citizenship to the legislation of Cleisthenes, which, in 508, had made citizens of all free men of Athens. This no doubt contributed to his democratic sympathies. In 493 he was elected archon, the chief judicial and civilian executive officer in Athens; this is the first recorded event of his life. As archon, he sponsored the first public works destined to make the defensible rocky bays of Piraeus, five miles from Athens, into harbours, replacing the nearer but unprotected beaches of Phaleron. He must also have been concerned in the trial of Miltiades, the great colonial Athenian prince, who arrived in flight from the Chersonese (Gallipoli) and was prosecuted by aristocratic rivals for having ruled there as a monarch. Themistocles himself took a cool view of Miltiades' autocratic character, but his judgment was not at fault if he helped to save the strategist and tactician who, in 490, beat off the first Persian attack on Athens at Marathon.

*Advocacy of a large navy.* After Marathon, most Athenians thought that the danger was past, but not Themistocles. He also saw that Marathon—a victory for Athens' spearmen, middle-class men who could afford the costly bronze panoply—could not be repeated if the enemy, strong in archers and cavalry, came again in much greater force. The only hope was to exploit the invader's supply difficulties, which would be great if Persia's naval allies, including the formidable Phoenicians, could be beaten at sea. To carry out this strategy, however, Greece needed far more warships—the newly developed, specialized triremes—than it then had. Themistocles urged that the Athenian fleet, then 70 strong, be doubled or trebled, but he was opposed. The opposition was not without political overtones. Building a strong navy would require the wealthy to pay higher taxes to purchase new ships while giving political weight to the men who rowed the galleys, the poorer voters. Maintaining a land-oriented defense, by comparison, would cost less and would increase the status of the infantry, whose ranks were drawn primarily from the middle class.

The 480s were a period of intense political struggle. Miltiades died in disgrace (489), and from 487 to 483 other leaders were successively ostracized. Though never himself defeated, Themistocles must have been attacked repeatedly; he was the man accused by his enemies of being a danger to the established order. Nonetheless, in 483 he won his greatest triumph. The state-owned silver mines near Sunium were the site of a rich strike, and he persuaded the assembly, instead of "declaring a dividend," to devote the whole surplus to increasing the navy. Thus when Xerxes I, the Persian king, marched in 480, Athens had 200 triremes, though many of the rowers were still untrained.

Themistocles further succeeded in selling his naval strategy to the Peloponnesians, headed by Sparta, who could raise another 150 triremes. The combined fleet was to fight not on their own doorstep, as Greeks preferred to do, but as far forward as possible, exploiting the geographical situation. Serving under a Spartan admiral (since Corinth and Aegina would not serve under an Athenian), Themistocles conducted the main fleet to the straits north of Euboea. Here their presence forced the enemy to approach en masse down a coast with few beaches, and a typical north Aegean storm there inflicted losses that probably, in the end, proved decisive. The Greeks were still outnumbered, however. In the Battle of Artemisium, fighting in a defensive half-moon formation, they suffered as well as inflicted heavy losses, and they knew that they must retire even before they heard that their small holding force on land had been destroyed at Thermopylae.

*Battle of Salamis.* One hope remained. Themistocles had persuaded the Athenians to evacuate women and children to the Peloponnese and, in the last resort, to retire to Salamis. If the Persians attacked that island citadel, a battle in the narrow sound might yet give a chance to the Greeks, with their armoured marines and heavier ships, against the better sailing ships commanded by the Persians. Persuading the Peloponnesians to join the Athenian fleet, Themistocles then lured Xerxes by a false message, suggesting that he himself was ready to change sides, into ordering an all-out attack. The Greeks enveloped the head of the Phoenician column as it emerged from the narrowest part of the strait and destroyed it; and though most of the other Asian contingents in the rear escaped, Xerxes had lost for good the command of the sea.

Sparta honoured Themistocles with a great ovation; but Athens, led during the crisis by the Areopagus, or council of nobles, gave the chief commands in 479 to the recalled exiles, Aristides and Xanthippus, and Themistocles' postwar history was a sad one. He outwitted the Spartans when they attempted to prevent Athens from rebuilding its defensive walls, but he failed to induce the people either to transfer their capital to Piraeus or, at that time, to reduce the powers of the Areopagus. The people, after their tremendous war effort, were in a mood of reaction. Though praised (not by name) in Aeschylus' *Persians* (472), Themistocles was at last ostracized. He lived at Argos for some years, during which democracy made headway in some parts of the Peloponnese. Sparta then accused him of complicity in alleged intrigues with Persia. He escaped, and, until his death in about 460, served as governor of some Asian Greek cities still subject to the son of Xerxes.

*Assessment.* Themistocles is often unfavourably viewed by early writers. Admittedly a master strategist, he is often depicted as a slick politician, bent on enriching himself even in the crisis of the great war. The reason for this bias is perhaps that he was a strong democrat, hated by the Athenian upper classes, and their views, passed on to their friend the historian Herodotus and to Plato, himself an aristocrat, colour the whole tradition. Herodotus introduces him only at the onset of the crisis as "newly come to the front" (which is wrong) and drops him from his story at the end of 480. Only the historian Thucydides does him justice and calls the darkest charges against him "alleged."

(A.R.Bu.)

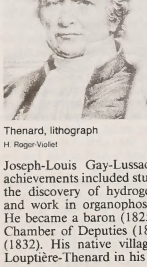
BIBLIOGRAPHY. The histories by Herodotus and Thucydides are primary. The *Life* by Plutarch is based on sources of various quality and must be used critically. Full discussions and a bibliography may be found in Peter Green, *The Year of Salamis, 480–479 B.C.* (1970), who uses and often disagrees with A.R. Burn, *Persia and the Greeks* (1962).

**Thenard, Louis-Jacques** (b. May 4, 1777, La Louptière, Fr.—d. June 21, 1857, Paris), French chemist, teacher, and author of an influential four-volume text on basic chemical theory and practice (1813–16).

A peasant's son, Thenard endured extreme hardships to gain his scientific education. His several teaching posts were obtained through the influence of Nicolas-Louis Vauquelin, who also arranged Thenard's succession to his own chair in chemistry at the Collège de France in 1802. He later taught at the École Poly-

technique and the Sorbonne and eventually became chancellor of the University of Paris.

In 1799 he discovered Thenard's blue, a pigment used in the colouring of porcelain. He did much notable research with his friend



Thenard, lithograph
H. Roger-Viollet

Joseph-Louis Gay-Lussac. His independent achievements included studies of esters (1807), the discovery of hydrogen peroxide (1818), and work in organophosphorus compounds. He became a baron (1825), a member of the Chamber of Deputies (1828–32), and a peer (1832). His native village was renamed La Louptière-Thenard in his honour (1865).

**thenardite,** any of a type of sodium sulfate mineral ($Na_2SO_4$) that has been deposited as an evaporation product near salt lakes and playas, as in the arid regions of northern Africa, Siberia, Canada, and the western United States. It is widespread as an efflorescence on arid soil and as a crust in volcanic fumarole deposits. For detailed physical properties, *see* sulfate mineral (table).

**Theobald,** French THIBAUD, or THIBAUT, name of rulers grouped below by country and indicated by the symbol •.

BLOIS

•**Theobald I,** also called THEOBALD THE CHEAT, or THE OLD, French THIBAUD LE TRICHEUR, or LE VIEIL (b. *c.* 908—d. *c.* 978), count of Blois, Chartres, and Tours.

Theobald earned his nickname "the Cheat" fighting with his neighbours, among them the kings of France, the dukes of Normandy, and the church of Reims. He seized the area around Blois about 940 and later augmented his holdings with the counties of Chartres and Châteaudun. In 945 Hugh the Great made Theobald responsible for holding the French king Louis IV prisoner.

•**Theobald IV,** also called THEOBALD THE GREAT, French THIBAUD LE GRAND (b. 1093—d. *c.* Jan. 10, 1152, Lagny-sur-Marne, France), count of Blois and of Chartres (from 1102) and count of Champagne (from 1125) as Theobald II. He was the grandson of Theobald III of Blois. Theobald IV reunited Champagne with Blois and thus again made his house a threat to the royal domains of France from both east and west. He became in effect the second person of France, alternatively the ally and the enemy of Louis VI and Louis VII. He helped his brother Stephen become king of England (1135). The countship was at the zenith of its power.

CHAMPAGNE

•**Theobald II:** *see* Theobald IV (Blois).

•**Theobald IV:** *see* Theobald I (Navarre).

NAVARRE

•**Theobald I,** also called THEOBALD THE TROUBADOUR, or THE POSTHUMOUS, French THIBAUD LE CHANSONNIER, or LE POSTHUME, Spanish TEOBALDO EL TROVADOR, or EL PÓSTUMO (b. May 30?, 1201, Troyes, France—d. July 7?, 1253, Pamplona, Navarre [now in Spain]), count of Troyes and of Champagne (from 1201), as Theobald IV, and king of Navarre (from 1234), the most famous of the aristocratic trouvères.

He was the son of Theobald III of Champagne, who died before his son was born, and Blanche of Navarre. He lived for four years at the court of King Philip II of France, to whom he did feudal homage in 1214. After Philip's death (1223), he supported Philip's son Louis VIII but deserted him in 1226 at the siege of Avignon, conducted by the king as part of his campaign against the Albigenses, a religious sect deemed heretical. On the death of Louis a few months later, Theobald joined a dissident league of barons who opposed Louis's widow and regent of France, Blanche of Castile. He soon abandoned the league and became reconciled with Blanche. It was rumoured that he was her lover and had poisoned her husband, and many of his poems are thought to be addressed to her. He led the crusade of 1239–40 and, after his return, spent the rest of his life in Champagne and Navarre.

Theobald left about 60 lyrics, mainly love songs and debates in verse, with two *pastourelles* (love songs between knight and shepherdess) and nine religious poems. Perhaps he found his true level in the *jeu-parti* (courtly love debate) in which he discusses with a crony from the crusades whether it is better to embrace one's love in the dark or to see her without embracing her, with wry allusions to the crony's crutch and his own potbelly. Theobald's lyrics, with their music, have survived in six manuscripts.

**Theobald** (b. *c.* 1090, near Bec, Normandy [France]—d. April 18, 1161), archbishop of Canterbury from 1138, prominent during the reigns of kings Stephen and Henry II of England.

Theobald entered the abbey of Bec in Normandy, became prior (*c.* 1127), was elected abbot in 1136, and was chosen archbishop of Canterbury in 1138. From 1139 to 1143 he was overshadowed by Henry of Blois, bishop of Winchester, who had secured the office of papal legate with powers equal or superior to those of the archbishop. Politically, Theobald was a cautious conformist, generally obedient to Stephen, but, when the king wished his son Eustace to be crowned to secure his succession, Pope Eugenius III forbade Theobald to carry out the rite, and the archbishop was forced to flee (1152). Soon reinstated, Theobald played a leading part in negotiating the treaty that brought Henry of Anjou to the throne, but after the crowning of Henry II (1154) the rest of his episcopate was uneventful.

He was a highly competent administrator but not a great spiritual leader; his household produced four archbishops and six bishops. Theobald is chiefly famous as patron of Thomas Becket, whom he made archdeacon of Canterbury, and of John of Salisbury, the historian and philosopher. He is also known for bringing to Oxford Vacarius, the Mantuan jurist who laid the foundations of the serious study of Roman law in England.

**Theobald, Lewis** (baptized April 2, 1688, Sittingbourne, Kent, Eng.—d. Sept. 18, 1744, London), the first Shakespearean editor to approach the plays with the respect and attention then normally reserved for classical texts.

When in 1726 Theobald brought out his *Shakespeare restored; or, a Specimen of the many Errors as well committed as unamended by Mr. Pope, in his late Edition of this poet,* Alexander Pope, whose edition of William Shakespeare had appeared a year earlier, was enraged and made Theobald the chief target of his satirical poem *The Dunciad.* In 1734 Theobald produced his own edition of Shakespeare in seven volumes, often using Elizabethan parallels as a guide to some brilliant emendations.

**Theobald, Simon:** *see* Simon of Sudbury.

**theobroma oil:** *see* cocoa butter.

**theobromine,** diuretic drug and major alkaloidal constituent of cocoa. Theobromine is a xanthine alkaloid, a methylxanthine, as are caffeine and theophylline, but it differs from them in having little stimulatory action upon the central nervous system. The stimulant effect of cocoa results from the caffeine that it contains rather than from the theobromine.

**Theocritus** (b. *c.* 300 BC, Syracuse, Sicily [Italy]—d. 260 BC), Greek poet, the creator of pastoral poetry. His poems were termed *eidyllia* ("idylls"), a diminutive of *eidos,* which may mean "little poems."

There are no certain facts as to Theocritus' life beyond those supplied by the idylls themselves. Certainly he lived in Sicily and at various times in Cos and Alexandria and perhaps in Rhodes. The surviving poems by Theocritus that are generally held to be authentic comprise bucolics and mimes, the scenes of which are laid in the country, and epics, lyrics, and epigrams, which are set in towns.

The bucolics are the most characteristic and influential of Theocritus' works. They introduced the pastoral setting in which shepherds wooed nymphs and shepherdesses and held singing contests with their rivals. They were the sources of Virgil's *Eclogues* and much of the poetry and drama of the Renaissance and were the ancestors of the famous English pastoral elegies, John Milton's "Lycidas," Percy Bysshe Shelley's "Adonais," and Matthew Arnold's "Thyrsis." Among the best known of his idylls are *Thyrsis* (Idyll 1), a lament for Daphnis, the original shepherd poet, who died of unrequited love, and *Thalysia* ("Harvest Home," Idyll 7), describing a festival on the island of Cos. In this the poet speaks in the first person and introduces contemporary friends and rivals in the guise of rustics.

Theocritus' idylls have none of the artificial prettiness of the pastoral poetry of a later age. They have been criticized as attributing to peasants sentiments and language beyond their capacity. There is something in the criticism, but comparison with modern Greek folk songs, which owe little to literary influences, reveals striking resemblances between them and Theocritus' bucolics, and there can be little doubt that both derive from real life. That life, set in a Mediterranean scenery of flowers, sun, sea, and mountainside and described by a master of style, will never lose its charm.

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**Theodahad** (d. December 536), Ostrogothic king of Italy and a philosopher who wrote a treatise on Plato; his assassination of his cousin Queen Amalasuntha, daughter of King Theodoric, furnished a pretext for the Byzantine emperor Justinian I to invade Italy.

The son of Theodoric's sister, Theodahad was invited to share the throne with Amalasuntha in 534, after the death of her son. Theodahad accepted the title of king, but Amalasuntha, who opposed the Ostrogoth nationalist faction and was friendly with the Byzantine emperor, continued to rule as she had during her son's minority. In 535 the queen was seized and carried off to an island in Lake Bolsena, near Orvieto; shortly thereafter she was strangled in her bath by assassins, with Theodahad's complicity. Under the guise of championing the murdered queen, Justinian dispatched his general Belisarius, who took Sicily and Naples and marched on Rome late in 536. Theodahad, deposed by the threatened Goths at an armed conclave in the Pontine marshes, fled

toward Ravenna, but he was captured and killed by a Goth on the Via Flaminia.

**Theodebald,** also spelled THEUDEBALD, French THÉODEBALD, or THIBAUD (d. 555), Merovingian king of Reims from 547 or 548, in succession to his father, Theodebert I. He proved incapable of continuing the latter's dynamic policies. He left no son, and on his death his kingdom passed to his granduncle, Chlotar I.

**Theodebert,** also spelled THEUDEBERT, French THIBERT, or THÉODEBERT, name of Merovingian rulers grouped below chronologically and indicated by the symbol •.

• **Theodebert I** (b. *c.* 495/500—d. 547 or 548), Merovingian king of Reims who succeeded his father, Theodoric I, in 533 or 534 and greatly expanded the area under Frankish hegemony.

A proven soldier before he came to the throne, Theodebert exploited the war in Italy between Byzantium and the Ostrogoths to gain extensive territory in the Alpine regions and the northeast of the peninsula, though most of this was lost after his death. With expansion also in the east as far as the later Brandenburg, Theodebert claimed control of peoples from the Baltic to beyond the Danube. By minting coins bearing his, rather than the Byzantine emperor's, effigy and name, Theodebert asserted his independence of Constantinople, against which he apparently even envisaged mounting an expedition. Just and generous, especially to the church, Theodebert is the most appealing of the Merovingians and, Clovis apart, perhaps the most remarkable personality among them. He was succeeded by his son, Theodebald.

• **Theodebert II** (b. *c.* 584—d. 612 or later), Merovingian king of Austrasia.

Theodebert succeeded his father, Childebert II, on the throne of Austrasia in 595 while his brother, Theodoric II, mounted that of Burgundy. After early cooperation against their cousin, Chlotar II of Neustria, whom they defeated at Dormelles (near Montereau) in 599 or 600, the brothers fell out. When Chlotar attacked Burgundy in 605, Austrasia stood aloof, and in 610 Theodebert seized Theodoric by duplicity and extorted the cession of Alsace. Theodoric responded by alliance with Chlotar and invasion; capturing Theodebert, who was childless, he delivered him to their grandmother, Brunhild, previously exiled from Theodebert's court, who forced him to become a cleric and perhaps had him murdered.

**Theoderich** (German personal name): *see under* Theodoric.

**theodicy** (from Greek *theos,* "god"; *dikē,* "justice"), the justification of God, which is concerned with reconciling the goodness and justice of God with the observable facts of evil and suffering in the world.

Gottfried Wilhelm Leibniz, in his *Theodicy* (1710), defended the justice of God in spite of the existence of evil. For him, God is almighty only in that he is able to do that which is logically possible. Certain factors may each be independently possible but mutually incompatible, and, because God created the world under these limitations, the created world is indeed "the best of all possible worlds."

Most theodicies aim at solving the theological problem of evil (*see* evil, problem of ).

**theodolite,** basic surveying instrument of unknown origin but going back to the 16th-century English mathematician Leonard Digges; it is used to measure horizontal and vertical angles. In its modern form it consists of a telescope mounted to swivel both horizontally and vertically. Leveling is accomplished with the aid of a spirit level; crosshairs in the telescope permit accurate alignment with the object sighted. After the telescope is adjusted precisely, the two accompanying scales, vertical and horizontal, are read.

Mounted on a tripod with adjustable legs, the theodolite is used in the field to obtain precise angular measurements for triangulation in road building, tunnel alignment, and other civil-engineering work. The transit is a variety of theodolite that has the telescope so mounted that it can be completely reversed, or transited. The phototheodolite, a combination camera and theodolite mounted on the same tripod, is used in terrestrial photogrammetry for mapmaking and other purposes.

**Theodora** (b. *c.* 497—d. June 28, 548, Constantinople [now Istanbul, Turkey]), Byzantine empress, wife of the emperor Justinian I (reigned 527–565), probably the most powerful woman in Byzantine history. Her intelligence and political acumen made her Justinian's most trusted adviser and enabled her to use the power and influence of her office to promote religious and social policies that favoured her interests.



Theodora, detail of a Byzantine mosaic in the Church of San Vitale, Ravenna, Italy

Andre Held—J.P. Ziolo

Little is known of Theodora's early life, but a combination of the official version with that found in the highly coloured *Secret History* of Procopius of Caesarea probably provides the best explanation. Her father was a bear keeper at the Hippodrome (circus) in Constantinople. She became an actress while still young, leading an unconventional life that included giving birth to at least one child out of wedlock. For a time, she made her living as a wool spinner. When Justinian met her, she had been converted to monophysitism, a nonorthodox doctrine. Attracted by her beauty and intelligence, he made her his mistress, raised her to the rank of patrician, and in 525 married her. When Justinian succeeded to the throne in 527, she was proclaimed augusta.

Theodora exercised considerable influence, and though she was never coregent, her superior intelligence and deft handling of political affairs caused many to think that it was she, rather than Justinian, who ruled Byzantium. Her name is mentioned in nearly all the laws passed during that period. She received foreign envoys and corresponded with foreign rulers, functions usually reserved for the emperor. Her influence in political affairs was decisive, as illustrated in the Nika revolt of January 532. The two political factions in Constantinople, the Blues and the Greens, united in their opposition to the government and set up a rival emperor. Justinian's advisers urged him to flee, but Theodora advised him to stay and save his empire, whereupon Justinian's general, Belisarius, herded the rioters into the Hippodrome and cut them to pieces.

Theodora is remembered as one of the first rulers to recognize the rights of women, passing strict laws to prohibit the traffic in young girls and altering the divorce laws to give greater benefits to women. She spent much of her reign trying to mitigate the laws against the monophysites. Though she succeeded in ending their persecution in 533, she never succeeded in changing Justinian's religious policy from its emphasis on orthodoxy and friendship with Rome.

The best-known representation of Theodora is the mosaic portrait in the Church of San Vitale in Ravenna. Her death, possibly from cancer or gangrene, was a severe blow to Justinian. Her importance in Byzantine political life is shown by the fact that little significant legislation dates from the period between her death and that of Justinian (565).

**Theodora** (b. 981?, Constantinople [now Istanbul, Turkey]—d. August 1056, Constantinople), Byzantine empress who reigned jointly with her sister Zoe in 1042 and on her own in 1055–56.

The daughter of the emperor Constantine VIII, Theodora possessed a strong and austere character and refused the hand of the heir presumptive, Romanus, who was married instead to her sister Zoe (1028). Though living in retirement she excited Zoe's jealousy and, on a pretext of conspiracy, was confined in a monastery. In 1042 the popular movement that caused the dethronement of Michael V also led to Theodora's installment as joint empress with her sister. After two months of active participation in government she allowed herself to be virtually superseded by Zoe's new husband, Constantine IX. Upon his death in 1055, in spite of her 70 years, she reasserted her dormant rights with vigour and frustrated an attempt to supersede her on behalf of the general Nicephorus Bryennius. By her firm administration she controlled the unruly nobles and checked numerous abuses; but she marred her reputation by excessive severity toward private enemies and the undue employment of menials for advisers.

**Theodore,** name of rulers grouped below by country or papacy and indicated by the symbol •.

Foreign-language equivalents:

| | |
|---|---|
| Amharic | Tewodros |
| Greek | Theodoros |
| Latin | Theodorus |
| Russian | Fyodor, or Fëdor |

### Byzantine Empire

• **Theodore I** LASCARIS, Lascaris also spelled LASKARIS (b. *c.* 1174—d. November 1221, Nicaea), first emperor of Nicaea, which was recognized as the Byzantine government-in-exile and as the legitimate successor of the Byzantine Empire during the crusaders' occupation of Constantinople.

A son-in-law of the Byzantine emperor Alexius III Angelus, Theodore distinguished himself during the sieges of Constantinople by the Latins in the Fourth Crusade (1203–04). After the Byzantine capital fell, he gathered a band of refugees, first at Brusa and then at Nicaea (modern Iznik), across the Bosporus in Asia Minor, and formed a new Byzantine state. In 1208 he assumed the title of emperor and defended his infant empire not only against the crusaders but also against David Comnenus, a rival Greek emperor in Trebizond to the east on the Black Sea, and against the Seljuq Turks. When the Seljuq sultan of Rūm, Kay-Khusraw, who had given asylum to the emperor Alexius, failed to persuade Theodore to abdicate, he invaded Theodore's territory in the spring of 1211. Theodore, however, de-

feated and killed Kay-Khusraw in battle and also captured and imprisoned Alexius.

After a period of warfare with Henry of Flanders, Latin emperor of Constantinople, Theodore signed a treaty (*c.* 1214) defining the frontiers between the Greek empire of Nicaea and the Latin empire of Constantinople. Theodore then annexed much of the territory of Trebizond. After Henry's death (1216), Theodore strengthened his ties to the Latin empire by taking as his third wife Maria, daughter of the empress Yolande, and also by proposing (1219) that Greek and Latin clergy meet in Nicaea to consider the reunion of the two churches.

In August 1219, Theodore made a lucrative commercial agreement with the Venetians in Constantinople. In 1222, shortly before his death, he negotiated a settlement with Yolande's son and successor as Latin emperor, Robert of Courtenay, to whom he betrothed his daughter Eudocia. On his death Theodore was succeeded as emperor of Nicaea by his son-in-law John III Vatatzes.

• **Theodore II** LASCARIS (b. 1222—d. August 1258), Byzantine emperor of Nicaea who—though not as capable as his grandfather or his father, Theodore I and John III Vatatzes, respectively—was an able ruler, a good soldier, and a man of letters; he succeeded in holding together the prosperous state east of Constantinople bequeathed to him by his father.

Theodore II, who had already been crowned as co-emperor, became sole ruler on the death of his father in November 1254. At the outset of his reign he renewed the alliance with the Seljuq Sultanate of Rūm (in modern Turkey). Early in 1255, however, the Bulgar tsar Michael II Asen invaded Thrace and Macedonia. After two victorious campaigns against the Bulgars (1255–56), Theodore compelled them to sign a treaty (May 1256).

In October 1256, Theodore's daughter Maria was married to Nicephorus, son of Michael, the despot of Epirus. As a condition of the marriage, however, Theodore demanded the towns of Dyrrachium (now Durrës, Alb.) and Servia (in Greece). Michael was enraged at this demand, and war broke out; it was still being waged at the time of Theodore's death.

ETHIOPIA

• **Theodore II:** *see* Tewodros II.

PAPACY

• **Theodore I** (b. Jerusalem—d. May 13, 649, Rome), pope from 642 to 649. Although noted for his generosity to the poor, he had to devote most of his pontificate to combatting Monothelitism, a heresy maintaining that Christ had only one will. Theodore refused to recognize the uncanonically installed patriarch Paul of Constantinople. Paul and his predecessor, Pyrrhus I, had relapsed into Monothelitism, for which Theodore excommunicated Pyrrhus in 648 and deposed Paul in 649.

• **Theodore II** (fl. 7th century, Italy), antipope from Sept. 21 to Dec. 15, 687.

A Roman archpriest, Theodore had already been a papal candidate when Pope John V died in 686. Following the death of Pope Conon, John's successor, a simultaneous double election conducted by opposing factions attempted to enthrone Theodore and his rival, Antipope Paschal, then a Roman archdeacon. Soon, another election followed that established Sergius I as the legitimate pontiff. Theodore submitted instantly and acknowledged Sergius, but Paschal refused to yield.

• **Theodore II** (b. Rome—d. December 897, Rome), pope for 20 days during December 897. He was elected during one of the darkest periods in papal history, caused by the "Cadaver Synod" at which Pope Stephen VI had posthumously deposed and desecrated the disinterred corpse of Pope Formosus. Despite his brief reign, Theodore vindicated Formosus' pontificate at a synod, after which he honourably buried the corpse—retrieved by Theodore's predecessor Romanus—at St. Peter's, Rome. Because of the intrigue in Rome over the Cadaver Synod, it is possible that Theodore was murdered for his acts.

RUSSIA

• **Theodore I–III:** *see* Fyodor I–III.

**Theodore** ABŪ KURRA (Syrian Melchite bishop): *see* Theodūrus Abū Qurrah.

**Theodore** ASCIDAS, Greek THEODOROS ASKIDAS (d. 558, probably Constantinople), monk-theologian and archbishop of Caesarea in Cappadocia, who was the leading advocate of a Platonist school of Christian theology and a principal consultant at the second Council of Constantinople in 553.

As a monk—and perhaps also abbot, of the "New Laura" (monastery) near Jerusalem, Theodore became the spokesman for Eastern Orthodox monks and theologians who adhered to the doctrine of the eminent 3rd-century theologian Origen, which included belief in the preexistence (before human conception) of souls, the eternal creation of the world, and the ultimate reconciliation of all, even the devil, with God. At Constantinople, to represent the Origenist party, Theodore contended with Pelagius, the legate of Pope Vigilius, and Mennas, patriarch of Constantinople, who considered Origen's doctrine erroneous if not heretical. The anti-Origenists gained the support of the emperor Justinian I, who in 543 issued an edict repudiating Origenist teaching. Although Theodore submitted, he continued his propagation of the doctrine. With a fellow Origenist, the Greek theologian Leontius of Byzantium, Theodore attempted to reconcile the disputing factions in the lingering Christological controversy that persisted after the general councils of Ephesus (431) and Chalcedon (451).

With encouragement from Emperor Justinian, who sought political and ecclesiastical harmony in the Christian East, Theodore was appointed bishop of Caesarea in 537 and was asked to devise a comprehensive Christological formula that would be satisfactory to the Monophysites and to the Antiochenes, the theological school vindicated at Chalcedon. By 543 Theodore and Leontius had begun criticizing the writings of prominent Antiochenes, particularly Theodore of Mopsuestia (d. *c.* 429), for their emphasis on the human personhood in Christ and associated this teaching with the heresy of Nestorius, the 5th-century patriarch of Constantinople, and with their anti-Origenist opponents.

In 544 Theodore persuaded Justinian to decree against the Three Chapters, a summary of Antiochene doctrine, and undertook to secure the support of the Eastern patriarchs. Pope Vigilius, who opposed the measure because such a denunciation would compromise the Council of Chalcedon, was brought to Constantinople from Rome (547) and was pressed by Justinian to condemn the Three Chapters. Western bishops, especially in northern Italy and Gaul, protested this setback to orthodoxy: and Vigilius, after being violently handled by the imperial party, excommunicated Theodore and his circle of Byzantine prelates. Before the opening of the council in 553, Theodore withdrew his opposition to the Three Chapters and apologized to the Pope. At the council he and Leontius of Byzantium submitted a conciliatory definition, the noted *enhypostasia* ("in the person") formula, maintaining that the human nature of Christ, although complete, had no personal identity of its own but achieved personalization only in the divine person of the eternal Logos (Word). Despite his having established the agenda for the council, Theodore could not prevent it from making an ambiguous condemnation of Origenism.

**Theodore** BAR KONAI (fl. early 9th century), Syrian scholar and author of a noted collection of annotations on the entire Syriac Bible. The work is also an important historical and theological source on Eastern religious sects during the first millennium of Christianity.

A native of Kaškar, Iraq, Theodore was probably a monk in the Nestorian Christian church, a heretical group adhering to the teachings of the 5th-century theologian Nestorius, who emphasized the human personhood of Christ while attenuating his divinity. Theodore's only extant work is the *Liber scholiorum* ("Book of Annotations"), the Latin designation of a vast Syriac collection of observations and elucidations taking their point of departure from biblical passages but developed into detailed considerations of philosophy, psychology, logic, and Eastern religions. Containing 11 *mēmrē*, or general sections of commentary, the work includes apologetic texts disputing non-Christian religions, particularly Islām and Manichaeism, an Oriental dualistic sect positing an evil deity responsible for the origins of the material world. The Syriac text of the *Liber scholiorum* was edited with Latin notes by Addaï Scher in the series *Corpus scriptorum Christianorum Orientalium* ("Corpus of Eastern Christian Writers"), vol. 65–66 (1912).

**Theodore** OF CANTERBURY, SAINT (b. *c.* 602, Tarsus, Cilicia, Asia Minor—d. Sept. 19, 690, Canterbury, Kent, Eng.; feast day September 19), seventh archbishop of Canterbury and the first archbishop to rule the whole English Church.

Appointed by Pope St. Vitalian, Theodore was consecrated in 668 and then set out from Rome with SS. Adrian, abbot of Nerida, Italy, and Benedict Biscop, later abbot of Wearmouth and Jarrow, Durham. In 669 they reached Canterbury, where Theodore made Adrian the abbot of SS. Peter and Paul monastery, afterward named St. Augustine's. There they created a famous school influential in the lives of such brilliant scholars as the celebrated historian St. Bede the Venerable and the skilled church architect St. Aldhelm.

Theodore organized the English Church, many sees of which were vacant on his arrival and others of which needed to be divided. In 672 he called at Hertford the first general synod of the English Church to end certain Celtic practices and to divide dioceses. The division issue was postponed, but the synod imposed the date of the Roman Easter, established obedience for clerics and monks, forbade bishops to interfere in other dioceses, and reaffirmed the church teaching on marriage and divorce.

During this period Theodore came into sharp conflict with Wilfrid, whom he had made bishop of York but whom he soon deposed. Wilfrid went to Rome in 677/678 to protest. Meanwhile, in 678, Theodore helped settle relations between King Aethelred of the Anglo-Saxon kingdom of Mercia and King Ecgfrith of Northumbria, whom Aethelred had defeated in battle. Theodore's synod at Hatfield in 679 cleared the English Church from associations with the heresy of the Monothelites (*q.v.*). In 686 he mended the conflict with Wilfrid by admitting his error and effecting Wilfrid's restoration. Theodore's *Penitential*, a collection of his rulings made by his disciples, became influential in England and on the Continent.

Theodore's greatest achievement was to adapt the Roman ideal of a centralized church to English conditions. His establishment of a centralized church under the archbishopric of Canterbury in close alliance with secular rulers

was maintained by his successors. No biography of Theodore has survived.

**Theodore** OF MOPSUESTIA (b. *c.* 350, Antioch, Syria—d. 428/429, Mopsuestia, Cilicia [now part of Turkey]), Syrian theologian, considered the greatest biblical interpreter of his time and the spiritual head of the exegetical School of Antioch.

Theodore studied under the celebrated sophist and rhetorician Libanius with his friend John Chrysostom, who in 369 influenced him to become an ascetic. Entering a monastery near Antioch, he lived and studied there until 378. Ordained in 381, he became bishop of Mopsuestia about 392. He engaged in the contemporary theological controversies plaguing the Eastern church and probably in 402/403 began the writings that made him Antioch's chief spokesman. Theodore wrote commentaries on the Lord's Prayer, the Nicene Creed, the sacraments, and most of the biblical books; he also wrote works on theological and practical problems, such as the Holy Spirit, the Incarnation, priesthood, exegetical method, theological controversies, and monasticism. Theodore's works became normative through their translation into Syriac at Edessa (modern Urfa, Tur.).

As an exegete he used unprecedented critical standards. Instead of the allegorical interpretation employed by the rival exegetical School of Alexandria, Egypt, Theodore used scientific, critical, philological, and historical methods that anticipated modern scholarship. By considering the historical circumstances in which the biblical books were written, he anticipated the modern view that many of the Psalms belong to the 2nd century BC and rejected as uncanonical such books as Chronicles, Esdras, and the Catholic Letters.

Theologically, Theodore insisted that Christ's person has two natures: divine and human. Basing this Christological issue on a psychological analysis of personality, he believed that the human and divine natures were some kind of union, as between body and soul. His Christology opposed that of the Alexandrians and curbed speculation at large through his appreciation of the human nature in Christ and his interest in the literal sense of Scripture. He composed a treatise on allegory and history, no longer extant, in which he criticized Origen, considered the most influential theologian of the early Greek church, for ignoring the literal sense of Scripture. Elsewhere, Theodore said that those who interpreted Scripture allegorically "turn everything backwards, since they make no distinction in divine Scripture between what the text says and dreams."

Theodore had a strong impact on the Nestorian church, or "the church of the East," which identified itself with Patriarch Nestorius of Constantinople, whom the Council (431) of Ephesus had condemned. Adhering to the School of Antioch, the Nestorian church called Theodore "the Interpreter" and regarded him as the main authority in all matters of faith. Controversy supported by the Alexandrians climaxed soon after Theodore's death. Though the Council (451) of Chalcedon secured the view of the human nature in Christ, the second Council (553) of Constantinople condemned Theodore's views and writings. After a Persian council in 484 acknowledged him as the guardian of right faith, the church of the East allied with Theodore's theology and has since been Nestorian.

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**Theodore** OF RHAITHU (fl. 6th–7th century), theologian-monk of a monastery at Rhaithu, a port on the Sinai Peninsula, considered the last of the Neo-Chalcedonian authors. His writings sought an orthodox formulation of doctrine on the nature of Christ. He thereby proposed to integrate the authoritative expression of Christ's coexisting human and divine essences as decreed by the Council of Chalcedon (451) with the widespread mystical variants popular among the Eastern monks and other proponents of monophysitism, a doctrine emphasizing the divine element in Christ to the derogation of his humanity.

Theodore's principal work, written between 580 and 620, was the *Proparaskeuē* ("The Preparation," or "Basic Indoctrination"), in which he attempted to justify some of the more contemplative Christological terminology of the eminent 5th-century orthodox theologian Cyril of Alexandria. By exposing the doctrinal deviations in the extreme theological positions of his time, viz., the concept of Christ as predominantly divine or human, advocated respectively by the monophysite or Nestorian schools, Theodore intended to show the middle ground of orthodox teaching. He also rejected the important early 6th-century attempt by the scholarly Severus of Antioch to achieve a doctrinal consensus but with a monophysitic orientation.

Of possible authenticity is the Aristotelian *Compendium of Logic* and a tract "On Sects" attributed to Theodore. He is currently thought to be identical with the semi-monophysite Theodore, bishop of Pharan, who is credited by some manuscripts with the *Compendium of Logic.* The critical and complete text of "The Preparation" was published by Franz Diekamp (1938).

**Theodore STUDITES, SAINT,** also called THEODORE OF STUDIOS, or STOUDION (b. 759, Constantinople [now Istanbul, Tur.]—d. Nov. 11, 826, Prinkipo, island in the Sea of Marmara; feast day November 11), abbot and leading opponent of iconoclasm, the doctrine opposing the veneration of religious images, which severely disturbed relations between the Byzantine and Roman churches.

Under the influence of his uncle, Abbot Plato of Symbola, later a saint, Theodore became a monk and, later, abbot of a monastery near Mount Olympus in Bithynia (northwestern Turkey). For opposing as adulterous the second marriage of the Byzantine emperor Constantine VI to his mistress Theodote in 795, Theodore was exiled to Thessalonica, Greece. After Constantine's overthrow in 797, Theodore was recalled by the empress Irene. Thereafter, his religious community moved to the monastery of Studios in Constantinople. In 806 he clashed with the emperor Nicephorus I (who asserted authority over the Eastern church) about the appointment of Patriarch Nicephorus of Constantinople. Theodore was condemned by a council and exiled a second time (809–811).

When iconoclasm was revived by the emperor Leo V, Theodore led the opposition against the iconoclasts and was again exiled (816–820). Recalled by the emperor Michael II, who nevertheless favoured the iconoclastic party, Theodore was not allowed to resume his abbacy. With his monks he spent the rest of his life near Constantinople. He had fought for church independence from imperial power; because the patriarchs of Constantinople often had to compromise with the Byzantine emperors, he opposed the patriarchs too.

Most of his works—which include homilies, three polemical treatises against the Iconoclasts, and nearly 600 letters—are in J.-P. Migne, *Patrologia Graeca* ("Greek Fathers"), vol. 99 (1903).

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**Theodore Roosevelt National Park,** three-sectional park commemorating President Theodore Roosevelt's interest in the West, in west-central North Dakota, U.S. Established in 1947, it lies along the Little Missouri River between Medora and Watford City. The park's 110 square miles (285 square km) comprises a petrified forest, Wind Canyon, and eroded badlands north of Medora; Theodore Roosevelt's Elkhorn Ranch cabin, 22 miles (35 km) north-northwest of Medora; and a scenic badlands area 12 miles (19 km) south of Watford City. Cottonwood, elm, and ash trees thrive in the area, which is inhabited by bison, coyotes, prairie dogs, and birds.

**Theodoret** OF CYRRHUS (b. *c.* 393, Antioch, Syria—d. *c.* 458/466), Syrian theologian-bishop, representative of Antioch's historico-critical school of biblical-theological interpretation, whose writings were a moderating influence on the 5th-century Christological disputes and contributed to the development of the Christian theological vocabulary.

First a monk, then by 423 bishop of Cyrrhus, near Antioch, Theodoret evangelized the region and contended with Christian sectarians in doctrinal questions giving rise to several treatises on apologetics, the systematic exposition of Christian faith, one of which, *Therapeutikē* ("The Cure for Pagan Evils"), has become a minor classic.

Influenced by the historical method of the 4th-century Antiochenes St. John Chrysostom and Theodore of Mopsuestia, Theodoret took issue with the allegorical trend in Alexandrian (Egypt) theology that stressed the divine-mystical element in Christ, addressing him exclusively in terms of God (monophysitism). Adapting with greater precision the analytical approach of his colleague Nestorius, Theodoret in his principal works, *On The Incarnation* and *Eranistēs* ("The Beggar"), written about 431 and 446, respectively, attributed to Christ an integral human consciousness with a distinct psychological ego. To harmonize this view with the traditional orthodoxy of the earliest church writers, he distinguished the concepts of nature (*i.e.,* the principle of action, twofold in the case of Christ's divinity and humanity) and person (*i.e.,* the common centre of attribution to Jesus as an individual). Theodoret responded several times to accusations of being a Nestorian heretic, answering with conciliatory statements that voiced his acceptance of the term "God-bearer" (*theotokos*) for the Virgin Mary and denied that his teaching "divided the one Son into two Sons."

The Alexandrians, persisting in the suppression of Antiochene teaching, arranged a church council packed with their own supporters, historically known as the Robber Synod, held at Ephesus in 449, in which Theodoret was declared a heretic and sent into exile. Released by the Eastern Roman emperor Marcian, after an appeal defining his doctrinal stance to Pope Leo the Great at Rome, he was partially vindicated in 451 at the General Council of Chalcedon. There the conciliar bishops acknowledged his orthodoxy on condition that he pronounce the condemnations (anathemas) against Nestorius, first devised by Cyril of Alexandria in early 431, in effect repudiating his own anti-anathemas by which he countercharged Cyril with teaching the absence of a human intellect in Christ (Apollinarianism). The council itself, however, did not endorse Cyril's anathemas in its final proceedings, apparently as a token approbation of Theodoret. Acutely aware of the two poles in the debate on Christ, Theodoret consistently considered the monophysites of Alexandria theologically more perilous than the Nestorians.

To identify Theodoret's precise position in this controversy is difficult because of his mediatory role in striving to integrate conflicting theologies and to avoid extremes. About a century after his death, his anti-anathemas against Cyril of Alexandria were rejected at the second general Council of Constantinople in 553. It remains debatable whether Theod-

oret's Christological theory ever evolved into an orthodox view or whether it essentially reduced itself to a Nestorian, dualist analysis of Christ. His 35 written works also included biblical commentaries and historical chronicles of the church and monasticism in the mid-5th century.

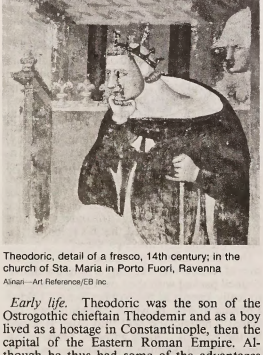
**Theodoric,** also spelled THEUDERIC, name of rulers grouped below by country, dynasty, or papacy and indicated by the symbol •.

Foreign-language equivalents:

| | |
|---|---|
| French | Thierry |
| German | Theoderich |
| Italian | Teodorico |
| Latin | Theodoricus |

## ITALY

**• Theodoric,** Late Latin THEODORICUS, byname THEODORIC THE GREAT (b. *c.* AD 454—d. Aug. 30, 526, Ravenna), king of the Ostrogoths (from 471), who invaded Italy in 488 and completed the conquest of virtually the entire peninsula and Sicily by 493, making himself king of Italy (493–526) and establishing his capital at Ravenna. In German and Icelandic legend, he is the prototype of Dietrich von Bern (*q.v.*).



Theodoric, detail of a fresco, 14th century; in the church of Sta. Maria in Porto Fuori, Ravenna
Alinari—Art Reference/EB inc.

*Early life.* Theodoric was the son of the Ostrogothic chieftain Theodemir and as a boy lived as a hostage in Constantinople, then the capital of the Eastern Roman Empire. Although he thus had some of the advantages of a Roman upbringing, he was said to have remained illiterate. This is undoubtedly an exaggeration: what is meant is that he never attained the skill in calligraphy that was expected of a ruler in the 5th and 6th centuries. At the time of his birth the Ostrogoths had recently escaped from the empire of the Huns, who had fiercely oppressed them, uprooting them from their homes in the Ukraine, transferring them to Pannonia, and taking away their grain. For more than 30 years after Theodoric's birth, the chief aim of the Ostrogoths was to find new land upon which they could settle and live in peace. In northern Pannonia they fought endlessly against other Germanic peoples, acted for and against the emperors at Constantinople, and sometimes received and sometimes were refused financial subsidies from the imperial government. On the death of his father in 471, Theodoric became his successor and soon led his people to new homes in Lower Moesia (in what is now Bulgaria), where they entered into relations, usually hostile, with another group of Ostrogoths led by Theodoric Strabo. Conditions in the Balkan provinces at this time were chaotic. Theodoric guided his people through the confusion with considerable skill but was unable to settle them safely and permanently on the land. The emperor Zeno gave him the title of patrician and the office of master of the soldiers and even appointed him as consul in 484; but in vain efforts to achieve his aims Theodoric frequently ravaged the imperial provinces and actually threatened Constantinople itself. In 488 Zeno ordered him to make his way to Italy, overthrow its barbarian ruler Odoacer, and govern the peninsula in the Emperor's name. With his people, who may have numbered 100,000 persons, Theodoric arrived in Italy in late August 489. In the following year he defeated Odoacer in three pitched battles and won control of nearly all Italy, but he could not take Ravenna, where Odoacer held out for more than three years. This war caused untold damage to city and countryside alike in northern Italy.

*Ruler of Italy.* The circumstances of Odoacer's death illustrate the crueller side of Theodoric's character, a side he normally concealed. When the Ostrogoths had failed to take Ravenna, the two leaders agreed to govern Italy jointly, and Odoacer admitted Theodoric into the impregnable city on March 5, 493. In the palace of Lauretum 10 days later, two Goths, pretending to be suppliants, suddenly seized Odoacer by the hands, and Theodoric cut him down with a sword. Theodoric went on to murder the dead man's wife and son and to massacre his followers remorselessly throughout northern Italy.

Whether Theodoric governed Italy as an independent king or as an official of the Roman emperor at Constantinople has been much debated. The truth appears to be that in theory he recognized the overlordship of the Eastern emperor; in practice, however, he was king both of the Romans and of the barbarians in Italy. In his official documents, he is simply "king" without qualification; he never defined of whom or of what he was the king. But there were some limits to his powers. He could not appoint legitimate consuls without confirmation by the emperor; he could issue edicts but not laws, though in practice there was little difference between the two; he could not confer Roman citizenship upon a Goth or appoint a Goth to a Roman civilian office or to the Senate; and his people could not legally intermarry with Romans. Early in his reign Theodoric put aside the skins or furs that Germanic rulers usually wore and surrounded his throne with something of Byzantine pomp. Unlike Odoacer, he dressed himself in the purple of the emperors.

Theodoric maintained peace in Italy throughout his 33-year reign. The Goths were settled in northern and central Italy, while Sicily and southern Italy as far north as Naples were free of them, but some of them lived in such overseas Ostrogothic dominions as Dalmatia and Pannonia. The Goths were divided from the Romans by language, for Gothic in the middle of the 6th century was both a spoken and a written language, used both for secular and for ecclesiastical matters. And they were further divided from the Romans by religion because they were Arian Christians, not Catholics, and they accepted the doctrines of the 4th-century heretical Gothic bishop Ulfilas.

Early in the 6th century Theodoric published his *Edict,* a collection of 154 rules and regulations. With one or two exceptions, these were not new laws but brief restatements in simple language of Roman laws that were already in existence. The *Edict* was a handbook issued for the convenience of judges, and it covered the cases that in the King's opinion were likely to come most frequently before the courts. The rules of the *Edict* applied to Goths as well as to Romans: in other words, the Goths were to be subject to Roman law, though not to Roman judges, and no provision was made for the recognition of their own national customs and usages. This was a discrepancy in Theodoric's policy of keeping Goths and Romans separate and of preventing fusion of the two nationalities.

Goths alone served in the army, and Romans were forbidden to carry arms. The Goths lived on the income of the estates on which they had been planted and also received an annual donative from the King. The warriors apparently went each year to Ravenna or wherever the King happened to be to receive the money from his own hand. On these occasions Theodoric would review the deeds of his troops, praising the brave and reprimanding the cowardly. Gothic soldiers on active service also received rations, either in kind or in the equivalent cash. Thus, the Ostrogoths of Theodoric's reign lived a very different life from that of their forebears, who had starved under the rule of the Huns; entering the Roman Empire and taking over one of its provinces had been profitable for them. The Romans of the kingdom continued to be governed by the old Roman civil service, which continued to exist more or less unchanged.

The great aim of Theodoric's administration was to preserve harmony between Goths and Romans. He was never guilty of religious persecution. In his letters of appointment and elsewhere, he stressed above all else that the Goths must not oppress the Roman population, must not plunder their goods or ravage their fields, and must try to live amicably with them. He made endless high-minded appeals to the warriors to behave decently. He even stooped to point out that "it is in your interests that the Romans should be undisturbed, for while they enrich our Treasury they multiply your donatives." In fact, the animosity of the Gothic rank and file against the Romans was made clear over and over again, and no plea that might have held it in check was left unused by the King. He never missed an opportunity to propagate the idea of *civilitas* ("civilized life" or "civilization"), a concept that includes the maintenance of peace and order, racial harmony, and the outlawing of oppression and violence. "We do not love anything that is uncivilized," says one of his documents, "we hate wicked pride and its authors. Our Piety execrates men of violence. In a law suit let justice prevail, not the strong arm."

The end of Theodoric's reign was disgraced by the murder of the Roman scholar Boethius, which the King later regretted. Theodoric died in August 526 and was buried in a remarkable tomb that still exists in Ravenna. He was succeeded by Athalaric, the son of his daughter Amalasuntha. (E.A.T.)

BIBLIOGRAPHY. No good biography of Theodoric has been published in English in recent years, and we must still rely on Thomas Hodgkin, *Italy and Her Invaders,* vol. 3–4 (1885), which, however, is excellent. See also Wilhelm Ensslin, *Theoderich der Grosse* (1947), a sound, reliable work.

## MEROVINGIAN DYNASTY

**• Theodoric I** (d. 533 or 534), Merovingian king of Reims from 511. Theodoric was the eldest son of Clovis I, but born of an unknown woman, unlike the other sons, whose mother was Clotilda. An able soldier, he played an important part in his father's campaigns against the Visigoths. On Clovis' death in 511 a fourfold division of his kingdom took place, each of his sons receiving some territories north of the Loire River and some to its south. No doubt as the most experienced of the four, Theodoric received those northern lands (the future Austrasia) most exposed to attack; their axis was the Rhine. In the 520s Theodoric gained a share of his brother Clodomir's kingdom when the dead king's sons were murdered by Theodoric's two other half-brothers, Childebert and Chlotar. Theodoric campaigned with Clodomir against

the Burgundians in 524 and with Chlotar against the Visigoths in 532. His greatest success lay in the subjection of the Thuringians, achieved with the help of Chlotar *c.* 531. It was perhaps now that the Saxons were temporarily also reduced to dependence. As violent and unscrupulous as most of the other Merovingian rulers, Theodoric was arguably the most vigorous and effective of Clovis' sons. He was succeeded by his son, Theodebert I.

• **Theodoric II** (b. *c.* 586—d. late 613, Metz, Fr.), younger son of the Merovingian Childebert II; he succeeded his father as king of Burgundy in 595. Cooperation with his brother, Theodebert II of Austrasia, was followed by discord, and in 612 Theodoric, supported by his grandmother, Brunhild, overthrew his brother. His death shortly afterwards led, after the weeks-long reign of his young son and successor, Sigebert III, to the reunification of the Frankish lands under Chlotar II.

• **Theodoric III** (d. 690/691), Merovingian ruler who succeeded his brother Chlotar III as king of Neustria and Burgundy in 673, at the instigation of Ebroïn, the Neustrian mayor of the palace. He was soon deposed by another brother, Childeric II, was restored in 675, then was momentarily deposed again in favour of a certain Clovis (allegedly Chlotar III's son), but recovered his throne in 676 and finally (679) also became king of Austrasia. A puppet pure and simple, he then had to watch his subjects fight one another until the final victory of Pepin II and the Austrasians at the Battle of Tertry in 687.

• **Theodoric IV** (d. 737), penultimate ruler of the Merovingian dynasty, the son of Dagobert III; he was king of the Franks from 721. A puppet who was controlled by Charles Martel, the grandfather of Charlemagne, Theodoric was totally ignored by chroniclers of the day.

## Papacy

• **Theodoric** (d. 1102, near Cava de' Tirreni, near Salerno, Duchy of Apulia), antipope from 1100 to 1102. As cardinal bishop of Santa Ruffina, he was elected pope by the faction headed by the Holy Roman emperor Henry IV during the struggle between empire and papacy, but in 1101 he was seized by the supporters of the legitimate pope, Paschal II, who had him confined in a monastery, where he died.

**Theodoric, Mausoleum of,** tomb built *c.* 520 in Ravenna, Italy, by the Arian Ostrogothic emperor Theodoric. The lower story is a decagon, while the upper story is circular and roofed with a remarkable monolithic dome 36 feet (11 metres) in diameter made of limestone imported from Istria.

When Ravenna was captured by the Catholic Belisarius in 540 the bones of Theodoric were scattered and the mausoleum converted into the church of Sta. Maria della Rotonda. The facade and portico were rebuilt in the 16th century.

**Theodoricus** (Latin personal name): *see under* Theodoric, except as below.

**Theodoricus** BRITO: *see* Thierry de Chartres.

**Theodoros** (Greek personal name): *see under* Theodore.

**Theodorus** (Latin personal name): *see under* Theodore, except as below.

**Theodorus** LECTOR, English THEODORE THE READER (fl. 6th century), Greek church historian, author of two significant epitomes of Byzantine history correlating data from leading 5th-century chroniclers, and constituting an essential source for events of that complex period. Its incorporation into a later Latin account provided the Western world with its basic knowledge of the Eastern church and empire.

Holding the office of *anagnōstēs*, or reader, at the basilica of Hagia Sophia (Holy Wisdom), Constantinople, Theodorus, from 520 to 530, composed his first chronicle, the *Eklogē ek tōn ekklēsiastikōn historiōn* ("Selections from Histories of the Church"), best known by its Latin title *Historia tripartita* because it derived from three separate 5th-century chronicles, those of Socrates Scholasticus, Sozomen, and Theodoret of Cyrrhus. The *Eklogē* recounts in four books the fortunes of the church from 313, early in the reign of the emperor Constantine the Great, to the year 439, in the reign of the emperor Theodosius II. Theodorus' method was to select, from the three narratives, one that he judged superior in style, noting the parallel readings in the margin and indicating any distinctions among them. This comparative evaluation of the chronicles continues to have historical importance, providing evidence for the textual history of each narrative.

Applying information from other civil and ecclesiastical records, Theodorus continued the *Eklogē* in a "Church History" of his own from the death of Theodosius II in 450 up to the accession of the emperor Justin I (518). Only excerpts from the work remain, preserved in later chronicles, in the theologically important tract "On Sacred Images" by the 8th-century advocate of religious art John of Damascus, and in the acts (787) of the second Council of Nicaea that condemned the Iconoclast (image destroyers) movement.

**Theodosius,** Greek THEODOSIOS, name of rulers grouped below by country or patriarchate and indicated by the symbol ●.

## Patriarchate

• **Theodosius I** BORADIOTES (b. Antioch—d. after 1183, Constantinople), Greek Orthodox patriarch of Constantinople (1179–83), inflexible opponent of the Muslim religion, critic of union with the Latin Church of the West, and guardian of Orthodox morality at the Byzantine court.

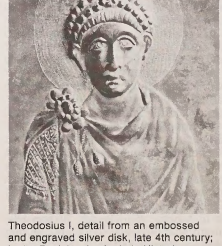
Of Armenian stock, Theodosius came to the patriarchal throne early in 1179. An open dispute arose concerning the oath of recantation required of Muslim converts to Christianity. The conservative Byzantine churchmen, including Theodosius and the scholarly metropolitan (archbishop), Eustathius of Thessalonica, upheld the stringent wording of the oath that required Christianized Muslims to renounce the Islāmic deity (Allāh) as a *theos holosphyros* ("wholly compacted God"; *i.e.*, absolutely monotheistic, with no differentiation of persons). Emperor Manuel I Comnenus, having unsuccessfully attempted to check the military incursions of the Seljuq Turks in 1176, considered the abjuration formula offensive to the Islāmic people. The Orthodox hierarchy presented an uncompromising front to Manuel I at a synod in Constantinople *c.* 1180, and Theodosius succeeded in persuading the physically weakened emperor to abandon his intention of rewriting the oath.

When Emperor Manuel, attempting a policy of invigorating Byzantium with an infusion of Latin blood, initiated cordial relations with Pope Alexander III, offering the possibility of reuniting the Greek and Latin churches, Theodosius apparently refused to cooperate. The patriarch consequently survived the turbulent period following Manuel I's death, when the populace rose up to massacre all Latins in Constantinople, although he protested the violation of the rights of sanctuary by the rival political factions.

With the overthrow of the crown prince Alexius by his cousin, Andronicus I Comnenus, Theodosius agreed to the expulsion of the Latin empress-mother and regent, Mary of Antioch. Later Theodosius incurred the enmity of Emperor Andronicus, who sought ecclesiastical sanction for the marriage of his illegitimate daughter Irene to Alexius. Appealing to Orthodox decrees prohibiting such a union, Theodosius refused to acquiesce to the Emperor's designs and was forced to abdicate his patriarchal office; he retired to an outlying monastery.

## Roman and Byzantine empires

• **Theodosius I,** byname THEODOSIUS THE GREAT, in full FLAVIUS THEODOSIUS (b. Jan. 11, AD 347, Cauca [Coca], Gallaecia—d. Jan. 17, 395, Mediolanum [Milan]), Roman emperor of the East (379–392) and then sole emperor of both East and West (392–395), who, in vigorous suppression of paganism and Arianism, established the creed of the Council of



Theodosius I, detail from an embossed and engraved silver disk, late 4th century; in the Real Academia de la Historia, Madrid

Giraudon—Art Resource/EB Inc.

Nicaea (325) as the universal norm for Christian orthodoxy and directed the convening of the second general council at Constantinople (381) to clarify the formula.

*Background and youth.* Theodosius was born in the province of Gallaecia in northwestern Spain. His father was to become the general Flavius Theodosius; his mother's name is unknown. His grandparents, like his parents, were probably already Christians. Theodosius, who grew up in Spain, did not receive an extensive education but was intellectually open-minded and acquired a special interest in the study of history.

While on his father's staff, he participated in his campaigns against the Picts and Scots in Britain in 368–369, against the Alemanni in Gaul in 370, and against the Sarmatians in the Balkans in 372–373. As a military commander in Moesia, a Roman province on the lower Danube, he defeated the Sarmatians in 374. When his father was sentenced to death and executed as a result of political intrigues by enemies at court, Theodosius withdrew to his Spanish estates. At the end of 376, he married Aelia Flacilla, also a Spaniard. His first son, the future emperor Arcadius, was born in 377, and his daughter Pulcheria in 378.

Immediately after the catastrophic defeat of the emperor Valens, who perished at the hands of the Visigoths and other barbarians on Aug. 9, 378, near Adrianople, the emperor Gratian unexpectedly summoned Theodosius to his court. When Theodosius had once again proved his military ability by a victory over the Sarmatians, Gratian proclaimed him co-emperor on Jan. 19, 379. His dominion was to be the eastern part of the empire, including the provinces of Dacia (present-day Romania) and Macedonia, which had been especially infiltrated by barbarians in the preceding few years.

*Early years as emperor.* In 379 and 380 Theodosius resided chiefly in Thessalonica. He sought first to rebuild the army, the discipline of which was considerably impaired, and to consolidate Rome's position on the Balkan peninsula. Military unpreparedness could not be overcome by conscription alone, which applied only to certain classes. Theodosius therefore directed that large numbers of Teutons, who had been barred from military service, be accepted by the army. By 379, however, when foreigners had already intermingled extensively with the rest of the army, both among the troops and in all ranks of the officer corps, Theodosius did no more than many of his predecessors to encourage this process. In contrast to the West, in Theodosius' provinces both Romans and Teutons were among the leading generals.

Recognizing that the barbarians, who had invaded the provinces as early as 375, could no longer be expelled by force and that he could count on Gratian for only limited assistance, Theodosius sought new possibilities for coexistence. This resulted in the friendly reception of the Visigoth Athanaric in 381 and the conclusion of a treaty of alliance, or *foedus,* with the main body of the Visigoths in the fall of 382. The Goths, who pledged themselves to lending military assistance, were assigned territory for settlement between the lower Danube and the Balkan mountains. Under this novel arrangement, an entire people was settled on imperial soil while retaining its autonomy. Theodosius may have hoped that the Goths would become integrated, as had a group of Goths who in *c.* 350 had settled near Nicopolis in Moesia; their leader, Bishop Ulfilas, undertook missionary work among the parties to the *foedus* of 382.

Some historians have regarded Theodosius as biassed in favour of the Goths. He has even been accused of having contributed decisively, through the treaty of 382, to the downfall of Rome. Yet, it should be noted that the policy of that treaty, which was undertaken in the justified expectation of raising Roman military strength and recultivating tracts of wasteland, by no means became customary. Instead, the Emperor took strict measures against further invasions by Teutonic bands and did not permit any doubts to arise as to Roman claims of superiority over the barbarians.

Theodosius' situation was complicated by the sharp antagonism that arose around 379 between disciples of the Nicene Creed (according to which Jesus Christ is of the same substance as God the Father) and several other Christian groups in his part of the empire. Theodosius himself, the first emperor who did not assume the title of *pontifex maximus* (supreme guardian of the old Roman cults), believed in the Nicene Creed, despite his Baptism only after a serious illness in the fall of 380.

Out of political as well as religious motives, he energetically undertook to bring about unity of faith within the empire. His position was improved by the fact that during 379 the followers of the Nicene Creed gained ground, whereupon Theodosius on Feb. 28, 380, without consulting the ecclesiastical authorities, issued an edict prescribing a creed that was to be binding on all subjects. Only persons who believed in the consubstantiality of God the Father, Son, and Holy Spirit were henceforth to be considered Catholic Christians, a designation that here appears for the first time in a document.

There is no doubt that the principle of religious intolerance was proclaimed in this edict. When assessing the edict, however—which should not be viewed simply as an isolated measure—it must be remembered that to the Christians Theodosius was emperor by the grace of God. While thus committed to defend the true faith, he by no means carried out his stated intention by force. The creed, prescribed in 380, was again defined at the beginning of 381 and ecclesiastically sanctioned, as it were, by a church council summoned to Constantinople by Theodosius in the summer of 381. That gathering is considered the second ecumenical council.

The Symbolum Nicaeno-Constantinopolitanum (*i.e.,* the Niceno-Constantinopolitan Creed [or Symbol]), which is still used by most Christians, along with the ranking by the council fathers of the bishop of Constantinople directly after the bishop of Rome, can thus be traced back to Theodosius. Henceforth, the emperor's authority in matters of faith was to be recognized by the bishops of the East. There is no ground, however, for speaking of a rigidly organized imperial church controlled by the emperor.

The period when Theodosius stayed mainly in Constantinople, dating from the end of 380 to 387, is that to which most of his measures to improve the capital may be attributed. The plan for the Forum Tauri, the largest public square known in antiquity, designed after the model of Trajan's Forum in Rome, is outstanding. It is unclear, however, to what extent the Emperor encouraged the flowering of art and literature in his time.

*The middle years.* In 383, Maximus, a Spaniard who had been proclaimed emperor by the troops in Britain, asserted himself as ruler in the Western provinces (*praefectura Galliarum*). Suspicions that Theodosius was in collusion with the usurper and thus implicated in the death of Emperor Gratian in August 383 are unfounded. Theodosius, who had to acknowledge the sovereignty of Gratian's stepbrother Valentinian II, born in 371 and the nominal ruler in Italy since the end of 375, could not interfere with Maximus, for he lacked both sufficient military strength and secure borders. Yet, when Maximus invaded Italy in 387 and Valentinian was forced to flee to Thessalonica, Theodosius soon decided upon countermeasures. His decision was perhaps hastened through the influence of Valentinian's mother, whose daughter Galla he had married at the end of 387, having been a widower since 386.

Theodosius' position by that time had become stronger. Long-standing negotiations with the Persians over the division of power in Armenia had resulted in a treaty that was to become the basis for a long period of peace on the eastern border. Having ordered one army division from Egypt to Africa and sent Valentinian with a fleet to Italy, Theodosius set out in the spring of 388 with the main body of troops to move against Maximus' army, which had invaded Pannonia in the Balkans. By July the enemy was defeated. When Maximus surrendered at the end of August he was branded as a usurper, but his followers were generally treated with leniency.

In the same year, Theodosius again relinquished the West to his co-emperor Valentinian but secured his own influence by placing the Frankish general Arbogast, a man he trusted, at Valentinian's side as principal adviser. By remaining in Italy until the spring of 391, where he resided mostly in Milan, Theodosius emphasized his claim to supreme authority throughout the empire. In 389 he visited Rome, where, accompanied by his four-year-old son Honorius, he made a triumphant entry.

In Milan, Theodosius found in Bishop Ambrose an ecclesiastic who was intent upon cooperating effectively with the Emperor and even upon forming a friendship with him, although Ambrose pointed out to Theodosius the limits of the power of temporal rulers more clearly than had others. A conflict had already arisen between them in 388 over Theodosius' punishment of orthodox fanatics who had set fire to a synagogue and to the shrine of a sect. As a devout Christian, Theodosius finally acceded to the Bishop's wishes in the matter but took pains to make him understand that he was not willing to grant the Bishop greater influence in affairs of government.

A new conflict arose in 390 when, following the murder of one of his generals in Thessalonica, Theodosius issued an order for brutal retaliation. It was rescinded too late, so that a horrible massacre resulted among the population there. Ambrose had the Emperor's action condemned in a church council and bade him do public penance. After a prolonged hesitation, Theodosius complied with the order and was readmitted to communion at Christmas 390.

His penance should not be construed as a victory of the church over the Emperor but only as a demonstration of the power of atonement over the penitent sinner. The claims that arose in future centuries that the church had been placed above the temporal power derived not from Theodosius' act of penance but only from the myth generated by it. Although Theodosius had gained an important ally in Ambrose, he continued intent on preserving the emperor's authority in the face of Ambrose and other bishops.

While maintaining an entirely friendly attitude toward the church, Theodosius still took care in his legislation to see that the material interests of the state were sacrificed only to a very limited extent to church or clergy. In addition, Theodosius decided to enforce more strongly against the pagans the religious policy he had pursued since 379. In February 391 he prohibited sacrifices and the visiting of temples. Up to that time, he had basically tolerated the pagans and had entrusted adherents of the old cults with the highest offices.

Quarrels between his second wife, Galla, and his son Arcadius, as well as his own view of the eastern capital as the centre of the empire, prompted Theodosius to move his residence back to Constantinople, where he arrived in November 391.

*Victory over pagan usurpers.* A new crisis arose for Theodosius three months after Valentinian's death on May 15, 392. Arbogast treacherously proclaimed as emperor of the West a former rhetoric teacher, Eugenius, who had close connections with the pagan aristocracy of the Senate. Theodosius, who did not yet dare to risk a civil war, delayed reception of a legation requesting recognition of Arbogast's puppet. On Nov. 8, 392, he made his edicts of 391 more stringent by completely prohibiting the worship of the pagan gods. He left no further doubts as to his position when he elevated his son Honorius to Augustus in January 393 and thereby demonstrated that he would no longer tolerate any emperor other than himself and his sons. Because he still refrained from military action, his enemies occupied Italy in the spring of 393. Led by Nicomachus Flavianus, the forces striving to preserve the pagan cults gathered around Eugenius.

The now inevitable struggle for power was thus at the same time a struggle that would decide whether pagan religions would once again be tolerated within the empire alongside Christianity. Theodosius did not set out from Constantinople until May 394. As in 388, he made his way toward the Danube and then the Sava with his powerful army. His force consisted largely of barbarians and their allies, one of whose leaders was Stilicho, a Vandal who had been married since 384 to the Emperor's niece Serena. Theodosius' sons Arcadius and Honorius stayed behind in the capital. Arcadius, who had been given the right to promulgate laws independently, was supposed to direct the government in the East.

Theodosius first met the enemy at the Frigidus River on the eastern border of Italy. Although Theodosius' advance guard, com-

posed almost entirely of Visigoths, suffered heavy losses during an attempted breakthrough on Sept. 5, 394, the emperor ventured to attack the following day and was victorious. Later Christian tradition, emphasizing Theodosius' piety and trust in God, essentially interpreted the victory as a divine judgment: the god of the Christians had triumphed over the old Roman gods. Following the deaths of Eugenius, Arbogast, and Nicomachus Flavianus, Theodosius showed himself lenient and strove to achieve the settlement between opposing forces that was necessary to strengthen imperial unity.

Probably as a result of the exertion of the campaign, Theodosius fell ill. He went to Milan, where he summoned Honorius in order to present him formally as Augustus of the West. Because Theodosius had appeared to recover, his death in January 395 was generally unexpected. On his deathbed he had entrusted Stilicho, promoted to generalissimo after the victory at the Frigidus, with the care of his two sons. From Ambrose's funeral oration, filled with praise of the Christian ruler, it is evident that contemporaries had no doubt as to the continuing unity of the empire, for the question of succession seemed to have been settled in the best possible way. Yet, all too soon it was to become apparent that Theodosius had not chosen his advisers with sufficient care and that the men who were guiding the sickly Arcadius were unwilling to cooperate with Stilicho, who remained loyal to the dynasty. After his death, Theodosius' body was borne in state to Constantinople and interred in the mausoleum erected by Constantius II.

(A.Lip.)

BIBLIOGRAPHY. Theodosius' religious policy is outlined in Noel Q. King, *The Emperor Theodosius and the Establishment of Christianity* (1960). Useful information may also be found in A.H.M. Jones, *The Later Roman Empire, 284–602: A Social Economic and Administrative Survey*, 2 vol. (1964, reprinted 1986).

**•Theodosius II** (b. April 10, 401, Constantinople [now Istanbul, Tur.]—d. July 28, 450), Eastern Roman emperor from 408 to 450. He was a gentle, scholarly, easily dominated man who allowed his government to be run by a succession of relatives and ministers.

The son of the Eastern emperor Arcadius (reigned 383–408), he was made coemperor in 402 and became sole ruler of the East upon his father's death in 408. At first the able Anthemius, praetorian prefect of the East, was regent for young Theodosius. Anthemius dropped out of sight in 414, when the emperor's sister Pulcheria received the title augusta and assumed the regency. Throughout his reign, most of the government remained out of Theodosius' hands.

At various times during his reign, Theodosius sent armies against the Vandals of Africa, the Persians, and the Huns. His generals defeated Persian (Sāsānian) invaders in 422 and 447, but campaigns against the Vandals, who had occupied most of Roman Africa in 429, ended in failure. Theodosius' policy of appeasing the mighty Hun leader Attila did not prevent massive Hun invasions of the Danubian provinces in 441–443 and 447. His reign was alsc troubled by a dispute over the heretical doctrines of Nestorius, whom Theodosius appointed patriarch of Constantinople in 428. Nestorius was deposed by a church council in 431.

Theodosius' name is associated with three important projects. The first, erection of an impregnable wall around Constantinople (413), was actually the work of Anthemius. The emperor did, however, have a hand in founding the University of Constantinople in 425 and in supervising compilation of the Theodosian Code (published 438), which codified the laws issued after 312. Theodosius died from injuries suffered during a hunting accident. His daughter Licinia Eudoxia married the Western Roman emperor Valentinian III (reigned 425–455).

**•Theodosius III** (d. after 717), Byzantine emperor from 715 to 717. He was an obscure tax collector of southwestern Asia Minor who against his will was proclaimed emperor by the troops of the Opsikion theme rebelling against Anastasius II. His supporters successfully captured Constantinople after a six months' siege, and Anastasius was deposed and entered a monastery. Theodosius was quite unsuited to imperial office and in 717 was forced to abdicate by the able commander of the Anatolikon troops, Leo III the Isaurian, and ended his life in a monastery at Ephesus.

*Where the same name may denote a person, place, or thing, the articles will be found in that order*

**Theodosius** OF ALEXANDRIA (fl. 6th century—d. June 566, Constantinople [now Istanbul, Tur.]), patriarch of Alexandria (535–566), theologian, and leader of the Monophysites in Egypt and Syria, who were reputed for their asceticism and also for their mystical prayer.

Through the support of the Byzantine empress Theodora, Theodosius was elected patriarch as the candidate of the moderate wing of the Monophysites, a group of Christians who believed that Christ had one nature rather than both divine and human natures. With his colleague Severus, the learned patriarch of Antioch, Theodosius favoured mysticism and a belief in a spiritualized Christ. He opposed the teachings of Eutyches (a monk who argued that the humanity of the incarnate Christ was unlike that of other men) and the extreme Monophysites and their candidate for the patriarchate. Lacking popular support, however, Theodosius fled Alexandria and took refuge in a neighbouring monastery until late May 535, when imperial troops drove the extremist Monophysite party from Alexandria. Although judged to be the legitimate patriarch, he was repudiated by a wide segment of Alexandria's population who sympathized with the more uncompromising Monophysites.

The Byzantine emperor Justinian I summoned Theodosius to Constantinople in December 536 in an attempt to win him over to the orthodox position on Christology as expressed in 451 by the Council of Chalcedon. Although Theodosius' moderate Monophysitism could not be reconciled with the conciliar decree, he was not forcefully constrained to abjure his views. He was, nevertheless, effectively prevented from administering his patriarchate by being detained for the remainder of his life under imperial surveillance at Constantinople together with like-minded Monophysite clergy. During his detention, Theodosius continued to play a leading role in the Monophysite church. After the death of Severus of Antioch, its principal spokesman, Theodosius emerged as its head throughout the Byzantine Empire. While avoiding outright confrontation with the orthodox emperor, he still succeeded in aiding and influencing independent churches in Antioch, Syria (the Jacobite church), and in Egypt (the Coptic church) and advancing their missionary activity. At the accession of Emperor Justin II in 565, Theodosius was given permission to return to Alexandria, but he died before departure and was buried at Constantinople with patriarchal honours. In his Byzantine exile Theodosius wrote treatises against the heresies of the tritheists, believers in three gods, and the Agnoetae, believers in Christ's fallible knowledge. His extant works include Coptic sermons and expositions of moderate Monophysite doctrine addressed to leading Byzantine figures. These writings are contained in the series *Patrologia Graeca*, J.-P. Migne (ed.), vol. 86 (1866).

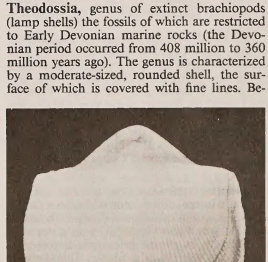
**Theodosius** OF PALESTINE, SAINT (b. *c.* 423, Cappadocia, Asia Minor [now southern Turkey]—d. Jan. 11, 529, near Jerusalem [now claimed by Israel]; feast day January 11), a principal proponent of orthodoxy in the Christological controversy (a dispute centring on the nature and person of Christ) and one of the fathers of Palestinian monasticism.

Introduced to the ascetic life about 451 by Simeon the Stylite near Antioch and by others at the convent of David's Tower at Jerusalem, Theodosius in 455 entered the monastery of the Theotokos south of Jerusalem. After being made administrator by the community's benefactress, he resigned from the office in order to lead a solitary life at the Cave of the Magi, Metopa, near Bethlehem. From 460 to 470 the influx of followers was great enough to warrant construction on an adjoining plateau of a large *coenobium* (Latin: "monastic convent"), whose discipline integrated arts and crafts with the ascetic life. The popularity of the foundation attracted pilgrims and travelers for whose convenience Theodosius, with material aid from Byzantine officials, erected hostels and shelters for the aged, the poor, and the insane. The monastic community of about 400 was composed of Greeks, Slavs, and Armenians who performed prayer exercises in their separate languages but who celebrated the Greek liturgy of the Lord's Supper together. Theodosius' ascetic fame earned him election in 493 as archimandrite (monastic superior) of all convents in the Jerusalem area.

With his patriarchal colleague, St. Sabas, Theodosius induced the monastic and lay population of Palestine to resist the attempts of influential Eastern churchmen and Byzantine princes to impose the heresy of the Monophysites (those who believed that Christ had one, essentially divine nature, rather than both human and divine natures). He was consequently exiled by the Byzantine emperor Anastasius I in 517 but returned to continue his convent's development after Anastasius' death in 518. Destroyed in the 15th century, the monastery of St. Theodosius was rebuilt by the Greek monks of Jerusalem at the beginning of the 20th century.

**Theodosius** THE GREAT: *see* Theodosius I *under* Theodosius (Roman and Byzantine empires).

**Theodossia,** genus of extinct brachiopods (lamp shells) the fossils of which are restricted to Early Devonian marine rocks (the Devonian period occurred from 408 million to 360 million years ago). The genus is characterized by a moderate-sized, rounded shell, the surface of which is covered with fine lines. Be-



*Theodossia*

By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

cause of its temporal restriction, *Theodossia* is a good index fossil and aids in the correlation of sometimes widely separated rock units.

**Theodotion** (fl. 2nd century AD), Hellenistic Jewish scholar and linguist and author of a Greek translation of the Old Testament. According to two early Christian writers of the 2nd and 4th centuries, Theodotion probably came from Ephesus in Asia Minor. He is reported to have adopted the Jewish faith after having been a Gnostic. Early historians assign his work of translation to *c.* 180–190.

Theodotion's version appeared in the sixth column of Origen's Hexapla, a 3rd-century version of the Old Testament presenting six Greek and Hebrew texts in parallel columns. It is not so much an independent translation as a revision of the Septuagint—the earliest Greek translation, dating in part from the 3rd century BC—supplying its omissions. Peculiar Hebrew words are not translated but transliterated into Greek letters, either in order to avoid conjectural readings or to give an authentic colour to the version. The popularity of Theodotion's translation in the early church can be deduced from its fragments that fill gaps in the Septuagint text of Jeremiah and from its version of Daniel that replaces the Septuagint translation. It was quoted in the 2nd century in the *Shepherd of Hermas* and by the Christian apologist Justin Martyr. The replacement of Daniel was so thorough that only two manuscripts (one of about the 3rd century and one of the 11th century) of the Greek Old Testament contain the Septuagint version. Theodotion's version of Daniel may go back to an older translation. The extant manuscripts of the Theodotion text were published in 1875.

**Theodotus** OF ANCYRA (d. *c.* 446), theologian, bishop of Ancyra, and a leading advocate of orthodoxy in the discussion of the nature and Person of Christ at the Council of Ephesus in 431. Theodotus was a determined opponent of Nestorius, bishop of Constantinople, whose views had led to the summoning of the council and whom Theodotus had earlier supported. Now standing beside Cyril of Alexandria, Nestorius' chief opponent, Theodotus affirmed the two-fold nature united in Christ's Person. Nestorius was condemned, and Theodotus served as a member of the delegation sent by the council to explain its decrees to the Nestorian-leaning emperor Theodosius II. The Nestorian party denounced Theodotus in 432 at its own Synod of Tarsus.

Theodotus' writings include an explanation of the Nicene Creed in which he asserted that Nestorius' views had already been condemned by the first Council of Nicaea in 325. Two sermons on Christmas and one on the "Feast of the Lights" (in honour of the Virgin Mary) are significant witnesses to the existence of these ritual celebrations in the early 5th century. A lost work in six books refuting Nestorius was referred to at the second Council of Nicaea in 787.

**Theodotus** THE GNOSTIC (fl. 2nd century AD), a principal formulator of Eastern Gnosticism, a system of religious dualism (belief in rival deities of good and evil) with a doctrine of salvation by *gnōsis*, or esoteric knowledge.

From the scant data available, Theodotus is known to have taught Gnosticism in Asia Minor *c.* 160–170, elaborating on the principles of the early-2nd-century Gnostic leader Valentinus. Theodotus' teachings, of primary importance for the study of primitive Gnosticism, survive in *Excerpta ex Theodoto* ("Extracts from Theodotus"), actually a scrapbook that the 2nd–3rd-century Christian philosophical theologian Clement of Alexandria appended to his *Stromata* ("Miscellanies"). Certain passages integrate the comments of Clement; thus, the unsystematic arrangement of the material causes problems of interpretation.

Essentially, the Gnosticism of Theodotus affirmed that the world is the product of a process of emanations, or radiations, from an ultimate principle of unconditioned being or eternal ideas. Intermediate beings in this hierarchy of perfection include God the creator of matter and Christ the redeemer, who united himself to the man Jesus at his baptism to bring men *gnōsis*. Salvation, he concluded, is reserved for Gnostic believers infused with *pneuma* ("spirit").

Theodotus further developed the role of the inferior spiritual beings, or angels, and their relation to Christ. He mentions a Eucharist of bread and water and anointing as a means for release from the domination of the evil power.

**Theodotus** THE TANNER (fl. 2nd century), principal exponent at Rome of the heresy of Adoptionism (*see* Monarchianism).

A wealthy and cultured tanner of Byzantium, Theodotus went to Rome *c.* 189 during the reign of Pope Victor I. He soon developed a following with his Dynamic Monarchianism. Condemned and excommunicated by Pope Victor in 190, Theodotus nevertheless continued to acquire disciples, forming the Theodotians, a sect that lasted into the 3rd century under another Theodotus, the Money-changer.

**Theodulf** OF ORLÉANS, Theodulf also spelled THEODULPHE, also called THEODULFUS (b. 750, probably Spain—d. 821, Angers, Anjou), prelate, poet, and one of the leading theologians of the Frankish Empire.

A member of Charlemagne's court, Theodulf became bishop of Orléans in 775 and abbot of Saint-Benoît-sur-Loire in 781. He worked for reform of the clergy within his diocese and established a hospice. In 800 he was in Rome for Charlemagne's coronation, and in 804 he succeeded the English scholar Alcuin as Charlemagne's chief theological adviser. Charlemagne involved Theodulf in the dispute concerning the Filioque clause in the Nicene Creed, which describes the procession of the Holy Ghost from the Father "and from the Son" and which is one of the causes of the division between the Greek and Roman churches. At Charlemagne's request, Theodulf defended the Filioque clause in his treatise *De Spiritu Sancto* ("Concerning the Holy Spirit"). It was also at Charlemagne's urging that Theodulf wrote his treatise on Baptism, *De ordine Baptismi* ("Concerning the Ordinance of Baptism"). Theodulf received the pallium, the symbol of episcopal authority, from Pope Stephen IV in 816. Charlemagne's son and successor Louis I the Pious, deposed Theodulf in 818 for participation in a revolt by Louis's nephew Bernard and imprisoned him in a monastery in Angers, where he died.

Theodulf's poem *Ad Carolum regem* ("To Charles the King") depicts Charlemagne surrounded by family and courtiers. A patron of the arts and a builder and restorer of churches, Theodulf had a palace and chapel built at Germigny-des-Prés *c.* 806 that survives in the *département* of Loiret as an important example of Carolingian architecture.

**Theōdūrus Abū Qurrah,** Arabic name of THEODORE ABŪ KURRA (b. *c.* 750, Edessa, Mesopotamia—d. *c.* 825), Syrian Melchite bishop, theologian, and linguist, early exponent of cultural exchange with Islāmic and other non-Christian peoples, and the first known Christian writer in Arabic.

Although Theōdūrus had long been reputed by historians as a principal advocate of orthodox doctrine in Christology (*see* Christological controversy), later scholarship showed him also to have been a pioneer in relating irenically with the independent Eastern Christian churches, Muslims, and non-Christians throughout Asia Minor. Specific data on Theōdūrus' life appeared only after his extant Greek works had been published in the West with Latin translations during the 16th and 17th centuries. A biography was reconstructed with elements from 9th-century Syriac, Arabic, and Armenian chronicles.

Having become a monk at the renowned monastery of St. Sabas near Jerusalem, he steeped himself in the Greek ascetical spirituality of the early 8th-century Byzantine monk John of Damascus. At St. Sabas Theōdūrus began his Syriac and Arabic writings, including tracts on philosophic theology arguing for monotheism, the possibility of revelation, human freedom, divine justice, and retribution for sin. His theism possibly influenced the Muslim Mu'tazilites, the early 9th-century theological school that produced the first rational exposition of Islāmic doctrine and reacted against its prevalent fatalism.

Toward the close of the 8th century, Theōdūrus was named bishop of Harran, near Edessa, and engaged in discussion with the diverse elements of its population, including the heterodox Monophysites who believed the nature of Christ to be exclusively divine, Muslims, Jews, Manichaeans (members of a dualist cult claiming rival deities of good and evil), and Sabaeans. He wrote Greek theological works, dedicated to Byzantine rulers, on the Iconoclastic Controversy (on the destruction of sacred images). In the first years of the 9th century, however, he was deposed as bishop by Theodoret, patriarch of Antioch, possibly because of Theōdūrus' advocacy of the orthodox Christological teaching enunciated by the Council of Chalcedon (451) and his sympathies toward papal leadership of Christendom.

Returning to the monastery of St. Sabas, Theōdūrus resumed an intense ascetical and literary activity, composing in 813 his noted "Letter to the Armenians" in support of the orthodox stand against the Iconoclasts and Monothelites (who denied Christ's human choice, affirming only divine will). On the same questions he addressed a tract (now lost) to Pope Leo III. Shortly after 815 he began a series of journeys to Alexandria and Armenia to encourage orthodox Christology. At the court of the Armenian prince Ashot Msaker he composed his longest Greek treatise, an explanation of terms used by the philosophers. After a sharp polemic with Syrian Monophysite prelates and theologians, he held vigorous discussions with the Muslim caliph at Baghdad on Islāmic and Christian monotheism.

Theōdūrus' Greek works are contained in the series *Patrologia Graeca*, J.-P. Migne (ed.), vol. 97 (1866). His Arabic works were first edited by P. Constantin Bacha in 1905.

**Theognis** (fl. late 6th–early 5th century BC, Megara, near Athens), elegiac poet, many of whose poems were addressed to his beloved, one Cyrnus. Theognis' poems were also much concerned with good breeding and are important for their portrayal of aristocratic society in a changing world. He allegedly wrote a poem on an unidentifiable episode in the history of Syracuse and 2,800 lines of admonitory verse, together with (or perhaps including) a collection of maxims for Cyrnus. Fewer than 1,400 lines survive. The poems ascribed to Theognis, many of them doubtfully, provide more than half the surviving corpus of classical Greek elegiac poetry.

**Theognostos** (fl. 9th century), Byzantine monk, theologian, and chronicler, coauthor of a report on the situation of the Eastern Church during the turbulent reign of Photius (858–867 and 878–886), the controversial patriarch of Constantinople. This theological chronicle, or "Letter of Appeal," constituted one of the most important documents on the resulting break (the Photian schism) between the Western and Greek churches.

An opponent of Photius, Theognostos supported the reigning patriarch, Ignatius, who was deposed by the emperor Michael III in 858. Photius was subsequently named patriarch and was encouraged by the new ruling faction in his development of an anti-Western theology and an independent identity for the Greek Orthodox Church. After helping Ignatius to compose the "Letter of Appeal" as a theological apology for his position, Theognostos delivered it to Pope Nicholas I at Rome *c.* 861 and solicited his aid in returning Ignatius to office. When Nicholas condemned Photius in 863, a bitter dispute ensued, causing a gulf between Byzantium and Rome. Theognostos returned to Constantinople in 868 with a papal message for the new emperor, Basil I, who, seeking a reconciliation with Rome, in turn deposed Photius. Patriarch Ignatius then made Theognostos superior of the Pege monastery and administrator of Hagia Sophia.

The "Letter of Appeal," Theognostos' anthology on the lives of the saints, and an address on the Virgin Mary have been published in the series *Patrologia Graeca,* J.-P. Migne (ed.), vol. 105 (1866).

**Theognostus** OF ALEXANDRIA (fl. late 3rd century), Greek theologian, writer, and prominent head of Alexandria's Catechetical school, at that time the intellectual centre for Hellenistic Christianity. Reputed to be one of the Greek Church's distinguished teachers, Theognostus assumed the leadership of the school *c.* 265, although the precise line of succession is not certain. His principal work, the *Hypotypōseis* (Greek: "Outlines"), is a doctrinal compendium in seven books intended for use at the school.

Adhering to the teaching of Origen, a theologian of the 2nd–3rd century, Theognostus organized his work and adopted his terminology from his master's *Peri archōn* ("On First Principles"). The *Hypotypōseis* was acclaimed by Gregory of Nyssa, a 4th-century intellectual leader of the Eastern Church, but was sharply attacked almost five centuries later by the Byzantine patriarch Photius of Constantinople, whose *Myriobiblion* ("Library"), or *Bibliotheca,* has preserved the fullest account of the work. Interpreting Theognostus' text as subordinating the Son and the Holy Spirit to the Father, Photius scorned what he considered Origenistic views of the divine Trinity. Yet the orthodox Athanasius of Alexandria appealed to the *Hypotypōseis* during the 4th-century controversy with Arianism, a heretical movement teaching that Christ is inferior to the divine nature, being the human form of the created Logos (Word).

The *Hypotypōseis* reflected other Origenistic opinions contrary to Neoplatonism, such as the noneternity of matter and the rational possibility of Christ's incarnation, tenets characteristic of the Christianized Hellenistic philosophy at the Alexandrian school. Despite his criticism, Photius still commended Theognostus' treatment of Christ's redemptive work and admired the clarity of his Attic literary style. An English translation of the extant fragments of the *Hypotypōseis* is contained in the collection *The Ante-Nicene Fathers,* Alexander Roberts (ed.), vol. 6 ( 1885). Newly discovered remains of the second book were published by Franz Diekamp in 1902.

**Theoleptus** OF PHILADELPHIA (b. *c.* 1250, Nicaea—d. *c.* 1326, Philadelphia), Greek Orthodox metropolitan of Philadelphia and theological polemicist and writer on Christian asceticism, who emerged as a central figure in the political and theological turmoil of his age.

A married deacon of the Eastern Church, in Bithynia, northwest Asia Minor, Theoleptus actively opposed the attempted church union of East and West promoted by the political strategy of the Byzantine emperor Michael VIII Palaeologus. With the majority of the Orthodox clergy, he repudiated the temporary decree of union promulgated by John XI Beccus, patriarch of Constantinople, and Pope Gregory IX at the general council of Lyon in 1274, and consequently was excommunicated by Beccus. Leaving his wife, Theoleptus retired into solitude *c.* 1275, probably on Mt. Athos, northwest Greece, the centre of Eastern Orthodox monasticism. There he practiced a form of contemplative prayer known as Hesychasm.

At the accession of the anti-unionist emperor Andronicus II (1282–1328) and patriarch Gregory I, reunion with Rome was formally rejected. Named archbishop of Philadelphia in 1285, Theoleptus composed a sharp critique of the Orthodox clergy who supported patriarch Beccus' unionist movement. His attack on patriarch Gregory II Cyprius' moderate doctrinal teaching on the Holy Spirit's relationship to both Father and Son caused Gregory's dismissal. Renowned as a spiritual director throughout Byzantium, Theoleptus was chosen by Empress Irene, widow of Emperor John Palaeologus, to be her adviser.

**theological liberalism,** a form of religious thought that establishes religious inquiry on the basis of a norm other than the authority of tradition. It was an important influence in Protestantism from about the mid-17th century through the 1920s.

The defining trait of this liberalism is a will to be liberated from the coercion of external controls and a consequent concern with inner motivation. Although some earlier indications of the liberal temper of mind existed, it became overtly evident during the Renaissance, when curiosity about natural man and appreciation for the human spirit developed, and during the Reformation.

The modern historical period of theological liberalism began, however, with the 17th-century French philosopher and mathematician René Descartes. This first phase, called Rationalism or the Enlightenment, lasted until about the mid-18th century. In designating the thinking self as the primary substance from which the existence of other realities was to be deduced (except that of God), Descartes initiated a mode of thinking that remained in force through the 19th century and laid the ground for the presuppositions of this modern consciousness: (1) confidence in human reason, (2) primacy of the person, (3) immanence of God, and (4) meliorism (the belief that human nature is improvable and is improving). The many persons influencing religious thought in this period included the philosophers Benedict de Spinoza (Dutch), Gottfried Wilhelm Leibniz and Gotthold Ephraim Lessing (both German), and John Locke and Samuel Clarke (both English), and the English writers and philosophers known as the Cambridge Platonists and the Deists.

The second stage of theological liberalism, Romanticism, lasted from the late 18th century to the end of the 19th. Marked by the discovery of the uniqueness of the individual and the consequent significance of individual experience as a distinctive source of infinite meaning, this premium upon personality and upon individual creativity exceeded every other value. The American and French revolutions provided the symbol of this spirit of independence and dramatically exemplified it in political action.

Jean-Jacques Rousseau and Immanuel Kant were the architects of Romantic liberalism. In theology, the German Friedrich Schleiermacher, called the father of modern Protestant theology, was outstanding. Unlike Kant, who saw in moral will the clue to man's higher nature, Schleiermacher seized upon the feeling of absolute dependence as being simultaneously that which "signifies God for us" and that which is distinctive in the religious response. Thus, self-consciousness in this deep religious sense becomes God-consciousness. According to Schleiermacher, the Christian is brought to this deeper vein of self-consciousness through the man Jesus, in whom the God-consciousness had been perfected. The nurture of God-consciousness in relation to Jesus Christ, Schleiermacher believed, led to the creation of the church as a fellowship of believers.

The German Albrecht Ritschl dominated liberal Protestant theology after Schleiermacher, and two other German theologians, Wilhelm Herrmann and Adolf von Harnack, were Ritschl's most prominent followers. In the United States, Horace Bushnell was the most significant liberal theologian. Another important liberal was Walter Rauschenbusch, leader of the Social Gospel movement.

The third period of theological liberalism, Modernism, from the mid-19th century through the 1920s, was marked by the discovery of the significance of historical time and an emphasis upon the notion of progress. The decisive events stimulating these interests were the Industrial Revolution and the publication of Charles Darwin's *Origin of Species* (1859). A determined course emerged among Modernists to bring religious thought into accord with modern knowledge and to solve issues raised by modern culture. The study of Christian doctrine was transformed into the psychological study of religious experience and into the sociological study of religious institutions and customs and the philosophical inquiry into religious knowledge and values. Among important figures during this period were Thomas Huxley and Herbert Spencer in England, William James, John Dewey, Shailer Mathews, and Harry Emerson Fosdick in the United States, and Ernst Troeltsch in Germany.

After the 1920s many theologically liberal ideas were challenged by Neo-orthodoxy, a theological movement in Europe and the United States that used the traditional language of Protestant orthodoxy and advocated a return to biblical faith centred in Christ, although it accepted modern critical methods of biblical interpretation.

**theology,** discipline of religious thought that is restricted in its narrower sense, because of its origination and format, to Christianity but that may be applied in a broader sense, because of its themes, to other religions. The themes of theology are God, man, the world, salvation, and eschatology (the study of the final events in the history of mankind).

A brief treatment of the discipline of theology follows. For full treatment, *see* MACROPAEDIA: Theology. The subject matter of the discipline is treated in a number of articles in the MACROPAEDIA. For a survey of systematic interpretations of the divine or sacred, *see* Religious and Spiritual Belief, Systems of. For a survey of major theological concerns within particular religions, *see* Doctrines and Dogmas, Religious. For treatment of Judeo-Christian theology, in the context of other aspects of the tradition, *see* Biblical Literature and Its Critical Interpretation; Christianity; Eastern Orthodoxy; Judaism; Protestantism; Roman Catholicism. For a treatment of Islāmic theology, *see* Islām, Muḥammad and the Religion of. For references to theological considerations in other religions, consult the Index.

For a description of the place of theology in the circle of learning and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Eight.

While the term theology as it originated in the works of Plato and other Greek philosophers denoted the teaching of myth, the discipline received its most distinctive content and methodology within Christianity. Largely

because of its resultant reflection of the particular concerns and categories of one tradition, the concept of theology as a neutral scientific tool applicable to religions in general is difficult to define. To apply such a framework indiscriminately in the discussion of other religions can result in forced analogies and false conclusions. In certain Eastern traditions, for example, in which no concept of "god" in the Western sense obtains, the enterprise of theology is relevant only to a very limited extent and in a very modified form. An additional difficulty lies in what is generally regarded as the explicit intent of the theologian to explicate his or her own faith.

Unlike the discipline of the history of religions, theology does not claim the perspective of detached observation and purely empirical analysis. Even though the extent varies from religion to religion, theology claims in some degree a normative element—arising out of the authority of a divine teacher, personal revelation, or some other kind of spiritual encounter that elicits commitment. The objects of the history of religions and those of theology, however, while they must be approached with different categories and criteria, resist strict separation.

It is the precedent of authority that most clearly distinguishes theology also from philosophy, the tenets of which are generally based on timeless evidence apprehensible by autonomous reason. Nevertheless, theology does employ reason in addressing many of the same concerns as philosophy. In fact, much of modern philosophy may be viewed as the secularization of theological concerns.

**Theophanes** THE CONFESSOR, SAINT (b. *c.* 752—d. *c.* 818, island of Samothrace, Greece; feast day March 12), Byzantine monk, theologian, and chronicler, a principal adversary of the heterodox in the Iconoclastic Controversy (concerning the destruction of sacred images). The annals he wrote are the leading source for 7th- and 8th-century Byzantine history.

Of a noble family related to the Macedonian dynasty, Theophanes became a monk shortly after marrying a patrician woman; he founded a monastery near Cyzicus. Advocating the early Christian tradition of using religious art to ornament worship, Theophanes, at the second general Council of Nicea (787), argued for its continued practice in the Eastern Church. He ridiculed Iconoclastic Byzantine emperors. After being imprisoned in Constantinople (814–815) by Emperor Leo V the Armenian, he was banished to the island of Samothrace, where he died. The Greek and Latin churches revere him as a saintly defender of orthodox faith; hence the title Confessor.

Between the years 810 and 814 Theophanes, at the invitation of a friend, the noted historian George Syncellus, wrote his chief work, the *Chronographia* ("Chronography"), a series of annals on Byzantine, Arabic, and Latin history, which is particularly valuable because it used older sources now lost and is the only comprehensive chronicle of 7th- and 8th-century Byzantium. According to modern historians, Theophanes lacked depth of scholarship, historical insight, and objectivity. His *Chronographia,* however, presents the sole detailed account of the Byzantine victory over the Arab besiegers of Constantinople (674–678) and describes the famous "Greek fire," an explosive mixture that could be hurled great distances and enabled the Byzantines to destroy the Arab fleet. Theophanes also graphically recorded the disastrous defeat of Emperor Nicephorus I by the Bulgarians near Pliska, July 26, 811, in which the Emperor was slain, the first Byzantine ruler to be killed by barbarians since Emperor Valens at the Battle of Adrianople in 378.

**Theophanes** THE GREEK (b. *c.* 1330/40—d. 1405), one of the leading late Byzantine painters of murals, icons, and miniatures who influenced the 15th-century painting style of the Novgorod school (*q.v.*) and the Moscow school (*q.v.*). His early career was spent in Constantinople and the Crimea, but after *c.* 1370 he worked in Russia. Although he painted hundreds of works, the only ones that can be certainly attributed to him are frescoes in the Church of the Transfiguration in Novgorod (1378).

**theophany** (from Greek *theophaneia,* "appearance of God"), manifestation of deity in sensible form. The term has been applied generally to the appearance of the gods in the ancient Greek and Near Eastern religions but has in addition acquired a special technical usage in regard to biblical materials. In the Old Testament, God is depicted as appearing in human form, in natural cataclysms, in a burning bush, a cloud, or a gentle breeze—forms often associated with the divine "name" or "glory" (originally a visible halo accompanying the divine appearance). Old Testament theophanies are presented as actual historical events or as prophetic visions with symbolic overtones. The mark of biblical theophanies is the temporariness and suddenness of the appearance of God, which is here not an enduring presence in a certain place or object. The extension of the term theophany to such New Testament events as the Baptism and transfiguration of Jesus (also called epiphanies) has been questioned as inappropriate because in Orthodox Christian doctrine Christ himself in his whole life and work and death is the manifestation of God. The incarnation of Christ, however, may be seen as the ultimate and fullest form of divine manifestation in a whole spectrum of theophanies.

**Théophile** DE VIAU, Viau also spelled VIAUD (French poet): *see* Viau, Théophile de.

**Theophilus** (d. Jan. 20, 842, Constantinople), Eastern Roman emperor (829–842), principal promoter of the 9th-century Byzantine renascence of learning, and the last advocate of the Eastern heresy of Iconoclasm (the destruction of religious images) in a reign beset by Arab invasions.

The son of the emperor Michael II, of the Phrygian dynasty traditionally favourable to Iconoclasm, Theophilus was liberally educated by the Byzantine scholar and ardent Iconoclast John Philoponus. He was also much influenced by the learned court of the early 9th-century caliph of Baghdad Hārūn ar-Rashīd.

Theophilus was crowned as co-emperor in 820 and shortly thereafter married a beauty, Theodora, chosen from a group of candidates. On becoming sole emperor in 829, he emulated Hārūn ar-Rashīd by wandering about the capital informally, listening to his subjects' complaints. An intelligent financier and administrator, he dispatched architects and engineers to construct fortresses which would anchor Byzantium's northern defenses against the Vikings and the Magyars. He also bolstered his defenses, east and west, against the Muslims. For despite his interest in their culture, Theophilus was compelled to war with the Muslims throughout his reign.

Having repelled the caliph Ma'mūn, Theophilus met with disastrous reversals at the hands of Ma'mūn's brother, the caliph al-Mu'taṣim, who struck at the most important centres of Asia Minor on the route to Constantinople. Theophilus was defeated in a bloody battle at Dazimon (now Dazmana, Tur.) in July 838. Ancyra fell, and a month later al-Mu'taṣim took Amorium, one of the empire's chief fortresses and the home of Theophilus' dynasty. Exploiting dissension within the Arab camp, however, Theophilus in 841, with the help of Spanish Moors, captured Melitene on the Armenian border, forcing al-Mu'taṣim to sign a truce.

Under Theophilus, Iconoclasm was given full rein. To weaken the political influence of Greek Orthodox monasticism, the Emperor and John Philoponus (who had become patriarch of Constantinople) mounted a persecution against the users of icons in Orthodox liturgy and devotion. Support for Iconoclasm soon waned, however, and the vast majority of the Greek Orthodox rallied to the defense of their sacred art.

The Byzantine cultural revival stimulated by Theophilus included two significant advances in the area of classical studies: the gradual substitution of the minuscule, or smaller, cursive hand for the uncial, or larger, script, and the increase in the number of *scriptoria,* or copyists' workshops. Theophilus also restored the University of Constantinople after its 8th-century decline and appointed the brilliant Byzantine teacher Leo the Mathematician as its new rector.

**Theophilus,** also called THEOPHILUS PRESBYTER, probable pseudonym of ROGER OF HELMARSHAUSEN (fl. 12th century), German monk who wrote *De diversis artibus* (*c.* 1110–40; also called *Schedula diversarum artium*), an exhaustive account of the techniques of almost all the known crafts of the first half of the 12th century. From his writings it can be deduced that Theophilus was of the Benedictine order and that he was a practicing craftsman. He may have been the celebrated German metalworker Roger of Helmarshausen, a monk who made a portable altar (1100) now in the cathedral treasury at Paderborn. Theophilus shows considerable interest in the techniques of metalwork, but he also discusses the crafts of wall painting, manuscript illumination, stained glass, and ivory carving. The work is divided into three books, and the introduction to each is of interest in reflecting the attitude to his art of a practicing medieval craftsman who was also an educated person. It contains the earliest references in Europe to paper and to oil painting. C.R. Dodwell edited the definitive Latin text with an English translation in 1961.

**Theophilus** OF ALEXANDRIA, SAINT (fl. early 5th century; feast day, Egyptian Coptic Church, October 15; in the Syrian Church, October 17), theologian and patriarch of Alexandria, Egypt, violent opponent of non-Christian religions, severe critic of heterodox influence among Christian writers and monks, and a major figure in the ecclesiastical politics of the Greek Orthodox Church of his day.

Reputed to have been an intellectually gifted student at Alexandria, Theophilus, a priest, was chosen patriarch in 385 and soon began a campaign to destroy the non-Christian religious shrines of North Africa. With the permission of the emperor Theodosius I, he destroyed the renowned temples to the gods Mithra, Dionysius, and Sarapis. Endowed with a fiery temperament, Theophilus obliterated all vestiges of these pagan shrines with a vengeance, even including the levelling (391) of the Sarapeum with its irreplaceable collection of classical literature. He used the stone from the temples to construct new Christian churches.

At first an adherent of the 3rd-century Christian Platonist Origen, Theophilus was challenged in 399 by a group of Egyptian monks on his statement approving Origen's concept of an absolutely immaterial God. Concurring with certain of the monks' anthropomorphic notions, he reversed his opinion two years later and denounced Origen's writings. In his consequent persecution of Origenist monks, he personally commanded troops sent to destroy their desert monasteries.

Summoned to Constantinople to explain his actions, Theophilus, with implacable hostility, impugned the orthodoxy of John Chrysostom,

the leading theologian, by implicating him in controverted points of Origenism. Successful in condemning and exiling Chrysostom at the Synod of the Oak in 403, Theophilus continued to play a principal role in the affairs of the Eastern Church and to further the influence of Alexandria over Constantinople. His nephew and successor as patriarch, Cyril, maintained the Alexandrian school as a bulwark of orthodoxy.

Although Theophilus is charged with ruthlessness by some of his contemporaries, others describe him as a sincere promoter of monasticism. He is honoured as a saint in the Egyptian Coptic and Syrian Churches. Theophilus' writings survive only in part. His correspondence on the Origenism dispute includes a tract against Chrysostom and letters to the Latin biblical scholar Jerome and to popes Anastasius I and Innocent I. These and a collection of his liturgical and pastoral addresses, some translated into Latin by Jerome, are contained in *Patrologia Graeca,* edited by J.-P. Migne (1857–66), vol. 65.

**Theophrastus** (b. *c.* 372 BC, Eresus, Lesbos—d. *c.* 287), Greek Peripatetic philosopher and pupil of Aristotle. He studied at Athens under Aristotle, and when Aristotle was forced to retire in 323 he became the head of the Lyceum, the academy in Athens founded by Aristotle. Under Theophrastus the enrollment of pupils and auditors rose to its highest point.

Theophrastus was one of the few Peripatetics who fully embraced Aristotle's philosophy in all areas of metaphysics, physics, physiology, zoology, botany, ethics, politics, and history of culture. His general tendency was to strengthen the systematic unity of those subjects and to reduce the transcendental or Platonic elements of Aristotelianism as a whole. Of his few surviving works, the most important are *Peri phytōn historia* ("Inquiry into Plants") and *Peri phytōn aitiōn* ("Growth of Plants"), comprising nine and six books, respectively. Of dubious origin are the smaller treatises attributed to him on fire, winds, signs of weather, scents, sensations, and other subjects. His notable *Charaktēres* (many English translations) consists of 30 brief and vigorous character sketches delineating moral types derived from studies that Aristotle had made for ethical and rhetorical purposes; this work later formed the basis for the masterpiece of Jean de La Bruyère, *Les Caractères* . . . (1699). In his ethical teachings, famous because of the assaults of the Stoic philosophers, Theophrastus reiterated Aristotle's notion of a plurality of virtues with their relative vices and acknowledged a certain importance to external goods, which the Stoics held were mere luxuries for human life.

Among Theophrastus' other works is the *Physikōn doxai* ("Opinions of Natural Philosophers"). As reconstructed by Herman Diels in *Doxographi Graeci* (1879), it provides a foundation for the history of ancient philosophy.

**Theophylactus** (pope): *see* Benedict VIII; Benedict IX.

**Theophylactus** OF OCHRIDA, also spelled THEOPHYLACT OF OHRID (b. *c.* 1050, Euboea, Aegean island of Greece—d. *c.* 1109), Greek Orthodox archbishop of Ochrida (modern Ohrid, Macedonia), theologian and linguistic scholar, who helped disseminate Byzantine culture among the Balkan Slavs during the early Middle Ages.

Having studied in Constantinople under the Neoplatonist philosopher Michael Psellus, Theophylactus became the first teacher of rhetoric in the patriarchal academy, was appointed tutor to the heir presumptive to the throne, and was made a deacon for the basilica of Hagia Sophia. During this period he composed his *Paideia basilikē* ("The Education of Monarchs").

By his election *c.* 1078 as archbishop of Ochrida, then under the Bulgars, Theophylactus in effect became the agent of the Byzantine policy of assimilating colonial peoples into the empire's governmental and cultural structure. His voluminous correspondence (to imperial and ecclesiastical authorities in Constantinople) is the best surviving source from this period on the state of the Bulgarian church and on its relations with the Greek world. In his letters Theophylactus expresses deep displeasure at being exiled to such a dreary outpost of the empire and shows an overriding sense of cultural superiority over the barbarian (*i.e.,* ignorant of Greek) Bulgars, by apologizing for having sometimes to mention Slavic proper names. Nonetheless, he vigorously defended the Slavs against the extortionist Byzantine tax collectors. This grievance, he wrote, was compounded by the often arbitrary practices of local Greek officials, and he cautioned the authorities in Constantinople to treat the Bulgars with restraint lest they revolt.

Sincerely complimenting the Slavic people, Theophylactus wrote the *Life of Clement of Ochrida,* the first Slavonic bishop, lavishing praise on Cyril and Methodius, the apostles to the Slavs and creators of the Slavic alphabet.

In his *Allocutio de iis quorum Latini incusantur* (*c.* 1090; "Address on Matters for Which the Latins Are Attacked"), Theophylactus sharply criticized his Greek co-religionists for slandering Western Christianity. Nonetheless, he disputed the papal claims to primacy over all Christendom and Western theological speculation on the Trinity. Viewing these as fundamental questions, he refused to compromise his Orthodox position.

**Theophylactus Simocattes,** also spelled THEOPHYLACT SIMOCATTA (b. Egypt—d. after 640, probably Constantinople), Byzantine historian whose chronicles of the Eastern Roman Empire provide a unique source for the Greek relations with the Slavs and Persians during the 6th and 7th centuries.

Descended from a family of high-ranking civil servants in Egypt, Simocattes held the position of prefect and imperial secretary at Constantinople under the emperor Heraclius (ruled 610–641). A protégé of Patriarch Sergius I, he gained a reputation for classical Byzantine literary style. His principal work is an eight-book history of the reign of Emperor Maurice (582–602), written between 628 and 638 (modern edition by C. de Boor, 1887). Treating principally of the Byzantine war in the East against Persia, the chronicle was supplemented by accounts of the Persian king Khosrow II (ruled 590–628); it also recorded the war in the Balkans against the Slavs and the Avars, including important data on various Turkish leaders. The "History" reveals the use of excellent eyewitnesses acquainted with Persian and Byzantine authorities and contains archives and ambassadorial testimony accessible to Simocattes in his official position of prefect.

Because of its extravagant allegorical form, however, Simocattes' writing makes for difficult reading. His ornate literary structure and vocabulary exemplified the Byzantine aesthetic principle of *mimēsis,* or imitation of what was considered the pure form of the Attic (classical Greek) historians. This method emphasized the preservation and transmission of the irreplaceable Greek tradition of learning and culture of which the Byzantines claimed to be the divinely chosen custodians. Simocattes' "History," moreover, follows the Byzantine technique of covering a carefully defined period of events, which resumes where the previous historian left off and closes at a point to be taken up by his successor. The consequent historical records are superior to any chronicle produced by the West during this time.

Of a rhetorical and sophistical nature is Simocattes' *Peri diaphorōn physikōn aporēmatōn kai epilyseōn autōn* ("On the Explanation and Solution of Physical Problems"), composed in dialogue form. A Latin edition, *Quaestiones Physicae* ("Questions in Physics") was edited in 1953 by L.M. Positano. Simocattes also wrote an exotic collection of letters, the *Epistolai ethikai, agroikikai, hetairikai* ("Ethical, Bucolic, and Love Letters"). This correspondence was edited by Rudolph Hercher as *Epistolographi Graeci* (1873; "Greek Epistolary").

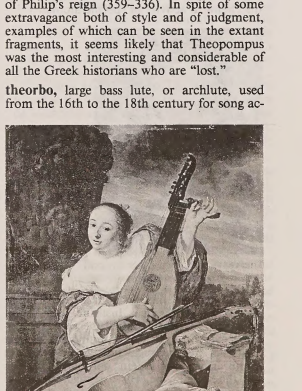
**theophylline,** alkaloidal drug used in medicine as an antiasthmatic, coronary vasodilator, and diuretic. Theophylline is a xanthine alkaloid, a methylxanthine chemically related to caffeine and theobromine. Along with caffeine, it is an active constituent of tea (*Camellia sinensis*), but it is commercially produced in pharmaceutical manufacture by chemical synthesis.

Administered orally or rectally in the treatment of asthma, it facilitates breathing by relaxing the bronchioles in the lungs. It is administered by injection for the treatment of congestive heart failure to stimulate the heart and increase the total output of blood by the heart. Given orally, it acts as a diuretic by inhibiting reabsorption in the renal (kidney) tubules.

**Theopompus** OF CHIOS (b. *c.* 380 BC, Chios, Ionia), Greek historian and rhetorician whose *Philippica,* though lost in original, has survived through the work of later writers to form one element in the tradition concerning the reign of Philip II of Macedon. Twice exiled from his native town, where he was one of the leaders of the aristocratic party, Theopompus spent time in Athens and Egypt.

His works, which were chiefly historical, also included the *Hellenica,* which treated the history of Greece, in 12 books, from 411 (where Thucydides breaks off) to 394—the date of the Battle of Cnidus. Of this work only a few fragments survive. A far more elaborate work was the *Philippica,* a history in 58 books of Philip's reign (359–336). In spite of some extravagance both of style and of judgment, examples of which can be seen in the extant fragments, it seems likely that Theopompus was the most interesting and considerable of all the Greek historians who are "lost."

**theorbo,** large bass lute, or archlute, used from the 16th to the 18th century for song ac-



Lady playing a theorbo in "The Musician," oil on canvas by Bartholomeus van der Helst, 1662; in the Metropolitan Museum of Art, New York City

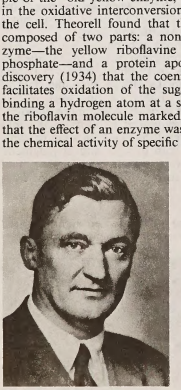
By courtesy of the Metropolitan Museum of Art, New York City, purchase, 1872

companiments and for basso continuo parts. It had six to eight single strings running along the fingerboard and, alongside them, eight off-the-fingerboard bass strings, or diapasons. Both sets of strings had separate pegboxes connected by an S curve in the instrument's neck. On 18th-century theorbos all but the two top courses of strings were double.

A similar, smaller instrument, the theorbolute, or French lute, was a modification of the regular double-strung lute, to which were added one to three off-the-fingerboard courses of bass strings. There were two pegboxes, one angled backward. Smaller and more agile than the theorbo, the theorbo-lute was the favourite of the 17th-century school of French lutenists; through them, it influenced the style of French harpsichord music.

**Theorell, Axel Hugo Teodor** (b. July 6, 1903, Linköping, Swed.—d. Aug. 15, 1982, Stockholm), Swedish biochemist whose study of enzymes that facilitate oxidation reactions in living cells contributed to the understanding of enzyme action and led to the discovery of the ways in which nutrients are used by organisms in the presence of oxygen to produce usable energy. Theorell won the Nobel Prize for Physiology or Medicine in 1955.

An assistant professor of biochemistry at Uppsala University (1932–33; 1935–36), Theorell was the first to isolate crystalline myoglobin, an oxygen-carrying protein found in red muscle (1932). At the Kaiser Wilhelm Institute, Berlin (1933–35), he worked with Otto Warburg in isolating from yeast a pure sample of the "old yellow enzyme," instrumental in the oxidative interconversion of sugars by the cell. Theorell found that the enzyme is composed of two parts: a nonprotein coenzyme—the yellow riboflavine (vitamin $B_2$) phosphate—and a protein apoenzyme. His discovery (1934) that the coenzyme actively facilitates oxidation of the sugar glucose by binding a hydrogen atom at a specific site on the riboflavin molecule marked the first time that the effect of an enzyme was attributed to the chemical activity of specific atoms.



Theorell
By courtesy of World Health Organization

As director of the biochemical department of the Nobel Medical Institute, Stockholm (1937–70), Theorell studied the oxidative enzyme cytochrome *c*, determining the precise nature of the chemical linkage between the iron-bearing, nonprotein porphyrin portion and the apoenzyme. His investigation of the hydrogen-transfer enzyme, alcohol dehydrogenase, led to the development of sensitive blood tests that have found wide application in the determination of legal definitions of drunkenness. Besides the Nobel Prize, Theorell received a number of awards and honours. He also served as president of the Swedish Royal Academy of Science and International Union of Biochemistry.

**theorem,** in mathematics and logic, a proposition or statement to be demonstrated. In geometry, a proposition is commonly considered as a problem (a construction to be effected) or a theorem (a statement to be proved). The statement "If two lines intersect, each pair of vertical angles is equal," for example, is a theorem. The so-called fundamental theorem of algebra asserts that every rational integral equation has at least one root or solution. The Greeks also recognized a proposition lying between a theorem and a problem, the porism, directed to producing or finding what is proposed.

**theosophy,** religious philosophy with mystical concerns that can be traced to the ancient world but that has been of catalytic significance in religious thought in the 19th and 20th centuries. The term *theosophy* is derived from the Greek *theos,* "god," and *sophia,* "wisdom," and is generally translated as "divine wisdom." All theosophical speculation has as its foundation the mystical premise that God must be experienced directly in order to be known at all.

In modern times theosophy has been widely identified with the doctrines promoted by religious mystic Helena Blavatsky through the Theosophical Society. The term may also be used in a more general sense to refer to a certain strain of mystical thought found in such thinkers as the ancient Greek philosophers Pythagoras and Plato, the Gnostic teachers Simon Magus and Valentinus, the Neoplatonist philosophers Plotinus and Proclus, the medieval northern European mystics Meister Eckhart and Nicholas of Cusa, the Renaissance speculative mystics Paracelsus and Giordano Bruno, the German philosophical mystic Jakob Böhme, and the German Romantic philosopher Friedrich Schelling. But the richest and most profound source of theosophical views has been Indian thought, where they may be traced from the earliest scriptural Vedas through the Upanishads and the *Bhagavadgītā* ("Song of the Lord") to modern times. Elements of theosophy may also be found in the other Asian religions, especially in Islāmic Ṣūfism, Buddhism, and Taoism.

Despite its diversity, theosophical speculation reveals certain common characteristics. The first of these is an emphasis on mystical experience. Whether ancient or modern, theosophical writers have agreed that a deeper spiritual reality exists and that direct contact may be established with that reality through intuition, meditation, revelation, or some other state transcending normal human consciousness. A second characteristic is an emphasis on esoteric doctrine. A distinction between an inner, or esoteric, teaching and an outer, or exoteric, teaching is commonly accepted, and much attention is devoted to deciphering the meaning concealed in sacred texts. Modern theosophists claim that all the world religions, including Christianity, contain such an inner teaching. A third characteristic is an interest in occult phenomena. Most theosophical speculation reveals a fascination with supernatural or other extraordinary occurrences and with the achievement of higher psychic and spiritual powers. It is held that knowledge of the divine wisdom gives access to the mysteries of nature and humankind's deeper being. A fourth characteristic is a preference for monism—the view that reality is constituted of one principle, such as mind or spirit. Despite a recognition of basic distinctions between the exoteric and esoteric, between the phenomenal world and a higher spiritual reality, and between the human and the divine, which suggests dualism, most theosophically inclined writers have affirmed an underlying, all-encompassing unity that subsumes all differentiation.

Since the 19th century theosophy has been identified with the Theosophical Society founded in 1875 in New York City by Helena Petrovna Blavatsky and Henry Steel Olcott. A woman of noble Russian descent, Blavatsky had immigrated to the United States in 1873 after many years of travel and occultist investigations throughout Europe and the Middle East. Olcott, an American lawyer, newspaperman, and student of spiritualism, soon fell under her sway. The two moved to India in 1878, eventually establishing their base of operations at Adyar, near Madras, which still serves as the international headquarters for the Theosophical Society. Branch societies were established throughout much of India and in the major cities of Europe. Blavatsky meanwhile authored a series of often obscure works that have since been accepted as classic expositions of theosophical doctrine; best known are her two-volume *Isis Unveiled,* published in 1877, and *The Secret Doctrine,* also in two volumes, published in 1888.

The Theosophical Society affirms the following objectives: (1) to form a nucleus of the universal brotherhood of humanity, without distinction of race, creed, sex, caste, or colour; (2) to encourage the study of comparative religion, philosophy, and science; and (3) to investigate unexplained laws of nature and the powers latent in human beings. The society insists that it is not offering a new system of thought but merely underscoring certain universal concepts of God, nature, and humanity that have been known to wise men in all ages and that may be found in the teachings of all the great religions. One of the society's most controversial claims concerns the existence of a brotherhood of Great Masters, or Adepts, who, it is asserted, have perfected themselves and are directing the spiritual evolution of humanity.

The Theosophical Society almost expired in the United States in the years following Blavatsky and Olcott's removal to India. During the 1880s and '90s it was revived by William Q. Judge (1851–96), an Irish-born American mystic, who succeeded in making the American section the most active unit in the international movement. The American wing, however, was to be repeatedly disrupted by schisms in later years. Following Blavatsky's death in 1891, tensions rapidly escalated between Judge and Olcott, culminating in the secession of the American movement from Indian control in 1895. After Judge's death in 1896, Katherine Tingley (1847–1929) succeeded to the headship of the American section; at her instigation the American headquarters was transferred to Point Loma in California, and the focus of the movement's work was recast along more practical lines. In 1950–51 the headquarters was moved to Pasadena, Calif. A new schism developed, with still a third group claiming to represent theosophy in America. Such sectarianism has declined in recent years.

Though Judge came to dominate the American work after 1891, Olcott maintained an uneasy control over the international movement. Upon his death in 1907, he was succeeded as president in India by the charismatic Englishwoman Annie Besant (1847–1933), whose leadership gave Indians a sense of pride in that they were exporting ideas of importance to the West. Besant's many books still provide one of the best expositions of theosophical belief. In 1911 she proclaimed Jiddu Krishnamurti (1895–1986), an obscure Indian youth, as the vehicle of a coming World Teacher, an act that led to much controversy. Krishnamurti subsequently renounced any claims to being a World Teacher and began a career of writing and teaching. Beginning in the 1920s he spent much time in the United States and Europe, where his books have enjoyed considerable popularity. He founded several schools and lectured before large audiences in North America, Europe, and India.

The influence of the Theosophical Society

has been rather significant, however, despite its small following. The movement has been a catalytic force in the 20th-century Asian revival of Buddhism and Hinduism and a pioneering agency in the promotion of greater Western acquaintance with Eastern thought. In the United States it has influenced a whole series of religious movements, including the I Am movement, Rosicrucianism, the Liberal Catholic Church, Psychiana, Unity, and sections of the New Thought movement.

**Theotokás, Yórgos,** Yórgos also spelled GEÓRGIOS (b. Aug. 27, 1906, Constantinople, Ottoman Empire [now Istanbul, Tur.]—d. Oct. 30, 1966, Athens, Greece), Greek novelist known for his clarity of expression and civilized writing.

Theotokás studied in Athens, Paris, and London, and his first literary venture was an essay, "Free Spirit" (1929). He published three novels before World War II, *Argo* (1936), probably the best known; *The Demon* (1938); and *Leonís* (1940), perhaps his best, set in the Constantinople of his childhood.

After the war Theotokás turned his attention to the theatre, writing plays and working as director of the National Theatre and later as president of the administrative committee of the State Theatre of Northern Greece. Of his plays, the best known is *The Game of Madness and Prudence,* set in Byzantine times. His last works were books of travel, including *Travel in the Middle East and the Holy Mountain* (1961).

**Theotókis, Konstantínos** (b. May 1872, Corfu, Greece—d. July 1, 1923, Corfu), Greek novelist of the realist school, whose clear and pure Demotic Greek was flavoured by Corfiote idioms.

Born into an aristocratic family of Corfu, Theotókis was given a sound education. At first much under the influence of Friedrich Nietzsche, he later, in Germany, became interested in socialism, an interest that coloured all his works, such as *Honour and Money* (1914), a novel with a distinctly social focus. His long novel *Slaves in Their Chains* (1922), set in Corfu during a period of social change, reveals the old aristocracy trying to keep up a way of life that is long past, the bourgeoisie on the decline, and the newly rich trying to use their wealth to buy social status. Two long stories, *The Convict* (1919) and *The Life and Death of Karavelas* (1920) are notable.

**Theotokópoulos, Doménikos** (painter): *see* Greco, El.

**Theotokos** (Greek: "God-Bearer"), in Eastern Orthodoxy, the designation of the Virgin Mary as mother of God. The term has had great historical importance because the Nestorians, who stressed the independence of the divine and human natures in Christ, opposed its use, on the ground that it compromised the human nature of Christ, and held that the more accurate and proper term for Mary was Christotokos ("Christ-Bearer"). The Council of Ephesus (431), basing its arguments on the unity of the person of Christ, anathematized all who denied that Christ was truly divine, and asserted that Mary was truly the mother of God. The Council of Chalcedon (451) used the term in formulating the definition of the hypostatic union (of Christ's human and divine natures).

**Thera,** Modern Greek THÍRA, also called SANTORÍN, or SANTORÍNI, island, southernmost island of the Cyclades group, Greece, in the Aegean Sea, sometimes included in the Southern Sporades group. The island has an area of 29 square miles (76 square km) and, together with other islands, forms an *eparkhía* ("eparchy") of the *nomós* (department) of Cyclades.

Geologically, Thera is the remaining eastern half of an exploded volcano. Its bow-shaped rim and the remnant isles of Thirasía and Aspronísi form an open lagoon that measures 37 miles (60 km) in circumference. In the centre of the lagoon are two active volcanic islets, Néa Kaméni ("New Burnt Island") and Palaía Kaméni ("Old Burnt Island"). Thera proper consists largely of lava and pumice, the latter of which is the island's main export. Red-wine grapes are also grown. The lagoon is rimmed by red-, white-, and black-striped volcanic cliffs rising to almost 1,000 feet (300 m). The summit of Thera is the 1,857-foot (566-metre) limestone Mount Profítis Ilías in the southeast. The chief town, Thíra (locally called Firá), was



The modern town of Thíra, overlooking the bay on the west coast of the island of Thera, Greece
Hy Simon—Photo Trends

badly damaged by earthquake in 1956. Other settlements include Emborion and Pírgos to the south and the port of Oía at the north entrance to the lagoon, which was destroyed by the 1956 earthquake.

Known as Calliste ("Most Beautiful") in antiquity, Thera was occupied before 2000 BC. One of the largest volcanic eruptions known occurred on the island. This is thought to have occurred about 1500 BC, although, based on evidence obtained during the 1980s from a Greenland ice-core and from tree-ring and radiocarbon dating, some scholars believe that it occurred earlier, during the 1620s BC. Ash and pumice from the eruption have been found as far away as Egypt and Israel, and there has been speculation that the eruption was the source of the legend of Atlantis and of stories in the Old Testament book of Exodus.

During the Bronze Age the island of Crete, some 70 miles (110 km) south of Thera, was the centre of Minoan civilization. About 1450 BC most major settlements in central and southern Crete were destroyed by fire and abandoned. In 1939 the Greek archaeologist Spyridon Marinatos suggested that the eruption on Thera had led to the collapse of the Minoan civilization; his theory was widely accepted. During the 1980s, however, archaeologists found evidence that Minoan culture continued to flourish for some time after the eruption. Archaeological evidence also indicated that the amounts of ash from the eruption that fell on Crete were not enough to cause significant damage to crops or buildings.

About the beginning of the first millennium BC, Dorian settlers from the mainland landed on Thera. About 630 the important Theran colony of Cyrene was settled on the north coast of Africa, in accord with a command of the Delphic oracle. From 308 to 145 the island, a member of the Cycladic League, was a Ptolemaic protectorate.

From that period date many of the ruins of the ancient city of Thera, unearthed (1895–1903) by a German archaeologist on the east coast. The earliest excavations by the French School at Athens (1869) uncovered a Middle Minoan, or Cycladic (*c.* 2000–*c.* 1570 BC), city beneath the pumice at the northern tip of Thirasía. Of even greater significance was the excavation begun by Marinatos during the 1960s south of Akrotíri village, which revealed a rich Minoan city buried under the volcanic debris just as it stood at the time of the eruption. The city (still being excavated) consisted of large, well-built, multi-story houses that contain some of the finest Minoan frescoes found in the Mediterranean. The discoveries show that strong links existed during the Bronze Age between Crete and Thera. Pop. (1981) eparchy, 11,381; island, 7,083.

**theralite,** any member of a group of intrusive igneous rocks that contains labradorite (basic plagioclase feldspar), nepheline, and titaniferous augite. Theralites are classified in the nepheline-tephrite group in this series (*see also* nephelinite). Olivine, biotite, orthoclase feldspar, and an alkali amphibole may be present as subordinate constituents. With the exception of nepheline and orthoclase, the minerals of theralites are usually present in well-shaped crystals. Nepheline itself may be largely represented by secondary zeolites.

Theralites are comparatively rare. They are found in the Odenwald, in Germany; the Serra de Monchique of Portugal; the Kola Peninsula of Russia; and Strathclyde region in Scotland. Closely related rocks include teschenite, essexite, and shonkinite.

**Theramenes** (d. 404/403 BC, Athens [now in Greece]), Athenian politician and general, active in the last years of the Peloponnesian War (431–404 BC) and controversial in his own lifetime and since. His father, Hagnon, a contemporary of Pericles, served repeatedly as one of the 10 annual generals of Athens.

In 411 Theramenes emerged as one of the revolutionary leaders who persuaded the Athenian assembly to suspend the traditional institutions and entrust supreme control temporarily to a Council of Four Hundred. The total defeat of the Athenian expedition to Sicily (415–413) and the consequent revolts of many of the subject-allies had weakened Athenian finances severely; the acknowledged purpose of the revolutionary movement was to revise the constitution on a more economical basis. But the Council of Four Hundred was only able to maintain itself for rather less than four months. It failed to win the allegiance of the main Athenian fleet, which was stationed at Samos. Divisions arose within the Council, and, in the autumn of 411, when a mutiny broke out among the troops who were fortifying Piraeus, the harbour of Athens, the

Council sent Theramenes to quell it. Instead, he put himself at the head of the mutineers. The ensuing meeting of the assembly deposed the Council and restored the traditional constitution in large part but restricted some of the privileges of citizenship to a body called the Five Thousand.

In 410, commanding 20 ships, Theramenes collaborated with Alcibiades and the main Athenian fleet in inflicting a complete defeat on the Peloponnesian fleet near Cyzicus on the shore of the Propontis (Sea of Marmara). Alcibiades installed a garrison at Chrysopolis under Theramenes to exact a tithe from all shipping that came from the Black Sea. This revenue enabled the Athenians to put an end to the regime of the Five Thousand and restore their traditional institutions in full.

In 406, as captain of a ship, Theramenes took part in the naval victory over the Peloponnesians at the islands of Arginusae off the west coast of Asia Minor. Returning to Athens after the battle, he led agitation against the eight generals who had commanded in the engagement; the six who returned to Athens were condemned for negligence in not having picked up survivors from the ships disabled in the battle and were executed.

In the winter of 405–404, when the Peloponnesians besieged Athens, Theramenes had himself dispatched to negotiate with Lysander. He stayed away for three months while Athens was being reduced to starvation. Then he headed the embassy that negotiated the terms of capitulation to the Spartans.

Theramenes was a leading member of the Board of Thirty, the so-called Thirty Tyrants, whom Lysander set up to rule the conquered city soon after the capitulation. A split developed between Theramenes and Critias, another of the leaders. Critias induced the Thirty to put Theramenes to death by forcing him to drink hemlock.

**Therapeutae,** Greek THERAPEUTAI ("Healers," or "Attendants"), singular THERAPEUTES, Jewish sect of ascetics closely resembling the Essenes, believed to have settled on the shores of Lake Mareotis in the vicinity of Alexandria, Egypt, during the 1st century AD. The only original account of this community is given in *De vita contemplativa* (*On the Contemplative Life*), attributed to Philo of Alexandria. Their origin and fate are both unknown. The sect was unusually severe in discipline and mode of life. According to Philo, the members, both men and women, devoted their time to prayer and study. They prayed twice every day, at dawn and at evening, the interval between being spent entirely on spiritual exercise. They read the Holy Scriptures, from which they sought wisdom by treating them as allegorical, believing that the words of the literal text were symbols of something hidden. Attendance to bodily needs, such as food, was entirely relegated to the hours of darkness.

Members of the community lived near one another in separate and scattered houses. Each house contained a chamber, or sanctuary, consecrated to study and prayer. The Therapeutae had, in addition to the Old Testament, books composed by the founders of their sect on the allegorical method of interpreting Scripture. Philo's account refers to the composition of "new psalms" to God in a variety of metres and melodies. For six days a week, members lived apart, seeking wisdom in solitude. On the Sabbath they met in the common sanctuary, where they listened to a discourse by the member most skilled in their doctrines and then ate a common meal of coarse bread and a drink of spring water. The sect revered the number 7 and its square, but the most sacred of numbers was 50. Thus, on the eve of the 50th day they observed an all-night festival, with a discourse, hymn singing, and a meal, followed by a sacred vigil.

The main distinction between the Therapeutae and the Essenes is that the latter were anti-intellectual, while "wisdom," Philo says, was the main objective of the Therapeutae. The Therapeutae shared with the Essenes a dualistic view of body and soul.

**therapeutic radiology:** *see* radiation therapy.

**therapeutics,** treatment and care of a patient for the purpose of both preventing and combating disease or alleviating pain or injury.

A brief treatment of therapeutics follows. For full treatment, *see* MACROPAEDIA: Diagnosis and Therapeutics.

The therapeutic aim of preventive medicine is either to obviate the opportunity for a disease to take hold, as by childhood immunizations or adhering to a healthy diet and exercise program, or to detect a disease in its earliest stages, as screening for colon cancer or mammograms for breast cancer are intended to do. Therapeutics involves a wide variety of techniques, including the use of drugs, surgery, radiation, mechanical devices, and psychiatry. In conventional modern medicine, therapeutic concepts and techniques are incorporated into such therapeutic specialties as pharmacology, immunology, preventive medicine, psychiatry, psychotherapy, and radiology.

The scope of therapeutics is broad, as indicated by the many types of therapy. Included are surgical therapy, the correction or removal of diseased tissues by surgical operation; biological therapy, which involves the use of biological products, such as serums, vaccines, and antitoxins; drug therapy, including chemotherapy, the use of pure chemicals to attack specific diseases; radiation therapy, the use of X rays and radioactive isotopes to destroy diseased tissues; and psychotherapy, the use of counseling or behavioral modification to treat emotional disorders. Other forms of therapy make use of gold, heat, high-frequency sound (ultrasound), oxygen at normal pressure or at high pressure, infrared rays, ultraviolet rays, hypnosis, water baths (hydrotherapy), and vitamins. Still other forms include acupuncture, physical therapy, and occupational therapy.

The application of measures to prevent and cure disease goes back to early human history. The ancient Greeks believed in the healthy effects of proper diet and exercise, and through trial and error people found much of therapeutic value in plants, animals, and minerals. Accidental discoveries, keen observations, and careful study resulted in useful findings. For example, the value of digitalis for heart diseases was learned by a physician in England investigating a brew made from foxglove. Many techniques, such as cupping (applying a cup to the body's surface in order to create a vacuum with which to draw up the skin), were tried widely and ultimately discarded.

Following basic chemical and physical research in the 19th century, modern chemotherapy and therapeutics were born. Major contributions were made by Louis Pasteur, Robert Koch, and Paul Ehrlich, among others. Drugs were purified, specific measures against disease were developed, diseases were identified and their causes determined, and techniques for diagnosis, treatment, and prevention of disease were found.

The development of more effective and purer drugs was an important factor, as was an understanding of the specificity of drug action. Formerly, a "shotgun approach" to therapy was often used. Today the physician can choose the type of anesthetic agent that is best for a certain type of operation, the best type of drug for pain, and the type of drug best suited to control muscle spasm, high blood pressure, allergy, or infection.

In addition to advances ensuing from improved technology and increased understanding of drugs and the human organism, much of the development of modern therapeutics was a result of the work of individuals such as Florence Nightingale and Joseph Lister who brought attention to bear on hygiene, health education, hospital facilities, surgical techniques, transportation of the sick and injured, and other related factors.

**therapsid,** any member of a major order (Therapsida) of reptiles of Permian and Triassic time (from 286 to 208 million years ago). Therapsids were the stock that gave rise to mammals. As early as the preceding Carboniferous Period (from 360 to 286 million years ago), there appeared a distinct evolutionary line, beginning with the archaic mammal ancestors, order Pelycosauria, and leading toward mammals. From one pelycosaur family sprang the therapsids.

Primitive therapsids are present as fossils in certain Middle Permian deposits; later forms are known from every continent except Australia but are commonest in the Late Permian and Early Triassic of South Africa. The limbs and limb girdles were modified for four-footed locomotion. The skull, as in mammals, had a single opening in the temporal region, bounded below by a bony arch. In most species the teeth were differentiated into mammal-like nipping incisors, large stabbing canines, and a series of grinding cheek teeth. The lower jaw, however, was reptilian in structure, being composed of seven bones instead of one as in mammals, and had a different, primitive articulation with the skull. In advanced forms, as in mammals, there was a bony palate in the roof of the mouth.

A notable therapsid side branch was that of the herbivorous dicynodonts (two-tuskers), in which upper canines were retained but the other teeth were replaced by a horny bill. Among carnivorous therapsids, gorgonopsians and therocephalians were characteristic of the Permian, and cynodonts and bauriamorphs



(Right) Dicynodont (*Kannemeyeria*), a herbivorous therapsid, being attacked by a pack of cynodonts (*Cynognathus*), carnivorous therapsids; detail of a restoration of Triassic time in South Africa by Charles R. Knight

By courtesy of the Field Museum of Natural History, Chicago, and the artist, Charles R. Knight

were advanced Triassic representatives. A few therapsids were still present in the Late Triassic and even into the Jurassic, but most had by then become extinct or had evolved into primitive mammals.

**Theravāda** (Pāli: "Way of the Elders"), form of Buddhism prevalent in Sri Lanka, Myanmar (Burma), Thailand, Cambodia, and Laos.

Theravāda, like all other Buddhist schools, claims to adhere most closely to the original doctrines and practices taught by the Buddha. Theravādins accept as authoritative the Pāli canon of ancient Indian Buddhism and trace their sectarian lineage back to the Elders (Sanskrit: Sthaviras; Pāli: Theras), who followed in the tradition of the senior monks of the first Buddhist *saṅgha,* or community.

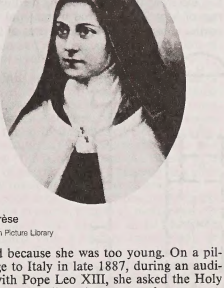
During the early centuries following the death of the Buddha, the community broke up into several sects that, in the beginning, differed little from one another, as far as is known (*see* eighteen schools). The first separation occurred in the 4th century BC at the time of the second council, when a group broke away from the Sthaviravādins and became known as the Mahāsaṅghika. A second major schism occurred when the Sarvāstivādins (who hold that "all is real") separated from the Vibhajyavādins (adherents of the Doctrine of Distinctions), presumably the Sthaviravādins. Those Vibhajyavādins that were distributed geographically in southern India and Sri Lanka became known as the Theravādins (the Pāli form of Sthaviravādins). During the reign of the emperor Aśoka (3rd century BC), the Theravāda school traveled to Sri Lanka, where it divided into three subgroups, known after their monastic centres as the Mahāvihārika, the Abhayagirikā, and the Jetavanīya. The Theravāda form of Buddhism gradually spread eastward, becoming dominant in Myanmar in the late 11th century and in Cambodia and Laos by the 13th and 14th centuries.

Theravāda Buddhism tends toward a conservative, orthodox interpretation of the Buddha's teaching. The ideal Theravāda Buddhist is the *arhat* (Pāli: *arahant*), or perfected saint, who attains enlightenment as a result of his own efforts. The role of the layman and monk are clearly differentiated by the Theravādins, who do not consider it possible to attain enlightenment as a layman. Theravādins profoundly revere the historical Buddha as a perfected master but do not pay homage to the numerous celestial Buddhas and bodhisattvas that are worshiped in Mahāyāna temples.

**theremin,** also called THEREMINVOX, or ETHEROPHONE, electronic musical instrument invented in 1920 in the Soviet Union by Leon Theremin (also called Lev Termen). It consists of a box with radio tubes producing oscillations at two sound-wave frequencies above the range of hearing; together, they produce a lower audible frequency equal to the difference in their rates of vibration. Pitch is controlled by moving the hand or a baton toward or away from an antenna at the right rear of the box. This movement alters one of the inaudible frequencies. Harmonics, or component tones, of the sound can be filtered out, allowing production of several tone colours over a range of six octaves.

**Thérèse** OF LISIEUX, SAINT, also called SAINT THERESA OF THE CHILD JESUS, OF THE LITTLE FLOWER, French SAINTE THÉRÈSE DE LISIEUX, OF SAINTE THÉRÈSE DE L'ENFANT-JÉSUS, OF LA PETITE FLEUR, original name MARIE-FRANÇOISE-THÉRÈSE MARTIN (b. Jan. 2, 1873, Alençon, Fr.—d. Sept. 30, 1897, Lisieux; canonized May 17, 1925; feast day October 1), Carmelite nun whose service to her Roman Catholic order, although outwardly unremarkable, was later recognized for its exemplary spiritual accomplishments.

After her mother's death in 1877, Thérèse moved with her family to Lisieux where she was raised by her sisters and an aunt. In the religious atmosphere of her home, Thérèse's faith developed early. At age 14 she requested admission to the Carmelite convent at Lisieux, where two of her sisters were cloistered, but was



St. Thérèse
BBC Hulton Picture Library

refused because she was too young. On a pilgrimage to Italy in late 1887, during an audience with Pope Leo XIII, she asked the Holy Father to be allowed to enter the convent. Eventually permission was granted, and in April 1888 she entered the Carmel.

Her years in the convent were difficult. While she suffered from depression, scruples, a causeless feeling of guilt, and, at the end, religious doubts, she kept the rule of the order to perfection and maintained a smiling, pleasant, and unselfish manner. She sought to perform everyday tasks simply and perfectly. Before her death from tuberculosis, she acknowledged that because of her difficult nature not one day had ever passed without a struggle. She promised "to spend my heaven doing good upon Earth." Her burial site at Lisieux became a place of pilgrimage, and a basilica bearing her name was built there. She was canonized on May 17, 1925, and is a patron saint of missions. In 1997 she was named a doctor of the church in view of the soundness of her spiritual wisdom, the originality of her theological thought, and the universal acceptance of her spiritual message. Her feast day is October 1.

The story of Thérèse's spiritual development was published as a collection of her journal essays, written by order of the prioress, her sister Pauline, and published in 1898 under the title *Historie d'une âme* ("Story of a Soul"). The core of her spiritual message, the "little way," is the recognition that any act, no matter how small, is infinitely valuable if done out of love.

**Theresienstadt,** Czech TEREZÍN, town in northern Bohemia, Czech Republic, founded in 1780 and used from 1941 to 1945 by Nazi Germany as a walled ghetto, or concentration camp, for Jews. Shipment of Jewish captives into Theresienstadt began in November 1941. After the entire non-Jewish population of 3,700 was evacuated in July 1942, thousands of German, Austrian, and Czech Jews began arriving monthly, giving Theresienstadt a peak population of 53,004 in September 1942. Jews from other parts of Europe, notably Denmark and The Netherlands, came thereafter; but the mass influx subsided in late 1943 as the death camps in Poland grew larger. Of the total numbers of inmates from 1941 to 1945 (about 141,000), about 33,500 died in the dense crowding of the ghetto, and 88,000 were shipped on to the extermination camps, especially Auschwitz.

After World War II, Theresienstadt was resurrected as a Czech town, under its Czech name, Terezín. Pop. (latest est.) less than 5,000.

**Thériault, Yves** (b. Nov. 28, 1916, Quebec City, Que., Can.—d. Oct. 20, 1983, Montreal?, Que.), prolific Canadian writer, with some 1,300 radio and television scripts and some 50 books to his credit. He was hailed as a literary genius after the publication of *Agaguk* (1958), a poignant tale about an Eskimo family faced with the white man's code of law.

Thériault, who dropped out of school at the age of 15, held a variety of jobs before becoming a writer for the National Film Board (1943–45) and Radio Canada (1945–50). His works include *Aaron* (1954), which explored the problems faced by a Jewish family in a Gentile world; *Ashini* (1960), a lyrical tale of the last chief of the Montagnais to live by ancestral customs; and *N'Tsuk* (1968), the life story of a 100-year-old Eskimo woman. Thériault's works were widely translated and won him many awards.

**thermae,** complex of rooms designed for public bathing, relaxation, and social activity that was developed to a high degree of sophistication by the ancient Romans. Although public baths are known to have existed in early Egyptian palaces, remains are too fragmentary to permit complete analysis of Egyptian types. Bathing occupied an important place in the life of the Greeks, as indicated by the remains of bathing rooms in the palace of Knossos (begun *c.* 1700 BC). The standardized architectural type of the thermae, however, was not developed until the Romans designed the great imperial thermae—Baths of Titus (AD 81), Baths of Domitian (95), Trajan's Baths (*c.* 100), Baths of Caracalla (217), and the Thermae of Diocletian (*c.* 302).

The general scheme consisted of a large open garden surrounded by subsidiary club rooms and a block of bath chambers either in the centre of the garden, as in the Baths of Caracalla, or at its rear, as in the Baths of Titus. The main block contained three large bath chambers—the frigidarium, calidarium (caldarium), and tepidarium—smaller bathrooms, and courts. Service was furnished by means of underground passageways, through which slaves could move swiftly without being seen. For lighting and for the roofing of the enormous rooms, the Romans developed an ingenious system of clerestory windows (windows in or near the roof or vault).

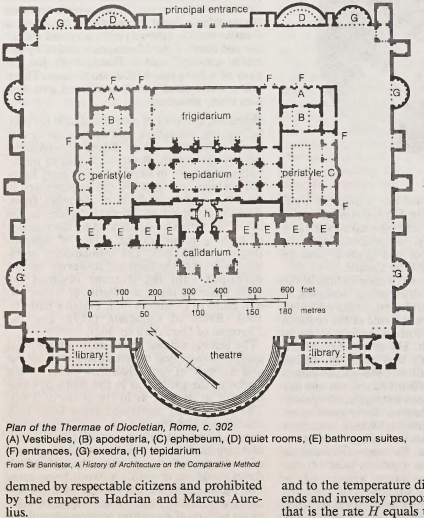
Modern discoveries of ancient sculpture in the Roman baths, such as the Laocoön group from the Baths of Caracalla in Rome, indicate the richness of the furnishings. Floors were marble or mosaic; walls were apparently sheathed with marble to a considerable height and decorated above with stucco reliefs and mosaic; and gilt bronze was used freely. This type of imperial bathing establishment was repeated in its essential form, but on a smaller scale, throughout the Roman Empire.

Although there is disagreement about the order of bathing activities, the Roman technique of bathing is thought to have followed a standardized pattern. The bather probably first entered the apodyterium, where he undressed. He was then anointed with oil in the elaeothesium, or unctuarium, before entering a room or court, where he indulged in rigorous exercise. After this activity, he proceeded to the calidarium (hot room) and to the sudatorium, or laconicum (steam room). The bather then moved to the tepidarium (warm room) and afterward to the frigidarium (cold room), where there was frequently a swimming pool. The bathing process was completed after the body was once more anointed with oil.

Roman baths varied in size from those in the larger, private houses to the great public thermae. The essential features present in all types of thermae were an adequate system of furnishing hot, tepid, and cold water; the heating of the hot portions of the bath, and sometimes also the tepidarium, by the

circulation of smoke and heated air from a fire under the floor through the hollow walls (*see also* hypocaust); and adequate basins for warm and cold water in the hot bath.

As a rule, men and women bathed separately. Mixed bathing is first recorded in the 1st century AD, by the Roman scholar Pliny the Elder. The practice, which seems to have been largely restricted to courtesans, was condemned by respectable citizens and prohibited by the emperors Hadrian and Marcus Aurelius.




*Plan of the Thermae of Diocletian, Rome, c. 302*
(A) Vestibules, (B) apodeteria, (C) ephebeum, (D) quiet rooms, (E) bathroom suites, (F) entrances, (G) exedra, (H) tepidarium
From Sir Bannister, *A History of Architecture on the Comparative Method*

**Thérmai, Gulf of,** Modern Greek THERMAÏKÓS KÓLPOS, English THERMAIC GULF, large gulf of the Aegean Sea in northeastern Greece between Thessaly, Macedonia, and the Chalcidice peninsula. Up to 60 mi (100 km) long northwest–southeast and about 40 mi wide at its broadest point, at the isthmus of Kassándra, it narrows in the extreme northeast into the Kólpos Thessaloníkis (Saloniki Bay), which is about 10 mi long by 5 mi wide. At the head of the bay lies the port of Thessaloníki, the second largest city and industrial centre of Greece.

The gulf's mountainous or marshy coasts provide few natural harbours, and there are no major cities or ports. Paralía (Vromóskala), the port of Kateríni, a tobacco centre of the plain of Piería, is an exception. Néa Mikhanióna is a small port on the Chalcidice. Just north of Paralía, an area of large salt pans, is the Toúzla Marsh, the silted-up harbour of ancient Pydna, near which the Romans defeated the last Macedonian king, Perseus, in 168 BC.

The Kólpos Thessaloníkis receives the Gallikós Potamós (river) and a secondary stream of the Chalcidice; the northern basin of the Gulf of Thérmai receives three major rivers: the Vardar (Axiós); the Loudhiás, which has been completely canalized, and the Aliákmon. The Piniós debouches into the Gulf of Thérmai just north of Ákra (cape) Dhermatás. A ship canal (completed 1937) through the isthmus of Kassándra links the Thermaikós with the Kólpos Kassándras to the east.

**thermal,** current of air rising from a locally hot patch of ground. *See* updraft and downdraft.

**thermal conduction,** transfer of energy (heat) arising from temperature differences between adjacent parts of a body.

Thermal conductivity is attributed to the exchange of energy between adjacent molecules and electrons in the conducting medium. The rate of heat flow in a rod of material is proportional to the cross-sectional area of the rod and to the temperature difference between the ends and inversely proportional to the length; that is the rate $H$ equals the ratio of the cross section $A$ of the rod to its length $l$, multiplied by the temperature difference $(T_2 - T_1)$ and by the thermal conductivity of the material, designated by the constant $k$. This empirical relation is expressed as: $H = -k(A/l)(T_2 - T_1)$. The minus sign arises because heat flows always from higher to lower temperature.

A substance of large thermal conductivity $k$ is a good heat conductor, whereas one with small thermal conductivity is a poor heat conductor or good thermal insulator. Typical values are 0.093 kilocalories/second-metre-°C for copper (a good thermal conductor) and 0.00003 kilocalories/second-metre°C for wood (poor thermal conductor).

*Articles are alphabetized word by word, not letter by letter*

**thermal energy,** internal energy present in a system in a state of thermodynamic equilibrium by virtue of its temperature. Thermal energy cannot be converted to useful work as easily as the energy of systems that are not in states of thermodynamic equilibrium. A flowing fluid or a moving solid, for example, possesses energy that can be converted to work in some mechanical device, such as a windmill or a waterwheel, but the same fluid or solid in a thermodynamic equilibrium state having the same energy (as thermal energy) can do no work unless it is combined with another substance at a different temperature, as in a heat engine.

**thermal expansion,** the general increase in the volume of a material as its temperature is increased. It is usually expressed as a fractional change in dimensions or volume per unit temperature change; a linear expansion coefficient is usually employed in describing the expansion of a solid, while a volume expansion coefficient is more useful for a liquid or a gas. If a crystalline solid is isometric (has the same structural configuration throughout), the expansion will be uniform in all dimensions of the crystal. If it is not isometric, there may be different expansion coefficients for different crystallographic directions, and the crystal will change shape as the temperature changes.

In a condensed medium, there is a dynamic balance between the cohesive forces holding the atoms or molecules together and the conditions created by temperature; higher temperatures imply greater distance between atoms. Expansion coefficients are specific for each material because the magnitudes of the bonding forces are specific.

**thermal fusion,** also called MELTING, change of a solid into a liquid when heat is applied. In a pure crystalline solid, this process occurs at a fixed temperature called the melting point (*q.v.*); an impure solid generally melts over a range of temperatures below the melting point of the principal component. Amorphous (noncrystalline) substances such as glass or pitch melt by gradually decreasing in viscosity as temperature is raised, with no sharp transition from solid to liquid.

The structure of a liquid is always less ordered than that of the crystalline solid and, therefore, the liquid commonly occupies a larger volume. The behaviour of ice, which floats on water, and of a few other substances are notable exceptions to the usual decrease in density upon melting.

Thermal fusion of a given mass of a solid requires the addition of a characteristic amount of heat, the heat of fusion. In the reverse process, the freezing of the liquid to form the solid, the same quantity of heat must be removed. The heat of fusion of ice, the heat required to melt one gram, is about 80 calories; this amount of heat would raise the temperature of a gram of liquid water from the freezing point (0° C, or 32° F) to 80° C (176° F).

**thermal junction** (device): *see* thermocouple.

**thermal neutron,** any free neutron (one that is not bound within an atomic nucleus) that has an average energy of motion (kinetic energy) corresponding to the average energy of the particles of the ambient materials. Relatively slow and of low energy, thermal neutrons exhibit properties, such as large cross sections (*q.v.*) in fission, that make them desirable in certain chain-reaction applications. Furthermore, the long de Broglie wavelengths of thermal neutrons make them valuable for certain applications of neutron optics. Thermal neutrons are produced by slowing down more energetic neutrons in a substance called a moderator after they have been ejected from atomic nuclei during nuclear reactions such as fission.

Quantitatively, the thermal energy per particle is about 0.025 electron volt—an amount of energy that corresponds to a neutron speed of about 2,000 metres per second and a neutron wavelength of about $2 \times 10^{-10}$ metre (or about two angstroms). Because the wavelength of thermal neutrons corresponds to the natural spacings between atoms in crystalline solids, beams of thermal neutrons are ideal for investigating the structure of crystals, particularly for locating positions of hydrogen atoms, which are not well located by X-ray diffraction techniques. Also, thermal neutrons are required for inducing nuclear fission in natu-

rally occurring uranium-235 and in artificially produced plutonium-239 and uranium-233.

**thermal radiation,** process by which energy, in the form of electromagnetic radiation, is emitted by a heated surface in all directions and travels directly to its point of absorption at the speed of light; thermal radiation does not require an intervening medium to carry it.

Thermal radiation ranges in wavelength from the longest infrared rays through the visible-light spectrum to the shortest ultraviolet rays. The intensity and distribution of radiant energy within this range is governed by the temperature of the emitting surface. The total radiant heat energy emitted by a surface is proportional to the fourth power of its absolute temperature (the Stefan–Boltzmann law).

The rate at which a body radiates (or absorbs) thermal radiation depends upon the nature of the surface as well. Objects that are good emitters are also good absorbers (Kirchhoff's radiation law). A blackened surface is an excellent emitter as well as an excellent absorber. If the same surface is silvered, it becomes a poor emitter and a poor absorber. A blackbody is one that absorbs all the radiant energy that falls on it. Such a perfect absorber would also be a perfect emitter.

The heating of the Earth by the Sun is an example of transfer of energy by radiation. The heating of a room by an open-hearth fireplace is another example. The flames, coals, and hot bricks radiate heat directly to the objects in the room with little of this heat being absorbed by the intervening air. Most of the air that is drawn from the room and heated in the fireplace does not reenter the room in a current of convection but is carried up the chimney together with the products of combustion.

**thermal spring:** *see* hot spring.

**thermal window,** also called THERM WINDOW, in Classical architecture, semicircular window divided into three sections by two mullions, or vertical strips. The base of the central section of a thermal window is wider than that of its two side sections. The thermal window is frequently featured in Renaissance architecture of the 16th century. Because it was especially popular in the works of the influential 16th-century Italian architect Andrea Palladio, it has come to be known as a Palladian motif.

The Italians adapted the form of the thermal window from a large, three-part window in the central hall of the Thermae, or Baths, of Diocletian, which were built in Rome in AD 302; this accounts for its other name, the Diocletian window. Thermal windows may also be found in the works of architects of the Renaissance revival of the late 19th and early 20th centuries.

**thermel** (device): *see* thermocouple.

**Thermidorian Reaction,** in the French Revolution, the revolt initiated on 9 Thermidor, year II (July 27, 1794), which resulted in the fall of Maximilien Robespierre and the collapse of revolutionary fervour and the Reign of Terror in France. By June of 1794 France had become fully weary of the mounting executions (1,300 in June alone), and Paris was alive with rumours of plots against Robespierre, member of the ruling Committee of Public Safety and leading advocate of the Terror. On 8 Thermidor (July 26) he gave a speech full of appeals and threats. The next day, the deputies in the National Convention shouted him down and decreed his arrest. He was arrested at the Hôtel de Ville, along with his brother Augustin, François Hanriot, Georges Couthon, and Louis de Saint-Just. The same guillotine that on 9 Thermidor executed 45 anti-Robespierrists executed, in the following three days, 104 Robespierrists, inaugurating a brief "White Terror" against Jacobins throughout France.

The coup was primarily a reassertion of the rights of the National Convention against the Committee of Public Safety and of the nation against the Paris Commune. It was followed by the disarming of the committee, the emptying of the prisons, and the purging of Jacobin clubs. The Directory that followed was neither authoritarian nor republican. Social and political life became freer, more extravagant, and more personally corrupt. There was a splurge of fashion and a conspicuous consumption of bourgeois wealth.

**thermionic emission,** also called the EDISON EFFECT, discharge of electrons from heated materials, widely used as a source of electrons in conventional electron tubes (*e.g.,* television picture tubes) in the fields of electronics and communications. The phenomenon was first observed (1883) by Thomas A. Edison as a passage of electricity from a filament to a plate of metal inside an incandescent lamp.

The heated sources of electrons are generally metals (for example, tungsten), metals sparsely contaminated with another metal (tungsten impregnated with a barium compound), or compounds that behave like metals or semiconductors. The emitting material is often in the form of a hairpin-shaped filament that is heated directly as part of an electric circuit or in the form of a cylinder that is heated indirectly by a separate filament running along its axis.

In thermionic emission, the heat supplies some electrons with at least the minimal energy required to overcome the attractive force holding them in the structure of the metal. This minimal energy, called the work function, is characteristic of the emitting material and the state of contamination of its surface.

At high temperatures, some metals emit positive ions, too; that is, some of their surface atoms devoid of at least one electron are evaporated into the surrounding space. *See also* field emission.

**thermionic power converter,** also called THERMIONIC GENERATOR, THERMIONIC POWER GENERATOR, or THERMOELECTRIC ENGINE, any of a class of devices that convert heat directly into electricity rather than first changing it to some other form of energy.

A brief treatment of thermionic devices follows. For full treatment, *see* MACROPAEDIA: Energy Conversion.

Thermionic devices consist of evacuated or plasma-filled cells in which electrons are boiled out of a hot cathode and collected at the cooler anode. In 1883 the American inventor Thomas A. Edison applied for a patent on a direct-conversion device that employed thermionic emission, although at the time he was not aware of the physical principles of the device. The Edison tube, which proved very inefficient, was essentially a carbon-filament light bulb into which an extra electrode had been inserted. No systematic effort was made to develop practical thermionic converters until the mid-1950s, at which time the impetus of space exploration awakened considerable interest in their potential. Thermionic converters seem particularly well suited as an electrical-power source for deep-space probes and various other space vehicles. Unlike conventional heat-power devices (*e.g.,* Rankine and Stirling cycle power plants), they have no rotating or reciprocating components, thereby eliminating the need for frequent maintenance. Moreover, heat for thermionic devices may come from any convenient source; it may be solar, chemical, or nuclear in origin. Other advantages include low system weight and the ability to withstand acceleration higher than 30 times the force of gravity. In addition, their high efficiency makes them suitable energy sources for use in low-power radio transmitters and for other applications in remote and hostile terrestrial environments (*e.g.,* undersea operations).

There are two principal types of thermionic devices—the vacuum converter and the gas-filled converter. The first variety has a vacuum gap of about 0.025 mm (0.001 inch) or less between the component electrodes. After the electron gas has been boiled out of the heated cathode (at temperatures from 1,000 to 2,500 K), it is passed through this gap to the comparatively cool anode, where it is condensed. The electron gas then passes through an external circuit and back to the cathode side to deliver electric power. The vacuum converter has only had limited practical applications.

The second type of thermionic converter is filled with the vapour of such metals as cesium, rubidium, or potassium. Those containing cesium are the most efficient because cesium has a particularly low ionization potential (3.87 electron volts). As soon as electrons escape from the cathode, they are accelerated by the potential generated by cesium ions immediately outside of that electrode. A few of the electrons help to produce ions, but most of them flow through the almost neutral plasma to the anode, with negligible energy loss.

**thermistor,** electrical-resistance element made of a semiconducting material consisting of a mixture of oxides of manganese and nickel; its resistance varies with temperature. Thermistors (temperature-sensitive, or thermal, resistors) are used as temperature-measuring devices and in electrical circuits to compensate for temperature variations of other components. They are also used to measure radio-frequency power and radiant power, such as infrared and visible light.

**Thermit,** also spelled THERMITE, powdered mixture used in incendiary bombs, in the reduction of metals from their oxides, and as a source of heat in welding iron and steel and in foundry work.

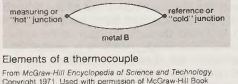
The powder consists of aluminum and the oxide of a metal such as iron. When ignited or heated, it gives off an enormous amount of heat as a result of the chemical combination of the aluminum with the oxygen of the oxide. The reaction temperature is estimated to be about 2,400° C (4,400° F).

Thermit was discovered by a German chemist, Hans Goldschmidt, in 1895. A U.S. patent granted in 1897 related principally to the use of aluminum as a reducing agent for producing metals free of carbon. The term is a registered trade name of Thermex Metallurgical Inc. The metal formed in the process is carbon-free but usually contains small amounts of aluminum.

**thermocline,** oceanic water layer in which water temperature decreases rapidly with increasing depth. A widespread permanent thermocline exists beneath the relatively warm, well-mixed surface layer, from depths of about 200 m (660 feet) to about 1,000 m (3,000 feet), in which interval temperatures diminish steadily. The deep waters below the thermocline layer decrease in temperature much more gradually toward the seafloor. In latitudes marked by distinct seasons, a seasonal thermocline at much shallower depths forms during the summer as a result of solar heating, and it is destroyed by diminished insolation and increased surface turbulence during the winter. Water density is governed by temperature and salinity; consequently, the thermocline coincides generally with the pycnocline, or layer in which density increases rapidly with depth. The middle layer of water in a lake or reservoir during the summer is also called a thermocline.

**thermocouple,** also called THERMAL JUNCTION, THERMOELECTRIC THERMOMETER, or

THERMEL, a temperature-measuring device consisting of two wires of different metals joined at each end. One junction is placed where the temperature is to be measured, and the other is kept at a constant lower tempera-




Elements of a thermocouple

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ture. A measuring instrument is connected in the circuit. The temperature difference causes the development of an electromotive force (known as the Seebeck effect) that is approximately proportional to the difference between the temperatures of the two junctions. Temperature can be read from standard tables, or the measuring instrument can be calibrated to read temperature directly.

Any two different metals or metal alloys exhibit the thermoelectric effect, but only a few are used as thermocouples—*e.g.,* antimony and bismuth, copper and iron, or copper and constantan (a copper-nickel alloy). Usually platinum, either with rhodium or a platinum-rhodium alloy, is used in high-temperature thermocouples.

A thermopile is a number of thermocouples connected in series; its results are comparable to the average of several temperature readings. A series circuit also gives greater sensitivity.

**thermodynamic equilibrium,** condition or state of a thermodynamic system, the properties of which do not change with time and that can be changed to another condition only at the expense of effects on other systems. For a thermodynamic equilibrium system with given energy, the entropy is greater than that of any other state with the same energy. For a thermodynamic equilibrium state with given pressure and temperature, the Gibbs free energy is smaller than that of any other state with the same pressure and temperature.

**thermodynamics,** systematic study of the relationship between heat, work, temperature, and energy, now encompassing the general behaviour of physical systems in a condition of equilibrium or close to it. It is a fundamental part of all the physical sciences.

A brief treatment of thermodynamics follows. For full treatment, *see* MACROPAEDIA: Thermodynamics, Principles of.

A central consideration of thermodynamics is that any physical system, whether or not it can exchange energy and material with its environment, will spontaneously approach a stable condition (equilibrium) that can be described by specifying its properties, such as pressure, temperature, or chemical composition. If the external constraints are changed (for example, if the system is allowed to expand), then these properties will generally alter. The science of thermodynamics attempts to describe mathematically these changes and to predict the equilibrium conditions of the system.

The subject was developed in the 19th century, when much interest centred on the question of the efficiency of heat engines, in which heat is converted into useful work. In all such devices there is an irreversible dissipation of useful energy because heat can never be converted to work with 100 percent efficiency.

The key concept in understanding these transformations is not energy but entropy. The law of conservation of energy, known as the first law of thermodynamics, ensures that, whenever energy is converted in form, its total quantity remains unchanged. In thermodynamics, interest centres on the usefulness of energy. Roughly speaking, ordered energy is useful, whereas disordered energy cannot be harnessed to do work. Thus, the energy stored in a battery is useful, whereas the energy from a fire that has dissipated into the environment is effectively lost. Entropy provides a measure of the degree of disorderedness of energy. Disordered energy has a high entropy. When the entropy of a system reaches a maximum, the system is totally disordered and no further large-scale change will spontaneously occur. This is the condition of equilibrium.

The second law of thermodynamics states that, in a closed system, the entropy does not decrease. That is, if the system is initially in a low-entropy (ordered) state, its condition will tend to slide spontaneously toward a state of maximum entropy (disorder). For example, if two blocks of metal at different temperatures are brought into thermal contact, the unbalanced temperature distribution (which represents a partial ordering of the energy) rapidly decays to a state of uniform temperature as energy flows from the hotter to the colder block. Having achieved this state, the system is in equilibrium.

The approach to equilibrium is therefore an irreversible process. The tendency toward equilibrium is so fundamental to physics that the second law is probably the most universal regulator of natural activity known to science.

An insight into entropy and the second law can be provided by the study of the microscopic constituents of matter (atoms and molecules). The temperature and pressure of a gas are traced to the agitation of the gas molecules. The entropic progress from order to disorder may then be viewed as an example of the general tendency of chaotic disruptions to disturb organization and structure. Any system that is subject to random agitations will eventually attain its most disordered condition.

The concept of temperature enters into thermodynamics as a precise mathematical quantity that relates heat to entropy. The interplay of these three quantities is further constrained by the third law of thermodynamics, which deals with the absolute zero of temperature and its theoretical unattainability. Absolute zero (approximately −273° C) would correspond to a condition in which a system had achieved its lowest energy state. The third law states that, as this minimum temperature is approached, the further extraction of energy becomes more and more difficult.

**thermoelectric device,** any of a class of devices that either convert heat directly into electricity or transform electrical energy into pumped thermal power for heating or refrigeration. Such devices are based on thermoelectric effects involving interactions between the flow of heat and of electricity through solid bodies.

A brief treatment of thermoelectric devices follows. For full treatment, *see* MACROPAEDIA: Energy Conversion.

The first important thermoelectric phenomenon was discovered in 1821 by Thomas Johann Seebeck, a German physicist. Known as the Seebeck effect, this phenomenon concerns the generation of an electric current or voltage in a circuit composed of two different conducting materials in cases in which the junctions between them are maintained at different temperatures. The flow of heat from the hotter to the cooler junction produces a current.

Jean-Charles-Athanase Peltier of France discovered another important thermoelectric effect in 1834. He found that, when a direct current flows through a circuit composed of different conductors, one junction between the materials is cooled while the other is heated, depending on the direction of the current flow. This phenomenon, called the Peltier effect, is essentially the inverse of the Seebeck effect and constitutes the basis for thermoelectric refrigeration.

A third major thermoelectric effect was discovered by the English physicist William Thomson (later Lord Kelvin) during the mid-1850s. The Thomson effect involves the reversible generation of heat when a current flows in a single conductor along which there is a temperature gradient.

The first and for many years the only useful thermoelectric device was the thermocouple, an instrument for measuring temperature whose operation is based on the Seebeck effect. Growing knowledge of solid-state physics in general and semiconductor materials in particular finally led to the development of practical thermoelectric-power generators and refrigeration systems during the 1950s.

Thermoelectric devices have a variety of applications. Metallic thermocouples, for example, are used in science laboratories and in industry to measure and control temperature, particularly in furnaces and other inaccessible or hazardous locations. Compact, durable thermoelectric generators are employed in remote equipment with moderate power requirements, such as telephone repeaters, Arctic weather stations, and unattended navigation buoys. Such devices have also been used aboard Earth-orbiting spacecraft, and in miniaturized form they have been employed as a power source for electronic cardiac pacemakers.

Thermoelectric cooling devices are used for temperature control in various kinds of electronic equipment to improve performance. Other applications include the employment of thermoelectric coolers to preserve blood plasma and antibiotics during storage and transport.

**thermokarst,** land-surface configuration that results from the melting of ground ice in a region underlain by permafrost. In areas that have appreciable amounts of ice, small pits, valleys, and hummocks are formed when the ice melts and the ground settles unevenly. The size and form of the features depends on the nature and extent of the ice. In general, regional thermokarst activity indicates an overall warming of the climate, whereas localized thermokarst forms may be caused by the moving of heavy vehicles over permafrost, the introduction of agriculture, or deforestation. Individual features have no characteristics that are exclusively due to thermokarst activity, and they are hard to distinguish from those formed by other means. Features resulting from the melting of dead glacial ice are not classified as thermokarst forms.

*Articles are alphabetized word by word, not letter by letter*

**thermoluminescence,** emission of light from some minerals and certain other crystalline materials. The light energy released is derived from electron displacements within the crystal lattice of such a substance caused by previous exposure to high-energy radiation. Heating the substance at temperatures of about 450° C (842° F) and higher enables the trapped electrons to return to their normal positions, resulting in the release of energy. The intensity of the emission can be correlated to the length of time that a given substance was exposed to radiation; the longer the time allowed for the radiation to build up an inventory of trapped electrons, the greater the energy released. Because of this feature, thermoluminescence has been exploited as a means of dating various minerals and archaeological artifacts.

**thermometry,** the science of measuring the temperature of a system or the ability of a system to transfer heat to another system. Temperature measurement is important to a wide

range of activities, including manufacturing, scientific research, and medical practice.

The accurate measurement of temperature has developed relatively recently in human history. The invention of the thermometer is generally credited to Galileo. In his instrument, built about 1592, the changing temperature of an inverted glass vessel produced the expansion or contraction of the air within it, which in turn changed the level of the liquid with which the vessel's long, openmouthed neck was partially filled. This general principle was perfected in succeeding years by experimenting with liquids such as mercury and by providing a scale to measure the expansion and contraction brought about in such liquids by rising and falling temperatures.

By the early 18th century as many as 35 different temperature scales had been devised. The German physicist Daniel Gabriel Fahrenheit in 1700–30 produced accurate mercury thermometers calibrated to a standard scale that ranged from 32°, the melting point of ice, to 96° for body temperature. The unit of temperature (degree) on the Fahrenheit scale is $^1/_{180}$ of the difference between the boiling (212°) and freezing points of water. The first centigrade scale (made up of 100 degrees) is attributed to the Swedish astronomer Anders Celsius, who developed it in 1742. Celsius used 0° for the boiling point of water and 100° for the melting point of snow. This was later inverted to put 0° on the cold end and 100° on the hot end, and in that form it gained widespread use. It was known simply as the centigrade scale until in 1948 the name was changed to honour Celsius. In 1848 the British physicist William Thomson (later Lord Kelvin) proposed a system that used the degree Celsius but was keyed to absolute zero (−273.15° C); the unit of this scale is now known as the kelvin. The Rankine scale employs the Fahrenheit degree keyed to absolute zero (−459.67° F).

Any substance that somehow changes with alterations in its temperature can be used as the basic component in a thermometer. Gas thermometers work best at very low temperatures. Liquid thermometers are the most common type in use. They are simple, inexpensive, long-lasting, and able to measure a wide temperature span. The liquid is almost always mercury, sealed in a glass tube with nitrogen gas making up the rest of the volume of the tube.

Electrical-resistance thermometers characteristically use platinum and operate on the principle that electrical resistance varies with changes in temperature. Thermocouples are among the most widely used industrial thermometers. They are composed of two wires made of different materials joined together at one end and connected to a voltage-measuring device at the other. A temperature difference between the two ends creates a voltage that can be measured and translated into a measure of the temperature of the junction end. The bimetallic strip constitutes one of the most trouble-free and durable thermometers. It is simply two strips of different metals bonded together and held at one end. When heated, the two strips expand at different rates, resulting in a bending effect that is used to measure the temperature change.

Other thermometers operate by sensing sound waves or magnetic conditions associated with temperature changes. Magnetic thermometers increase in efficiency as temperature decreases, which makes them extremely useful in measuring very low temperatures with precision. Temperatures can also be mapped, using a technique called thermography that provides a graphic or visual representation of the temperature conditions on the surface of an object or land area.

**thermonuclear bomb,** also called HYDROGEN BOMB, or H-BOMB, weapon whose enormous explosive power results from an uncontrolled, self-sustaining chain reaction in which isotopes of hydrogen combine under extremely high temperatures to form helium in a process known as nuclear fusion (*q.v.*). The high temperatures that are required for the reaction are produced by the detonation of an atomic bomb.

A thermonuclear bomb differs fundamentally from an atomic bomb in that it utilizes the energy released when two light atomic nuclei combine, or fuse, to form a heavier nucleus. An atomic bomb, by contrast, uses the energy released when a heavy atomic nucleus splits, or fissions, into two lighter nuclei. Under ordinary circumstances atomic nuclei carry positive electrical charges that act to strongly repel other nuclei and prevent them from getting close to one another. Only under temperatures of millions of degrees can the positively charged nuclei gain sufficient kinetic energy, or speed, to overcome their mutual electric repulsion and approach close enough to each other to combine under the attraction of the short-ranged nuclear force. The very light nuclei of hydrogen atoms are ideal candidates for this fusion process because they carry weak positive charges and there is thus less resistance to overcome.

The hydrogen nuclei that combine to form heavier helium nuclei must lose a small portion of their mass (about 0.63 percent) in order to "fit together" in a single larger atom. They lose this mass by converting it completely into energy, according to Albert Einstein's famous formula: $E = mc^2$. According to this formula, the amount of energy created is equal to the amount of mass that is created multiplied by the speed of light squared. The energy thus produced forms the explosive power of a hydrogen bomb.

Deuterium and tritium, which are isotopes of hydrogen, provide ideal interacting nuclei for the fusion process. Two atoms of deuterium, each with one proton and one neutron, or tritium, with one proton and two neutrons, combine during the fusion process to form a heavier helium nucleus, which has two protons and either one or two neutrons. In current thermonuclear bombs, lithium deuteride is used as the fusion fuel; it is transformed to tritium early in the fusion process.

In a thermonuclear bomb, the explosive process begins with the detonation of what is called the primary stage. This consists of a relatively small quantity of conventional explosives, the detonation of which brings together enough fissionable uranium to create a fission chain reaction, which in turn produces another explosion and a temperature of several million degrees. The force and heat of this explosion are reflected back by a surrounding container of uranium and are channeled toward the secondary stage, made up of tritium or other fusion fuel. The tremendous heat initiates fusion, and the resulting explosion of the secondary stage blows the uranium container apart and causes it too to fission, thus contributing to the explosion and producing fallout (the deposition of radioactive materials from the atmosphere) in the process. (A neutron bomb is a thermonuclear device in which the uranium container is absent, thus producing much less blast but a lethal "enhanced radiation" of neutrons.) The entire series of explosions in a thermonuclear bomb takes a fraction of a second to occur.

A thermonuclear explosion produces blast, light, heat, and varying amounts of fallout. The concussive force of the blast itself takes the form of a shock wave that radiates from the point of the explosion at supersonic speeds and that can completely destroy any building within a radius of several miles. The intense white light of the explosion can cause permanent blindness to people gazing at it from a distance of dozens of miles. The explosion's intense light and heat set wood and other combustible materials afire at a range of many miles, creating huge fires that may coalesce into a firestorm. The radioactive fallout contaminates air, water, and soil and may continue years after the explosion; its distribution is virtually worldwide.

Thermonuclear bombs can be hundreds or even thousands of times more powerful than atomic bombs. The explosive yield of atomic bombs is measured in kilotons, each unit of which equals the explosive force of 1,000 tons of TNT. The explosive power of hydrogen bombs, by contrast, is frequently expressed in megatons, each unit of which equals the explosive force of 1,000,000 tons of TNT. Hydrogen bombs of more than 50 megatons have been detonated, but the explosive power of the weapons mounted on strategic missiles usually ranges from 100 kilotons to 1.5 megatons. Thermonuclear bombs can be made small enough (a few feet long) to fit in the warheads of intercontinental ballistic missiles; these missiles can travel almost halfway across the globe in 20 or 25 minutes and have computerized guidance systems so accurate that they can land within a few hundred yards of a designated target.

Edward Teller and other American scientists developed the first hydrogen bomb, which was tested at Enewetak atoll on Nov. 1, 1952. The U.S.S.R. first tested a hydrogen bomb on Aug. 12, 1953, followed by the United Kingdom in May 1957, China (1967), and France (1968). During the late 1980s there were some 40,000 thermonuclear devices stored in the arsenals of the world's nuclear-armed nations. This number declined during the 1990s. The massive destructive threat of these weapons has been a principal concern of the world's populace and of its statesmen since the 1950s. *Compare* neutron bomb. *See also* arms control.

**thermonuclear reaction,** fusion of two light atomic nuclei into a single heavier nucleus by a collision of the two interacting particles at extremely high temperatures, with the consequent release of a relatively large amount of energy. Chains of thermonuclear reactions, such as the proton-proton cycle (*q.v.*) and the carbon cycle (*q.v.*), account for the energy radiated from the Sun and most other stars. In an uncontrolled state, this type of nuclear reaction is responsible for the destructive force of thermonuclear bombs. *See also* nuclear fusion; fusion reactor.

**thermoperiodicity,** also called THERMAL PERIODICITY, the growth or flowering responses of plants to alternation of warm and cool periods. Daily temperature fluctuations produce dramatic effects on the growth or flowering of most plants. The lack of lower night temperatures frequently results in poor growth, as can be observed in plants that are grown indoors in even-temperature surroundings. This phenomenon has been applied in the production of tomatoes. The most flowers are produced when tomatoes are grown at 26.7° C (80° F) during the day and 17.2°–20° C (63°–68° F) at night. Thermoperiodic effects are distinct from photoperiodic effects (caused by duration of light).

**Thermopylae,** Modern Greek THERMOPÍLAI, narrow pass on the east coast of central Greece between the Kallídhromon massif and the Maliakós Gulf, about 85 miles (136 km) northwest of Athens. In antiquity its cliffs were by the sea, but silting has widened the distance to more than a mile. Its name, meaning "hot gates," is derived from its hot sulfur springs.

The pass, some 4 miles (6 km) in length, has figured in numerous invasions. There, in August 480 BC, during the second Persian in-

vasion of Greece, a small Greek force under the Spartan king Leonidas defended Attica and Boeotia against the southward advance of Xerxes' Persian army while Greek fleets at nearby Cape Artemesium fought off the attacking Persian navy. Leonidas' troops held the pass for three days until the Persians, guided along another mountain pass by the Greek traitor Ephialtes, outflanked them. Sending the majority of his troops to safety, Leonidas remained to delay the Persians with 300 Spartans, their helots, and 1,100 Boeotians, all of whom died in battle. Although the Persians won at Thermopylae and conquered central Greece, they suffered considerable losses in the battle, and most of the Greek troops and ships were able to escape to the Isthmus of Corinth to rejoin the main Greek forces. This battle became celebrated in history and literature as an example of heroic resistance against great odds. A large marble and bronze monument commemorating the battle was erected in 1955. In 279 BC the Greeks delayed the invading Celts at Thermopylae, and in 191 BC the Seleucid king Antiochus III fortified the pass against the Romans under Acilius Glabrio.

**thermoreception,** the sensory capacity an animal uses to determine the temperature of its immediate environment.

A brief treatment of thermoreception follows. For full treatment, *see* MACROPAEDIA: Sensory Reception.

Thermoreception is important not only because it helps the animal to respond to dangerous situations (*e.g.*, being exposed to fire) but because it also aids in the regulation of the animal's body temperature. Life processes can continue only when the temperature of the body stays inside certain limits, between about 0° C (32° F) and 45° C (113° F), depending on the kind of animal. Outside these limits, the tissue structures and chemical components vital to life suffer damage.

Warm-blooded animals (homoiotherms), such as birds and mammals, have metabolisms that maintain their body temperatures at stable levels. Thermoreception, then, helps a warm-blooded animal keep its body temperature fixed by regulating autonomic responses to temperature changes in its environment. By contrast, the body temperature of cold-blooded animals (poikilotherms), *e.g.*, insects and reptiles, changes with the temperature of the environment. Thus, thermoreception stimulates a cold-blooded animal to find an environment that is within its required temperature range.

The study of thermoreceptors began when it was found that sensations of temperature are generated by minute areas of the skin that are sensitive to heat and cold. The application of electrodes to particular areas of the body further allowed researchers to trace the electrical impulses of specific nerve cells and, thus, to examine involuntary responses to temperature that are not consciously registered.

The nerve cells responsible for thermoreception function in basically the same way in all animals. If the temperature is raised, the frequency of impulses from warm-receptors speeds up and the frequency of impulses from cold-receptors slows down, in both cases quite suddenly. If the temperature is lowered, the responses of the two kinds of receptors are reversed. In any event, if the temperature stabilizes at the new level, the frequency of impulses soon returns to close to its initial level, where it remains until the temperature changes again. It should be noted that, in many cases, thermoreceptor cells respond also to chemical, mechanical, or electrical stimuli. Although the mechanism of thermoreception is similar in all animals, the distribution of thermoreceptor cells varies widely from species to species.

A fascinating thermoreceptive organ is found in certain snakes called pit vipers, including rattlesnakes. These snakes have small pits beneath their eyes that contain a delicate membrane, laced with thermoreceptive cells. Even without the use of its eyes, nose, and tongue, a rattlesnake can use these pits to locate an animal 40 cm (16 inches) away that is 10° C (18° F) warmer than the general surroundings. The pit organs serve to detect temperature differentials or changes, not the level of temperature itself.

**thermoregulation,** also called HEAT REGULATION, the maintenance of an optimum temperature range by an organism. Cold-blooded animals (poikilotherms) pick up or lose heat by way of the environment, moving from one place to another as necessary. Warm-blooded animals (homoiotherms) have additional means by which they can heat and cool their bodies. Muscular activity can be an important source of heat in both kinds of animals. *See* thermoreception.

**Thermos flask:** *see* vacuum flask.

**thermosphere,** region of increasing temperature above the mesosphere. The base of the thermosphere (the mesopause) is at an altitude of about 80 km (50 miles), whereas its top (the thermopause) is at about 450 km.

**thermostat,** device to detect temperature changes for the purpose of maintaining the temperature of an enclosed area essentially constant. In a system including relays, valves, switches, etc., the thermostat generates signals, usually electrical, when the temperature exceeds or falls below the desired value. It usually is used to control the flow of fuel to a burner, of electric current to a heating or cooling unit, or of a heated or cooled gas or liquid into the area it serves. The thermostat is also an element in some types of fire-detection warning systems.

**theropod,** any member of a suborder (Theropoda) of saurischian ("reptile-hipped") dinosaurs. The theropods included all the carnivorous or predaceous dinosaurs except the staurikosaurs. They were the most differentiated group of saurischian dinosaurs, ranging in size from the chicken-sized *Compsognathus,* the smallest known adult dinosaur, which probably weighed 1–2 kg (2–4 pounds) to the huge *Tyrannosaurus,* which weighed 6 tons or more. Theropod remains have been recovered from the Late Triassic through the Late Cretaceous periods (from 230 to 66.4 million years ago) and from all continents except Antarctica.

All the theropods were obligate bipeds. Their hind legs were dominant and designed for support and locomotion, while the forelimbs were shortened and had mobile hands, probably adapted for grasping and tearing prey. Despite the group's name, which means "beast (*i.e.,* mammal) foot," theropod feet usually resembled those of birds. Many scientists believe that all modern birds are descended from one line of small theropods.

**Theroux, Paul (Edward)** (b. April 10, 1941, Medford, Mass., U.S.), American novelist and travel writer.

Theroux graduated from the University of Massachusetts in 1963. Until 1971 he taught English in Malawi, Uganda, and Singapore; thereafter, he lived in England and devoted all his time to writing. Several of his early novels—including *Girls at Play* (1969), *Jungle Lovers* (1971), and *Saint Jack* (1973)—centre on the social and cultural dislocation experienced by Westerners in postcolonial Africa and Southeast Asia. Later novels include *The Family Arsenal* (1976), about a group of terrorists in the London slums, and *The Mosquito Coast* (1982), about an American inventor who attempts to create an ideal community in the Honduran jungle.

Theroux first achieved commercial success with a best-selling travel book, *The Great Railway Bazaar* (1975), describing his four-month train journey through Asia. Other travel books include *The Old Patagonian Express* (1979) and *The Happy Isles of Oceania* (1992).

**Thesaurus Linguae Latinae,** dictionary of the Latin language, published at Leipzig, the most important and definitive such undertaking of modern times. It is being prepared by the Universities of Berlin, Göttingen, Leipzig, and Munich in Germany and by Vienna University in Austria.

The work, twice interrupted by world wars and complicated by the partition of Germany after World War II, is still in progress. Illustrated with quotations from every classical author down to the Antonines (mid-2nd century AD), the dictionary is ultimately to include every word (except the most familiar particles) used in the text of these writings and to be a complete historical Latin dictionary. There is also to be a selection of important passages from the works of all authors down to about AD 600.

The collecting of quotations was begun in 1894; publication began in 1900, with 9 volumes (*A–O*) completed by 1981. In the *A–B* sections, proper names are included in alphabetical order; from *C* on, names are given in a supplement begun in 1907. Since 1949 publication has been overseen by an international commission. It is expected that work on the thesaurus will be completed during the first half of the 21st century.

**Thesavalamai,** traditional law of the Tamil country of northern Sri Lanka, codified under Dutch colonial rule in 1707. The Dutch, to facilitate the administration of their colonial territories in Ceylon, established there an elaborate system of justice based on Roman-Dutch law and the customary law of the land.

A Dutch official spent three years in the Tamil country collecting their traditional law; this collection, after a revision by a group of prominent Tamils, was promulgated as authoritative in 1707. Although partially outdated, much of the *Thesavalamai* is still observed today as law in parts of Sri Lanka. Most historians consider these legal contributions to be the main legacy of Dutch rule there.

**Theseum,** temple in Athens dedicated to Hephaestus and Athena as patrons of the arts and crafts. Its style indicates that this, the best-preserved ancient Greek temple in the world, is slightly older than the Parthenon (*i.e., c.* 450–440 BC), and the unknown architect may even have changed his plan for the interior after seeing Ictinus' Parthenon designs. The temple has been known as the Theseum since the Middle Ages, apparently because some of its sculptures represent the exploits of Theseus. The Theseum is a Doric peripteral (*i.e.,* surrounded by a single row of columns) temple, with 13 columns at the sides and 6 at the ends.

Enough fragments of the east pedimental sculpture have been discovered to recover the theme, the apotheosis of Heracles. The frieze contains sculptures only in the metopes of the east front and in those of the sides immediately adjoining it; the frontal metopes represent the labours of Heracles, the lateral the exploits of Theseus. As in the Parthenon there is a sculptured frieze above the exterior of the cella walls; this, however, extends only over the east and west fronts and the east ends of the sides. The eastern frieze represents a battle scene with seated deities on either hand, the western one a *kentauromachia* (battle of centaurs). The temple is of Pentelic marble—except for the foundation and the lowest stylobate step, which are of Piraic stone, and the frieze of the cella, which is Parian marble.

The outstanding preservation of the temple is due to its conversion into a Christian church in the Middle Ages.

**Theseus,** great hero of Attic legend, son of Aegeus, king of Athens, and Aethra, daughter of Pittheus, king of Troezen (in Argolis), or of the sea god, Poseidon, and Aethra. Legend relates that Aegeus, being childless, was allowed by Pittheus to have a child (Theseus) by Aethra. When Theseus reached manhood, Aethra sent him to Athens. On the journey he encountered many adventures. At the Isthmus of Corinth he killed Sinis, called the Pine Bender because he killed his victims by tearing them apart between two pine trees. Next Theseus dispatched the Crommyonian sow (or



Theseus killing the Minotaur, detail of a vase painting by the Cleophrades Painter, 6th century BC; in the British Museum

By courtesy of the trustees of the British Museum

boar). Then from a cliff he flung the wicked Sciron, who had kicked his guests into the sea while they were washing his feet. Later he slew Procrustes, who fitted all comers to his iron bed by hacking or racking them to the right length.

On his arrival in Athens, Theseus found his father married to the sorceress Medea (*q.v.*), who recognized Theseus before his father did and tried to persuade Aegeus to poison him. Aegeus, however, finally recognized Theseus and declared him heir to the throne. After crushing a conspiracy by the Pallantids, sons of Pallas (Aegeus' brother), Theseus successfully attacked the fire-breathing bull of Marathon. Next came the adventure of the Cretan Minotaur, half man and half bull, shut up in the legendary Cretan Labyrinth (*see* Ariadne; Minos; Minotaur).

Theseus had promised Aegeus that if he returned successful from Crete, he would hoist a white sail in place of the black sail with which the fatal ship bearing the sacrificial victims to the Minotaur always put to sea. But he forgot his promise; and when Aegeus saw the black sail, he flung himself from the Acropolis and died.

Theseus then united the various Attic communities into a single state and extended the territory of Attica to the Isthmus of Corinth. To the Isthmian Games in honour of Melicertes (*see* Leucothea), he added games in honour of Poseidon. Alone or with the Greek hero Heracles he captured the Amazon princess Antiope (or Hippolyte). As a result the Amazons attacked Athens, and Hippolyte fell fighting on the side of Theseus. By her he had a son, Hippolytus, beloved of Theseus' wife, Phaedra (*see* Hippolytus). Theseus is also said to have taken part in the Argonautic expedition and the Calydonian boar hunt.

The famous friendship between Theseus and Pirithous, one of the Lapiths, originated when Pirithous drove away some of Theseus' cows. Theseus pursued, but when he caught up with him the two heroes were so filled with admiration for each other that they swore brotherhood. Pirithous later helped Theseus to carry off Helen (*q.v.*). In exchange, Theseus descended to the lower world with Pirithous to help his friend rescue Persephone, daughter of the goddess Demeter. But they were caught and confined in Hades until Heracles came and released Theseus.

When Theseus returned to Athens, he faced an uprising led by Menestheus, a descendant of Erechtheus, one of the old kings of Athens. Failing to quell the outbreak, Theseus sent his children to Euboea, and after solemnly cursing the Athenians he sailed away to the island of Scyros. But Lycomedes, king of Scyros, killed Theseus by casting him into the sea from the top of a cliff. Later, according to the command of the Delphic oracle, the Athenians fetched the bones of Theseus from Scyros and laid them in Attic earth.

Theseus' chief festival, called Theseia, was on the eighth of the month Pyanopsion (October), but the eighth day of every month was also sacred to him.

**Thesiger, Frederick John Napier:** *see* Chelmsford, Frederick John Napier, 1st Viscount and 3rd Baron.

**Thesmophoria,** in Greek religion, ancient festival held in honour of Demeter Thesmophoros and celebrated by women in many parts of the Greek world. The meaning of the name Demeter Thesmophoros still remains a matter of disagreement, although a possible translation is "bringer of treasure or wealth," an obsolete sense of *thesmos.* Or, the name Thesmophoria is perhaps the primary one, from which the epithet of the goddess was derived; it means "the carrying of things laid down."

The celebrants were free women who seem to have been married. They observed chastity for several days and abstained from certain foods. The festival lasted three days, although in Attica it was lengthened to five. The original days were Pyanopsion (October) 12–14 and were called respectively *anodos* (or *kathodos*), *nēsteia,* and *kalligeneia.* At least a great part of the Thesmophoria was carried out by torchlight and was accompanied by ceremonial coarse abuse among the women, a common means of promoting fertility.

It is plausible to assume the first day was called ascent (*anodos*) and descent (*kathodos*) and to connect it with the rite known to have been performed at some time in the festival. Pigs were thrown into an underground chamber, called a megaron. They were left there until the parts of them not eaten by the guardian snakes had had time to rot. The remains were then brought up by women who had observed chastity for three days. These women also carried, or some of the celebrants did, certain well-known symbols of fertility, including pinecones and figures made of dough, in the shapes of serpents and men. The remains of the pigs were laid on an altar and if taken and mixed with seed were believed to ensure a good crop. Apparently the figures, like the pigs, were also thrown into the chasms. These objects are all connected with fertility; the mixing of all manner of magical things with seeds to make them sprout better is a widespread custom. The ancients tried to explain these matters as commemorations of the abduction of Kore (Persephone), daughter of Demeter, but it is rather the legends that grew out of the ritual, now no longer understood. The *nēsteia* was the day of fasting, with the women sitting upon the ground. The third day, *kalligeneia,* was "the fair birth" and probably indicated the happy issue of all the magic in the fertility of the ground, and of men and beasts as well.

**Thespiae,** Greek THESPIAI, ancient Greek city of Boeotia by the Thespius (modern Kanavári) River and at the eastern foot of Mt. Helicon; site of the "Eros" of Praxiteles, one of the most famous statues in the ancient world, and home of the sanctuaries and festivals of the Muses. Thespiae is important in Greek history chiefly as an enemy of nearby Thebes. After the Battle of Thermopylae in 480 BC, most Boeotian cities joined the Persians, but Thespiae and Plataea continued to resist them. The Thespians, aroused by Theban intervention and enmity, served Sparta as a base against Thebes from 379 to 372. The Thebans destroyed Thespiae in 371 BC, but the town was soon rebuilt. Thespiae survived under the Roman Empire as an important Boeotian town.

**Thespis** (fl. 6th century BC, Athens), Attic Greek poet from the deme (district) of Icaria who reputedly originated the actor's role in drama. He was often considered the "inventor of tragedy," and his name is recorded as the first to win a prize for tragedy at the Great Dionysia, *c.* 534 BC. The significance of the claim depends on the interpretation of scanty evidence about Thespis and the view taken of the development of Greek drama. Aristotle, according to the rhetorician Themistius, said that tragedy in its earliest stage was entirely choral until the prologue and speeches were first introduced by Thespis. Thus Thespis was indeed the first "actor," and tragic dialogue began when he exchanged words with the leader of the chorus.

**Thessalonians, letters of Paul to the,** two New Testament letters written by Paul from Corinth, Greece, about AD 50 and addressed to the Christian community he had founded in Macedonia.

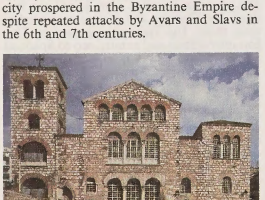
The first letter was written after Timothy, his co-worker, returned from Thessalonia to report that the new converts had stood fast in the Lord despite persecution. Apparently to refute slanderous charges that he used guile and flattery to gain converts, Paul points out that the Thessalonians themselves were eyewitnesses to his "holy and righteous and blameless" behaviour (2:10). He likewise calls attention to the fact that he worked night and day so as not to burden anyone. In answer to a question that disturbed the community, Paul explained that everyone, both the living and the dead, will share Christ's Resurrection at the time of his Second Coming.

The second letter was written shortly after the first, but some question Pauline authorship because there is notable ambiguity about the proximity of Christ's Second Coming. Christians apparently believed that it was useless to work because the end of the world was close at hand. The letter thus explains that the final day will not arrive until after the Antichrist appears and proclaims himself God. Christians must consequently continue "to earn their own living" (3:12), as did Paul himself in Thessalonia, who "did not eat any one's bread without paying" (3:8).

**Thessaloníki,** formerly SALONIKA, historically THESSALONICA, city, capital and residence of the minister for northern Greece and administrative centre of the *nomós* (department) of Thessaloníki, on the west side of the Chalcidice (Khalkidhikí) peninsula at the head of a bay on the Thermaïkós Kólpos (Gulf of Thérmai). An important industrial and commercial centre, second to Athens in population and to Piraeus as a port, it is built on the foothills and slopes of Mt. Khortiátis (Kissós; 3,940 ft [1,201 m]), overlooking the delta plains of the Gallikós and Vardar rivers.

Founded in 316 BC and named for a sister of Alexander the Great, Thessaloníki after 146

was the capital of the Roman province of Macedonia. As a military and commercial station on the Via Egnatia, which ran from the Adriatic Sea east to Byzantium (*i.e.*, Constantinople), it grew to great importance in the Roman Empire. Two letters written by the Apostle Paul were addressed to its inhabitants (Thessalonians), and its first bishop, Gaius, was one of Paul's companions. The city prospered in the Byzantine Empire despite repeated attacks by Avars and Slavs in the 6th and 7th centuries.



The Byzantine Church of Áyios Dimítrios, Thessaloníki, Greece

© Chris Hellier/Ancient Art & Architecture Collection

In the following centuries the city was attacked by Arabs, Bulgarians, Normans, and others, and many barbarities were committed on its people. Its allegiance was forced under one or another ruler until after 1246, when it passed into the revived Byzantine Empire. Harassed constantly by the Ottoman Turks, the desperate city ceded itself to Venice in 1423, but the Ottoman sultan Murad II took it with a terrible massacre in 1430. At the end of that century the severely reduced population was augmented by an influx of 20,000 Jews driven from Spain. Thessaloníki became a part of the Ottoman Empire and remained so for almost the next five centuries.

Thessaloníki was the birthplace of Mustafa Kemal (Atatürk), and it became the headquarters for the Ottoman Liberty Society, a faction of the Young Turk movement that initiated the Turkish revolution of 1908. The city was captured by the Greek army in 1912 during the First Balkan War and was ceded to the Greek kingdom by the Treaty of Bucharest (1913). The Greek king George I was assassinated there on a visit on March 18, 1913. From 1915 to 1918 Thessaloníki served as the base for Allied operations in the Turkish straits. In 1916 the Greek premier Eleuthérios Venizélos formed a provisional government in Thessaloníki that declared war on Bulgaria and Germany. In 1941 the city was captured by Germans, during whose occupation most of the city's approximately 60,000 Jews were deported and exterminated.

The Via Egnatia traverses the city from east to west, between the Vardar Gate and the Kalamaria Gate, respectively. A 4th-century brick and marble arch built by the emperor Galerius spans the road on the east. The upper citadel walls (built during the reign of Theodosius I, 379–395) survive with restorations. Once the second city of the Byzantine Empire after Constantinople, Thessaloníki is remarkable for its many fine Byzantine churches. The domed basilica of Ayía Sofía (early 8th century) was converted into a mosque in 1585–89. Its nave, forming a Greek cross, is surmounted by a hemispherical dome covered with a rich mosaic dating from the 9th to the 10th century. The Church of Áyios Dimítrios, the city's patron saint, is early 5th century; it was entirely reconstructed in 1926–48. The Panaghia Chalkeon (1028 or 1042) is another excellent example of the Greek-cross design that inspired many later Byzantine churches. Dating from the 5th century, the little Church of Osios David is especially noted for its early mosaics.

Modern Thessaloníki is the terminus of rail lines to other areas of Greece and the Balkans. The harbour was opened to navigation in 1901. The city exports chrome, manganese, and numerous raw and processed agricultural products. Thessaloníki in the 1960s became a major industrial centre with the construction of a large complex including oil refineries, petrochemical plants, and steel works. The city's other industries produce liquors, hides, textiles, carpets, bricks, tiles, soap, and flour. The city is the seat of a metropolitan bishop of the Greek Orthodox Church. It has a university (founded 1925) and an American college, a German school, and a French lycée. The city was damaged by fire in 1890, 1898, 1910, and especially in 1917 and was extensively damaged by an earthquake in 1978. Pop. (1991 prelim.) 377,951.

**Thessaly,** Modern Greek THESSALÍA, region of northern Greece south of Macedonia, lying between upland Epirus and the Aegean Sea and comprising chiefly the fertile Tríkala and Larissa lowlands. It is well delineated by topographical boundaries: the Khásia and Cambunian mountains (north), the Óthris massif (south), the main Pindus Mountains (west), the Olympus massif (northeast), and the coastal ranges of Óssa and Pelion (southeast). Thessaly is drained by several tributaries of the Piniós River, which empties into the Aegean Sea after passing through the Vale of Tempe. Several passes carry highway traffic to and from the region, and the main railway from Athens to Thessaloníki (Salonika) enters Thessaly by the Coela Pass and exits through the Vale of Tempe.

Generally the most level district of Greece, Thessaly is split by a range of hills into a southwestern sector dominated by the town of Tríkala and an eastern sector centring on Larissa (Lárisa). To the southeast the Magnesia Peninsula, a prolongation of the Pelion massif, encloses the Pagasitikós Gulf (Gulf of Vólos).

The home of an extensive Neolithic culture to about 2500 BC, Thessaly later remained on the fringe of the Bronze Age civilization of Greece, although Mycenaean settlements have been discovered, as at Iolcos near Vólos. Toward the end of the Mycenaean period the Thessali entered the fertile plain from Thesprotía in southern Epirus and imposed an aristocratic rule on the older inhabitants. The rich lowlands became the home of such baronial families as the Aleuads of Larissa and the Scopads of Crannon, who organized a pan-Thessalian federation under an elected military chief and controlled the Amphictyonic League of northern Greek states in the 6th century BC. The plains proved well suited to horse breeding, and the Thessalians were strong in cavalry.

In the Classical period the natural isolation and character of the people kept Thessaly aloof from the main currents of Greek life. Politically unstable because of tribal rivalries, they never long sustained a concerted action. The Aleuads joined the Persians during the Greco-Persian Wars. After the 4th century they were usually Macedonian vassals until, in 148, Rome incorporated Thessaly into the province of Macedonia.

About AD 300 the emperor Diocletian made Thessaly a province, with its capital at Larissa; in the Byzantine Empire it was attached to the theme (military district) of Thessalonica. From the 7th century to the 13th it was invaded or controlled by Slavs, Saracens, Bulgars, and Normans. The influx of nomad Vlachs (Walachians) from the Danube was so intensive by the 12th and 13th centuries that Thessaly came to be called Great Walachia (Megale Vlachia); colonies of Vlach herdsmen are still found there. In the 14th century it was overrun by Catalans and Serbs, the latter setting up the capital at Tríkala. When in 1394 the Turks assumed rule, they retained Tríkala as seat of the pasha of Thessaly. In 1881 most of Thessaly was ceded to Greece by Turkey, and after the Balkan Wars (1912–13) the remainder north of the Vale of Tempe passed into the Greek kingdom.

**Thetford,** town ("parish"), Breckland district, county of Norfolk, England. The town lies on the edge of Thetford Chase Forest. It possesses the remains of a Cluniac priory, a Benedictine nunnery, and a large medieval mound known as Castle Hill. Excavations have revealed traces of a Saxon town of about 4,000 inhabitants with considerable industry and a mint.

Officially designated an "expanded town" for London's overspill population, Thetford has grown since 1960. It has a number of industries, including paper and pulp manufacture, canning, and light engineering. Pop. (1981) 19,593.

**Thetford-Mines,** city, Chaudière-Appalaches region, southern Quebec province, Canada. Originating after the discovery of asbestos deposits there in 1876, it was called Kingsville and later renamed after Thetford, Norfolk, Eng. Situated 60 miles (100 km) south of the city of Quebec, Thetford-Mines overcame the problems brought about by the encroachment of open-pit mining upon its urban area to become the centre of one of the world's greatest asbestos-producing areas. Other economic activities of the Thetford-Mines area include chromium and feldspar mining, dairying, sawmilling, and the manufacture of fibreglass and jute bags. Inc. village, 1892; town, 1905; city, 1912. Pop. (1991) 17,273.

**Thetis,** in Greek mythology, a Nereid loved by Zeus and Poseidon. When Themis (goddess of Justice), however, revealed that Thetis was destined to bear a son who would be mightier than his father, the two gods gave her to Peleus, king of the Myrmidons of Thessaly. Thetis, unwilling to wed a mortal, resisted Peleus' advances by changing herself into various shapes. But, assisted by the wise centaur Chiron, Peleus finally captured her.

All the gods brought gifts to their wedding. The child of their union was the warrior Achilles, but, according to some authorities, Thetis bore seven children, all of whom perished either when she attempted to render them immortal by fire or when she destroyed them as the tokens of an unwilling alliance. She befriended Zeus when the other gods revolted, and she rescued both Hephaestus and Dionysus from the sea. She had a sanctuary at Sparta.

**Theudebald** (Merovingian king): *see* Theodebald.

**Theudebert** (name of Merovingian kings): *see under* Theodebert.

**Theuderic** (personal name): *see under* Theodoric.

**Theudis,** also spelled TEUDIS (d. 548), the first Visigothic king of Spain (531–548), in the sense that he was the first to reside there permanently. An Ostrogoth, he had acquired great possessions in the valley of the Ebro by marriage with a Roman lady when Theodoric the Great chose him to be the regent and guardian for the three-year-old Amalaric, who had inherited the Visigothic kingdom. Theudis, who resided first at Barcelona and then at Seville, became king himself when Amalaric was assassinated in a Frankish invasion in 531. He endeavoured to complete his mastery of the diocese of Spain by occupying Mauritania Tingitana, but he was defeated by the Roman imperial officers at Ceuta. He

was in due course murdered at Seville by his usurping successor Theudigisel (Theudesgesil).

**Theveste** (Algeria): *see* Tébessa.

**thiamine,** also spelled THIAMIN: *see* vitamin $B_1$.

**thiazine,** any of three organic compounds of the heterocyclic series, having molecular structures that include a ring of four atoms of carbon and one each of nitrogen and sulfur.

Many compounds of 1,4-thiazine are known, most of them derivatives of phenothiazine ($C_{12}H_9NS$), which was discovered in 1883. Phenothiazine has been used as a vermifuge for livestock and also as an insecticide. Drugs of the phenothiazine type include chlorpromazine, a tranquillizer; promethazine hydrochloride (Phenergan), a long-acting antihistaminic; and diethazine hydrochloride (Diparcol), used in treatment of parkinsonism. A large group of dyes has the phenothiazine structure, including methylene blue.

Compounds in which the sulfur and nitrogen atoms are adjacent (1,2-thiazine and its derivatives) are extremely rare. 1,3-Thiazine itself is not known; an important compound containing its structure is cephalosporin C, a useful antibiotic.

*Consult the* INDEX *first*

**thiazole,** any of a class of organic compounds of the heterocyclic series characterized by a ring structure composed of three carbon atoms, one nitrogen atom, and one sulfur atom. This ring structure occurs in such important biologically active natural products as thiamine (vitamin $B_1$), bacitracin, and the penicillins, and in numerous synthetic drugs, dyes, and industrial chemicals.

The simplest member of the thiazole family is thiazole itself, a rarely prepared liquid with the molecular formula $C_3H_3NS$. Other thiazole compounds include rhodanine and the dye rhodanine red derived from it, and the yellow dye primuline. Synthetic drugs belonging to the thiazole family include sulfathiazole, sulfasuxidine, and thiazolsulfone (Promizole). 2-Mercaptobenzothiazole (Mertax) is a thiazole derivative used for accelerating the vulcanization of rubber.

**Thibaud** (French personal name): *see under* Thibaut, or Theobald, except as below.

**Thibaud, Jacques** (b. Sept. 27, 1880, Bordeaux, Fr.—d. Sept. 1, 1953, near Mt. Cemet, French Alps), French violinist known for his performances of Mozart, Beethoven, and 19th-century French works.

Thibaud studied at the Paris Conservatoire (first prize, 1896) and then played violin in a Paris café. He was invited to join the orchestra of Édouard Colonne, the conductor noted for his championing of contemporary music, and he appeared as soloist with it in 1898. He toured widely, and in 1905 he formed a famous trio with two other gifted performers, the French pianist Alfred Cortot and the Spanish cellist Pablo Casals. His playing was admired for its fine tone and expressive dynamics. He was killed in an airplane accident en route to French Indochina.

**Thibault, Jacques-Anatole-François,** also called THIBAUT, ANATOLE-FRANÇOIS: *see* France, Anatole.

**Thibaut** (French personal name): *see under* Thibaud, or Theobald, except as below.

**Thibaut, Anton Friedrich Justus** (b. Jan. 4, 1772, Hameln, Hanover—d. March 28, 1840, Heidelberg, Baden), German jurist and leader of the philosophical school that maintained the tradition of natural law in a spirit of moderate rationalism. He is remembered chiefly because his call for the codification of German law, reflecting the rise of German nationalism after the Napoleonic wars, was vigorously opposed by F.K. von Savigny, leader of the historical school of jurisprudence.

Thibaut studied law at Göttingen, Königsberg, and Kiel, where, in 1796, he qualified as teacher of law. He was appointed professor of civil law at Kiel in 1798, then at Jena in 1802, and at Heidelberg in 1806. In 1834 he became a member of the court of arbitration of the German Confederation.

Thibaut's main publications are *Theorie der logischen Auslegung des römischen Rechts* (1799; "Theory of the Logical Interpretation of Roman Law") and *System des Pandektenrechts* (1803; the general part translated as *An Introduction to the Study of Jurisprudence,* 1879), which long remained one of the leading textbooks of Roman law applied as the common law of Germany. In 1814 he published an essay "On the Need for a Civil Code for Germany," inspired by patriotic sentiment and rationalist belief in the merits of codification. Also a serious student of music, he wrote *Über Reinheit der Tonkunst* (1825; *On Purity in Musical Art,* 1877).

**Thibaw,** also spelled THEEBAW (b. 1858, Mandalay, Burma—d. Dec. 19, 1916, Ratnagiri Fort, India), last king of Burma, whose short reign (1878–85) ended with the occupation of Upper Burma by the British.

Thibaw was a younger son of King Mindon (reigned 1853–78) and studied (1875–77) in a Buddhist monastery. As king he was strongly influenced by his wife, Supayalat, and her mother, and his accession to the throne was accompanied by much violence and civil strife.

In an attempt to enlist the aid of the French against the British, who had annexed Lower Burma during his father's reign, Thibaw's government sent a mission to Paris in 1883. Two years later a commercial treaty was concluded, and a French representative arrived in Mandalay. Rumours circulated that Thibaw's government had granted the French economic concessions in exchange for a political alliance, and British officials in Rangoon, Calcutta, and London began demanding immediate annexation of Upper Burma.

An occasion for intervention was furnished by the case of the British-owned Bombay-Burmah Trading Corporation, which extracted teak from the Ningyan forest in Upper Burma. When Thibaw charged it with cheating the government, demanding a fine of £100,000, the Indian viceroy, Lord Dufferin, sent an ultimatum to Mandalay in October 1885 demanding a reconsideration of the case. Thibaw ignored the ultimatum, and on Nov. 14, 1885, the British invaded Upper Burma, capturing Mandalay two weeks later. Thibaw was deposed and Upper Burma incorporated into the province of British Burma. Thibaw was exiled to India, where he remained until his death.

**Thibert** (name of Merovingian kings): *see under* Theodebert.

**Thibodaux,** city, seat (1808) of Lafourche Parish, southeastern Louisiana, U.S., on Bayou Lafourche, 45 mi (72 km) southwest of New Orleans. Founded as a river depot *c.* 1750, it was settled by French, Spanish, Acadians, and Des Allemands (Germans from John Law's ill-fated economic venture known as the Mississippi Bubble). St. John's Episcopal Church was established in 1841 by Leonidas Polk, the "Fighting Bishop" of the Confederacy. Several antebellum plantation homes are preserved, including those of Henry Schuyler Thibodaux (Louisiana acting governor, 1824) and Edward Douglass White, U.S. Supreme Court chief justice. Its economy depends on sugar, cattle and truck farming, light manufacturing, and the oil and gas industry. Thibodaux is the seat of Nicholls State University (1948). Inc. city, 1838. Pop. (1990) city, 14,035; Houma-Thibodaux MSA, 182,842.

**thick-headed fly,** an elongated, wasplike insect of the family Conopidae (order Diptera). It is brownish in colour, often with yellow markings, and between about 6 and 25 millimetres (0.2 and 1 inch) long; the head is thicker than the thorax.

In some species the long and slender proboscis (feeding organ) is bent. Eggs are deposited on or in host insects (*e.g.*, adult wasps, bumble bees, grasshoppers), and the larvae are parasitic.

**thicket:** *see* coppice.

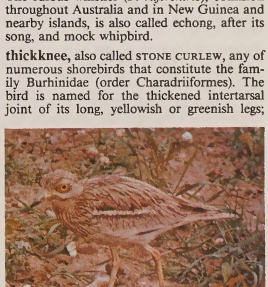
**thickhead,** also called WHISTLER, any of about 35 species constituting the songbird family Pachycephalidae (order Passeriformes), considered by some authors to be a subfamily of Muscicapidae. Thickheads have heavy-



Golden whistler (*Pachycephala pectoralis*)
Painting by Albert E. Gilbert

looking, seemingly neckless foreparts and are named alternatively for their loud, melodious voices. Thickheads are insectivorous inhabitants of mangrove swamps, scrublands, and open forests from southern Asia to southwestern Pacific islands and Australia. Most are 15 to 18 centimetres (6 or 7 inches) long. In the main genus, *Pachycephala,* males of most species are yellow and green, with black, white, or reddish-brown markings. The most westerly form is the gray thickhead, or mangrove whistler (*P. cinerea*), found from India to Malaysia. The golden whistler (*P. pectoralis*) ranges from Australia to the Fiji islands and the Malay Peninsula (about 80 races). The rufous whistler (*P. rufiventris*), common throughout Australia and in New Guinea and nearby islands, is also called echong, after its song, and mock whipbird.

**thicknee,** also called STONE CURLEW, any of numerous shorebirds that constitute the family Burhinidae (order Charadriiformes). The bird is named for the thickened intertarsal joint of its long, yellowish or greenish legs;



European stone curlew (*Burhinus oedicnemus*)
John Markham

or, alternatively, for its size (about that of a curlew, 35 to 50 centimetres, or 14 to 20 inches) and cryptic brown plumage, together with its preference for stony wastelands.

There are nine species, in Europe, Asia, Africa, Australia, and Central and South America. The bill has a swollen tip, and the head is large and broad: hence another widely used name, dikkop (Afrikaans, "thickhead"). Most of the nine species are nocturnal and have big yellow eyes. At dusk these birds utter wailing or croaking cries. They live mainly on beetles and worms but also on crustaceans, frogs, and mice. They can fly well but normally keep to the ground, running about rapidly with head lowered. They lay two large, nearly oval eggs in a nest on the ground.

The European stone curlew (*Burhinus oedicnemus*), called Norfolk plover in England, breeds across southern Europe to India and northern Africa. A tropical African species is known as the water dikkop (*B. vermiculatus*). The double-striped thickknee (*B. bistriatus*) inhabits the American tropics. Others are the great stone curlew (*Esacus recurvirostris*), also called stone plover or reef thickknee, of coastal rivers of India; and the beach stone curlew (*Orthorhamphus magnirostris*) of Australia.

**thief ant:** *see* fire ant.

**Thiel** (The Netherlands): *see* Tiel.

**Thiene, Saint Cajetan of:** *see* Cajetan of Thiene, Saint.

**Thierry** (French personal name): *see under* Theodoric, except as below.

**Thierry,** also called THIERRY OF ALSACE, French THIERRY D'ALSACE, Dutch DIEDERIK VAN DEN ELZAS (b. 1100—d. Jan. 4, 1168, Grevelingen, Flanders), count of Flanders (1128–68), son of Thierry II, duke of Upper Lorraine, and Gertrude, daughter of Robert I the Frisian, count of Flanders. He contested the county of Flanders with William Clito on the death of Charles the Good in 1127. He was recognized by Ghent, Bruges, and Ypres and consolidated his position when William was killed at Alost in 1128. He married the widow of Charles the Good, Marguerite of Clermont, and proved himself at home a wise and prudent prince, encouraging the growth of popular liberty and of commerce. In 1146 he took part in the Second Crusade and distinguished himself by his exploits. In 1157 he resigned the countship to his son Philip of Alsace and betook himself once more to Jerusalem. On his return from the East, Thierry retired to a monastery to die in his own land.

**Thierry** DE CHARTRES, also called THIERRY THE BRETON, Latin THEODORICUS, or TERRICUS, CARNOTENSIS, or BRITO (b. *c.* 1100, France—d. *c.* 1150, Chartres, Fr.), French theologian, teacher, encyclopaedist, one of the foremost thinkers of the 12th century.

According to Peter Abelard, Thierry attended the Council of Soissons in 1121, at which Abelard's teachings were condemned. He taught at Chartres, where his brother Bernard of Chartres, a celebrated Platonist, was chancellor. Sometime after 1136 he began teaching in Paris, where he had the Latinist, John of Salisbury, among his pupils. In 1141 he became archdeacon and chancellor of Chartres. After attending the Diet of Frankfurt in 1149, he later retired to a monastic life.

His unpublished *Heptateuchon* ("Book in Seven Volumes") contains the "classics" of the seven liberal arts, including works by Cicero on rhetoric and by Aristotle on logic. His cosmology, mainly expounded in his commentary on Genesis, attempts to harmonize Scripture with Platonic and other physical or metaphysical doctrines; it teaches that God—who is everything—is the ultimate form from which all other forms were created. In the Latin West, he was among the first to promote the Arabian knowledge of science, thus contributing to that important movement beginning in the 11th century in which Eastern science was—through Latin translations of Arabic works—introduced into the West, where science had disappeared with the Latin Roman Empire.

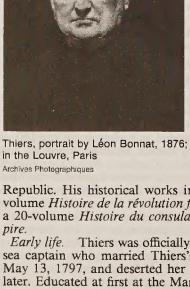
**Thierry, (Jacques-Nicolas-) Augustin** (b. 1795—d. 1856), French historian whose discursive method of presenting history in picturesque and dramatic terms makes him one of the outstanding Romantic historians.

Thierry was educated at Blois and at the École Normale in Paris, where he first met Saint-Simon. He was fired with Saint-Simon's ideal society of the future, becoming his secretary in 1814 and always calling himself the "adopted son" of the socialist visionary.

As a professional historian he was influenced particularly by the works of Sir Walter Scott, and, though he himself wrote no romances, his conception of history fully recognized the dramatic element. His main subjects are the Germanic invasions, the Norman Conquest, the formation of the medieval communes, the gradual ascent of the nations toward free government, and parliamentary institutions. From Claude Fauriel he learned to consult original sources; and, in writing his most original and ambitious work, *L'Histoire de la conquête de l'Angleterre par les Normands* (3 vol. 1825; *History of the Conquest of England by the Normans*, 1825), he made use of Latin chronicles and Anglo-Saxon laws. This work cost Thierry his eyesight. He was obliged to engage secretaries, and in 1830 he became totally blind. In 1841 the French Academy awarded him the first Prix Gobert, a prize bestowed on him for the next 15 years.

An ardent supporter of the revolution of July 1830 and of the triumph of liberal ideas, Thierry was always interested in the destiny of the bourgeoisie, as is evident from some of his works.

**Thiers, (Louis-)Adolphe** (b. April 18, 1797, Marseille—d. Sept. 3, 1877, Saint-Germain-en-Laye, near Paris), French statesman, journalist, and historian, a founder and the first president (1871–73) of the Third



Thiers, portrait by Léon Bonnat, 1876; in the Louvre, Paris
Archives Photographiques

Republic. His historical works include a 10-volume *Histoire de la révolution française* and a 20-volume *Histoire du consulat et de l'empire.*

*Early life.* Thiers was officially the son of a sea captain who married Thiers's mother on May 13, 1797, and deserted her four months later. Educated at first at the Marseille school that now bears his name, he studied law at Aix-en-Provence, where he met his lifelong friend, the historian François Mignet. In 1821 he went to Paris and became a contributor to the influential newspaper *Constitutionnel.* In January 1830 he helped found a new opposition newspaper, *National,* which almost openly advocated a change of dynasty should the reactionary king Charles X attempt to circumscribe public liberties. During the revolution of July 27–29, 1830, which overthrew King Charles, he took refuge in a Paris suburb and returned on the 29th to win support for Louis-Philippe, duke of Orléans. He was rewarded by being made a member of the Council of State and was elected to the Chamber as a deputy for Aix-en-Provence.

*Political career.* Under the Orleanist monarchy, Thiers was undersecretary of state for the treasury (1830), minister of the interior (1832 and 1834–36), and minister of trade and public works (1833–34). During those years, he was the most notable representative of the Party of Resistance (conservative moderates). He mercilessly crushed all insurrections, in particular those of the legitimists under the Duchesse de Berry in 1832 and of the Republicans in 1834. Premier and minister of foreign affairs (1836 and 1840), in his second term of office his support of the Egyptian pasha Muhammad 'Ali almost led to war with England because of a conflicting Middle Eastern policy. Forced to resign by King Louis-Philippe's determination to avert war, Thiers nevertheless remained a leader of the resistance party.

After the Revolution of February 1848, Thiers returned to the Assembly as a representative for Seine Inferieure. Though he helped elect Prince Louis-Napoleon to the presidency of the Second Republic (1849), the two later became estranged. Exiled from 1851 to 1853, Thiers again became a deputy under the Second Empire and was originally one of those who favoured war with Prussia in 1870. During the war crisis, however, Thiers changed his views and became an opponent of the aggressive policy that he had previously advocated. This swing stood him in good stead after the French defeat in September 1870; he thus became the wise man who had foreseen the folly of pursuing such a policy without adequate military power. He was clever enough to remain out of the national defense government set up after the fall of the Empire (September) and thus had no responsibility for the final French surrender in January 1871. In February he was elected simultaneously for 26 *départements* and on February 17 became "chief of the executive power of the French Republic." In August 1871 he became president of the republic. Thiers believed that France could be united under a conservative republic and tried to win the monarchist opposition over to this view. His first major task was to restore political order. In concert with the Germans, he ruthlessly used troops to defeat the Paris insurrection known as the Commune (March–May 1871), thus destroying for many years the strength of French Socialists and workers' movements. But even this did not win him the support of the monarchists, and in 1873 he resigned. Meanwhile, his financial skill had enabled France to pay off ahead of time the indemnity due the Germans. But his military law of 1872 failed to establish an adequate professional army and the five years' conscription period he introduced seriously depleted the labour force.

Thiers joined the republican opposition in what was now a mainly royalist Assembly. He died suddenly in September 1877, at Saint-Germain-en-Laye, just outside Paris, while preparing an election manifesto.

*Assessment.* Thiers probably achieved greater power and wealth than any French politician of his time, but his ability was not greatly appreciated by those whom he served. His *Histoire de la révolution française,* which appeared in 10 volumes between 1823 and 1827, and his *Histoire du consulat et de l'empire,* published in 20 volumes between 1845 and 1862, made a notable contribution to the growth of nationalism in France. In addition,

his effecting the return of Napoleon's body to France from St. Helena in 1840 fostered the Napoleonic legend. Of himself, Thiers fairly successfully promoted the image of an old, shrewd, and wise patriot, although, by those of left-wing sympathies, he was never regarded as anything but an inveterate enemy of social reform. (J.Vi.)

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**Thiès**, city, west-central Senegal. Situated 35 miles (56 km) east of Dakar, it is an important transportation centre, serving as the junction of the eastern Dakar–Niger River railway and the northern rail and road systems. This central location has spawned light industries and processing plants, making Thiès one of the largest cities in Senegal. Reserves of aluminum phosphate found near Thiès are being exploited. Pop. (1998 est.) 320,000.

**Thietmar,** also spelled DIETMAR, or DITHMAR (b. July 25, 975, Hildesheim, Saxony [now in Germany]—d. Dec. 1, 1018, Merseburg, March of Thuringia), bishop of Merseburg and chronicler whose history of the three Ottos and Henry II, Saxon kings of Germany and Holy Roman emperors, is an important medieval Saxon document.

The son of John Siegfried, Graf von Walbeck, and a relative of the royal house, Thietmar spent his youth in Magdeburg, joined the brotherhood of the church of Magdeburg in 991, was made prior of the convent of Walbeck in 1002, and became bishop of Merseburg seven years later. Between 1012 and 1018 he wrote an eight-book chronicle based on German annals from 908 to 1018. Having accompanied Henry II on military expeditions against the Slavs, he attributed to him the recovery of Saxon lands from the Slavic peoples. He was one of the first scholars to employ the word Teutonici to distinguish the German people from non-Germans within the Holy Roman Empire and to develop a vague concept of imperialism in contrast to traditional tribalism.

**Thieu, Nguyen Van:** *see* Nguyen Van Thieu.

**thighbone:** *see* femur.

**thigmotrich,** any protozoan of the ciliate order Thigmotrichida, found living parasitically in and about the gills or in the mantle cavity of bivalve mollusks. On the anterior part of the cell are long cilia (hairlike processes) for attaching to the host. The mouth opening is posterior; in some genera, such as *Goniocoma* and *Holocoma,* it has been replaced by an anterior suctorial tentacle. The taxonomy of the Thigmotrichida was undergoing revision in the late 20th century.

**Thika,** town, south-central Kenya. It lies in the highland region just northeast of the capital city of Nairobi, at an elevation of 4,943 feet (1,507 m) above sea level. Situated in a fruit-growing area, Thika specializes in fruit canning (notably pineapples); the production of textiles, matches, and tinplate cans are other leading industries. Thika is the site of the National Horticultural Research Centre, which engages in agronomic research. Pop. (latest est.) 88,600.

**Thimann, Kenneth V.,** in full KENNETH VIVIAN THIMANN (b. Aug. 5, 1904, Ashford, Kent, Eng.—d. Jan. 15, 1997, Haverford, Pa., U.S.), English-born American plant physiologist who isolated auxin, an important plant growth hormone.

Thimann studied chemistry at Imperial College in London, where he received a Ph.D. in biochemistry in 1928. After teaching for two years at King's College for Women in London, Thimann went to the United States, where he served on the faculties at the California Institute of Technology in Pasadena (1930–35), Harvard University (1935–65), and the University of California at Santa Cruz from 1965. He became a U.S. citizen in 1941.

Thimann began his search for the growth hormone with Hermann Dolk in the early 1930s at the California Institute of Technology. Most of the work was completed when Dolk died in 1933; the next year Thimann obtained and isolated pure auxin in the form of $\beta$-indolylacetic acid (IAA). With several coworkers, Thimann proved that auxin promotes cell elongation, formation of roots, and growth of buds. These discoveries led to the development of a widely used synthetic auxin, 2,4-D. By using this and similar chemicals, the premature falling of fruit can be prevented and cut stems can be stimulated to grow abundant roots; in addition, because high concentrations of auxins are toxic to most plants, synthetic auxins are effective weed killers.

Thimann also demonstrated that the action of auxin on bud formation involves an interaction with another growth hormone, kinetin, isolated by Folke Skoog and Carlos Miller around 1956. Publications of his research include *The Natural Plant Hormones* (1972), *Hormones in Living Plants* (1977), and *Senescence in Plants* (1980).

**thimble,** small, bell-shaped implement designed to protect the end of the finger when sewing. Among the earliest known thimbles, dating from before AD 79, were those made of bronze and found at Pompeii and Herculaneum. Modern thimbles are almost exclusively produced in plastic or soft metals. Purely decorative thimbles are produced in an endless variety of materials and forms as collectibles.

**thimerosal,** antiseptic for the skin and mucous membranes, sometimes marketed under the trade name Merthiolate. It is an organic compound containing mercury and is related to merbromin (trade name Mercurochrome) and nitromersol (trade name Metaphen). Thimerosal disinfects by the action of the mercury in the molecule, precipitating the protein of microorganisms and disrupting their metabolisms. Thimerosal occurs as a light-coloured crystalline powder, soluble in water and in alcohol. It is used as a 0.1 percent alcoholic tincture or aqueous solution.

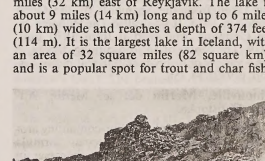
**Thimphu,** also spelled THIMBU, capital of Bhutan. The city, situated in the west-central part of the country, is in the Himalaya Mountains on the Raidak (also called Thimphu, or Wong) River at about 7,000 feet (2,000 m) above sea level. It was designated the official seat of government in 1962 (formerly the seat was wherever the king resided), and a large construction program was undertaken with Indian aid. Tashi Chho *dzong* (fortress, or castle), the traditional fortified monastery that has been remodeled and extended to house the offices of the royal government, is one of the finest specimens of traditional Bhutanese architecture. Terraced fields around the royal palace indicate the high priority given to agriculture. The principal crops in the area are rice, corn (maize), and wheat. Lumbering is also important, and there is a sawmill in the city. A hydroelectric power plant began operation in 1966. The city has an airplane landing strip, and the Indo-Bhutan National Highway (opened 1968) connects the capital to Phuntsholing, the principal gateway into Bhutan from India. Pop. (1999 est.) 28,000.

**thin-layer chromatography,** in analytical chemistry, technique for separating dissolved chemical substances by virtue of their differential migration over glass plates or plastic sheets coated with a thin layer of a finely ground adsorbent, such as silica gel or alumina, that is mixed with a binder such as starch or plaster of paris. The technique, which has become a standard analytical tool in food and pharmaceutical laboratories, is especially useful for separating the components of naturally occurring substances, notably those found in animal and vegetable tissues called lipids and the volatile and fragrant components of plants and flowers known as terpenes.

For thin-layer chromatography, a sample of the mixture to be separated is deposited at a spot near one end of the plate and a suitable solvent is allowed to rise up the plate by capillary action. The components of the sample become separated from one another because of their different degrees of attachment to the coating material on the plate or sheet. The solvent is then allowed to evaporate, and the location of the separated components is identified, usually by application of reagents that form coloured compounds with the substances. Thin-layer chromatography has a distinct advantage over paper chromatography in that the thin-layer chromatographic plate or sheet is able to withstand strong solvents and colour-forming agents.

**thing,** in medieval Scandinavia, the local, provincial, and, in Iceland, national assemblies of freemen that formed the fundamental unit of government and law. Meeting at fixed intervals, the *things,* in which pure democracy theoretically operated, legislated at all levels, elected royal nominees, and settled all legal questions. They were presided over by the local chieftain or by a law speaker (one unusually learned in the unrecorded law) and were dominated by the most influential members of the community. In Iceland the *things* ultimately led to the founding of the Althing, the Icelandic Parliament. In the 13th and 14th centuries the *things* in other countries gradually lost their prerogatives to bureaucratized courts and noble-clerical councils.

**Thingvalla, Lake,** Icelandic THINGVALLAVATN, lake, southwestern Iceland, 20 miles (32 km) east of Reykjavík. The lake is about 9 miles (14 km) long and up to 6 miles (10 km) wide and reaches a depth of 374 feet (114 m). It is the largest lake in Iceland, with an area of 32 square miles (82 square km), and is a popular spot for trout and char fishing. The lake drains southward to the Atlantic Ocean via the Sog River, which is itself a tributary of the Ölfusá River. On its northern shore stands Thingvellir, the historical meeting place of the Althing (parliament) from 930 until 1798; it has been part of a national park since 1928. Thingvellir was also the site of the proclamation of the Republic of Iceland on June 17, 1944.



Thingvellir, on the north shore of Lake Thingvalla, meeting place of the Althing (parliament), 930–1798
Earl Dibble—Photo Researchers

**Thinite** DYNASTIES (*c.* 3100–*c.* 2686 BC), 1st and 2nd dynasties of Egypt, so named by the Egyptian historian Manetho (fl. 300 BC) after This (modern al-Barbā), a city near Abydos, where some of its kings were allegedly buried. Menes (*c.* 3100–3040 BC), the traditional founder of the dynasty, was thought to have united the country and established Memphis as his capital. A few campaigns were recorded against the Bedouin tribes of the Sinai Peninsula, the Libyans, and the Nubians.

**thiocarbamide** (chemistry): *see* thiourea.

**thiol,** also called MERCAPTAN, any of a class of organic chemical compounds similar to the alcohols and phenols but containing a sulfur atom in place of the oxygen atom. Thiols are among the odorous principles in the scent of skunks and of freshly chopped onions; their presence in petroleum and natural gas is objectionable because they have disagreeable odours, interfere with catalysts used in refining processes, and produce sulfur dioxide upon combustion.

Thiols show many reactions like those of the hydroxyl compounds, such as formation of thioesters and thioethers (sulfides). Toward oxidation, however, they differ profoundly from alcohols: whereas oxidation of an alcohol usually leads to a product in which the oxidation state of a carbon atom has been changed, oxidation of a thiol affects the sulfur atom. Mild oxidants convert thiols to disulfides, and more vigorous reagents result in the formation of sulfonic acids. Aliphatic thiols are commonly prepared from alkyl halides and sodium hydrosulfide or from olefins and hydrogen sulfide. Aromatic thiols can be made from the amino compounds by way of the diazonium salts. A thiol generally has a much lower boiling point than the hydroxyl compound of like structure; for example, methanethiol boils at 6° C (43° F), methanol at 65 C (149° F). The lower aliphatic thiols are useful as warning odorants in fuel gases and are somewhat toxic.

**Thionville,** town, Moselle *département,* Lorraine region, northeastern France, on the canalized Moselle River, near the Luxembourg border. It has remains of a 13th-century castle, built by the counts of Luxembourg. Formerly a part of the Holy Roman Empire, Thionville was taken from the Spaniards by the Great Condé in 1643. It was called Diedenhofen by the Germans, who held it from 1870 until 1919. The centre of an iron-mining district, it has a variety of heavy metallurgical industries. Pop. (1982) 34,758.

**Thionville, Merlin de:** *see* Merlin, Antoine-Christophe.

**thiophene,** the simplest sulfur-containing aromatic compound, with molecular formula $C_4H_4S$, which closely resembles benzene in its chemical and physical properties. It occurs with benzene in coal tar, from which source it was first isolated in 1883. Today, thiophene is prepared commercially from butane or butene and sulfur or sulfur dioxide. Certain thiophene derivatives occur as plant pigments and other natural products. Biotin is a reduced thiophene derivative. The antihistamine methapyrilene (Thenylene) and certain other synthetic pharmaceuticals contain the thiophene nucleus, but there are few synthetic thiophene compounds of importance.

**thiourea,** also called THIOCARBAMIDE, an organic compound that resembles urea (*q.v.*) but contains sulfur instead of oxygen; *i.e.,* the molecular formula is $CS(NH_2)_2$, while that of urea is $CO(NH_2)_2$. Like urea, it can be prepared by causing a compound with the same chemical composition to undergo rearrangement, as by heating ammonium thiocyanate ($NH_4SCN$). A method of preparation more commonly used consists of the addition of hydrogen sulfide to cyanamide. Thiourea exhibits many of the chemical properties of urea, but it has little commercial application. The small quantity of thiourea consumed is utilized primarily in photography as a fixing agent, in the manufacture of a thermosetting resin, as an insecticide, as a textile-treating agent, and as starting material for certain dyes and drugs. Thiourea forms as colourless crystals melting at 182° C (360° F). It is toxic, although the fatal dosage is not well established.

**Thira** (Greece): *see* Thera.

**Third Department,** Russian TRETYE OTDELENIYE, also called THIRD SECTION OF HIS IMPERIAL MAJESTY'S OWN CHANCERY IN RUSSIA, office created by Emperor Nicholas I (July 15 [July 3, old style], 1826) to conduct secret police operations. Designed by Count A.Kh. Benckendorff, who was also its first chief administrator (1826–44), the department was responsible for political security.

It conducted surveillances and gathered information on political dissidents, religious schismatics, and foreigners. It banished suspected political criminals to remote regions and operated prisons for "state criminals." It was also responsible for prosecuting counterfeiters of money and official documents and for conducting censorship. It functioned in conjunction with the Corps of Gendarmes (formed in 1836), a well-organized military force that operated throughout the empire, and with a network of anonymous spies and informers.

Originally intended to protect the common people of Russia from the exploitation and corrupt practices of the dominant classes, it became a particularly repressive institution. In the 1870s it was responsible for the arrest of many Narodniki (Populists), who had gone into the countryside to improve conditions and agitate politically among the peasantry; it became a major target for revolutionary terrorists, who assassinated its head, Gen. N.V. Mezentsev, in 1878.

The department was abolished in 1880 by Gen. M.T. Loris-Melikov, who was appointed by Alexander II to assume many executive responsibilities and to undermine the revolutionary movement by instigating a series of moderate reforms. The department's functions were transferred to the department of the police of the Ministry of Interior.

**Third Estate,** French TIERS ÉTAT, in French history, with the nobility and the clergy, one of the three orders into which members were divided in the pre-Revolutionary Estates-General (*q.v.*); it represented the great majority of the people, and its transformation into a National Assembly in June 1789 marked the beginning of the French Revolution.

**Third International** (Socialist federation): *see* International, Third.

**Third Reich,** official Nazi designation for the regime in Germany (*q.v.*) from January 1933 to May 1945, as the presumed successor of the medieval and early modern Holy Roman Empire of 800 to 1806 (the First Reich) and the German Empire from 1871 to 1918 (the Second Reich).

**Thirkell, Angela (Margaret)** (b. Jan. 30, 1890, London—d. Jan. 29, 1961, Bramley, Surrey, Eng.), author of more than 30 lighthearted novels about English middle- and upper-class life in Barsetshire dealing with descendants of characters in Anthony Trollope's novels set in the same fictional locale.

The daughter of a classical scholar, Thirkell was also the cousin of Rudyard Kipling. Her novels, usually peopled with genteel, snobbish characters, are noted for their gentle irony, absurdity of tone, and understated sophistication. Some of her better known novels include *Coronation Summer* (1937), *Pomfret Towers* (1938), *The Brandons* (1939), *Northbridge Rectory* (1941), *Growing Up* (1943), *Headmistress* (1945), *Miss Bunting* (1946), and *The Duke's Daughter* (1951).

**Thirteen Articles of Faith,** also called THIRTEEN PRINCIPLES, a summary of the basic tenets of Judaism as perceived by the 12th-century Jewish philosopher Moses Maimonides. They first appeared in his commentary on the Mishna, *Kitāb al-Sirāj,* as an elaboration on the section Sanhedrin 10, which sets forth the reasons why a Jew would be denied resurrection. Maimonides' formulation was an attempt to put forth true concepts of God and faith as a tool in avoiding error. His statement, although presented by him as a form of dogma, was a personal concept and has been much debated and revised. The numerous versions of the Articles of Faith include the hymn *Yigdal,* written about 1300 and adopted into most prayer services.

**Thirteen Years' War** (1454–66), war between Poland and the Teutonic Knights that began as a revolt by the Prussian populace against their overlords, the Teutonic Knights, and was concluded by the Treaty of Toruń (Thorn; Oct. 19, 1466). In 1454 rebel Prussian groups petitioned Casimir IV of Poland for aid against the Knights. Casimir declared war on them, and in 1462 won the decisive Battle of Puck. In the Treaty of Toruń, the Teutonic Order surrendered the eastern part of Pomerania (Pomerelia) and western Prussia—eastern Prussia was a vassal state of the Polish crown, with its own diet and administration and capital at Königsberg—and the order was opened to Poles.

**Thirty, Battle of the,** French COMBAT DES TRENTES (March 27, 1351), episode in the struggle for the succession to the duchy of Brittany between Charles of Blois, supported by the King of France, and John of Montfort, supported by the King of England. The combat at arms was celebrated by an unknown trouvère and retold with variations by Jean Froissart.

When, in spite of a truce, John Bramborough, the English captain of Ploërmel, continued his ravages in the district of Josselin, Jean de Beaumanoir, captain of Josselin and marshal of Brittany, sent Bramborough a challenge. Thus on March 27, 1351, a fight took place near Ploërmel, with 30 picked champions, knights and squires, on either side. Beaumanoir's side comprised 30 Bretons, Bramborough's 20 Englishmen, 6 German mercenaries, and 4 Brabançons. The battle, fought with lances, swords, daggers, and maces, is reminiscent of the last fight of the Burgundians in the *Nibelungenlied,* especially in the advice of Geoffroy du Bois to his wounded leader, who was asking for water: "Drink your blood, Beaumanoir; that will quench your thirst!" The victory was decided by Guillaume de Montauban, who mounted his horse and overthrew seven of the English champions, the rest being forced to surrender. All the combatants were either dead or seriously wounded, Bramborough being among the slain. The prisoners were well treated and released for a small ransom.

**30 Doradus,** also called TARANTULA NEBULA (catalog number NGC 2070), immense ionized-hydrogen region in the Large Magellanic Cloud, a satellite galaxy of the Milky Way system (in which the Earth is located). The nebula consists of a cloud of interstellar gas—principally hydrogen—lit from within by young, hot stars that ionize the gas around them. As the atoms in the gas recombine, they emit visible light. The total mass of the nebula is about 1,000,000 solar masses, and its diameter is 170 parsecs (550 light-years), making it the largest region of ionized gas in the entire Local Group (*q.v.*) of galaxies.

**38th parallel,** parallel of latitude that in East Asia roughly demarcates North and South Korea. The line was chosen by U.S. military planners at the Potsdam Conference, in July 1945, as an army boundary, north of which the U.S.S.R. was to accept the surrender of the Japanese forces in Korea and south of which the Americans were to accept the Japanese surrender. The line was intended as a temporary division of the country, but the onset of the Cold War led to the establishment of a separate U.S.-oriented regime in South Korea under Syngman Rhee and a communist regime in North Korea under Kim Il-sung.

After the onset of the Korean War between North and South Korea in June 1950, United Nations forces, which, under U.S. general Douglas MacArthur, had come to the aid of the south, moved north of the 38th parallel in an attempt to occupy North Korea. With the intervention of Chinese troops, the war came to a stalemate roughly along that parallel. The cease-fire line, fixed at the time of the armistice agreement, gave South Korea possession of an eastern mountainous area north of the parallel, which was the major battlefront when the demarcation line was fixed.

**Thirty-nine Articles,** the doctrinal statements of the Church of England. With *The Book of Common Prayer,* they present the liturgy and doctrine of that church. The Thirty-nine Articles developed from the Forty-two Articles, written by Archbishop Thomas Cranmer in 1553 "for the avoiding of controversy in opinions." These had been partly derived from the Thirteen Articles of 1538, designed as the basis of an agreement between Henry VIII and the German Lutheran princes, which had been influenced by the Lutheran Augsburg Confession (1530).

The Forty-two Articles were eliminated when Mary I became queen (1553) and restored Roman Catholicism. After Elizabeth I became queen (1558), a new statement of doctrine was needed. In 1563 the Canterbury Convocation (the periodic assembly of clergy of the province of Canterbury) drastically revised the Forty-two Articles, and additional changes were made at Elizabeth's request. A final revision by Convocation in 1571 produced the Thirty-nine Articles, which were approved by Elizabeth and imposed on the clergy.

In form they deal briefly with the doctrines accepted by Roman Catholics and Protestants alike and more fully with points of controversy. They are often studiously ambiguous, however, because the Elizabethan government wished to make the national church as inclusive of different viewpoints as possible.

The status of the Thirty-nine Articles varies in the several churches of the Anglican communion. Since 1865, Church of England clergy have had to declare only that the doctrine in the Articles is "agreeable to the Word of God." In the Protstant Episcopal Church in the United States, neither clergy nor laity is required formally to subscribe to them.

**Thirty Years' War** (1618–48), in European history, a series of wars fought by various nations for various reasons, including religious, dynastic, territorial, and commercial rivalries. Its destructive campaigns and battles occurred over most of Europe, and, when it ended with the Treaty of Westphalia in 1648, the map of Europe had been irrevocably changed.

A brief treatment of the Thirty Years' War follows. For full treatment, *see* MACROPAEDIA: European History and Culture.

Although the struggles that created it erupted some years earlier, the war is conventionally held to have begun in 1618, when the future Holy Roman emperor Ferdinand II, in his role as king of Bohemia, attempted to impose Roman Catholic absolutism on his domains, and the Protestant nobles of both Bohemia and Austria rose up in rebellion. Ferdinand won after a five-year struggle. In 1625 King Christian IV of Denmark saw an opportunity to gain valuable territory in Germany to balance his earlier loss of Baltic provinces to Sweden. Christian's defeat and the Peace of Lübeck in 1629 finished Denmark as a European power, but Sweden's Gustav II Adolf, having ended a four-year war with Poland, invaded Germany and won many German princes to his anti-Roman Catholic, anti-imperial cause.

Meanwhile the conflict widened, fueled by political ambitions of the various powers. Poland, having been drawn in as a Baltic power coveted by Sweden, pushed its own ambitions by attacking Russia and establishing a dictatorship in Moscow under Władysław, Poland's future king. The Russo-Polish Peace of Polyanov in 1634 ended Poland's claim to the tsarist throne but freed Poland to resume hostilities against its Baltic archenemy, Sweden, which was now deeply embroiled in Germany. Here, in the heartland of Europe, three denominations vied for dominance: Roman Catholicism, Lutheranism, and Calvinism. This resulted in a Gordian tangle of alliances as princes and prelates called in foreign powers to aid them. Overall, the struggle was between the Holy Roman Empire, which was Roman Catholic and Habsburg, and a network of Protestant towns and principalities that relied on the chief anti-Catholic powers of Sweden and the United Netherlands, which had at last thrown off the yoke of Spain after a struggle lasting 80 years. A parallel struggle involved the rivalry of France with the Habsburgs of the empire and with the Habsburgs of Spain, who had been attempting to construct a cordon of anti-French alliances.

The principal battlefield for all these intermittent conflicts was the towns and principalities of Germany, which suffered severely. During the Thirty Years' War, many of the contending armies were mercenaries, many of whom could not collect their pay. This threw them on the countryside for their supplies, and thus began the "wolf-strategy" that typified this war. The armies of both sides plundered as they marched, leaving cities, towns, villages, and farms ravaged. When the contending powers finally met in the German province of Westphalia to end the bloodshed, the balance of power in Europe had been radically changed. Spain had lost not only the Netherlands but its dominant position in western Europe. France was now the chief Western power. Sweden had control of the Baltic. The United Netherlands was recognized as an independent republic. The member states of the Holy Roman Empire were granted full sovereignty. The ancient notion of a Roman Catholic empire of Europe, headed spiritually by a pope and temporally by an emperor, was permanently abandoned, and the essential structure of modern Europe as a community of sovereign states was established.

**Thisbe:** *see* Pyramus and Thisbe.

**thistle,** weedy species of *Cirsium, Carduus, Echinops, Sonchus,* and other plant genera of the family Asteraceae. The word *thistle* most often refers to prickly leaved species of *Carduus* and *Cirsium,* which have dense heads of small, usually pink or purple flowers. Plants of the genus *Carduus,* sometimes called plumeless thistles, have spiny stems and flower heads without ray flowers. Canadian thistle (*Cirsium arvense*) is a troublesome weed in agricultural areas of North America, and more than 10 species of sow thistle (*Sonchus*) are widespread throughout Europe. Some species of globe thistle (*Echinops*) are cultivated as ornamentals.



Field thistle (*Cirsium discolor*)
John H. Gerard

*To make the best use of the Britannica, consult the* INDEX *first*

**Thistle, The Most Ancient and Most Noble Order of the,** exclusive Scottish order of knighthood whose modern period dates from its founding by James II of Great Britain (James VII of Scotland) in 1687, although, like many chivalric orders, it probably has its origins much further back in history.

Tradition has it that as early as about 757 King Angus (Achaius) of the Scots founded a chivalric order and introducted the cult of St. Andrew into Scotland. More definite information exists concerning an order in the European Middle Ages. James II of Scotland, seeking to bring rebellious nobles under the control of the monarchy, created an order of knighthood in 1452. His son James III (reigned 1460–88) probably instituted some order as well and, for much the same reason, initiated also the thistle as the royal emblem. When James II of England was exiled (1688), the modern order fell into abeyance; it was revived, however, by Queen Anne in 1703.

The membership of the order established in 1687 comprised the British sovereign and eight knights. Queen Anne increased the number of knights to 12, and in 1827 the number was raised to 16, which is its current number. The only foreigner admitted has been King Olaf V of Norway. Conferment of the order entails induction into knighthood. Holders are entitled to add K.T. (Knight of the Thistle) after their name. In order of precedence, Knights of the Thistle are ranked just below Knights of the Garter, these two orders being the oldest and most prestigious in Britain.

There are five officers—chancellor, dean, secretary, Lyon king of arms, and gentleman usher of the Green Rod. The order, dedicated to St. Andrew, patron saint of Scotland, celebrates its feast day on November 30 (St. Andrew's Day). The beautiful Thistle chapel, built in 1911, is in St. Giles's Cathedral, Edinburgh.

The insignia comprises a star bearing St. Andrew's cross in the centre of which is a green thistle on a field of gold, a badge portraying St. Andrew and his cross, and a collar consisting of thistles alternating with sprigs of rue. All insignia are returned upon the holder's death. The motto of the order, *Nemo me impune lacessit* ("No one provokes me with impunity"), is also the motto of all Scottish regiments, although more popularly rendered as "Wha daur meddle wi' me?"

**Thistlewood, Arthur** (b. 1774, Tupholme, Lincolnshire, Eng.—d. May 1, 1820, London), revolutionary who in 1820, a time of economic distress and radical unrest in England, organized the Cato Street Conspiracy to assassinate all the members of the British Cabinet.

The son of a successful farmer, Thistlewood visited the United States and France and returned to England in 1794 obsessed with the idea that the first duty of a patriot was to overthrow the government. He served in the army briefly, then drifted rather aimlessly un-

til December 1816, when he helped plan an uprising (the Spa Fields Riot) in which the Bank of England and the Tower of London were to be seized. After the rioters were dispersed, Thistlewood and another conspirator were arrested but were eventually acquitted. Thistlewood was imprisoned (1818–19), however, for issuing a challenge to a duel to the 1st Viscount Sidmouth, a former prime minister. (As home secretary Sidmouth had been chiefly responsible for the Six Acts of 1819, which were intended to suppress radical movements.)

Released from prison, Thistlewood learned that the Cabinet ministers had arranged to dine at the Earl of Harrowby's house in Grosvenor Square, London, on Feb. 23, 1820. The police heard of Thistlewood's plot to murder the Cabinet members, and, on the evening of the 23rd, as Thistlewood and several armed accomplices were preparing to leave a room in Cato Street for Grosvenor Square, officers appeared and arrested some of them. Thistlewood himself escaped but was captured the next day. Found guilty of high treason, he and four others were hanged.

**Thívai** (Greece): *see* Thebes.

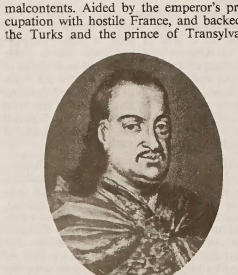
**Thjórs River,** Icelandic THJÓRSÁ, longest stream in Iceland. Rising from the central plateau northeast of Hofs Glacier, it flows southwestward for 143 miles (230 km) and then discharges into the Atlantic Ocean southeast of Selfoss. The Thjórs River and its largest tributary, the Tungna (80 miles [129 km] long), carry away meltwater from Vatna, Hofs, and several smaller glaciers, while draining a basin of 2,907 square miles (7,530 square km), the lower third of which is part of the island's most extensive farming region. Because of its size and its location in the densely populated southwest, the Thjórs generates more electrical power than any other stream in Iceland.

**Thlingchadinne** (people): *see* Dogrib.

**thod pa** (in Buddhism): *see* kapāla.

**Thököly, Imre** (b. Sept. 25, 1657, Késmárk, Slovakia—d. Sept. 13, 1705, İzmit, Ottoman Empire [now in Turkey]), Hungarian patriot, a leader of the Hungarian Protestants in their struggle against Austrian Habsburg rule.

The scion of a rich Protestant family, Thököly moved to Transylvania after his father was executed for having had a role in the Hungarian magnates' conspiracy against the Habsburg emperor Leopold I (1670). His family properties sequestered, he later led the Hungarian Protestant resistance to the continuing repressive Habsburg policy and in 1680 was elected commander in chief of the malcontents. Aided by the emperor's preoccupation with hostile France, and backed by the Turks and the prince of Transylvania, Thököly overran much of upper Hungary and forced Leopold to restore Hungarian liberties (Treaty of Sopron, 1681) and to recognize his own quasi-sovereignty in north Hungary. He soon resumed hostilities against the emperor, however, allying himself with the Turks and taking the title of prince over his own dominions. In 1683 he joined with the Turks in their final attempt to take Vienna. The siege was repulsed, however, and Thököly's fortunes collapsed with those of his Turkish allies. His rebellion was crushed, his fortresses captured, and his wife taken in custody to Vienna. His fortunes briefly revived in 1690, when he was installed by the Turks as prince of Transylvania and defeated the imperial forces at Zernest (August 1690); but, after the Treaty of Carlowitz (1699), Ottoman influence was significantly diminished and Thököly was forced to spend his remaining years in exile in Turkey.



Thököly, engraving by P. Steven, 1680
By courtesy of the National Szechenyi Library, Budapest

**tholeiite,** fine-grained extrusive igneous rock, a basalt that contains plagioclase feldspar (labradorite), clinopyroxene (augite with pigeonite or hypersthene), and iron ore (magnetite and ilmenite). Tholeiitic lavas often contain glass, but little or no olivine. Tholeiite occurs as extensive plateaus (volumes on the order of 200,000 to 800,000 cubic km [50,000 to 200,000 cubic miles]) in the Pacific Northwest and the Deccan, western India, as well as in the lavas of the Lake Superior region, South Africa, Western Australia, and South America.

**tholos,** plural THOLOI, Latin THOLUS, plural THOLI, in ancient Greek architecture, a circular building with a conical or vaulted roof and with or without a peristyle, or surrounding colonnade. In the Mycenaean period, tholoi were large ceremonial tombs, sometimes built into the sides of hills; they were beehive-shaped and covered by a corbeled arch. In classical Greece, the tholos at Delphi had a peristyle; the tholos in Athens, serving as a dining hall for the Athenian Senate, had no outside columns. The tholos at Epidaurus, designed



The tholos at Marmaria, Delphi, Greece, *c.* 390 BC
© Farrell Grehan—Photo Researchers

by Polyclitus, was a circular chamber with a Doric colonnade outside and a Corinthian within; it contained exquisite carvings. The foundations were a series of concentric walls with doors and partitions that made a subterranean labyrinth. The tholos at Olympia, known as the Philippeum, was a round building of the Ionic order, with Corinthian half columns on the inside; it was erected by Philip II of Macedon to commemorate his victory over the Greeks at Chaeronea in 338 BC.

**Thomas,** SAINT (b. probably Galilee—d. traditionally AD 53, Madras, India; Western feast day December 21, feast day in Roman and Syrian Catholic churches July 3, in the Greek church October 6), one of the Twelve Apostles. His name in Aramaic (Te'oma) and Greek (Didymos) means "twin"; John 11:16 identifies him as "Thomas, called the Twin." He is called Judas Thomas (*i.e.,* Judas the Twin) by the Syrians.

Thomas' character is outlined in The Gospel According to John. His devotion to Jesus is clearly expressed in John 11:5–16: when Jesus planned to return to Judaea, the disciples warned him of the Jews' animosity ("now seeking to stone you"), to which Thomas soon replied, "Let us also go, that we may die with him." At the Last Supper (John 14:1–7) Thomas could not comprehend what Jesus meant when he said: "I will come again and will take you to myself, that where I am you may be also. And you know the way where I am going." Thomas' question, "how can we know the way?" caused Jesus to answer, "I am the way, and the truth, and the life."

Perhaps the best-known event in his life is the one from which the phrase "doubting Thomas" developed. In John 20:19–29 he was not among those disciples to whom the risen Christ first appeared, and, when they told the incredulous Thomas, he requested physical proof of the Resurrection, fulfilled when Christ reappeared and specifically asked Thomas to touch his wounds. His sudden realization of truth ("My Lord and my God") made Thomas the first person to explicitly acknowledge Jesus' divinity.

Thomas' subsequent history is uncertain. According to the 4th-century *Ecclesiastical History* of Bishop Eusebius of Caesarea, he evangelized Parthia (modern Khorāsān). Later Christian tradition says Thomas extended his apostolate into India, where he is recognized as the founder of the Church of the Syrian Malabar Christians, or Christians of St. Thomas. In the apocryphal *Acts of Thomas,* originally composed in Syriac, his martyrdom is cited under the king of Mylapore at Madras, where are to be found St. Thomas Mount and San Thomé Cathedral, his traditional burial place. His relics, however, supposedly were taken to the West and finally enshrined at Ortona, Italy. He allegedly visited the court of the Indo-Parthian king Gondophernes, who put him in charge of building a royal palace (the *Acts of Thomas* states that he was a carpenter); he was imprisoned for spending on charity the money entrusted him.

In addition to the apocryphal works, other similar writings related or accredited to Thomas are the *Gospel of Thomas* (among the Coptic Gnostic papyri found in 1945 in Upper Egypt), *The Book of Thomas the Athlete,* and *Evangelium Joannis de obitu Mariae* ("The Message of John Concerning the Death of Mary").

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**Thomas À KEMPIS,** original name THOMAS HEMERKEN (b. 1379/80, Kempen, near Düsseldorf, the Rhineland [now in Germany]—d. Aug. 8, 1471, Agnietenberg, near Zwolle, Bishopric of Utrecht [now in The Netherlands]), Christian theologian, the probable author of *De Imitatione Christi* (*Imitation of Christ*), a devotional book that, with the exception of the Bible, has been considered the most influential work in Christian literature.

About 1392 Thomas went to Deventer, Neth., headquarters of the learned Brethren of the Common Life, a community devoted to education and the care of the poor, where he studied under the theologian Florentius Radewyns, who in 1387 had founded the Congregation of Windesheim, a congregation of Augustinian canons regular (*i.e.,* ecclesiastics living in community and bound by vows). Thomas joined the Windesheim congregation at Agnietenberg monastery, where he remained almost continually for over 70 years. He took his vows in 1408, was ordained in 1413, and devoted his life to copying manuscripts and to directing novices.

Although the authorship is in dispute, he

probably wrote the *Imitation*. Remarkable for its simple language and style, it emphasizes the spiritual rather than the materialistic life, affirms the rewards of being Christ centred, and supports Communion as a means to strengthen faith. His writings offer possibly the best representation of the *devotio moderna* (a religious movement created by Gerhard Groote, founder of the Brethren of the Common Life) that made religion intelligible and practicable for the "modern" attitude arising in the Netherlands at the end of the 14th century. Thomas stresses asceticism rather than mysticism, and moderate—not extreme—austerity.

**Thomas** AQUINAS, SAINT, also called AQUINAS, Italian SAN TOMMASO D'AQUINO, byname DOCTOR ANGELICUS (Latin: Angelic Doctor) (b. 1224/25, Roccasecca, near Aquino, Terra di Lavoro, Kingdom of Sicily—d. March 7, 1274, Fossanova, near Terracina, Latium, Papal States; canonized July 18, 1323; feast day January 28, formerly March 7), Italian Dominican theologian, the foremost medieval Scholasticist, whose *Summa theologiae* and *Summa contra gentiles* form the classical systematization of Roman Catholic theology.

A brief treatment of St. Thomas Aquinas follows. For full treatment, *see* MACROPAEDIA: Thomism, Thomas Aquinas and.

Thomas joined the newly founded Dominican order and was sent to the University of Paris (1245). He went to Cologne (1248–52), returned to Paris to prepare for the degree of master of theology (1252–56), and began teaching at Paris in 1256. He was theological adviser and lecturer to the papal Curia (1259–68) and then returned to Paris to argue his position concerning the relation of faith and reason (*i.e.*, that reason is able to operate within faith yet according to its own laws) against the rationalistic Averroists on the one hand, and concerning the authentic values of created nature against traditional theologians on the other. In 1272 Thomas returned to Italy to establish a Dominican house of studies at the University of Naples and defended the Aristotelian current of thought against the Franciscan scholar.

**Thomas** BECKET, SAINT, also called THOMAS À BECKET, or THOMAS OF LONDON: *see* Becket, Saint Thomas.

**Thomas** OF BROTHERTON: *see* Norfolk, Thomas of Brotherton, Earl of.

**Thomas** OF CANTELUPE, SAINT, also called SAINT THOMAS OF HEREFORD: *see* Cantelupe, Saint Thomas de.

**Thomas** OF WOODSTOCK: *see* Gloucester, Thomas of Woodstock, Duke of.

**Thomas** THE RHYMER, also called THOMAS LEARMONT, OF THOMAS OF ERCELDOUNE (fl. 1220–97), Scottish poet and prophet who was likely the author of the metrical romance *Sir Tristrem*, a version of the widely diffused Tristan legend. The romance was first printed in 1804 by Sir Walter Scott from a manuscript of about 1300. Thomas is now probably best known through the ballad "Thomas the Rhymer," included by Scott in his *Minstrelsy of the Scottish Border* (1802). In popular lore he was usually coupled with Merlin and other English seers. His prophecies first appear in literary form in the early 15th-century *Romance and Prophecies of Thomas of Erceldoune* (edited 1875 by J.A.H. Murray). The 19th-century Russian poet Mikhail Lermontov claimed Thomas as an ancestor.

**Thomas, Albert** (b. June 16, 1878, Champigny-sur-Marne, Fr.—d. May 7, 1932, Paris), French statesman, political leader, and historian, who was the first director of the League of Nations' International Labour Organisation (1919–21).

Thomas graduated from the prestigious École Normale Supérieure in Paris, where he won scholarships that enabled him to do research in Russia, Germany, and the eastern Mediterranean on the topic of working-class history and the causes of socialism, trade unionism, and the cooperative movement. His most significant scholarly work was *Le Syndicalisme allemand* (1903; "German Syndicalism").

In 1904 Thomas was appointed assistant editor of *L'Humanité*, the official organ of the Socialist Party. He soon came to play a significant role as a leader of the moderate groups within the national labour movement. In 1910 he was elected to the Chamber of Deputies, where he became one of the leaders of the moderate wing of the Socialist Party.



Albert Thomas
By courtesy of the Bibliotheque Nationale, Paris

During World War I (1914–18) Thomas successfully organized the French railways. He became under secretary of state for artillery (1915) and then minister for munitions (1916–17). With the overthrow of the tsar in Russia, Thomas was sent in April 1917 to Petrograd (now St. Petersburg) to work with the Russian provisional government under Aleksandr Kerensky on the production of munitions in an attempt by France to maintain cooperation with the new Russian republic.

After the war Thomas was appointed the first director of the League of Nations' International Labour Organisation; he worked for the extension of its influence and the elaboration of international labour law. The claims of this work led him in 1921 to resign his seat in the Chamber.

**Thomas, Ambrose**, in full CHARLES LOUIS AMBROSE THOMAS (b. Aug. 5, 1811, Metz, Fr.—d. Feb. 12, 1896, Paris), French composer best known for his operas, particularly *Mignon*, written in a light, melodious style.

Thomas attended the Paris Conservatory, concluding his studies by winning the Prix de Rome in 1832 for his cantata *Hermann et Ketty*. In 1835 he launched himself on a career as an opera composer and began teaching at the conservatory in 1856.

After a series of pleasantly melodious works he produced his masterpiece and one of the most successful operas in history, *Mignon* (1866), which by 1894 had received more than 1,000 performances at the Opéra-Comique alone. This and his next opera, *Hamlet* (1868), brought him international fame, and in 1871 he became director of the Paris Conservatory.

**Thomas, Clarence** (b. June 23, 1948, Pinpoint, near Savannah, Ga., U.S.), associate justice of the U.S. Supreme Court (from 1991). In succeeding to the seat of the ultra-liberal Thurgood Marshall, he gave the court a decisive conservative cast.

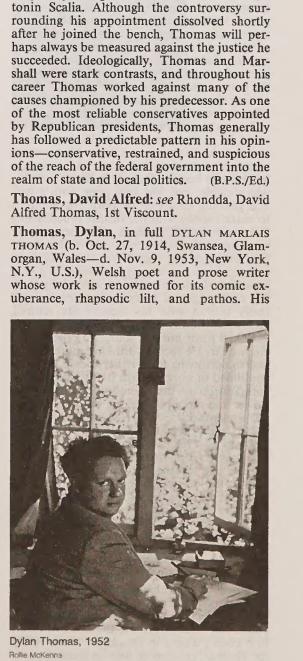
Thomas's father abandoned the family when Thomas was two years old. Thomas was educated in Savannah, Ga., at an all-African American Roman Catholic primary school run by white nuns and then at a boarding-school seminary, where he graduated as the only African American in his class. He attended Immaculate Conception Abbey in his freshman year of college and then transferred to Holy Cross College in Worcester, Mass., where he graduated in 1971. He received a law degree from Yale University in 1974. Thomas subsequently was an assistant attorney general in Missouri (1974–77), a lawyer with the Monsanto Co. (1977–79), and an assistant to Republican Senator John C. Danforth of Missouri (1979–81).

In the Ronald Reagan and George Bush administrations, Thomas served as assistant secretary in the U.S. Department of Education (1981–82), chairman of the Equal Employment Opportunity Commission (1982–90), and judge on the U.S. Court of Appeals for the Federal District (1990–91), a post to which he was appointed by Bush. Marshall's retirement gave Bush the opportunity to replace one of the court's most liberal members with a conservative. Despite Thomas's appeal to Republicans, his nomination engendered controversy for several reasons: he had little experience as a judge; he had produced little judicial scholarship; and he refused to answer questions about his position on abortion (he claimed during his confirmation hearings that he had never discussed the issue). Nevertheless, Thomas seemed headed for easy confirmation until he was accused by a former aide, an African American law professor, of making sexually offensive comments to her in an apparent campaign of seduction. Thomas denied the charge, and a deeply divided Senate only narrowly confirmed Thomas's nomination by a vote of 52 to 48.

On the Supreme Court, Thomas maintained a relatively quiet presence but evidenced a strong conservatism in his votes and decisions, frequently siding with fellow conservative Antonin Scalia. Although the controversy surrounding his appointment dissolved shortly after he joined the bench, Thomas will perhaps always be measured against the justice he succeeded. Ideologically, Thomas and Marshall were stark contrasts, and throughout his career Thomas worked against many of the causes championed by his predecessor. As one of the most reliable conservatives appointed by Republican presidents, Thomas generally has followed a predictable pattern in his opinions—conservative, restrained, and suspicious of the reach of the federal government into the realm of state and local politics. (B.P.S./Ed.)

**Thomas, David Alfred:** *see* Rhondda, David Alfred Thomas, 1st Viscount.

**Thomas, Dylan**, in full DYLAN MARLAIS THOMAS (b. Oct. 27, 1914, Swansea, Glamorgan, Wales—d. Nov. 9, 1953, New York, N.Y., U.S.), Welsh poet and prose writer whose work is renowned for its comic exuberance, rhapsodic lilt, and pathos. His



Dylan Thomas, 1952
Rollie McKenna

personal life, especially his reckless bouts of drinking (he died of an overdose of alcohol), was celebrated.

Thomas spent his childhood in southwestern Wales. His father taught English at the Swansea grammar school, which in due course the boy attended. Because Dylan's mother was a farmer's daughter, he had a country home he could go to when on holiday. His poem "Fern Hill" (1946) describes its joys.

Although he edited the school magazine, contributing poetry and prose to it, Thomas did badly at school, since he was always intellectually lazy with regard to any subject that did not directly concern him. His practical knowledge of English poetry was enormous, however. He had begun writing poems at a very early age, and scholars have shown that the bulk of his poetic output was completed, at least in embryonic form, by the time he moved to London at the age of 21. At age 16 he left school to work as a reporter on the *South Wales Evening Post.*

His first book, *18 Poems,* appeared in 1934, and it announced a strikingly new and individual, if not always comprehensible, voice in English poetry. His original style was further developed in *Twenty-Five Poems* (1936) and *The Map of Love* (1939). Thomas' work, in its overtly emotional impact, its insistence on the importance of sound and rhythm, its primitivism, and the tensions between its biblical echoes and its sexual imagery, owed more to his Welsh background than to the prevailing taste in English literature for grim social commentary. Therein lay its originality. The poetry written up to 1939 is concerned with introspective, obsessive, sexual, and religious currents of feeling; and Thomas seems to be arguing rhetorically with himself on the subjects of sex and death, sin and redemption, the natural processes, creation and decay. The writing shows prodigious energy, but the final effect is sometimes obscure or diffuse.

Thomas basically made London his home for some 10 years from about 1936. In 1937 he married the Irishwoman Caitlin Macnamara, with whom he had two sons and a daughter. He had become famous in literary circles, was sociable, and was very poor, with a wife and growing family to support. His attempts to make money with the British Broadcasting Corporation (BBC) and as a film scriptwriter were not sufficiently remunerative. He wrote film scripts during World War II, having been excused from military service owing to a lung condition. Unfortunately, he was totally lacking in any sort of business acumen. He fell badly behind with his income tax returns, and what money he managed to make was snatched from him, at source, by the British Exchequer. He took to drinking more heavily and to borrowing from richer friends. Still, he continued to work, though in his maturity the composition of his poems became an ever-slower and more painstaking business.

The poems collected in *Deaths and Entrances* (1946) show a greater lucidity and confirm Thomas as a religious poet. This book shows an advance in sympathy and understanding due, in part, to the impact of World War II and to the deepening harmony between the poet and his Welsh environment, for he writes generally in a mood of reconciliation and acceptance. He often adopts a bardic tone and is a true romantic in claiming a high, almost priestlike function for the poet. He also makes extensive use of Christian myth and symbolism and often sounds a note of formal ritual and incantation in his poems. The re-creation of childhood experience produces a visionary, mystical poetry in which the landscapes of youth and infancy assume the holiness of the first Eden ("Poem in October," "Fern Hill"); for Thomas, childhood, with its intimations of immortality, is a state of innocence and grace. But the rhapsodic lilt and music of the later verse derives from a complex technical discipline, so that Thomas' absorption in his craft produces verbal harmonies that are unique in English poetry.

Meanwhile the London or London-based atmosphere became increasingly dangerous and uncongenial both to Thomas and to his wife. As early as 1946 he was talking of emigrating to the United States, and in 1947 he had what would seem to be a nervous breakdown but refused psychiatric assistance. He moved to Oxford, where he was given a cottage by A.J.P. Taylor, a distinguished historian. His trips to London, however, principally in connection with his BBC work, were grueling, exhausting, and increasingly alcoholic. In 1949 Taylor's wife financed the purchase of a cottage, the Boat House, Laugharne, and Thomas returned to Wales. In the following year his first American tour was arranged, and for a while it seemed as if a happy compromise had been arranged between American money and Welsh tranquility.

The progress Thomas wrote is linked with his development as a poet, and his first stories, included in *The Map of Love* and *A Prospect of the Sea* (1955), are a by-product of the early poetry. But in *Portrait of the Artist as a Young Dog* (1940), the half-mythical Welsh landscapes of the early stories have been replaced by realistically and humorously observed scenes. A poet's growing consciousness of himself, of the real seriousness hidden behind his mask of comedy, and of the world around him is presented with that characteristic blend of humour and pathos which is later given such lively expression in his "play for voices," *Under Milk Wood* (1954). This play, which evokes the lives of the inhabitants of a small Welsh town, shows Thomas' full powers as an artist in comedy; it is richly imaginative in language, dramatic in characterization, and fertile in comic invention.

*Under Milk Wood* was presented at the Poetry Center in New York City in 1953, and its final version was broadcast by the BBC in 1954. In 1952 Thomas published his *Collected Poems,* which exhibited the deeper insight and superb craftsmanship of a major 20th-century English poet. The volume was an immediate success on both sides of the Atlantic. But, because of the insistence of the Inland Revenue, his monetary difficulties persisted. He coped with his exhausting American tours by indulging in reckless drinking bouts. There were far too many people who seem to have derived pleasure from making the famous poet drunk. His personal despair mounted, his marriage was in peril, and at last, while in New York City and far from his Welsh home, he took such an overdose of hard liquor that he died.

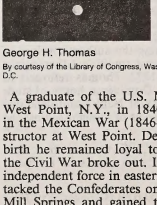
BIBLIOGRAPHY. Constantine FitzGibbon, *The Life of Dylan Thomas* (1965, reissued 1975), is the official biography of the poet, commissioned by his trustees and approved by his widow. Other biographical studies are John Malcolm Brinnin, *Dylan Thomas in America* (1955, reprinted 1989), by Thomas' friend and American agent; and Paul Ferris, *Dylan Thomas* (1977, reprinted 1989). Detailed explications of Thomas' poems are found in William York Tindall, *A Reader's Guide to Dylan Thomas* (1962, reissued 1984). Collections of critical essays include C.B. Cox (ed.), *Dylan Thomas* (1966, reissued 1987); R.B. Kershner, Jr., *Dylan Thomas* (1976); and Georg Gaston (ed.), *Critical Essays on Dylan Thomas* (1989). J. Alexander Rolph, *Dylan Thomas: A Bibliography* (1956, reprinted 1974), is supplemented by Ralph Maud and Jeff Towns Glover, *Dylan Thomas in Print: A Bibliographical History* (1970); and Georg Gaston, *Dylan Thomas: A Reference Guide* (1987).

**Thomas, E(dward) Donnall** (b. March 15, 1920, Mart, Texas, U.S.), American physician noted for his cancer research. In 1990 he was corecipient (with Joseph E. Murray) of the Nobel Prize for Physiology or Medicine.

Thomas studied at the University of Texas (B.A., 1941; M.A., 1943) and the Harvard Medical School (M.D., 1946). He served at a few hospitals and a research centre before becoming a professor of medicine at Columbia University's College of Physicians and Surgeons (1955–63) and the University of Washington School of Medicine (from 1963) in Seattle, where he was also associated with the Fred Hutchinson Cancer Research Center.

Thomas was a researcher and author mainly in the fields of hematology, cancer research, irradiation biology, and biochemistry. He received the Nobel Prize for his work in transplanting bone marrow from one person to another—an achievement related to the cure of patients with leukemia and other blood cancers or blood diseases.

**Thomas, George H(enry)** (b. July 31, 1816, Southampton county, Va., U.S.—d. March 28, 1870, San Francisco), Union general in the American Civil War (1861–65), known as "the Rock of Chickamauga" after his unyielding defense in combat near that stream in northwestern Georgia in September 1863.



George H. Thomas
By courtesy of the Library of Congress, Washington, D.C.

A graduate of the U.S. Military Academy, West Point, N.Y., in 1840, Thomas served in the Mexican War (1846–48) and as an instructor at West Point. Despite his Southern birth he remained loyal to the Union when the Civil War broke out. In command of an independent force in eastern Kentucky, he attacked the Confederates on Jan. 19, 1862, at Mill Springs and gained the first important Union victory in the west. He served under General Don Carlos Buell and was offered but refused the chief command. Under General William S. Rosecrans, he was engaged at Stones River (Murfreesboro), Tenn., and was in charge of the most important part of the maneuvering from Decherd to Chattanooga, Tenn. On Sept. 19–20, 1863, after two days of conflict along Chickamauga Creek in Georgia 12 miles (19 km) south of Chattanooga, General Thomas adroitly organized Union defenses and withstood violent attack on the left wing until reserve units allowed an orderly withdrawal of Union troops. For this action he was promoted to brigadier general and succeeded Rosecrans in command of the Army of the Cumberland shortly before the great victory at Chattanooga (November), in which he and his army played a conspicuous role.

In the autumn of 1864, Union General William Tecumseh Sherman called on Thomas to deal with the threat to Union communications by the Confederate forces of General John B. Hood. Thomas had achieved his objective by Christmas, checking the enemy army at Franklin, Tenn. (November 30), and finally at Nashville, Tenn. (December 15–16). At that historic battle, Thomas inflicted on Hood the worst defeat sustained in the open field on either side during the war. Thomas was made a major general and received the thanks of Congress.

After the war Thomas commanded the military departments in Kentucky and Tennessee

until 1869, when he was placed in charge of the Division of the Pacific with headquarters at San Francisco.

**Thomas, Isaiah** (b. Jan. 19, 1749, Boston, Mass. [U.S.]—d. April 4, 1831, Worcester, Mass.), radical anti-British printer and journalist who published the *Massachusetts Spy* in Boston from 1770 to 1802. (The paper continued publication until 1904.)

At an early age Thomas was apprenticed to a printer, and by the age of 17 he was regarded an excellent printer himself. With a partner he founded the *Massachusetts Spy* in 1770, and he soon bought out his partner. The paper carried the first eyewitness account of the battles of Lexington and Concord, the opening engagements of the American Revolutionary War, and the reports helped to solidify colonial resistance to British rule. The *Spy* became recognized as one of the most important newspapers in the colonies. Thomas moved it to nearby Worcester in 1778.

Thomas branched out into bookselling activities in 1788, and at one time he had more than 20 bookstores operating in the Boston area. He published popular books for both children and adults. Thomas was an astute businessman, and he grew wealthy in his various ventures. He turned over control of the *Spy* to his son in 1802.

Thomas' library was the major documentary source for the monumental *A History of Printing in America,* compiled over two years and published in two volumes in 1810 and still a major historical source. He founded the American Antiquarian Society.

**Thomas, J.H.,** in full JAMES HENRY THOMAS (b. Oct. 3, 1874, Newport, Monmouthshire, Eng.—d. Jan. 21, 1949, London), British trade-union leader and politician, a shrewd and successful industrial negotiator who lost his standing in the labour movement when he joined Ramsay MacDonald's coalition government (August 1931). Later (May 1936) he was found responsible for the leakage of details of a proposed national budget to Stock Exchange speculators, and he left public life.

A locomotive cleaner from the age of 15, Thomas in 1904 was chosen national president of the Amalgamated Society of Railway Servants and in 1918 became general secretary of the National Union of Railwaymen (NUR). He served as president of the Trades Union Congress (1920) and of the International Federation of Trade Unions (1920–24). Partly because of his moderation, the General Strike of 1926 was settled peacefully.

From 1910 Thomas was a Labour Party member of the House of Commons. During World War I he declined office in David Lloyd George's coalition ministry and opposed military conscription; otherwise, however, he supported the British war effort, and in 1917 he was made a privy councillor. Under MacDonald, Thomas sat in the cabinet as secretary of state for the colonies (January–November 1924); as lord privy seal and minister for employment (June 1929–June 1930); and as secretary of state for the dominions (June 1930–June 1935). When he retained office in MacDonald's coalition, he had to leave the Labour Party and the NUR, which deprived him of his pension. In Stanley Baldwin's government he once more was colonial secretary (November 1935–May 1936) until his resignation because of the budget scandal.

**Thomas, Lewis** (b. Nov. 25, 1913, Flushing, N.Y., U.S.—d. Dec. 3, 1993, New York, N.Y.), American physician, researcher, author, and teacher best known for his essays, which contain lucid meditations and reflections on a wide range of topics in biology.

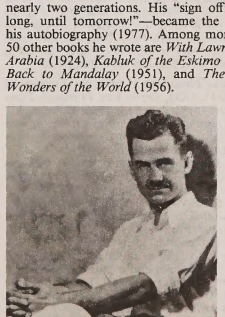
Lewis attended Princeton University, Princeton, N.J., and Harvard Medical School (M.D., 1937). He served in the U.S. Navy Medical Corps and taught at Johns Hopkins and Tulane universities and at the University of Minnesota Medical School. In 1954 he moved to New York University School of Medicine, which he left as dean in 1969 to teach in the pathology department at Yale University. From 1973 to 1983 he was president of the Memorial Sloan-Kettering Cancer Center.

Thomas' first book, *The Lives of a Cell: Notes of a Biology Watcher* (1974), was a collection of 29 essays originally written for the *New England Journal of Medicine.* His later essays were collected in *The Medusa and the Snail* (1979), *The Youngest Science* (1983), *Late Night Thoughts on Listening to Mahler's Ninth Symphony* (1983), and *The Fragile Species* (1992).

**Thomas, Lowell (Jackson)** (b. April 6, 1892, Woodington, Ohio, U.S.—d. Aug. 29, 1981, Pawling, N.Y.), preeminent American radio commentator, and an explorer, lecturer, author, and journalist. He is especially remembered for his association with T.E. Lawrence (Lawrence of Arabia).

Thomas attended Valparaiso (Ind.) University (B.Sc., 1911), the University of Denver (B.A., M.A., 1912), and Princeton University (M.A., 1916). During his early 20s he worked as a war correspondent in Europe and the Middle East, eventually following Lawrence into the Arabian Desert and filing the exclusive story and pictures of the famous Revolt in the Desert that helped to make Lawrence famous. Before he was 30 Thomas had put together two expeditions to explore the far north. These trips and his film and verbal records of them established his reputation as an adventurer and a reporter.

In 1926 Thomas worked at KDKA, a pioneering radio station in Pittsburgh. He joined the Columbia Broadcasting System (CBS) as radio news commentator in 1930, and during World War II he again became a foreign correspondent. He appeared on the first television news broadcast in 1939 and the first daily television program in 1940. He covered political conventions for CBS in 1952, 1956, and 1960. His television program "High Adventure with Lowell Thomas" (CBS, 1957–58) introduced the peoples and customs of remote lands, much as his early illustrated lectures had done for live audiences. Despite his appearances on television, Thomas' principal medium was radio, and his nightly news broadcasts were an American institution for nearly two generations. His "sign off"—"So long, until tomorrow!"—became the title of his autobiography (1977). Among more than 50 other books he wrote are *With Lawrence in Arabia* (1924), *Kabluk of the Eskimo* (1932), *Back to Mandalay* (1951), and *The Seven Wonders of the World* (1956).



Lowell Thomas
Brown Brothers

**Thomas, Martha Carey** (b. Jan. 2, 1857, Baltimore, Md., U.S.—d. Dec. 2, 1935, Philadelphia, Pa.), American educator and feminist and the second president of Bryn Mawr College (Bryn Mawr, Pa.).

Thomas earned a B.A. from Cornell University (Ithaca, N.Y.) in 1877 and a Ph.D. from the University of Zürich in 1882. She then became dean of English at Bryn Mawr College, which opened in 1885. From 1894 to 1922 she was president of the college.

Thomas maintained rigid standards at Bryn Mawr, shaping a formal curriculum and insisting that the standards of women's colleges should be as demanding as those of men's colleges. Thomas was also an ardent suffragist. In 1908 she was first president of the National College Women's Equal Suffrage League, and she later was a leading member of the National American Woman Suffrage Association. After 1920 she advocated the policies of the National Woman's Party and was an early promoter of an equal rights amendment to the U.S. Constitution.

**Thomas, Norman (Mattoon)** (b. Nov. 20, 1884, Marion, Ohio, U.S.—d. Dec. 19, 1968, Huntington, N.Y.), American socialist, social reformer, and frequent candidate for political office.



Norman Thomas
Brown Brothers

Following his graduation from Union Theological Seminary, New York City, about 1911, Thomas accepted the pastorate of the East Harlem Church and the chairmanship of the American Parish, a settlement house in one of the poorest sections of New York City. He became a pacifist and opposed U.S. participation in World War I. Then, in 1918 Thomas joined the Socialist Party, and, leaving his East Harlem posts the same year, was appointed secretary of the newly formed Fellowship of Reconciliation, an international pacifist organization. In 1921 he became associate editor of the influential liberal weekly *The Nation,* and the following year he was made executive codirector of the League for Industrial Democracy—a position he held for more than 10 years. He was also one of the founders of the American Civil Liberties Union.

Thomas ran for governor of New York on the Socialist Party ticket in 1924; he ran for mayor of New York City twice (1925, 1929) and for president of the United States in six successive elections beginning in 1928. He was generally critical of the Democratic New Deal administration of Franklin D. Roosevelt, holding that it stressed solution of economic emergencies to the neglect of moral issues.

In 1935 Thomas severed his connection with the *New Leader,* a magazine then dominated by the Marxist "Old Guard" of the Socialist Party, and supported the newly founded *Socialist Call.* This internal factionalism, added to Thomas' pacifist resistance to intervention in World War II, weakened his public influence, though he remained the party's unofficial popular spokesman in years to come.

Following World War II, as chairman of the Postwar World Council, he devoted much of his energy to the problems of international peace and pressed for a cessation of fighting in Indochina.

Thomas' many books include *The Test of Freedom* (1954), *Mr. Chairman, Ladies and Gentlemen* (1955), *The Prerequisites for Peace* (1959), and *Socialism Re-examined* (1963).

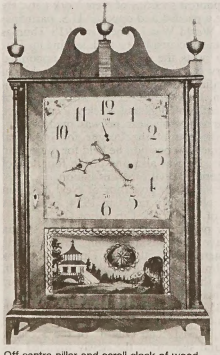
BIBLIOGRAPHY. Harry Fleischman, *Norman Thomas*, new ed. (1969); W.A. Swanberg, *Norman Thomas, the Last Idealist* (1976).

**Thomas, R(onald) S(tuart)** (b. March 29, 1913, Cardiff, Glamorgan [now South Glamorgan], Wales—d. Sept. 25, 2000, Llanfairynghornwyr, Gwynedd), Welsh clergyman and poet whose lucid, austere verse expresses an undeviating affirmation of the values of the common man.

Thomas was educated in Wales and ordained in the Church of Wales (1936), in which he held several appointments, including vicar of St. Hywyn (Aberdaron) with St. Mary (Bodferi) from 1967, as well as rector of Rhiw with Llanfaelrhys from 1973.

He published his first volume of poetry in 1946 and gradually developed his unadorned style with each new collection. His early poems, most notably those found in *Stones of the Field* (1946) and *Song at the Year's Turning Point: Poems 1942–1954* (1955), contained a harshly critical but increasingly compassionate view of the Welsh people and their stark homeland. In Thomas' later volumes, starting with *Poetry for Supper* (1958), the subjects of his poetry remained the same, yet his questions became more specific, his irony more bitter, and his compassion deeper. In such later works as *The Way of It* (1977), *Frequencies* (1978), *Between Here and Now* (1981), and *Later Poems 1972–1982* (1983), Thomas was not without hope when he described with mournful derision the cultural decay affecting his parishioners, his country, and the modern world. His *Collected Poems 1945–1990* was published in 1993.

**Thomas, Seth** (b. Aug. 19, 1785, Wolcott, Conn., U.S.—d. Jan. 29, 1859, Plymouth Hollow, Conn.), American clock manufacturer who was one of the pioneers in the mass production of clocks.



Off-centre pillar and scroll clock of wood by Seth Thomas, *c.* 1618 under license from Eli Terry; in the American Clock and Watch Museum, Bristol, Conn.

By courtesy of the American Clock and Watch Museum, Bristol, Conn., and Kenneth D. Roberts; photograph, Edward Goodrich

Apprenticed as a carpenter and joiner, Thomas worked building houses and barns until 1807, when, because of his woodworking skills, the clockmakers Eli Terry and Silas Hoadley invited him to join them in a wholesale clockmaking enterprise. The firm of Terry, Thomas, and Hoadley, after about a year of setting up the required machinery, produced some 4,000 clocks in the following two years, with Thomas responsible for fitting the components together. The clocks were designed to hang on a wall, although purchasers sometimes had standing cabinets made to contain them.

Thomas and Hoadley bought Terry's interest in 1810, and in 1812 Thomas sold his interest to Hoadley, opening his own factory in Plymouth Hollow. As the operation prospered, Thomas purchased the rights to manufacture the shelf clock originated by Terry, and he built his own mill to roll brass and make wire.

Thomas organized the Seth Thomas Clock Company at Plymouth Hollow in 1853, and soon after his death the western portion of Plymouth Hollow was made into a separate town named Thomaston in his honour. His son, also named Seth (1816–88), continued and enlarged the business.

**Thomas, Sidney Gilchrist** (b. April 16, 1850, London, Eng.—d. Feb. 1, 1885, Paris, Fr.), British metallurgist and inventor who discovered (1875) a method for eliminating phosphorus (a major impurity in some iron ores) in the Bessemer converter. The method is now called the Thomas-Gilchrist process, the Thomas process, or the basic process.

Thomas was preparing to matriculate in medicine at London University when his father died. Abandoning his plans, he instead took a job, briefly, as a classics teacher and then as a junior clerk in the police courts. He remained in this position until 1879, when his process first proved commercially viable.

Thomas studied applied chemistry and metallurgy at the Royal School of Mines while working as a clerk. By 1875 he had determined that the key to phosphorus removal in the Bessemer converter was the use of a lining composed of a strong basic substance (such as burned limestone) with which the phosphorus could combine and be eliminated in slag. With the aid of his cousin, Percy Gilchrist, Thomas was able to experiment and perfect his product; he applied for a patent in 1877. In the years that followed, Thomas was able to give up his menial job in the police courts and devote time and attention to other problems that interested him. The years in the dank courts had taken their toll, however, and his health failed.

**Thomas, Theodore (Christian Friedrich)** (b. Oct. 11, 1835, Esens, East Friesland, Prussia [Germany]—d. Jan. 4, 1905, Chicago, Ill., U.S.), German-born American conductor who was largely responsible for the role of symphony orchestras in many American cities.

A violin prodigy, Thomas moved with his family to New York City, where he was to become a shaping force in practically every aspect of the city's musical life. While in his 20s, he instituted a chamber-concert series that drew praise from both sides of the Atlantic, and he also conducted for the Brooklyn Philharmonic. In 1862 he initiated the Irving Hall Symphonic Soirées and a year later began an outdoor summer series. The Theodore Thomas Orchestra set out in 1869 on the first of its North American tours.

Thomas was appointed conductor of the New York Philharmonic in 1877, leaving for a short period to found the Cincinnati College of Music (1878–80). In 1891 the enticement of forming a full-time resident orchestra took him to Chicago, and he led the Chicago Symphony Orchestra until his death. His interpretations of the standard repertoire were highly respected, and he premiered works of many contemporaries, including Peter Ilich Tchaikovsky, Johannes Brahms, and Richard Strauss.

**Thomas, W(illiam) I(saac)** (b. Aug. 13, 1863, Russell county, Va., U.S.—d. Dec. 5, 1947, Berkeley, Calif.), American sociologist and social psychologist whose fields of study included cultural change and personality development and who made important contributions to methodology.

Thomas taught sociology at the University of



W.I. Thomas, *c.* 1890

By courtesy of Oberlin College, Oberlin, Ohio

Chicago (1895–1918), the New School for Social Research, New York City (1923–28), and Harvard University (1936–37). His *Sex and Society* (1907) is considered the first fully secular work on the subject by an American sociologist. *Source-Book for Social Origins* (1909) and *Primitive Behaviour* (1937) reflect his interest in ethnography. *The Unadjusted Girl* (1923) is a psychological study of personality. His major work, *The Polish Peasant in Europe and America*, 5 vol. (1918–20), written in collaboration with Florian Znaniecki, applies the comparative method to the study of nationalities and analyzes social problems by means of personal history.

**Thomas, William,** also called ISLWYN (b. April 3, 1832, Ynysddu, Monmouthshire [now in Gwent], Wales—d. Nov. 20, 1878, Mynyddislwyn, Monmouthshire), clergyman and poet, considered the only successful practitioner of the long Welsh poem in the 19th century. His major work is the uncompleted philosophical poem *Y Storm* (1856; *The Storm*).

Originally a land surveyor, Thomas was ordained in the Calvinistic Methodist ministry in 1859. From his youth he wrote poetry in Welsh, under the bardic name Islwyn. A master of strict Welsh metres, he was also highly accomplished at blank verse; he published a considerable body of work, largely characterized by a mystical and melancholy tone. Although he was relatively unknown in his time, some of his work later was judged to be among the finest 19th-century Welsh poetry.

**Thomas Cup,** trophy signifying world supremacy in the sport of badminton. The cup was donated in 1939 by Sir George Thomas for a series of men's international team competitions to be managed by the International Badminton Federation (IBF), of which Thomas was then president. The first tournament was held in 1948–49 and won by Malaya. Tournaments are held every two years.

**Thomason, George** (b. *c.* 1602, England—d. February/April 1666, Mickleham, Surrey, Eng.), English bookseller whose collection of printed books, handbills, pamphlets, ballads, newspapers, and other writings (cataloged and bound from 1640 to 1661) constitute one of the most important historical sources for the English Civil Wars and Commonwealth. The original collection reportedly contained more than 32,000 separate items; the extant "Thomason Collection" in the British Museum numbers 22,255 items in 2,008 leather volumes.

As a youth Thomason was apprenticed to a London bookseller (1617–26), after which he became a member of the Stationers' Company and set up shop in the area of St. Paul's Churchyard, where he lived and worked for the rest of his life, marrying (1631) and raising a large family. He was a close friend of the poet John Milton and the pamphleteer William Prynne and was a staunch Presbyterian (being briefly imprisoned in 1651 for his political activities).

Thomason started his collection at the outset of the struggles between the monarchy and Parliament and worked in secret because of the censorship existing throughout the subsequent changes of regime. The annotated collection was a personal legacy and brought him no income; and, though he was otherwise, as a publisher and bookseller, a major supplier of books to the University of Oxford and occasionally to Cambridge and was a frequent book-buying traveler to the European continent, he died in penury.

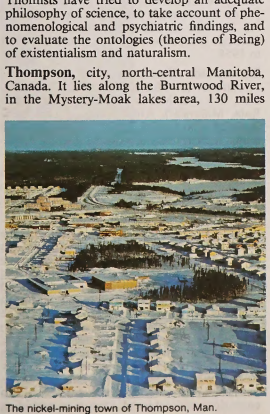
In 1761 Thomason's collection was bought from his descendants by George III, who presented it to the British Museum.

**Thomism,** philosophical and theological system developed by Thomas Aquinas, by his later commentators, and by modern revivalists of the system, known as neo-Thomists.

A brief treatment of Thomism follows. For full treatment, *see* MACROPAEDIA: Thomism, Thomas Aquinas and.

Distinguishing between the realms of nature (in which reason and philosophy hold sway) and of supernature (in which faith and theology are dominant), Thomas synthesized the thought of the Greek philosophers Aristotle and Plato and that of Augustine and other early Church Fathers, though he successfully developed a complex and distinctive corpus of thought of his own. He distinguished between essence and existence and maintained that the human soul is a unique subsistent form, substantially united with matter to constitute human nature. The thought of Thomas was analyzed and restated especially by Dominican commentators up through the 16th century. In the 19th and 20th centuries, owing to modern social and intellectual issues, the study of Thomism was revived, especially under the influence of the Jesuits and the papacy, as a philosophical basis to answer contemporary problems. Since the mid-20th century neo-Thomists have tried to develop an adequate philosophy of science, to take account of phenomenological and psychiatric findings, and to evaluate the ontologies (theories of Being) of existentialism and naturalism.

**Thompson,** city, north-central Manitoba, Canada. It lies along the Burntwood River, in the Mystery-Moak lakes area, 130 miles (210 km) north of Lake Winnipeg. Planned in 1956 by the International Nickel Company of Canada and named for John F. Thompson, the company chairman, the community was completed in 1961. Its integrated nickel mining-smelting-refining plant was the first in the Western Hemisphere. Economically, Thompson is entirely dependent upon nickel extraction from the Thompson and Birchtree mines, which are among the most productive in Canada. The city is served by a branch line of the Canadian National Railway extending from The Pas (243 miles [391 km] southwest) to Churchill (240 miles [390 km] northeast) on Hudson Bay. Thompson has air service to Winnipeg. Inc. 1967. Pop. (1991) 14,977.



The nickel-mining town of Thompson, Man.
George Hunter

**Thompson, Sir Benjamin,** COUNT (Graf) VON RUMFORD (b. March 26, 1753, Woburn, Mass. [U.S.]—d. Aug. 21, 1814, Auteuil, France), American-born British physicist, government administrator, and a founder of the Royal Institution of Great Britain, London. His investigations of heat overturned the theory that heat is a liquid form of matter and established the beginnings of the modern theory that heat is a form of motion.

In 1772 Thompson married a wealthy widow, Sarah Walker, and lived in Rumford (now Concord), N.H. Loyal to the British crown, he served as a spy after the outbreak of the American Revolution, but in 1776 he was forced to flee to London, leaving his wife and daughter behind. There he served for a time as a government clerk and undersecretary of state. As a lieutenant colonel he later commanded a British regiment in New York, but with the end of the war he resigned himself to exile.

Knighted by King George III in 1784, Thompson subsequently received the crown's permission to enter the Bavarian civil service and became war and police minister and grand chamberlain to the elector of Bavaria. He introduced numerous social reforms and brought James Watt's steam engine into common use. His work resulted in improved fireplaces and chimneys, and among his inventions are a double boiler, a kitchen range, and a drip coffeepot. He also introduced the potato as a staple food. He was created a count of the Holy Roman Empire in 1791. Interest in gunpowder and weaponry stimulated his physical investigations, and in 1798 he began his studies of heat and friction. He reported some of his findings in the classic paper "An Experimental Enquiry Concerning the Source of the Heat which is Excited by Friction" (1798) and made one of the earliest measurements of the equivalence of heat and mechanical energy.

Thompson returned to England in 1798 and continued his researches on heat. In 1799, with Sir Joseph Banks, he helped establish the Royal Institution of Great Britain and chose the British chemist Sir Humphry Davy as lecturer. He established the Rumford professorship at Harvard College as well as the Rumford medals of the Royal Society (London) and the American Academy of Arts and Sciences, Boston.

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**Thompson, Sir D'Arcy Wentworth** (b. May 2, 1860, Edinburgh, Scot.—d. June 21, 1948, St. Andrews, Fife), Scottish zoologist and classical scholar noted for his influential work *On Growth and Form* (1917, new ed. 1942).

Thompson was educated at the Edinburgh Academy, the University of Edinburgh, and at Trinity College, Cambridge (1880–83). In 1884 he became professor of biology at University College, Dundee, in Scotland, where he built a teaching museum of zoology, and in 1917 he became senior professor of natural history at the University of St. Andrews.

In *On Growth and Form* Thompson interpreted and analyzed the growth and structure of organisms in mathematical and physical terms. This approach was a departure from contemporary zoology, which analyzed organic form in terms of comparative anatomy, evolutionary theory, and phylogenetics. Thompson developed a theory of transformation in which the evolution of one species into another is viewed as a process of major transformations involving the whole organism, rather than successive minor changes in the body parts. His other writings include works on classical scholarship, such as *A Glossary of Greek Birds* (1895, new ed. 1936), and he also contributed many papers and reports on fishery statistics and oceanography. He was knighted in 1937.

**Thompson, David** (b. April 30, 1770, London, Eng.—d. Feb. 10, 1857, Longeuil, near Montreal, Que., Can.), English explorer, geographer, and fur trader in the western parts of what are now Canada and the United States. He was the first white man to explore the Columbia River from source to mouth. His maps of western North America served as a basis for all subsequent ones.

Thompson was apprenticed to the Hudson's Bay Company in 1784 and worked as a clerk in Canada until 1796, when he made an expedition for the company to Lake Athabasca. He left the company in 1797 to join and become a partner in the rival North West Company and continued to explore and trade on the western plains.

In 1797 Thompson descended a stretch of the Missouri River, and in 1798 he discovered Turtle Lake, one of the headwaters of the Mississippi River. In 1807 he crossed the Rocky Mountains by the Howse Pass and built the first trading post on the Columbia River. Having explored what is now northwest Montana, Thompson descended the length of the Columbia River in 1811. He then settled in Terrebonne, near Montreal, and drew up maps of the newly explored territory.

Thompson headed a commission that surveyed the border between Canada and the United States from 1818 to 1826, and he also conducted other surveys but was not recognized as a geographer until after his death.

**Thompson, Dorothy** (b. July 9, 1894, Lancaster, N.Y., U.S.—d. Jan. 30, 1961, Lisbon, Port.), American newspaperwoman and writer, one of the most famous journalists of the 20th century.

The daughter of a Methodist minister, Thompson attended the Lewis Institute in Chicago and Syracuse (New York) University (A.B., 1914), where she became ardently committed to suffragism. After World War I she went to Europe as a freelance correspondent and became famous for an exclusive interview with Empress Zita of Austria after Emperor Charles's unsuccessful attempt in 1921 to regain his throne. In 1925 she became head of the Berlin bureau of the *New York Evening Post* and met the novelist Sinclair Lewis. She married him in London in 1928 (her second of three marriages). On their return to America, Thompson led a domestic life for a few years but, back in Europe, she began reporting about the Nazi movement, infuriating Adolf Hitler so much that, by his own personal order in 1934, she became the first American correspondent to be expelled from Germany. In 1936, for the *New York Herald Tribune,* she began her newspaper column "On the Record," which became hugely popular and eventually was syndicated to as many as 170 daily papers (1941–58). On network radio and in popular speeches, she warned against Hitler, and *Time* magazine rated her the country's second most popular woman (after Eleanor

Roosevelt). She and Lewis were divorced in 1942.

Thompson wrote many books, including *New Russia* (1928), *I Saw Hitler!* (1932), *Refugees: Anarchy or Organization* (1938), *Let the Record Speak* (1939), and *The Courage to*



Dorothy Thompson, 1934
AP/Wide World Photos

*Be Happy* (1957). In her final years, she continued to write a monthly column for the *Ladies' Home Journal.* She was president of the American PEN club from 1936 to 1940.

**Thompson, Edward Herbert** (b. Sept. 28, 1856, Worcester, Mass., U.S.—d. May 11, 1935, Plainfield, N.J.), American archaeologist who was an early interpreter of Mayan civilization through his examination of the city and religious shrine of Chichén Itzá in Yucatán.

Though lacking formal training in archaeology, Thompson was an enthusiastic antiquarian. With the understanding that he could devote some time to the study of Mayan remains, he was appointed U.S. consul at Mérida, Mex., in 1885. He lived closely with the Maya Indians, learning their language and adopting their way of life. Through their friendship, he learned the lore of the Maya and secured assistance with his excavations.

Principal subjects of his work at Chichén Itzá included the great terraced pyramid, the astronomical observatory, the ceremonial court with its evidence of ritual games, and the temple decorated with a frieze of jaguars and shields and interior wall paintings of warriors.

Difficulties with the Mexican government finally forced him to flee. He recounted his experiences in *People of the Serpent* (1932).

**Thompson, E.P.,** in full EDWARD PALMER THOMPSON (b. Feb. 3, 1924—d. Aug. 28, 1993, Upper Wick, Worcester, Eng.), British social historian and political activist whose *The Making of the English Working Class* (1963) had a major influence on post-World War II historiography. Thompson helped found the British New Left in the 1950s and in the 1980s became a prominent antinuclear activist.

Thompson was born into a family of Methodist missionaries. After serving as a tank troop leader during World War II, he took a B.A. at Corpus Christi College, Cambridge (1946), where he joined the British Communist Party. In the decade that followed, he devoted himself to peace activism, taught at the University of Leeds, worked on his first book, a biography of William Morris, the 19th-century socialist and leader of the Arts and Crafts Movement. In 1948 he married a fellow historian, Dorothy Sale; their enduring intellectual partnership was a prominent feature of the postwar British left.

Outraged by the Soviet suppression of the Hungarian uprising in 1956, Thompson bitterly broke from the British Communist Party. He remained a dedicated Marxist, however, and cofounded a new journal, *The New Left Review,* around which many other disaffected leftists formed a noncommunist political movement, the New Left. This same dissident impulse informed Thompson's historical thinking, particularly his most famous book, *The Making of the English Working Class.*

In the passionately eloquent prose style that became his trademark, Thompson attacked the prevailing Marxist emphasis on impersonal economic forces as the key vectors of historical change and Marxism's interpretation of 19th-century class consciousness as an automatic by-product of the new industrial factory system. Nothing was automatic about the rise of the working class, he argued: 19th-century workers had forged their own collective identity through a difficult process in which the initiative, moral conviction, and imaginative efforts of individuals had made a crucial difference. In a now-famous phrase, he described himself as seeking to rescue British workers "from the enormous condescension of posterity." The book provoked a widespread renewal of scholarly interest in grassroots history narrated "from below."

Teaching at the University of Warwick (Coventry, Eng.) from 1965, Thompson produced a steady stream of influential essays, notably "The Moral Economy of the English Crowd in the Eighteenth Century" (1971), which focused on the transition from a paternalist model of economic relationships—in which moral notions of reciprocity across class lines still held sway—to a modern model based on market forces. Thompson framed the term *moral economy* as a conceptual hybrid, arising out of the overlapping spheres of cultural norms, social practices, and economic institutions. The sophistication and flexibility of this construct made it attractive to scholars in many fields.

In the early 1980s, Thompson plunged into antinuclear activism and came to be viewed as one of the most trusted moral leaders of western Europe. He sought to persuade his audiences that they placed too great an emphasis on faceless and monolithic socioeconomic forces acting upon human beings and paid too little attention to individual personality, moral choice, and other expressions of human experience and initiative. Self-consciously aligning himself with a long tradition of British radical dissenters, he sought to demonstrate that society's downtrodden should not be seen, or see themselves, as helpless and passive objects of history. This lifelong stance of defiant dissent infused his posthumously published *Witness Against the Beast* (1993), a full-scale reassessment of the poet William Blake and the radical movements of the Romantic era.

(M.D.Be./Ed.)

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**Thompson, Francis** (b. Dec. 18, 1859, Preston, Lancashire, Eng.—d. Nov. 13, 1907, London), English poet of the Aesthetic movement of the 1890s, whose most famous poem, "The Hound of Heaven," describes the pursuit of the human soul by God.

Thompson was educated in the Roman Catholic faith at Ushaw College, a seminary in the north of England. He studied medicine at Manchester, but not conscientiously, and went to London to seek a livelihood. Poverty reduced him to selling matches and newspapers, and ill health drove him to opium. He wrote his first poems after finding light work with a shoemaker, and in 1888 the publication of two of his poems in Wilfrid Meynell's periodical, *Merry England,* aroused the admiration of Robert Browning. Meynell and his wife, Alice, befriended Thompson, induced him to enter a hospital, nursed him through convalescence, and in 1893 arranged publication of a collection, *Poems,* which was highly praised.

From 1893 to 1897 Thompson lived near a Franciscan priory in north Wales, during which period he wrote *Sister Songs* (1895) and *New Poems* (1897). He also wrote a number of prose works, mostly published posthumously,



Francis Thompson, oil painting by J. Lavalle, 1938, from a sketch by N. Lytton; in Boston College
From the T.L. Connolly, S.J. Thompson Collection, Boston College

including the essay *Shelley* (1909). *The Works of Francis Thompson,* 3 vol. (1913), were published by Meynell. Thompson died of tuberculosis.

**Thompson, Sir J. Eric S.,** in full SIR JOHN ERIC SIDNEY THOMPSON (b. Dec. 31, 1898, London, Eng.—d. Sept. 9, 1975, Cambridge, Cambridgeshire), leading English ethnographer of the Mayan people. Thompson devoted his life to the study of Mayan culture and was able to extensively decipher early Mayan glyphs, determining that, contrary to prevailing belief, they contained historical as well as ritualistic and religious records. He also discovered that present-day Mexican Indians preserve many ancestral customs. His books include *The Rise and Fall of Maya Civilization* (1954) and *Maya History and Religion* (1970).

Thompson studied anthropology at the University of Cambridge and, upon graduation, joined the Carnegie Institution excavation in the Yucatán in 1926. He worked with the Carnegie Institution of Washington from 1935 to 1958.

**Thompson, Jim,** byname of JAMES H.W. THOMPSON (b. March 21, 1906, Greenville, Del., U.S.—d. March 26, 1967, near Tanah Rata, Malaysia?), American-born Thai businessman who turned Thai silk making into a major industry selling worldwide and became an authority on Thai art. His mysterious disappearance in 1967 became a sensation in Southeast Asia and elsewhere.

The son of a wealthy textile manufacturer, Thompson graduated from Princeton University (1928) and studied architecture at the University of Pennsylvania. After working as an architect in New York City from 1931 to 1940, he served as an intelligence officer in the Office of Strategic Services (OSS) during World War II in North Africa, Europe, and the China-Burma-India theatre, ending up in Bangkok. In the postwar period, in 1947, he returned to Thailand permanently, became interested in the old cottage industry of silk weaving, and, through his influential contacts in America, began selling luxury silks in New York City and elsewhere. His Thai Silk Company, Ltd., was founded in 1948. He sold to couturiers and achieved a coup in providing the silks used for the costumes of the musical *The King and I* (1951). By the 1960s business

was flourishing and inspired the growth of several Thai competitors in an expanding industry.

Meanwhile, Thompson became a Thai art collector and built in central Bangkok a splendid Thai-style home (now open to tourists). He became the best-known Western foreigner in Bangkok and perhaps in all Southeast Asia.

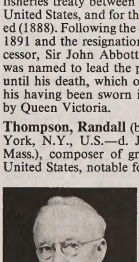
On a holiday trip to the Cameron Highlands of Malaya in 1967, Thompson mysteriously disappeared after leaving his cottage for a walk through jungle trails. No trace of him was ever found.

**Thompson, Sir John,** in full SIR JOHN SPARROW DAVID THOMPSON (b. Nov. 10, 1844, Halifax, Nova Scotia [Canada]—d. Dec. 12, 1894, Windsor Castle, Berkshire, Eng.), jurist and statesman who was premier of Canada from 1892 to 1894.

Thompson was called to the bar in Nova Scotia in 1865 and appointed queen's counsellor in 1879. He entered politics in 1877 as Liberal-Conservative member for Antigonish in the provincial legislature, becoming attorney general in 1878; he became premier of Nova Scotia in 1882 but was defeated in the same year. After serving as judge in the provincial Supreme Court, he was appointed minister of justice in 1885 in Sir John Macdonald's federal administration, having been elected to the Dominion Parliament for Antigonish.

Thompson successfully defended the government in various politico-religious controversies, including reactions to the 1885 execution of Louis Riel, to the Jesuits' Estates Act (1888–89), and to the subordination of the French language. In 1888 he helped arrange a fisheries treaty between Great Britain and the United States, and for this work he was knighted (1888). Following the death of Macdonald in 1891 and the resignation of Macdonald's successor, Sir John Abbott, in 1892, Thompson was named to lead the party. He was premier until his death, which occurred minutes after his having been sworn into the privy council by Queen Victoria.

**Thompson, Randall** (b. April 21, 1899, New York, N.Y., U.S.—d. July 9, 1984, Boston, Mass.), composer of great popularity in the United States, notable for his choral music.



Randall Thompson
By courtesy of the Harvard University News Office

Thompson studied at Harvard University and later with the composer Ernest Bloch. He taught at a number of universities and colleges and was director of the Curtis Institute of Music, Philadelphia (1939–41), before joining the faculties at Princeton and, later, Harvard (emeritus professor after 1965).

Thompson's style is conservative and Neoclassical, combining traditional forms with 20th-century styles. It also exhibits a highly developed sense of form and counterpoint.

Of his three symphonies the second was especially successful. Notable among his vocal works are the *Alleluia* for unaccompanied choir (1940) and *The Testament of Freedom* for men's voices and orchestra (1942; to words by Thomas Jefferson), both of which achieved great popularity. Thompson's other works include a one-act opera, *Solomon and Balkis* (1942), and an oratorio, *The Nativity According to St. Luke* (1965).

**Thompson, Silvanus Phillips** (b. June 19, 1851, York, Yorkshire, Eng.—d. June 12, 1916, London), British physicist and historian of science known for contributions in electrical machinery, optics, and X rays.

He received both a B.A. (1869) and a D.Sc. (1878) from the University of London and was a popular teacher at University College, Bristol (1876–85), and at the City and Guilds Technical College, Finsbury (1885–1916). While teaching, Thompson contributed to the development of electric dynamo machines and radiotelegraphy.

Thompson was a prolific lecturer and writer on a wide range of scientific and technical subjects. Among his many works were *Elementary Lessons in Electricity and Magnetism* (1881) and the long-popular *Calculus Made Easy* (1910). Thompson was an active Quaker, and he was an outspoken critic of the British government and its South African policies during the Boer War.

**Thompson, Smith** (b. Jan. 17, 1768, Amenia, N.Y. [U.S.]—d. Dec. 18, 1843, Poughkeepsie, N.Y.), associate justice of the United States Supreme Court (1823–43).

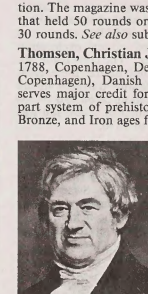
Thompson studied law under James Kent and was admitted to the bar in 1792. Two years later he married Sarah Livingston, thereby allying himself with the Jeffersonian Republicans of the anti-Burr faction in New York. After serving a term in the state legislature, he was appointed to the state Supreme Court in 1802. Thompson served on the state bench until President James Monroe named him secretary of the navy in 1818. In 1823 he was appointed to the U.S. Supreme Court; and, once certain that his presidential ambitions were hopeless, he accepted. He continued to harbour political hopes, however, and in 1828, without resigning from the bench, he ran for the governorship of New York and, after a caustic campaign, was defeated.

Thompson did not share Chief Justice John Marshall's nationalist views and dissented from many of his opinions; few of Thompson's opinions for the Court related to constitutional questions. His opinion in *Kendall* v. *United States* (1838) contained a passage rejecting the theory, ascribed to President Andrew Jackson, that a president may enforce his own interpretation of the Constitution in executing laws. The passage was deleted from the printed opinion at the request of the attorney general, who denied that the theory had been mentioned in oral argument.

**Thompson River,** major tributary of the Fraser River, in southern British Columbia, Canada. The North Thompson (210 miles [340 km]) rises in the Cariboo Mountains east of Wells Gray Provincial Park and follows an easterly then southwesterly course to Kamloops; the South Thompson (206 miles) emerges from Shuswap Lake and flows northwesterly to Kamloops, where the two streams unite for about 100 miles (160 km) and merge with the Fraser at Lytton. The river was explored by Simon Fraser in 1808 and was named for David Thompson, an explorer and geographer erroneously credited with having reached its upper course.

**Thompson submachine gun,** byname TOMMY GUN, submachine gun patented in 1920 by its American designer, General John T. Thompson. The weapon became famous during the U.S. Prohibition era (1920–33) as the gun used by gangsters. Indeed it became so widely known in that era that it is commonly (but erroneously) believed to be the first submachine gun. It weighed almost 10 pounds (4.5 kg) empty and fired .45-calibre ammunition. The magazine was either a circular drum that held 50 rounds or a box that held 20 or 30 rounds. *See also* submachine gun.

**Thomsen, Christian Jürgensen** (b. Dec. 29, 1788, Copenhagen, Den.—d. May 21, 1865, Copenhagen), Danish archaeologist who deserves major credit for developing the three-part system of prehistory, naming the Stone, Bronze, and Iron ages for the successive stages

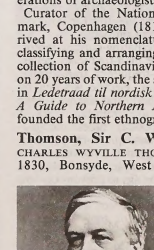


Christian Thomsen, oil painting by an unknown artist
By courtesy of the Royal Danish Embassy, London

of human technological development in Europe. His tripartite scheme brought the first semblance of order to prehistory and formed the basis for chronological schemes developed for other areas of the globe by succeeding generations of archaeologists.

Curator of the National Museum of Denmark, Copenhagen (1816–65), Thomsen arrived at his nomenclature in the course of classifying and arranging the museum's large collection of Scandinavian antiquities. Based on 20 years of work, the scheme was published in *Ledetraad til nordisk Oldkyndighed* (1836; *A Guide to Northern Antiquities*). He also founded the first ethnographic museum.

**Thomson, Sir C. Wyville,** in full SIR CHARLES WYVILLE THOMSON (b. March 5, 1830, Bonsyde, West Lothian, Scot.—d.



Sir C. Wyville Thomson, 1877
BBC Hulton Picture Library

March 10, 1882, Bonsyde), Scottish naturalist who was one of the first marine biologists to describe life in the ocean depths.

After studying medicine at the University of Edinburgh, Thomson lectured in botany, but he concentrated increasingly on zoology after his appointment to chairs of natural history at Cork and Belfast (1853–68), in Ireland.

When he was appointed professor of natural history at Edinburgh (1870), Thomson had already turned his attention exclusively to the study of marine invertebrates. Aboard two deep-sea dredging expeditions north of Scotland (1868–69), he discovered a wide variety of invertebrate life forms—many previously believed extinct—to a depth of 650 fathoms. He also found that deep-sea temperatures are not as constant as had been

supposed, indicating the presence of oceanic circulation. Thomson described these findings in *The Depths of the Sea* (1873).

In 1872 he embarked on an exploration aboard HMS "Challenger." The crew made observations and soundings of the three great ocean basins at 362 stations during a highly successful circumnavigation of 68,890 nautical miles (127,600 kilometres). Thomson was knighted on his return in 1876.

**Thomson, Charles Poulett:** *see* Sydenham, Charles Poulett Thomson, 1st Baron.

**Thomson, Elihu** (b. March 29, 1853, Manchester—d. March 13, 1937, Swampscott, Mass., U.S.), U.S. electrical engineer and inventor whose discoveries in the field of alternating-current phenomena led to the development of successful alternating-current motors. He was also a founder of the U.S. electrical industry.

Thomson left England for Philadelphia as a child and later taught chemistry and mechanics at the Central High School there. With a fellow teacher, Edwin J. Houston, he designed an arc lighting system that attracted financial backing and led to the founding (1880) of the American Electric Company in New Britain, Conn., of which Thomson held 30 percent of the stock and was chief electrical engineer. In 1882 a group from Lynn, Mass., bought controlling interest in the company and moved it to Lynn. Thomson went to Lynn with the company, which in 1883 was renamed the Thomson–Houston Electric Company, and remained there as a consultant to the General Electric Company, which was formed in 1892 by the merger of Thomson–Houston with the Edison General Electric Company.

In addition to his alternating-current motor, Thomson invented the high-frequency generator (1890), the high-frequency transformer, the three-coil generator, electric welding by the incandescent method, and the watt-hour meter. Thomson also did important work in radiology, improving X-ray tubes and pioneering in making stereoscopic X-ray pictures. He was the first to suggest the provision of a mixture of helium and oxygen for workers in caissons and tunnel borings to prevent caisson disease (bends). He held some 700 patents and received many awards.

**Thomson, George** (b. March 4, 1757, Limekilns, Fife, Scot.—d. Feb. 18, 1851, Leith, Midlothian), Scottish amateur editor and publisher of Scottish folksongs, which he attempted to provide with semiclassical settings.

Impressed by foreign vocalists at Edinburgh Musical Society concerts, Thomson determined to anthologize Scottish folk songs in arrangements for voice and piano trio by prestigious European composers. From 1791 to 1841 he published 300 songs in six volumes, using personal funds gained from his 59-year clerkship with the Board of Trustees for the Encouragement of Arts and Manufacturers of Scotland.

Thomson was not interested in the songs as they were originally sung and culled most of his selections from earlier published editions. He employed such leading Scottish poets as Robert Burns and Sir Walter Scott to substitute sentimental lyrics for ribald ones, while the composers, Joseph Haydn and Ludwig van Beethoven among them, tried to accommodate Scottish melodies to Viennese harmonies. *The Select Collection of Scottish Airs* was criticized for lack of national authenticity, and Beethoven denounced Thomson for simplifying his piano music for the amateur musician. Thomson also published volumes of Welsh and Irish airs and commissioned Sir Henry Bishop to compose a cantata on Burns's poem "The Jolly Beggars." His granddaughter married the novelist Charles Dickens.

**Thomson, Sir George Paget** (b. May 3, 1892, Cambridge, Cambridgeshire, Eng.—d. Sept. 10, 1975, Cambridge), English physicist, joint recipient, with Clinton J. Davisson of the United States, of the Nobel Prize for Physics in



Sir George Paget Thomson
The Mansell Collection

1937 for demonstrating that electrons undergo diffraction, a behaviour peculiar to waves that is widely exploited in determining the atomic structure of solids and liquids.

The only son of the noted physicist Sir J.J. Thomson, he worked in the Cavendish Laboratory at Cambridge University after World War I. In 1922 he was appointed professor of natural philosophy at the University of Aberdeen, where he conducted experiments demonstrating that a beam of electrons is diffracted upon passage through a crystalline substance, thus confirming Louis de Broglie's prediction that particles should display the properties of waves that have a wavelength ($\lambda$) equal to the ratio of the Planck constant ($h$) to the momentum ($p$) of the particle; that is, $\lambda = h/p$.

In 1930 Thomson became professor of physics at the Imperial College of Science in London; there he concentrated on studies of the neutron and nuclear fusion. He was knighted in 1943 and nine years later became master of Corpus Christi College, Cambridge, from which he retired in 1962. His works include *Theory and Practice of Electron Diffraction* (1939) and *J.J. Thomson and the Cavendish Laboratory in His Day* (1965).

**Thomson, J(ohn) Edgar** (b. Feb. 10, 1808, Springfield Township, Pa., U.S.—d. May 27, 1874, Philadelphia), U.S. civil engineer and president of the Pennsylvania Railroad Company who consolidated a network of railroad lines from Philadelphia to Chicago.

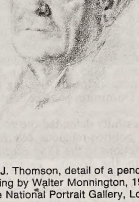
Thomson joined the Pennsylvania engineer corps at 19. At that time, the corps was surveying the best course for a rail line from Philadelphia to Columbia. In 1830, he became head of the engineering division for the Camden & Amboy Railroad in New Jersey. From 1832 to 1847, he was chief engineer for the Georgia Railroad, which constructed an Atlanta-to-Augusta line, the longest line built by one company up to that time.

In 1847, the Pennsylvania Railroad was incorporated to build a railroad system that would allow Pennsylvania to compete with New York and other eastern states in operating trade lines to the west. Hired as chief engineer of the railroad in 1847, he was president by 1852 and held that position until his death. By careful choice of the route and the location of the Horseshoe Curve, Thomson completed a through line that crossed the Alleghenies without using inclined grades. The line's Philadelphia-to-Pittsburgh service began in February 1854.

In the next 20 years, Thomson extended the line west by creating the Pennsylvania Company to lease and develop systems from Pittsburgh to Chicago. He also pushed east and south, leasing the lines of the United Companies of New Jersey in 1871 and acquiring an interest in the Southern Railway Security Company in 1873. To establish Philadelphia as a centre for transatlantic trade, he helped found the American Steamship Company in 1870.

Altogether, Thomson expanded the Pennsylvania Railroad's lines from 250 to 6,000 miles of track. Among the improvements that he introduced were a system for handling passenger baggage and the use of steel rather than iron rails.

**Thomson, Sir J(oseph) J(ohn)** (b. Dec. 18, 1856, Cheetham Hill, near Manchester—d. Aug. 30, 1940, Cambridge, Cambridgeshire, Eng.), English physicist who helped revolutionize the knowledge of atomic structure by his discovery of the electron (1897). He received the Nobel Prize for Physics in 1906 and was knighted in 1908.



Sir J.J. Thomson, detail of a pencil drawing by Walter Monnington, 1932; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

*Education and early career.* Thomson was the son of a bookseller in a suburb of Manchester. When he was only 14, he entered Owens College, now the Victoria University of Manchester. He was fortunate in that, in contrast with most colleges at the time, Owens provided some courses in experimental physics. In 1876 he obtained a scholarship at Trinity College, Cambridge, where he remained for the rest of his life. After taking his B.A. degree in mathematics in 1880, the opportunity of doing experimental research drew him to the Cavendish Laboratory. He began also to develop the theory of electromagnetism. As set forth by James Clerk Maxwell, electricity and magnetism were interrelated; quantitative changes in one produced corresponding changes in the other.

Prompt recognition of Thomson's achievement by the scientific community came in 1884, with his election as a fellow of the Royal Society of London and appointment to the chair of physics at the Cavendish Laboratory. Thomson entered physics at a critical point in its history. Following the great discoveries of the 19th century in electricity, magnetism, and thermodynamics, many physicists in the 1880s were saying that their science was coming to an end like an exhausted mine. By 1900, however, only elderly conservatives held this view, and by 1914 a new physics was in existence, which raised, indeed, more questions than it could answer. The new physics was wildly exciting to those who, lucky enough to be engaged in it, saw its boundless possibilities. Probably not more than a half dozen great physicists were associated with this change. Although not everyone would have listed the same names, the majority of those qualified to judge would have included Thomson.

*Discovery of the electron.* Thomson's most important line of work, interrupted only for lectures at Princeton University in 1896, was

that which led him, in 1897, to the conclusion that all matter, whatever its source, contains particles of the same kind that are much less massive than the atoms of which they form a part. They are now called electrons, although he originally called them corpuscles. His discovery was the result of an attempt to solve a long-standing controversy regarding the nature of cathode rays, which occur when an electric current is driven through a vessel from which most of the air or other gas has been pumped out. Nearly all German physicists of the time held that these visible rays were produced by occurrence in the ether—a weightless substance then thought to pervade all space—but that they were neither ordinary light nor the recently discovered X-rays. British and French physicists, on the other hand, believed that these rays were electrified particles. By applying an improved vacuum technique, Thomson was able to put forward a convincing argument that these rays were composed of particles. Furthermore, these rays seemed to be composed of the same particles, or corpuscles, regardless of what kind of gas carried the electric discharge or what kinds of metals were used as conductors. Thomson's conclusion that the corpuscles were present in all kinds of matter was strengthened during the next three years, when he found that corpuscles with the same properties could be produced in other ways; *e.g.*, from hot metals. Thomson may be described as "the man who split the atom" for the first time, although "chipped" might be a better word, in view of the size and number of electrons. Although some atoms contain many electrons their total mass is never so much as 1/1000 that of the atom.

By the turn of the century most of the scientific world had fully accepted Thomson's far-reaching discovery. In 1903 he had the opportunity to amplify his views on the behaviour of subatomic particles in natural phenomena when, in his Silliman Lectures at Yale, he suggested a discontinuous theory of light; his hypothesis foreshadowed Einstein's later theory of photons. In 1906 he received the Nobel Prize for Physics for his researches into the electrical conductivity of gases; in 1908 he was knighted; in 1909 he was president of the British Association for the Advancement of Science; and in 1912 he received the Order of Merit.

Thomson was, however, by no means a scientific recluse. During his most fruitful years as a scientist, he was administrative head of the highly successful Cavendish Laboratory. (It was there that he met Rose Elizabeth Paget, whom he married in 1890.) He not only administered the research projects but also financed two additions to the laboratory buildings primarily from students' fees, with little support from the university and colleges. Except for its share of a small government grant to the Royal Society to aid all British universities and all branches of science, the Cavendish Laboratory received no other government subsidy, nor were there contributions from charitable corporations or industry. A gift from a devoted staff member made possible the purchase of a small liquid-air machine essential for Thomson's research on positive rays, which greatly increased knowledge of the recently discovered atomic nuclei.

Thomson was, moreover, an outstanding teacher; his importance in physics depended almost as much on the work he inspired in others as on that which he did himself. The group of men he gathered around him between 1895 and 1914 came from all over the world, and after working under him many accepted professorships abroad. Seven Nobel Prizes were awarded to those who worked under him. Thomson took his teaching duties very seriously; he lectured regularly to elementary classes in the morning and to postgraduates in the afternoon. He considered teaching to be helpful for a researcher, since it required him to reconsider basic ideas that otherwise might have been taken for granted. He never advised a man entering a new research field to begin by reading the work already done. Rather, Thomson thought it wise that he first clarify his own ideas. Then he could safely read the reports of others without having his own views influenced by assumptions that he might find difficult to throw off.

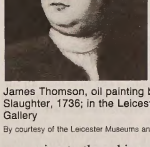
Thomson demonstrated his wide range of interests outside science by his interest in politics, current fiction, drama, university sports, and the nontechnical aspects of science. Although he was not athletic, he was an enthusiastic fan of the Cambridge cricket and rugby teams. But his greatest interest outside physics was in plants. He enjoyed long walks in the countryside, especially in hilly regions near Cambridge, where he searched for rare botanical specimens for his elaborate garden. In 1918 Thomson was made master of Trinity College. This position, in which he remained until his death, gave him the opportunity of meeting many young men whose interests lay outside the field of science. He enjoyed these meetings and made many new friends.

*Assessment.* To a large extent, it was Thomson who made atomic physics a modern science. The studies of nuclear organization that continue even to this day and the further identification of elementary particles all followed his most outstanding accomplishment, his discovery of the electron in 1897. Although this new physics has continued to raise more theoretical questions than can be answered at present, from the start it rapidly gave rise to practical applications in technology and industry. (G.P.T.)

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**Thomson, James** (b. Sept. 11, 1700, Ednam, Roxburgh, Scot.—d. Aug. 27, 1748, Richmond, Eng.), Scottish poet whose best verse foreshadowed some of the attitudes of the Romantic movement. His poetry also gave



James Thomson, oil painting by S. Slaughter, 1736; in the Leicester Art Gallery

By courtesy of the Leicester Museums and Art Gallery

expression to the achievements of Newtonian science and to an England reaching toward great political power based on commercial and maritime expansion.

Educated at Jedburgh Grammar School and the University of Edinburgh, Thomson went to London in 1725. While earning his living there as a tutor, he published his masterpiece, a long, blank verse poem in four parts, called *The Seasons: Winter* in 1726, *Summer* in 1727, *Spring* in 1728, and the whole poem, including *Autumn,* in 1730.

*The Seasons* was the first sustained nature poem in English and concludes with a "Hymn to Nature." The work was a revolutionary departure; its novelty lay not only in subject matter but in structure. What was most striking to Thomson's earliest readers was his audacity in unifying his poem without a "plot" or other narrative device, thereby defying the Aristotelian criteria revered by the Neoclassicist critics.

Thomson's belief that the scientist and poet must collaborate in the service of God, as revealed through nature, found its best expression in *To the Memory of Sir Isaac Newton* (1727).

The poet also is remembered as the author of the famous ode "Rule, Britannia," from *Alfred, a Masque* (1740, with music by T.A. Arne); for his ambitious poem in five parts, *Liberty* (1735–36); and for *The Castle of Indolence* (1748), an allegory in Spenserian stanzas of what may occur when Indolence overcomes Industry.

**Thomson, James,** pseudonym BYSSHE VANOLIS, or B.V. (b. Nov. 23, 1834, Port Glasgow, Renfrew, Scot.—d. June 3, 1882, London), Scottish Victorian poet who is best remembered for his sombre, imaginative poem "The



James Thomson, engraving, 1869, after a photograph

BBC Hulton Picture Library

City of Dreadful Night," a symbolic expression of his horror of urban dehumanization.

Reared in an orphanage, Thomson entered the Royal Military Academy, Chelsea, became a regimental schoolmaster, and in 1851 was sent to Ireland. There he met the freethinker and radical Charles Bradlaugh, who was to be of great importance to his literary career.

In 1862 Thomson was discharged from the army and went to London, where he supported himself as a clerk while writing essays, poems, and stories, many of them published in Bradlaugh's *National Reformer,* a worker's weekly. "The City of Dreadful Night" first appeared in this periodical in 1874. Thomson's chronic depressions and periods of alcoholism made either social or professional success difficult, and eventually he quarrelled even with Bradlaugh. Nevertheless, the publication of a volume of Thomson's poetry, *The City of Dreadful Night and Other Poems* (1880), received favourable critical attention.

Thomson's poem "Insomnia" is autobiographical; and in "Mater Tenebrarum" and elsewhere among his writings, passages of self-revelation are frequent. He was an admirer and translator of Giacomo Leopardi, but, unlike the Italian poet, Thomson did not temper his pessimism with any kind of social optimism. No other Victorian poet displays more bleakly the dark underside of an age of change and hope.

**Thomson, Sir John Arthur** (b. July 8, 1861, Salton, East Lothian, Scot.—d. Feb. 12, 1933, Limpsfield, Surrey, Eng.), Scottish naturalist whose clearly written books on biology and attempts to correlate science and religion led to wider public awareness of progress in the biological sciences.

A professor of natural history at the Uni-

versity of Aberdeen (1899–1930), Thomson concentrated his research on soft corals. He collaborated with the biologist Sir Patrick Geddes in writing several popular books, including *The Evolution of Sex* (1889), *Evolution* (1911), *Sex* (1914), *Biology* (1924), and *Life: Outlines of General Biology* (1931). Thomson also wrote *Outlines of Zoology* (9th ed. 1944), *The Wonder of Life* (1914), and *Science and Religion* (1925). He was knighted in 1930.

**Thomson, Joseph** (b. Feb. 14, 1858, Penpont, Dumfries, Scot.—d. Aug. 2, 1895, London, Eng.), Scottish geologist, naturalist, and explorer who was the first European to enter several regions of eastern Africa and whose writings are outstanding contributions to geographical knowledge, exceptional for their careful records and surveys. Thomson's gazelle (*Gazella thomsoni*), the most common gazelle of eastern Africa, was named for him.

A member of the Royal Geographical Society's expedition of 1878 to east-central Africa, he took charge after the death of the expedition's leader, Alexander Keith Johnston, leading the party over unknown territory to the northern end of Lake Nyasa and then to Lake Tanganyika. An attempt to reach the Congo was thwarted by hostile Buye (Waruwa) tribesmen, and he returned to the east African coast by way of Tabora, in present-day Tanzania, discovering Lake Rukwa.

In 1882 the Royal Geographical Society launched what was to be Thomson's major expedition, to try to find the shortest route from Zanzibar to Uganda. Traveling unarmed from the coastal city of Mombasa, in modern Kenya, he went by way of Kilimanjaro, surviving two crossings through the country of the Masai people, who had previously barred passage. He was the first European to note the existence of Lake Baringo, and he reached Lake Victoria on Dec. 10, 1882.

He secured British trading rights at Sokoto and Gwandu, in present-day Nigeria (1885), traveled privately in Morocco (1888), and in 1890 entered the service of Cecil Rhodes's British South Africa Company, making mining and trade agreements in what is now Zambia. Thomson's writings include *To the Central African Lakes and Back* (1881) and *Through Masai Land* (1885).

**Thomson, Peter W(illiam)** (b. Aug. 23, 1929, Melbourne, Vic., Australia), golfer, the first Australian to win the British Open.

Thomson won the British Open five times (1954–56, 1958, and 1965), a record shared with J.H. Taylor and James Braid and exceeded only by Harry Vardon, who won six times. Thomson won the New Zealand Open nine times from 1950 through 1971 and the Australian Open three times. Active on the international golf tour, Thomson also won a number of international open titles. He retired in 1979.

Instrumental in helping to develop a Far East professional golf tour, Thomson was awarded the Order of the British Empire in 1980. He was coauthor with Desmond Zwar of *This Wonderful World of Golf* (1969), and he wrote a newspaper column.

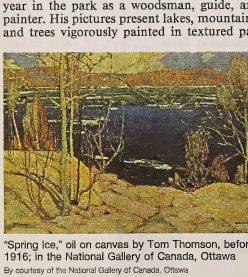
**Thomson (of Fleet), Roy Herbert Thomson, 1st Baron** (b. June 5, 1894, Toronto, Ont., Can.—d. Aug. 4, 1976, London, Eng.), Canadian-born British publisher, owner of *The Times* of London and other newspapers and communications media.

Early in life Thomson worked as a clerk and salesman, later failed as a prairie farmer and supplier of motor parts, then sold radios successfully and built his own radio station at North Bay, Ont., which brought in advertising revenue and helped to sell radio sets. In 1933 Thomson opened a second station, at Timmins, 200 miles (320 km) farther north. In 1934 he took over an ailing Timmins weekly newspaper and made it a daily; two other radio stations were added, and by 1944 four more. That year he also acquired four newspapers. He moved back to Toronto, and his chain of newspapers grew to include some in the United States, where, in 1960, he purchased the Brush Moore group.

In 1952 Thomson was defeated as a Conservative candidate for election to Canada's federal Parliament, but, in the same year, he was invited to buy *The Scotsman* newspaper and went to Edinburgh to run it. Seeing its potential, he also took up the franchise of Scottish television. He left the Canadian side of his business to his son Kenneth's management but, regarding Canada as his base, continued to expand there into television. In 1959 he acquired the Kemsley group of newspapers, the largest in Britain, which included the *Sunday Times,* to which he added (1962) Britain's first colour magazine supplement. In 1963 he became a British citizen, set up the Thomson Foundation, and in 1964 was created a baron. In 1967 he made his most outstanding newspaper purchase, *The Times* of London. Lord Thomson strove to give the newspaper needed financial stability with an initial investment of £5,000,000. In 1972, in his last major venture, he formed a consortium with Occidental and Getty Oil to acquire a North Sea oil concession.

**Thomson, Tom,** byname of THOMAS JOHN THOMSON (b. Aug. 4, 1877, Claremont, Ont., Can.—d. July 8, 1917, Algonquin Provincial Park), landscape painter devoted to the Canadian wilderness.

Encouraged by fellow designers in a Toronto commercial-art firm, Thomson began to paint about 1911. In 1913 he and his colleagues (including A.Y. Jackson and J.E.H. MacDonald) went to paint in Algonquin Provincial Park. After this trip Thomson spent part of each year in the park as a woodsman, guide, and painter. His pictures present lakes, mountains, and trees vigorously painted in textured patterns of brilliant colour. They provided an impetus to the formation of the Toronto-based landscape painters originally known as the Group of Seven.

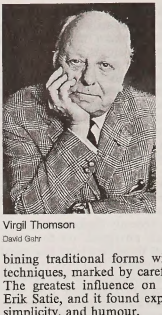


"Spring Ice," oil on canvas by Tom Thomson, before 1916; in the National Gallery of Canada, Ottawa

By courtesy of the National Gallery of Canada, Ottawa

**Thomson, Virgil** (b. Nov. 25, 1896, Kansas City, Mo., U.S.—d. Sept. 30, 1989, New York, N.Y.), American composer, conductor, and music critic whose forward-looking ideas stimulated new lines of thought among contemporary musicians.

Thomson studied at Harvard University and later with Nadia Boulanger, a noted teacher of musical composition, in Paris. There he came under the strong influence of early 20th-century French composers, especially the group known as Les Six, whose most prominent members were Darius Milhaud, Arthur Honegger, and Francis Poulenc. Thomson wrote in a variety of styles, including Gregorian chant, variations on Baptist hymns, Impressionism, and Neoclassicism, often combining traditional forms with contemporary techniques, marked by careful craftsmanship. The greatest influence on him was that of Erik Satie, and it found expression in clarity, simplicity, and humour.



Virgil Thomson

David Gahr

His operas are among his best-known works; *Four Saints in Three Acts* (1928) and *The Mother of Us All* (1947), based on the life of Susan B. Anthony, boast libretti by Thomson's close friend Gertrude Stein, an avant-garde American writer. A later opera was *Lord Byron* (1968), which combined and unified the various styles in which Thomson composed. His instrumental music includes two symphonies, several symphonic poems, and concerti for cello and flute (composed 1950 and 1954, respectively).

Thomson composed songs, choral works, chamber music, piano pieces, and film music, including the scores for Pare Lorentz' pioneering documentaries *The River* (1936) and *The Plow that Broke the Plains* (1937) and for Robert Flaherty's *Louisiana Story* (the film score of which won a Pulitzer Prize for music in 1949). He was music critic for the New York *Herald Tribune* (1940–54) and published several collections of penetrating, perceptive critical articles. His autobiography, *Virgil Thomson,* was published in 1966. Among his other books are *Music Revisited, 1940–54* (1967) and *American Music Since 1910* (1971).

**Thomson atomic model,** earliest theoretical description of the inner structure of atoms, proposed about 1900 by Lord Kelvin and strongly supported by Sir Joseph John Thomson, who had discovered (1897) the electron, a negatively charged part of every atom. Though several alternative models were advanced in the 1900s by Lord Kelvin and others, Thomson held that atoms are uniform spheres of positively charged matter in which electrons are embedded. Popularly known as the plum-pudding model, it had to be abandoned (1911) on both theoretical and experimental grounds in favour of the Rutherford atomic model, in which the electrons describe orbits about a tiny positive nucleus.

**Thomson effect,** the evolution or absorption of heat when electric current passes through a circuit composed of a single material that has a temperature difference along its length. This transfer of heat is superimposed on the common production of heat associated with the electrical resistance to currents in conductors. If a copper wire carrying a steady electric current is subjected to external heating at a short section while the rest remains cooler, heat is absorbed from the copper as the conventional current approaches the hot point, and heat is transferred to the copper just beyond the hot point. This effect was discovered (1854) by the British physicist William Thomson (Lord Kelvin).

**Thomson Multimedia S.A.,** leading French electronics manufacturer that sells popular

consumer electronics brands such as RCA, Technicolor, and Thomson.

The original company was formed in 1966 with the merger of Compagnie Française Thomson-Houston and Hotchkiss-Brandt, becoming known as Thomson-Brandt SA in 1972. Because its management was long dominated by career military officers, Thomson-Brandt relied heavily on defense contracts. In 1972, for example, it invented the video-disk system but overlooked its vast commercial potential, selling it only as a military training tool. At this time it derived more than half its sales from its technology subsidiary, Thomson-CSF, which manufactured telephone systems and switching equipment.

With the ascendance of the Socialist Party in France in 1981, Thomson-Brandt was nationalized in 1982, and the company came under the management of civilian directors sympathetic to the Socialists. It was reorganized in 1983 into a holding company with a group of subsidiaries. In 1987 the firm bought General Electric's consumer-electronics division, including RCA, and sold GE its medical-equipment unit. This led to the formation of Thomson Consumer Electronics in 1988, which became Thomson Multimedia in 1995. Thomson became a publicly traded company in 1999. By the 21st century the firm remained a leading producer of DVD players, video equipment, telephones, and television components. Thomson was an early developer of thin TV screens. Its owners include the French government, DirecTV, Microsoft, NEC, and Alcatel.

**thomsonite,** rare mineral in the zeolite family, similar to natrolite (*q.v.*).

**Thon Buri,** section of Metropolitan Bangkok, Thailand's capital and largest city. Located on the west bank of the Chao Phraya River, Thon Buri was formerly a separate city and *changwat* (province) from Bangkok proper, across the river, to which it was linked by three bridges. Thon Buri city was the national capital from 1767 to 1782. In 1972 it was merged with Phra Nakhon, the former province encompassing Bangkok proper, to form one city-province called Krung Thep Mahanakhon (*q.v.*; Bangkok Metropolitan City). Thon Buri's best-known structure is the temple complex of Wat Arun ("Temple of the Dawn") along the riverfront.

**Thonet, Michael** (b. July 2, 1796, Boppard, Trier [Germany]—d. March 3, 1871, Vienna, Austria), German-Austrian pioneer in the industrialization of furniture manufacture, whose experiments in the production of bent-wood furniture widely influenced both contemporary and modern styles and whose functional and exquisitely designed chairs are still being manufactured.

A humble artisan who set up his own workshop specializing in parquetry (1819), Thonet began in 1830 to experiment with new cabinetmaking techniques. He developed a system of steambent veneers and glued four or five together, from which he made complete chairs that were light and curvilinear. Similar but less free techniques were in use at the time in New York City by the German-born furniture maker John Henry Belter.

Thonet's inventiveness attracted the attention of Richard Metternich, who in 1842 invited Thonet to settle in Vienna; for the next five years he worked on the Neorococo interiors of the Liechtenstein Palace. Some of his work there included bent, solid wood, formed by methods familiar to wheelwrights; these pieces were subcontracted through the firm of Carl Leistler and Son, then decorating the palace, with whom Thonet had gone into partnership (dissolved in 1849).

His representative works shown at the Great Exhibition, London (1851), were a huge success. In 1853 he incorporated with his sons, renaming his firm Gebrüder Thonet. By 1856 he had perfected the bending by heat of solid beechwood into curvilinear shapes, and he was ready for mass production, exporting as far as South America. Factories were later established in Hungary and Moravia. Catapulting to success, he opened salons throughout Europe (including Moscow) and in the United States (New York City and Chicago). By 1870 his Viennese firm was producing furniture in hitherto unheard-of quantities—some 400,000 pieces annually. After his death the enterprise was conducted by his sons, who continued to open more factories.

Among Thonet's most popular designs were those of café chairs, rocking chairs, and hat stands. His solid bentwood furniture, never out of production, was again made fashionable in the 1920s by the renowned modern architect and designer Le Corbusier. The utilitarian chairs, mass-produced at low prices, were seen all over the Western world and shown in the paintings of such artists as Toulouse-Lautrec and John Sloan. Interest in Art Nouveau in the 1960s accounted for still another—and continuing—revival of Thonet's bentwood furniture.

**Thonon-les-Bains,** town, Haute-Savoie *département,* Rhône-Alpes region, southeastern France, on a lacustrine terrace overlooking the southern shore of Lake Geneva near the mouth of the Dranse River. It was the capital of the historic district of Chablais. The site was occupied by the Romans and later by the Burgundians, and during the Wars of Religion in the 16th century it was fought over by the Bernese and the Duke of Savoy. In the Place du Château, site of a fortified château built by the dukes of Savoy and destroyed by the French in 1589, is a statue of General Joseph-Marie Dessaix, who organized and led a Savoyard military unit during the Revolution. The church of Saint-Hippolyte, decorated in 17th-century style, has a 12th-century crypt and a 13th-century font embellished with the arms of the House of Savoy. Attached to it is a modern, neo-Gothic basilica dedicated to St. Francis of Sales, who conducted missionary work in the vicinity and was responsible for the renunciation of Protestantism by the inhabitants of Chablais at the end of the 16th century. A museum in the Château de Sonnaz contains exhibits devoted to the prehistoric Lake Dwellers, as well as a hydrological model of Lake Geneva.

Thonon-les-Bains is a popular summer resort, much frequented for its mineral springs. The town is also a centre for trade in cheeses. In addition to metallurgical industries, there are factories producing plumbing fixtures, bicycle parts, electrical apparatus, paper, cigarettes, furniture, and food products. A government fish hatchery produces trout, salmon, and char used to stock Lake Geneva and the rivers and lakes of the *département.* A funicular railway runs from the lakeshore to the town. Pop. (1999) 28,980.

**Thor,** deity common to all the early Germanic peoples, a great warrior represented as a red-bearded, middle-aged man of enormous strength, an implacable foe to the harmful race of giants but benevolent toward mankind. His figure was generally secondary to that of the god Odin, who in some traditions was his father; but in Iceland, and perhaps among all northern peoples except the royal families, he was apparently worshiped more than any other god. There is evidence that a corresponding deity named Thunor, or Thonar, was worshiped in England and continental Europe, but little is known about him.

Thor's name was the Germanic word for thunder, and it was the thunderbolt that was represented by his hammer, the attribute most commonly associated with him. The hammer, Mjollnir, had many marvelous qualities, including that of returning to the thrower like a boomerang; it is frequently carved on runic stones and funerary stelae.

Among Thor's chief enemies was the world serpent Jörmungand (Jörmungandr), symbol of evil. According to tradition, Thor failed to smash the skull of Jörmungand, and the two are destined to kill each other in the Ragnarök (the end of the world of gods and men).

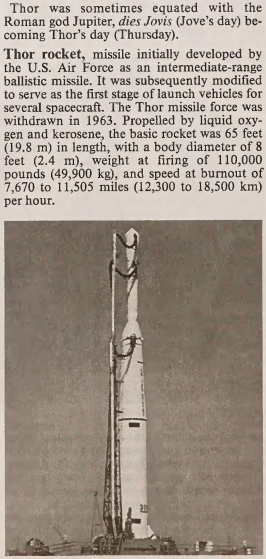


Thor with his hammer, Mjollnir, on his knees, bronze statuette from northern Iceland, *c.* AD 1000; in the National Museum of Iceland, Reykjavík

By courtesy of the National Museum of Iceland, Reykjavík

Thor was sometimes equated with the Roman god Jupiter, *dies Jovis* (Jove's day) becoming Thor's day (Thursday).

**Thor rocket,** missile initially developed by the U.S. Air Force as an intermediate-range ballistic missile. It was subsequently modified to serve as the first stage of launch vehicles for several spacecraft. The Thor missile force was withdrawn in 1963. Propelled by liquid oxygen and kerosene, the basic rocket was 65 feet (19.8 m) in length, with a body diameter of 8 feet (2.4 m), weight at firing of 110,000 pounds (49,900 kg), and speed at burnout of 7,670 to 11,505 miles (12,300 to 18,500 km) per hour.



Thor Delta rocket used to launch the TIROS 4 weather satellite, February 1962

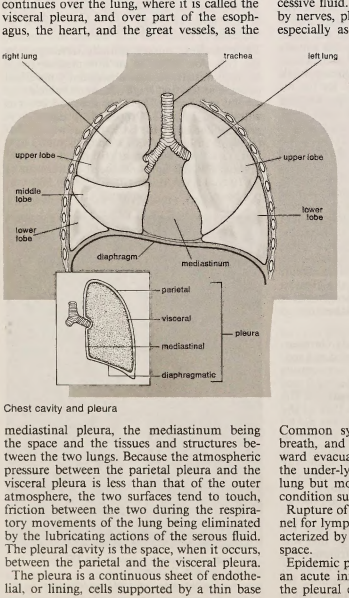
By courtesy of the National Aeronautics and Space Administration

For space launching, three additional small auxiliary motors were strapped to a Thor rocket used as a first stage, resulting in the Thrust-Augmented Thor (TAT), nearly twice as powerful as the original Thor. Total thrust at lift-off was 330,000 pounds. Adding an Agena rocket as a second stage resulted in the two-stage Thor–Agena rocket, used to launch the Air Force's Discoverer space satellites.

Long Tank Thor, an advanced version of the Thor space launch vehicle, first appeared in the summer of 1966. It was capable of placing 20 percent heavier military payloads into space than TAT, had an overall length of 70.5 feet, and a body diameter of 8 feet.

**thoracic cavity,** also called CHEST CAVITY, the second largest hollow space of the body. It is enclosed by the ribs, the vertebral column, and the sternum, or breastbone, and is separated from the abdominal cavity (the body's largest hollow space) by a muscular and membranous partition, the diaphragm. It contains the lungs, the middle and lower airways—the tracheobronchial tree—the heart, the vessels transporting blood between the heart and the lungs, the great arteries bringing blood from the heart out into general circulation, and the major veins into which the blood is collected for transport back to the heart. Within the thoracic cavity, the smaller cavity that contains the heart and the beginnings of the great vessels that enter and leave the heart is called the pericardial sac. The chest also contains the esophagus, the channel for food from the throat to the stomach.

The chest cavity is lined with a serous membrane, so called because it exudes a thin fluid, or serum. This portion of the chest membrane is called the parietal pleura. The membrane continues over the lung, where it is called the visceral pleura, and over part of the esophagus, the heart, and the great vessels, as the




Chest cavity and pleura

mediastinal pleura, the mediastinum being the space and the tissues and structures between the two lungs. Because the atmospheric pressure between the parietal pleura and the visceral pleura is less than that of the outer atmosphere, the two surfaces tend to touch, friction between the two during the respiratory movements of the lung being eliminated by the lubricating actions of the serous fluid. The pleural cavity is the space, when it occurs, between the parietal and the visceral pleura.

The pleura is a continuous sheet of endothelial, or lining, cells supported by a thin base of loose connective tissue. The membrane is well supplied with blood vessels, nerves, and lymph channels. The vessels of the visceral part of the pleura are intimately related with those of the lungs and bronchi; its arteries are branches of the bronchial arteries, and its veins mingle with the pulmonary network of capillaries. Beneath its inner side is a network of tiny lymph channels, or capillaries, that penetrate the lung substance, or parenchyma, and drain to the lymph nodes at the hilus of each lung, the point of entrance and departure for bronchi, blood vessels, and nerves.

Diseases affecting the pleura and pleural cavity, other than primary tumours, are brought by the blood vessels or may spread from contiguous structures. The pleural cavity may be contaminated by the rupture of either the visceral pleura or the parietal pleura.

Accumulation of fluid in the pleural cavity is called hydrothorax. If the fluid is bloody, it is termed hemothorax; and if it contains pus, pyothorax. The accumulation of fluid may or may not be accompanied by air. When air is present, the affix -pneumo- is inserted in each of the names mentioned—*e.g.*, hydropneumothorax, etc.

The penetration of air into the pleural cavity from outside, as from a penetrating wound of the chest, or from within, by rupture of dilated alveoli (air sacs of the lung) or of a cyst, will produce a pneumothorax, converting this cavity into a positive pressure chamber and collapsing the lung, which in turn will lead to decreased oxygenation of the venous blood. The collapse may also have a deleterious effect upon the heart.

Inflammation of the pleura, usually diffuse, affecting one or both sides, is called pleurisy. Two forms are distinguished: (1) simple, dry, or fibrinous pleurisy; and (2) exudative pleurisy, in which the membrane gives off excessive fluid. Since the pleura is well supplied by nerves, pleurisy can be extremely painful, especially as the lung moves in respiration. Common symptoms are pain, shortness of breath, and fever. Treatment is directed toward evacuation of fluid and alleviation of the under-lying condition, often an infected lung but more rarely a diffuse inflammatory condition such as rheumatoid arthritis.

Rupture of the throacic duct, the main channel for lymph, gives rise to chylothorax, characterized by escape of lymph into the pleural space.

Epidemic pleurodynia, or Bornholm disease, an acute infection of the various tissues of the pleural cavity by the group B Coxsackie virus, is characterized by a general feeling of ill health and by pain in the chest muscles and the upper part of the abdomen. This pain is usually increased by respiration and cough, and pain in other muscles is often present. The condition subsides in two to five days but sometimes may take weeks to disappear.

**thoracic squeeze,** also called LUNG SQUEEZE, compression of the lungs and thoracic (chest) cavity that occurs during a breath-holding dive under water. During the descent, an increase in pressure causes air spaces and gas pockets within the body to compress.

The lungs are among the few bodily organs that are influenced by pressure differences.

Because the lung tissue is elastic and interspersed with tubules and sacs of air, it is capable of some enlargement when air is inhaled and some shrinkage when it is exhaled. Too much air causes rupture of lung tissue, while too little air causes compression and collapse of the lung walls.

As external pressure on the lungs is increased in a breath-holding dive (in which the diver's only source of air is that held in his lungs), the air inside the lungs is compressed, and the size of the lungs decreases. If one descends to a depth of 100 feet (about 30 metres), the lung shrinks to about one-fourth its size at the surface. Excessive compression of the lungs in this manner causes tightness and pain in the thoracic cavity. If compression continues, the delicate lung tissue may rupture and allow tissue fluids to enter the lung spaces and tubules. The outer linings of the lungs (pleural sacs) may separate from the chest wall, and the lung may collapse.

The predominant symptom felt by the diver is pain when the pressure becomes too great; this can be relieved by ascending. If the thoracic squeeze has been sufficient to cause lung damage, the diver may have difficulty in breathing, may exhale frothy blood, and may even become unconscious. Artificial respiration may be necessary if the breathing has stopped. Any symptoms of thoracic squeeze call for prompt medical attention.

Animals such as seals and whales that descend to much greater depths than man on a single breath of air have special adaptations to help them. The sperm whale is reported to dive to 3,300 feet (about 1,000 metres), more than 10 times the depth that man can tolerate. These aquatic mammals have been found to have more elastic chest cavities than man; their lungs, even when reduced, do not separate from the chest wall; and their bodies are adapted to use the gases in the bloodstream more conservatively.

**thoracotropic hormone,** also called ECDYSIOTROPIC HORMONE, or PROTHORACOTROPIN, neurohormone secreted in arthropods. After being released by neurosecretory cells of the brain, the thoracotropic hormone is carried by the blood to the prothoracic glands, where it stimulates the release of ecdysone in insects or crustecdysone in crustaceans, steriod hormones that initiate molting (the periodic shedding of the outer skeleton). *See also* juvenile hormone.

**Thórarensen, Bjarni Vigfússon** (b. Dec. 30, 1786, Brautarholt, near Reykjavík, Ice.—d. Aug. 24, 1841, Modhruvellir), first Romantic nationalist poet of Iceland.

The precocious son of a prominent family, at age 20 Thórarensen completed law studies in Copenhagen, where he also attended the lectures of the German philosopher Henrik Steffens, who introduced Romanticism to Denmark. His stay abroad increased his nostalgic devotion to Iceland, which he regarded as the birthplace of heroism, in contrast to cosmopolitan Denmark. He returned to serve as deputy justice in 1811, and as justice of the Supreme Court from 1817 to 1833, when he became governor of North and East Ice-

land. Thórarensen's enthusiasm for Iceland's primitive traditions and his reintroduction of the simple Eddaic metres were instrumental in turning the Icelanders' attention away from Europe and back to their own past. His songs, such as "Thú nafnkunna Landid" ("You Renowned Land"), in which he eulogizes Iceland's poverty and isolation for preserving its people from softness, made him revered as a poet.

*Consult the* INDEX *first*

**Thorarensen, Jakob** (b. May 18, 1886, Húnavatnssýsla, Ice.—d. 1972, Iceland), Icelandic poet whose interest was in the daily heroism of the worker.

Born in the barren country of the north, a kinsman of the Romantic nationalist poet Bjarni Thórarensen, Jakob worked on the farm and in fishing boats. When he was 19, he went to Reykjavík to be a carpenter and worked at the trade for many years before he could take up full-time writing. He had only a simple elementary education, but he read widely and built up a library of books in Icelandic and the Scandinavian languages.

His first collection of verse, *Snaeljós* (1914; "Glare of the Snow"), interpreted the strength and self-sufficiency of the farmers and fishermen of Iceland. His short stories, published from 1929 to 1939, were in the same vein as his poetry and limned sharply drawn characters against a simple background.

**thorax,** in amphibians, reptiles, birds, and mammals, the chest. In humans and other mammals the chest is that part of the body between the neck and abdomen. In humans the bony framework of the thorax consists of the 12 thoracic vertebrae, 12 pairs of ribs, and the sternum (breastbone). The mammalian thorax contains the chief organs of respiration and circulation, namely, the lungs, some air passages, the heart, and the great vessels (*see* thoracic cavity). Below, it is bounded by the diaphragm. The bony framework is encased with muscles, fat, and cutaneous tissues.

In insects the thorax is the middle of the three major divisions of the body. It is composed of three parts, each of which commonly bears a pair of legs; the rearward two parts usually each bear a pair of wings.

**Thorbecke, Johan Rudolf** (b. Jan. 14, 1798, Zwolle, Neth.—d. June 5, 1872, The Hague), leading Dutch political figure of the mid-19th century who, as prime minister (1849–53, 1862–66, 1871–72), consolidated the parliamentary system created by the constitution of 1848.

Thorbecke began his career as a lecturer at German, Belgian, and Dutch universities and published treatises on history and law. His liberal ideas, influenced by the historical-juridical school of the German scholar Friedrich Karl von Savigny, were expressed in his *Aanteekening op de grondwet* (1839; "A Note on the Constitution"). He was the chief author of the constitution of 1848, which transformed The Netherlands; instead of a constitutional monarchy in which an authoritarian king ruled with a parliament of limited powers, the nation was given a constitutional monarchy in which Parliament controlled both legislation and executive powers. Thorbecke himself became prime minister in 1849 as head of the Liberal Party. He soon strengthened the constitution by sponsoring measures extending the franchise and providing for the direct election of provincial and municipal governments.

Thorbecke, especially in his first and second ministries, promoted free trade through navigation acts and abolition of excise duties and sponsored the construction of new canals and waterways. In the growing *schoolstrijd* ("school conflict") he favoured "neutral" (nondenominational) schools, opposing the conservative Liberals and Roman Catholics, who wanted state-supported parochial schools.

Thorbecke abolished slavery in the Dutch East Indian colonies but maintained a system of exploitation of the native agriculture. He also founded a polytechnic school at Delft and a new type of secondary school for the middle classes. Throughout his political career, he was opposed by King William III. After Thorbecke's death in 1872, the split between the progressive and conservative factions of the Liberal Party deepened, enabling the religious parties eventually to take power.

**Thoreau, Henry David** (b. July 12, 1817, Concord, Mass., U.S.—d. May 6, 1862, Concord), American essayist, poet, and practical philosopher, renowned for having lived the doctrines of Transcendentalism as recorded in his masterwork, *Walden* (1854), and for having been a vigorous advocate of civil liberties, as evidenced in the essay "Civil Disobedience" (1849).



Thoreau, portrait by Samuel Worcester Rowse, 1854; in the Concord Free Public Library, Massachusetts

By courtesy of the Corporation of the Free Public Library, Concord, Mass.

*Early life.* Thoreau was born in 1817 in Concord, Mass. Though his family moved the next year, they returned in 1823, not to move again. Even when he grew ambivalent about the village after reaching manhood, it remained his world, for he never grew ambivalent about its lovely setting of woodlands, streams, and meadows. Little distinguished his family. He was the third child of a feckless small businessman named John Thoreau and his bustling, talkative wife, Cynthia Dunbar Thoreau. His parents sent him in 1828 to Concord Academy. There he impressed his teachers and so was permitted to prepare for college. Upon graduating from the academy, he entered Harvard in 1833. At Harvard he was a good student, but he was indifferent to the rank system and preferred to use the school library for his own purposes. Graduating in the middle ranks of the class of 1837, he searched for a teaching job and secured one in Concord at his old grammar school. But he was no disciplinarian, and he resigned after two shaky weeks, after which he worked for his father in the family pencil-making business. In June 1838 he started a small school with the help of his brother John. Despite its progressive nature, it lasted for three years, until John fell ill.

A canoe trip that he and John took along the Concord and Merrimack rivers in 1839 confirmed him in the opinion that he ought to be not a schoolmaster but a poet of nature. As the 1840s opened, he took up the profession of poet. He struggled to stay in it and succeeded throughout the decade, only to falter in the 1850s.

*Friendship with Emerson.* Sheer chance made his entrance to writing easier, for he came under the benign influence of the essayist and poet Ralph Waldo Emerson, who had settled in Concord during Thoreau's sophomore year at Harvard. By the autumn of 1837, they were becoming friends. Emerson sensed in Thoreau a true disciple—that is, one with so much Emersonian self-reliance that he would still be his own man. Thoreau saw in Emerson a guide, a father, and a friend.

With his magnetism Emerson attracted others to Concord. Out of their heady speculations and affirmatives came New England Transcendentalism. In retrospect it was one of the most significant literary movements of 19th-century America, with at least two authors of world stature, Thoreau and Emerson, to its credit. Essentially it combined romanticism with reform. It celebrated the individual rather than the masses, emotion rather than reason, nature rather than man. It conceded that there were two ways of knowing, through the senses and through intuition, but asserted that intuition transcended tuition. Similarly, it conceded that matter and spirit both existed. It asserted, however, that the reality of spirit transcended the reality of matter. It strove for reform yet insisted that reform begin with the individual, not the group or organization.

*Literary career.* In Emerson's company Thoreau's hope of becoming a poet looked not only proper but feasible. Late in 1837, at Emerson's suggestion, he began keeping a journal that covered thousands of pages before he scrawled the final entry two months before his death. He soon polished some of his old college essays and composed new and better ones as well. He wrote some poems—a good many, in fact—for several years. Captained by Emerson, the Transcendentalists started a magazine, *The Dial;* the inaugural issue, dated July 1840, carried Thoreau's poem "Sympathy" and his scrap of essay on the Roman poet Aulus Persius Flaccus.

*The Dial* published more of Thoreau's poems and then, in July 1842, the first of his outdoor essays, "Natural History of Massachusetts." Though disguised as a book review, it showed that a nature writer of distinction was in the making. Then followed more lyrics, and fine ones, such as "To the Maiden in the East." There followed another nature essay, remarkably felicitous, "A Winter Walk." *The Dial* died with the issue of April 1844. Before it expired, however, it let Thoreau publish a richer variety of writing than any other magazine ever would.

In 1840 he fell in love with and proposed marriage to an attractive visitor to Concord named Ellen Sewall. She accepted his proposal but then immediately broke off the engagement at the insistence of her parents. Thoreau remained a bachelor for life. During two periods, 1841–43 and 1847–48, he stayed mostly at the Emersons' house.

Yet in spite of Emerson's hospitality and friendship, Thoreau grew restless; his condition was accentuated by grief over the death in January 1842 of his brother John, who died of lockjaw after cutting his finger. In 1842 he stayed on Staten Island as tutor in the household of Emerson's brother, William, while trying to cultivate the New York literary market. His literary activities went indifferently, however, and the effort to conquer New York failed. Confirmed in his distaste for city life and disappointed by his failure, he returned home to Concord in late 1843.

*Move to Walden Pond.* Back he went to making pencils and grinding graphite. By early

1845 he felt more restless than ever, until he decided to take up an idea of a Harvard classmate who had once built a waterside hut in which one could loaf or read. In the spring he picked a spot by Walden Pond, a small glacial lake located 2 miles (3 km) south of Concord on land Emerson owned.

Early in the spring of 1845, Thoreau, then 27 years old, began to chop down tall pines with which to build the foundations of his home on the shores of Walden Pond. From the outset the move gave him profound satisfaction. Once settled, he restricted his diet for the most part to what fruit and vegetables he found growing wild and the beans he planted and hoed. When not busy weeding his bean rows and trying to protect them from hungry woodchucks, or occupied with fishing, swimming, or rowing, he spent long hours observing and recording the local flora and fauna, reading, and writing *A Week on the Concord and Merrimack Rivers* (1849) and making entries in his journals, which later he would polish and include in *Walden.* Much time, too, was spent in meditation.

Out of such activity and thought came *Walden,* a series of 18 essays describing his experiment in basic living and his effort to set his time free for leisure. Several of the essays provide Thoreau's original perspective on the meaning of work and leisure and describe his experiment in living as simply and self-sufficiently as possible, while in others Thoreau describes the various realities of life at Walden Pond: his intimacy with the small animals he came in contact with; the sounds, smells, and look of woods and water at various seasons; the music of wind in telegraph wires—in short, the felicities of learning how to fulfill his desire to live as simply and self-sufficiently as possible. The physical act of living day by day at Walden Pond is what gives the book authority, while Thoreau's command of a clear, straightforward, but elegant style helped raise it to the level of a literary classic.

Thoreau stayed for two years at Walden Pond (1845–47). In the summer of 1847 Emerson invited him to stay with his wife and children again, while Emerson himself went to Europe. Thoreau accepted. In September 1847 he left his cabin forever.

Midway in his Walden sojourn Thoreau had spent a night in jail. On an evening in July 1846 he was accosted by Sam Staples, the constable and tax gatherer. Sam asked him amiably to pay his poll tax, which he had omitted paying for several years. He declined and Sam locked him up. The next morning a still-unidentified lady, perhaps his aunt, Maria, paid the tax. Thoreau reluctantly emerged, did an errand, and then went huckleberrying. A single night, he decided, was enough to make his point. His point was that he could not support a government that endorsed slavery and waged an imperialist war against Mexico. His defense of the private, individual conscience against the expediency of the majority found expression in his most famous essay, "Civil Disobedience," which was first published in May 1849 under the title "Resistance to Civil Government." The essay received little attention until the 20th century, when it found an eager audience. To many, its message still sounds timely: there is a higher law than the civil one, and the higher law must be followed even if a penalty ensues. So does its consequence: "Under a government which imprisons any unjustly, the true place for a just man is also a prison."

*Later life and works.* When Thoreau left Walden, he passed the peak of his career, and his life lost much of its illumination. Slowly his Transcendentalism drained away as he turned surveyor in order to support himself. He collected botanical specimens for himself and reptilian ones for Harvard, jotting down their descriptions in his journal. He established himself in his neighbourhood as a sound man with rod and transit, and he spent more of his time in the family business; after his father's death he took it over entirely. Thoreau made excursions to the Maine woods, to Cape Cod, and to Canada, using his experiences on the trips as raw material for three series of magazine articles: "Ktaadn [sic] and the Maine Woods," in *The Union Magazine* in 1848; "Excursion to Canada," in *Putnam's Monthly* in 1853; and "Cape Cod," in *Putnam's* in 1855. These works present Thoreau's zest for outdoor adventure and his appreciation of the natural environment that had for so long sustained his own spirit.

As Thoreau became less of a Transcendentalist he became more of an activist—above all, a dedicated Abolitionist. As much as anyone in Concord, he helped to speed fleeing slaves north on the so-called Underground Railroad. He lectured and wrote against slavery, with "Slavery in Massachusetts," a lecture delivered in 1854, as his hardest indictment. In the Abolitionist John Brown he found a father figure beside whom Emerson paled; the fiery old fanatic became his ideal. By now Thoreau was in poor health, and when Brown's raid on Harpers Ferry failed and he was hanged, Thoreau suffered a psychic shock that probably hastened his own death. He died, apparently of tuberculosis, in 1862.

*Assessment.* To all appearances, Thoreau lived a life of bleak failure. His neighbours viewed him with familiarity verging on contempt. He had to pay for the printing of *A Week on the Concord and Merrimack Rivers;* when it sold a mere 220 copies, the publishers dumped the remaining 700 on his doorstep. *Walden* (the second and last of his books published during his lifetime) fared less badly but still took five years to sell 2,000 copies. And yet Thoreau is now regarded as both a classic American writer and a cultural hero of his country. The present opinion of his greatness stems from the power of his principal ideas and the lucid, provocative writing with which he expressed them.

Thoreau's two famous symbolic actions, his two years in the cabin at Walden Pond and his night in jail for civil disobedience, represent his personal enactment of the doctrines of New England Transcendentalism as expressed by his friend and associate Emerson, among others. In his writings Thoreau was concerned primarily with the possibilities for human culture provided by the American natural environment. He adapted ideas garnered from the then-current Romantic literatures in order to extend American libertarianism and individualism beyond the political and religious spheres to those of social and personal life. "The life which men praise and regard as successful is but one kind. Why," Thoreau asked in *Walden,* where his example was the answer, "should we exaggerate any one kind at the expense of the others?" In a commercial, conservative, expedient society that was rapidly becoming urban and industrial, he upheld the right to self-culture, to an individual life shaped by inner principle. He demanded for all men the freedom to follow unique lifestyles, to make poems of their lives and living itself an art. In a restless, expanding society dedicated to practical action, he demonstrated the uses and values of leisure, contemplation, and a harmonious appreciation of and coexistence with nature. Thoreau established the tradition of nature writing later developed by the Americans John Burroughs and John Muir, and his pioneer study of the human uses of nature profoundly influenced such conservationists and regional planners as Benton MacKaye and Lewis Mumford. More important, his life, so fully expressed in his writing, has had a pervasive influence because it was an example of moral heroism and an example of the continuing search for a spiritual dimension in American life.

MAJOR WORKS. The most significant and enduring works by Thoreau are listed here in order of original publication; when he made substantial revisions, especially in the essays, the volumes in which the revised versions first appeared are likewise noted:

"Ktaadn and the Maine Woods" (1848; revised and expanded in *The Maine Woods,* 1864); *A Week on the Concord and Merrimack Rivers* (1849); "Resistance to Civil Government" (1849; republished as "Civil Disobedience" in *A Yankee in Canada,* 1866); *Walden* (1854); "The Last Days of John Brown" (1860; republished in *A Yankee in Canada*); "Walking" (1862; republished in *Excursions,* 1863); "Life Without Principle" (1863; republished in *A Yankee in Canada*); and *Faith in a Seed: The Dispersion of Seeds and Other Late Natural History Writings* (posthumously, 1993).

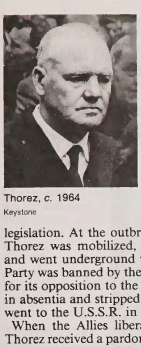
*The Writings of Henry Thoreau,* 20 vol. (1906, reprinted 1968), is the standard "Walden" edition of Thoreau's books, essays, and journal. It is being replaced by the Princeton Edition of *The Writings of Henry D. Thoreau* (starting in 1971 with the publication of its version of *Walden*) which is producing books of high textual and editorial quality. *Collected Poems,* ed. by Carl Bode, enlarged ed. (1964, reissued 1970), brings together the many versions of the poetry he wrote, particularly in his younger days.

BIBLIOGRAPHY. The definitive life is Walter Harding, *The Days of Henry Thoreau,* 2nd ed. (1982, reissued 1992). Its still-useful predecessor is Henry Seidel Canby, *Thoreau* (1939, reprinted 1965). *The Correspondence of Henry David Thoreau,* ed. by Walter Harding and Carl Bode (1958, reprinted 1974), contains not only all the letters by Thoreau available when the edition was compiled but the letters to him as well. Richard Lebeaux, *Young Man Thoreau* (1977), and *Thoreau's Seasons* (1984), are applications of psychoanalytic-sociological theory to Thoreau's life and family relationships. Other biographical studies include William Howarth, *The Book of Concord: Thoreau's Life as a Writer* (1982); Walter Harding and Michael Meyer, *The New Thoreau Handbook* (1980); Robert D. Richardson, Jr., *Henry Thoreau; A Life of the Mind* (1986); and Bob Pepperman Taylor, *America's Bachelor Uncle: Thoreau and the American Polity* (1996). Good general critical studies are Sherman Paul, *The Shores of America: Thoreau's Inward Exploration* (1958, reissued 1972); Wendell Glick (compiler), *The Recognition of Henry David Thoreau: Selected Criticism Since 1848* (1969); William J. Wolf, *Thoreau: Mystic, Prophet, Ecologist* (1974); and Richard J. Schneider, *Henry David Thoreau* (1987). The prime studies of *Walden* alone are Charles R. Anderson, *The Magic Circle of Walden* (1968); Stanley Cavell, *The Senses of Walden,* expanded ed. (1981, reissued 1992); and Joel Myerson (ed.), *Critical Essays on Henry David Thoreau's Walden* (1988).

*To make the best use of the Britannica, consult the* INDEX *first*

**Thorez, Maurice** (b. April 28, 1900, Noyelles-Godault, France—d. July 11, 1964, at sea en route to Yalta), French politician and leader of the French Communist Party.

Thorez became a coal miner at age 12 and joined the Socialist Party in 1919. He joined the Communist Party about 1920 and was imprisoned several times for agitation. In 1923 he became party secretary for the Pas-de-Calais and rose rapidly until he became in 1930 secretary-general of the party, a position he held until his death. In 1932 he was elected to the Chamber of Deputies and was reelected in 1936. The success of the Nazis in Germany stimulated Thorez to action against the right wing in France. In 1934, after being called to Moscow for talks with the Soviet leadership, he suddenly switched his party to participation in the Popular Front—an alliance between Communists, Socialists, and Radical Socialists. The front, because of strong electoral discipline, managed to win the elections of 1936 and to enact long-neglected social



Thorez, *c.* 1964
Keystone

legislation. At the outbreak of World War II, Thorez was mobilized, but he left the army and went underground when the Communist Party was banned by the Daladier government for its opposition to the war. Thorez was tried in absentia and stripped of his nationality. He went to the U.S.S.R. in 1943.

When the Allies liberated France in 1944, Thorez received a pardon from the new French government headed by General Charles de Gaulle. That November he returned to France from the Soviet Union, and in 1945 his citizenship was restored. He was again elected to the Chamber of Deputies and was reelected throughout the Fourth Republic (1946–58). He was a minister of state under de Gaulle in 1945 and a deputy premier in 1946 and 1947 but thereafter was in no French cabinet.

In 1958 the Communist Party failed to prevent de Gaulle's coming to power. In the ensuing elections the party's strength in the Chamber dropped to only 10 seats, but Thorez himself retained his seat. He published *Fils du peuple* (1937; *Son of the People*) and *Une politique de grandeur française* (1945; "Politics of French Greatness"). Thorez was basically a Stalinist, and after Khrushchev's denunciation of Stalin in 1956 he extolled the dead leader.

**Thorfinn Karlsefni** (b. 980, Iceland—d. after 1007), Icelandic-born Scandinavian leader of an early colonizing expedition to North America. His travels were recounted in the *Saga of Erik* and the *Tale of the Greenlanders.*

Thorfinn must have been given his nickname, Karlsefni, at an early age, since it means "promising boy." His grandfather in about 900 had led many Norwegians to colonize Iceland, and by 986 their descendants felt so hard-pressed for stock-farming land there that they followed the lead of Erik the Red and migrated to Greenland. Thorfinn, who was a successful trader and sea captain, reached what was known as the eastern settlement of Greenland with a group of colonists in 1003. There he married Gudrid, who was the widow of one of Erik the Red's sons, Thorstein.

Thorfinn and Gudrid were persuaded by Erik to lead an expedition to Vinland (believed to be in the area of present-day Labrador, Nova Scotia, or New England), which had been discovered three years earlier by another of Erik's sons, Leif Eriksson. In about 1004 the couple set out with about 130 people in three ships and sailed westward, possibly making their first landfall on the North American continent at Baffin Island. They followed the coastline southward until they reached a heavily wooded region, perhaps some part of the Gulf of St. Lawrence shore, and settled there to engage in haymaking, hunting, and fishing. Thorfinn's and Gudrid's son, Snorri (b. *c.* 1005), was the first European born on the North American mainland.

That first winter the Scandinavian colonists met no people, but the next summer they were visited by friendly natives who were probably Eskimo. The next summer they were visited by more numerous and less friendly natives, and fighting ensued, which the Scandanavians won but at the cost of some lives. Three years after the landing, Thorfinn and the rest of the colonists abandoned Vinland and returned to Greenland. Later they returned to Iceland.

**Thorgilsson, Ari** (Icelandic historian): *see* Ari Thorgilsson the Learned.

**thorianite,** thorium dioxide mineral ($ThO_2$) that is very heavy, hard, and coloured dark gray to brownish black or bluish black. Originally found as waterworn grains and crystals in the gem gravels of Ceylon (now Sri Lanka), thorianite also occurs sparsely in the black

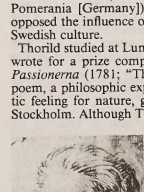


Thorianite from Andramondambo, Madagascar
By courtesy of the Field Museum of Natural History, Chicago; photograph, John H. Gerard—EB Inc.

river and beach sands of Alaska, Madagascar, and Siberia. The refractory nature and scarcity of thorianite have restricted its commercial use as a source of thorium. It forms a solid-solution series with uraninite in which uranium atoms replace thorium atoms in the crystal structure. Rare earths and radiogenic lead and helium are often present. Varieties containing much uranium have been found in pegmatites in Quebec and Ontario and in serpentine at Easton, Pa. For detailed physical properties, *see* oxide mineral (table).

**Thorild, Thomas,** original name THOMAS THORÉN (b. April 18, 1759, Svarteborg, Swed.—d. Oct. 1, 1808, Greifswald, Swedish Pomerania [Germany]), poet and critic who opposed the influence of French classicism on Swedish culture.

Thorild studied at Lund and was a tutor who wrote for a prize competition in Stockholm. *Passionerna* (1781; "The Passions"), his first poem, a philosophic expression of a pantheistic feeling for nature, greatly startled literary Stockholm. Although Thorild became increas-



Thorild, pen-and-ink drawing by A.U. Berndes, *c.* 1780; in a private collection
By courtesy of the Svenska Portrattarkivet, Stockholm

ingly involved in political writing during his later years, he also wrote some of the best Swedish poetry of the time, including the *Götamannasånger* ("Gothic Men's Songs"), written in aphoristic formulations reminiscent of the ancient Swedish legal style. He pleaded for positive literary evaluation in his *En critik öfver critiker* (1791–92; "A Critique of Critics"). Thorild was banished for political libel after the assassination of Gustav III. He went to Greifswald in 1795 and was appointed professor and librarian there.

**thorite,** thorium silicate, $ThSiO_4$, one of the most important thorium minerals. Almost always altered by hydration, it occurs in syenite near Brevik, Nor., and in the gem gravels of Sri Lanka. Thorite is mined commercially in the United States at Cripple Creek, Colo., and at Hall Mountain, Idaho. Although the mineral is usually light brown, an orange-yellow gem variety known as orangite occurs in Madagascar. For detailed physical properties, *see* silicate mineral (table).

**thorium** (Th), radioactive chemical element of the actinide series, in Group IIIb of the periodic table, atomic number 90; it is a useful nuclear-reactor fuel. Discovered (1828) by Jöns Jacob Berzelius, thorium is silvery white but turns gray or black on exposure to air. It is about half as abundant as lead and is three times more abundant than uranium in the Earth's crust. Thorium is commercially recovered from the mineral monazite and occurs also in thorite and thorianite. Thorium has been produced in commercial quantities by reduction of the fluoride ($ThF_4$) and dioxide ($ThO_2$) and by electrolysis of the chloride ($ThCl_4$).

The metal may be extruded, rolled, forged, swaged, and spun, but drawing is difficult because of thorium's low tensile strength. This and other physical properties such as melting and boiling points are greatly affected by small amounts of certain impurities, such as carbon and thorium dioxide. Thorium is added to magnesium and magnesium alloys to improve their high-temperature strength. It is used in commercial photoelectric cells for measuring ultraviolet light of wavelengths ranging from 2,000 to 3,750 angstroms.

The radioactivity of thorium was found independently (1898) by Gerhard Carl Schmidt and by Marie Curie. Natural thorium is a mixture of radioactive isotopes, predominantly the very long-lived thorium-232 ($1.41 \times 10^{10}$ year half-life), the parent of the thorium radioactive-decay series. Other isotopes occur naturally in the uranium and actinium decay series, and thorium is present in all uranium ores. Thorium-232 is useful in breeder reactors because on capturing slow-moving neutrons it decays into fissionable uranium-233. Synthetic isotopes have been prepared; thorium-229 (7,340-year half-life), formed in the decay chain originating in the synthetic actinide element neptunium, serves as a tracer for ordinary thorium (thorium-232).

Thorium exhibits an oxidation state of +4 in most of its compounds and forms many complex ions. The dioxide ($ThO_2$), a very refractory substance, has many industrial applications; thorium nitrate is a common commercial salt.

| | |
|---|---|
| atomic number | 90 |
| atomic weight | 232.038 |
| melting point | *c.* 1,700° C (3,100° F) |
| boiling point | *c.* 4,000° C (7,200° F) |
| specific gravity | *c.* 11.66 (17° C) |
| valence | 4 |
| electronic config. | 2-8-18-32-18-10-2 or (Rn)$6d^27s^2$ |

**thorium series,** set of unstable heavy nuclei comprising one of the four radioactive series (*q.v.*).

**Thorlákssun, Gudbrandur** (b. 1541, Stadharbakki, Ice.—d. 1627, Hólar), Reformation scholar and Lutheran bishop who was responsible for the successful implantation of Lutheranism in Iceland.

In 1570 when Thorlákssun became bishop of Hólar, a post he was to hold for 56 years, Protestantism, imposed on Iceland by Danish rulers, had only nominal acceptance. Versed

in theology, natural science, languages, and mathematics, he began an energetic campaign to make the conversion actual by education and publication of religious works. In all he published 84 works, the most important of which was the *Gudbrandsbiblia*, a complete Bible in Icelandic, using Oddur Gottskálksson's New Testament. Much of the Old Testament he translated himself, and the work, published in 1584, adorned with woodcuts and ornamented initials, was a monument of literature and craftsmanship. Copies commanded the price of two or three cows.

In 1589 Thorláksson published a new *Sálmabók* (hymnbook) intended expressly to compete with the ballads about trolls and heroes, and the songs of love and invective so popular in Icelandic tradition. He made a second attempt with the *Vísnabók* (verse book, 1612), an anthology including Catholic poems such as *Lilja*—purged of elements incompatible with Lutheran orthodoxy—and new Reformation verses. He introduced the Lutheran catechism in the schools and the first Lutheran prayer and service books. He also determined the geographic position of Iceland and made the best map of Iceland then known.

**Thorn** (Poland): *see* Toruń.

**thorn forest**, dense, scrublike vegetation characteristic of dry subtropical and warm temperate areas with a seasonal rainfall averaging 250 to 500 millimetres (about 10 to 20 inches). This vegetation covers a large part of southwestern North America and southwestern Africa and smaller areas in Africa, South America, and Australia. In South America, thorn forest is sometimes called *caatinga*. Thorn forest grades into savanna woodland as the rainfall increases and into desert as the climate becomes drier.

A thorn forest consists primarily of small, thorny trees that shed their leaves seasonally. Cacti, thick-stemmed plants, thorny brush, and arid-adapted grasses make up the ground layer. Many annual plants grow, flower, and die during the brief rainy season.

**Thorn-Prikker, Jan,** byname of JOHAN THORN-PRIKKER (b. June 5, 1868, The Hague—d. March 5, 1932, Cologne), Dutch painter, designer, and decorator in the Art Nouveau style. He was an important figure in modern religious art, best known for his use of symbolism in stained-glass windows.

Thorn-Prikker's student work was impressionistic, and he also assimilated the contemporary influences of various Symbolist groups. In 1891–93 he exhibited with Les Vingt (The Twenty), a group of Belgian painters who emphasized the spiritual aspects of Symbolist art. With Jan Toorop and Henry van de Velde, prominent fellow members of the group, he brought to Symbolist concerns the elegant linear stylization of Art Nouveau.

Thorn-Prikker's work is generally more abstract and tranquil than that of his associates. A notable painting is "The Bride" (1893). Particularly in his stained glass designs, he pioneered the expression of Christian themes in a modern idiom. From 1904 he taught and worked in Germany, designing mosaic murals, textiles, and stained glass.

**thornapple** (tree): *see* hawthorn.

**Thorndike, Edward L(ee)** (b. Aug. 31, 1874, Williamsburg, Mass., U.S.—d. Aug. 9, 1949, Montrose, N.Y.), U.S. psychologist whose work on animal behaviour and the learning process led to the theory of connectionism, which states that behavioral responses to specific stimuli are established through a process of trial and error that affects neural connections between the stimuli and the most satisfactory responses.

Thorndike graduated from Wesleyan University in 1895. He began his studies of animal behaviour as a graduate student under the psychologist William James at Harvard University (1895–97) and continued them under James McKeen Cattell at Columbia University, where he received his Ph.D. (1898) and where he spent most of his career. He first proposed his two behavioral laws, the law of effect and the law of exercise, in his doctoral dissertation, written in 1898–1901 and published in 1911 as *Animal Intelligence*. He regarded adaptive changes in animal behaviour as analogous to human learning and suggested that behavioral associations (connections) could be predicted by application of the two laws. The law of effect stated that those behavioral responses that were most closely followed by a satisfactory result were most likely to become established patterns and to occur again in response to the same stimulus. The law of exercise stated that behaviour is more strongly established when the connection of stimulus and response has been more frequently made. Over the years, Thorndike continued to conduct experiments on animal behaviour and in 1932 determined that the second of his laws was not entirely valid in all cases. He also modified the law of effect to state that rewards for appropriate behaviour always substantially strengthened associations, while punishments for inappropriate responses only slightly weakened the association between the stimulus and the wrong response. Thorndike's early work is regarded as the first laboratory study of animal learning. His emphasis on measurement and the quantitave analysis of data, as opposed to merely descriptive accounts of experiments, has been enormously influential in modern psychology, particularly affecting behaviourist experimentation.

While still a graduate student at Columbia, Thorndike began an association with Robert S. Woodworth, with whom he studied transference of learning. In a paper published in 1901, Thorndike and Woodworth found that learning in one area does not facilitate learning in other areas; where specific training in one task seemed to cause improvement in learning another, the improvement could be attributed to common elements in the two exercises, not to overall enhancement of the subject's learning abilities. This finding supported proponents of school curricula that emphasized practical, relevant subject matter and activities.

As professor of educational psychology at Columbia from 1904 to 1940, Thorndike influenced several generations of teachers and, through his encouragement of research on individual differences, learning, and mental measurement, contributed significantly to the development of a more scientifically grounded and efficient type of schooling. An ardent advocate of the transformation of qualitative data into numerical values, he advanced the use of statistics in social science research, chiefly through his handbook, *An Introduction to the Theory of Mental and Social Measurements* (1904). Other important works in the early part of his career were *The Principles of Teaching Based on Psychology* (1906), *Education: a First Book* (1912), and *Educational Psychology*, 3 vol. (1913–14; 2nd ed., 1921). These books were responsible for many of the earliest applications of psychology to classroom instruction in arithmetic, algebra, reading, writing, and language and also did much to expose the deficiencies and inequalities in the U.S. educational system of the time.

When his investigations in the 1920s of adult learning revealed that continued learning ability was determined by inborn personal factors rather than age, adult education was revitalized. Throughout his career, Thorndike published a prodigious number of books and articles; among later works of note were *The Psychology of Wants, Interests, and Attitudes* (1935) and *Human Nature and the Social Order* (1940).

**Thorndike, Dame (Agnes) Sybil** (b. Oct. 24, 1882, Gainsborough, Lincolnshire, Eng.—d. June 9, 1976, London), English actress of remarkable versatility.

The daughter of a canon of Rochester Cathedral, she performed with Annie Horniman's company in Manchester (1908–09 and 1911–13), and then joined the Old Vic Company



Dame Sybil Thorndike, 1934
BBC Hulton Picture Library

in London (1914–18), where she helped to establish not only the theatre's name as a home of Shakespeare but also her own as the most promising English tragic actress of the day. She went on to prove her versatility in a great variety of parts, modern as well as classical, comic as well as tragic (including some male parts, among them the Fool in *King Lear*). In 1924 she created the title role in Shaw's *Saint Joan*. She was created a Dame of the British Empire in 1931.

Her superb health and vigour did not desert her in middle age. In her 60s she broke new ground, giving a whole gallery of portraits of elderly women having in common nothing but the meticulous and humorous observation which the actress had brought to their creation. In 1962 she undertook an arduous tour of Australia, and made numerous stage appearances throughout the decade, including taxing roles in *The Viaduct* (1966) and *There Was An Old Woman* (1969). She opened the Thorndike Theatre outside London in 1969.

**Thorndike–Barnhart dictionaries,** notable series of school dictionaries widely used in the United States. Their content is based on the theories of Edward Lee Thorndike, an educational psychologist, and Clarence Lewis Barnhart, lexicographer and editor, both pioneers in producing for school-aged readers dictionaries that were more than simplified versions of adult references.

Decisions regarding entries and their definitions were based on data compiled by Thorndike, who applied his educational-psychology expertise to lexicography. These data, which dealt with the frequency of word use in certain kinds of literature at various grade levels, were combined with Thorndike's first-time use for young readers of illustrative examples in definitions. This approach ultimately led to the separate publication of several dictionaries for particular grade-level groups.

After Thorndike's death (1949), Barnhart continued the preparation and editorship of the series. Although each of the dictionaries has undergone continuous revision, the original lexicographical principles are still intact.

**Thornhill, Sir James** (b. 1675, Melcombe Regis, Dorset, Eng.—d. May 13, 1734, Thornhill, Dorset), English painter, the first to excel in historical painting, whose style was in the Italian Baroque tradition.

Thornhill became the history painter and sergeant painter to George I and George II, master of the Painters' Company in 1720, fellow of the Royal Society in 1723, and member of Parliament from 1722 to 1734 and was

knighted in 1720. He was one of the original directors of Kneller's Academy of Painting, and when this closed, and he had failed to establish a "royal academy," he opened his own drawing school, which also proved unsuccessful.

The eight scenes in the dome of St. Paul's Cathedral (1715–19) and the allegories in the Painted Hall, Greenwich Hospital (1708–27), are his two most considerable works. His paintings were largely executed on the ceilings and stairs of such country houses and palaces as Hampton Court, Blenheim, and Chatsworth. Among Thornhill's few canvases are the altarpiece for St. Mary's Parish Church, Weymouth, and a group portrait of the members of the House of Commons in which he was assisted by William Hogarth, his son-in-law. Thornhill also did portraits (his sitters including Isaac Newton and Richard Steele), book illustrations, theatre scenery, and the rose window of the north transept of Westminster Abbey (1721).

**Thorns, Crown of,** the wreath of thorns was placed on the head of Jesus Christ at his crucifixion, whereby the Roman soldiers mocked his title of "King of the Jews." A relic purported to be the Crown of Thorns was transferred from Jerusalem to Constantinople by 1063. The French king Louis IX (St. Louis) took the relic to Paris about 1238 and had the Sainte-Chapelle built (1242–48) to house it. The thornless remains are kept in the treasury at Notre-Dame Cathedral in Paris.

**Thornton, Henry** (b. March 10, 1760, London, Eng.—d. Jan. 16, 1815, London), English economist, banker, and philanthropist.

Thornton was the son of a noted merchant and philanthropist. He became a leading member of the Clapham Sect, an austere, evangelical branch of the Church of England, and a close associate of William Wilberforce in his campaign against slavery. In 1782 Thornton was elected to Parliament for Southwark, a seat he held until the end of his life. Thornton was noted for his integrity and antislavery views and felt he could best maintain his independence by refusing to join either the Whigs or Tories. In Parliament he was regarded by his peers as an authority on all matters of finance. His private life was as idealistic as his public one; he gave away most of his income to charity.

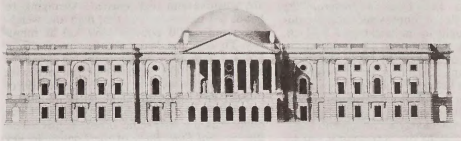
Thornton was an exceptional monetary theorist. His major contributions in this field were his ideas on interest, velocity of circulation, prices, and the effects of banking on currency. In *An Enquiry into the Nature and Effects of the Paper Credit of Great Britain* (1802), he defended the Bank of England against charges that its excessive issue of paper money had been responsible for a general rise in prices. Thornton adopted the antibullionist position, *i.e.,* that banks reflect rather than cause high prices and that it is impossible to overissue a convertible currency. Thus he opposed a contraction of the note issue in response to high prices. However, he gradually became more critical of the Bank of England, and in his Bullion Report of 1810, which inquired into the cause of the high price of gold bullion, he favoured contraction of the issue of paper money.

**Thornton, William** (b. May 20, 1759, Jost Van Dyke, near Tortola, British Virgin Islands—d. March 28, 1828, Washington, D.C.), British-born American architect, inventor, and public official, best known as the creator of the original design for the Capitol at Washington, D.C.

Thornton studied medicine at the University of Edinburgh (1781–84) and received his M.D. from the University of Aberdeen (1784). After travel on the European continent he returned to Tortola and then went to the United States in 1787. In the following year he became a U.S. citizen and settled in Philadelphia. The Library Company of Philadelphia promoted a competition (1789) for its new building that Thornton won without any formal study of architecture.

From 1790 to 1792 he was again at Tortola, where he first heard of the important competition for the Capitol at Washington. He submitted designs that were received months after the competition closed; yet the judges, not satisfied with those previously submitted, selected Thornton's. His revised Georgian design of 1795 was executed as the exterior of the north and south wings adjacent to the central rotunda, though Benjamin H. Latrobe completely redesigned the interiors. From 1794 to 1802 Thornton was a commissioner of the city of Washington. He designed several residences in the city, including the Octagon (1798–1800), which was used in 1814 by President James Madison after the White House was burned and is now headquarters of the American Institute of Architects.

From 1802 to 1828 he served as first superintendent of the Patent Office. He and a fellow inventor, John Fitch, were among the first developers of the paddle-wheel steamboat. Thornton defended in his *Short Account of the Origin of Steamboats,* published in 1814, their experiments done between about 1778 and 1790 against Robert Fulton's later claims of first inventing a steam-powered boat. He also patented eight inventions between 1802 and 1827 for improving such devices as firearms and stills.



East elevation of the United States Capitol building, drawing and design by William Thornton, 1792; in the Library of Congress, Washington, D.C.
By courtesy of the Library of Congress, Washington, D.C.

**Thornton Island** (Kiribati): *see* Caroline Atoll.

**thorny devil** (lizard): *see* moloch.

**Thornycroft, Sir Hamo,** in full SIR WILLIAM HAMO THORNYCROFT (b. March 9, 1850, London, Eng.—d. Dec. 18, 1925, Oxford), English sculptor who executed many public monuments in a lively classical style.

The son of the sculptor Thomas Thornycroft, Hamo studied under his father, at the schools of the Royal Academy, and in Italy, where he was particularly interested in Michelangelo. He established his own reputation as a sculptor in the 1880s, was elected a royal academician in 1888, and was knighted in 1917. Among his works in London are monuments to General Charles George Gordon (1888, formerly Trafalgar Square), Oliver Cromwell (1899, Westminster), Dean John Colet (1902, St. Paul's School, Hammersmith), William Gladstone (1905, Strand), and the architect Richard Norman Shaw (bas-relief, 1914, New Scotland Yard). His brother was Sir John Isaac Thornycroft, a naval engineer.

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**Thornycroft, Sir John Isaac** (b. Feb. 1, 1843, Rome, Papal States [Italy]—d. June 28, 1928, Bembridge, Isle of Wight, Eng.), English naval architect and engineer who made fundamental improvements in the design and machinery of torpedo boats and built the first torpedo boat for the Royal Navy.

Soon after he established his launch-building and engineering works at Chiswick, London, in 1866, Thornycroft received the order for the first torpedo boat of the Royal Navy, HMS *Lightning,* which he completed in 1877. At the same time, he experimented with hull form and propeller design and patented a hull that could skim, rather than cut through, the water. He also designed water-tube boilers for torpedo boats as well as one of the earliest ship stabilizers. During World War I, he designed and built coastal torpedo speedboats ("scooters"), which could skim over minefields. He pioneered the use of oil fuel for the Royal Navy and was knighted in 1902.

**Thoroddsen, Jón (Thortharson)** (b. Oct. 5, 1818/19, Bardastrandarsýsla, Iceland—d. March 8, 1868, Leirá), writer commonly known as the father of the Icelandic novel.

Thoroddsen studied law in Copenhagen, but an unhappy love affair—which is reflected in his novels—led him to seek solace in literature. The novels of Sir Walter Scott caught his imagination and undoubtedly influenced him.

His *Piltur og stúlka* (1850; *Lad and Lass*), finished just before he went back to Iceland to become a district judge, is an unpretentious love story that reveals his gift for concise satirical sketches of people and places. It was the first full-scale Icelandic novel. His second novel, *Madur og kona* (1876; "Man and Woman"), was unfinished when he died. His two works make up an unsophisticated picture of the Icelandic society of his day that has not since been surpassed.

**Thorold,** city, regional municipality of Niagara, southeastern Ontario, Canada. It lies along the Welland Ship Canal, 4 miles (6.5 km) south of St. Catharines. Founded in 1788 and named after a British member of Parliament, Sir John Thorold, the town grew with the development of the canal, beginning in 1829. Thorold is now an industrial and shipping centre, on the edge of the Niagara Escarpment, at the Twin Flight Locks. Its industries include paper, pulp, and lumber milling, quarrying, and the manufacture of abrasives. Inc. town, 1875; city, 1975. Pop. (1991) 17,542.

**thorough bass,** also called CONTINUO, BASSO CONTINUO, or FIGURED BASS, in music, a system of partially improvised accompaniment played on a bass line, usually on a keyboard instrument. The use of the thorough bass was customary during the 17th and 18th centuries, when only the bass line was written out, or "thorough" (archaic spelling of "through"), giving considerable leeway to the keyboard player, usually an organist or harpsichordist, in the realization of the harmonic implications of the bass in relation to the treble part or parts. A low melody instrument, such as a viola da gamba, cello, or bassoon, usually served to reinforce the bass, and the keyboard player received additional guidance in most instances from figures placed above the bass notes, a kind of musical short-

hand indicating the intervallic constitution of the chords in question.

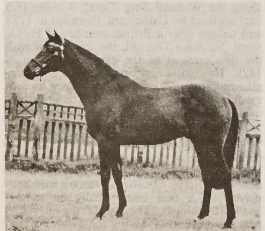
Basso continuo composition was a logical outgrowth of the monodic revolution (*c.* 1600), which declared the supremacy of the treble in opposition to the textural homogeneity of Renaissance polyphony. The harmonic substance of multi-voiced music was now literally contracted into an instrumentalist's two hands; the immediate repercussions for both sacred and secular music prompted Agostino Agazzari as early as 1607 to publish a manual of instructions, *Del sonare sopra il basso.*

According to J.F. Daube's *General-Bass* (1756), the style of improvised accompaniment was brought to its height by J.S. Bach: "He knew how to introduce a point of imitation so ingeniously in either right or left hand and how to bring in so unexpected a countertheme, that the listener would have sworn that it had all been composed in that form with the most careful preparation. . . ." Thorough bass was thus not merely a convenient shorthand; it gave zest to the accompaniment by inviting the performer to draw on his capacity for spontaneous improvisation.

In figured-bass notation the intervals are counted from the bass up. For example, $\frac{5}{3}$ above G indicates a chord built on G containing the intervals of a seventh (G–f) and a third (G–b), that is, G–b–(implied d)–f. The performer can manipulate the spacing of the chord but normally does not play above the solo part. The figures are kept to a minimum, indicating only the most characteristic intervals as well as accidentals (nonimplicit sharps, flats, or naturals). Normally only the main harmonies, and not the passing harmonies, are indicated. Passing notes are added by the performer.

Thorough-bass realization can vary from simple harmonization to extensive explorations of harmony and counterpoint. A "full accompaniment" may require as many notes as the fingers can accommodate, and in such cases the rules forbidding consecutive fifths and the like are waived, except as they apply to the two outside (bottom and top) parts.

**Thoroughbred,** breed of horse developed in England for racing and jumping. The origin of the Thoroughbred may be traced back to records indicating that a stock of Arab and Barb horses was introduced into England as early as the 3rd century. Natural conditions



Thoroughbred
Sally Anne Thompson—EB Inc.

favoured development of the original stock, and selective breeding was encouraged by those interested in racing. Under the reigns of James I and Charles I, 43 mares—the so-called Royal Mares—were imported into England, and a record, the General Stud Book, was begun in which were listed only those horses that may be traced back to the Royal Mares in direct line, or to one of three other horses imported to England: the Byerly Turk (imported in 1689), the Darley Arabian (after 1700), and the Godolphin Barb (about 1730). The English Thoroughbred has since been introduced to most countries, where it is bred for racing or used to improve local breeds. A son of the Darley Arabian, Bulle Rock, was imported to Virginia in 1730. During the following 45 years, 186 Thoroughbreds imported from England became the foundation of Thoroughbred breeding in the United States.

Thoroughbreds have delicate heads, slim bodies, broad chests, and short backs. Their short leg bones allow a long, easy stride. They are sensitive and high-spirited. Averaging 16 hands (64 inches, or 163 cm) high and weighing about 1,000 pounds (450 kg) at maturity, Thoroughbreds are usually bay, chestnut, brown, black, or gray. Outstanding for speed and stamina, they have been combined with and have improved several other breeds of horses. The term thoroughbred is sometimes incorrectly used to mean purebred, but Thoroughbreds are a specific breed, registered in the *General Stud Book* of the English Jockey Club, organized about 1750, or in the studbooks of similar clubs in other countries. *See also* Sporting Record: *Horse racing.*

A horse having only one Thoroughbred parent is called a Grade Thoroughbred in the United States and a half-bred in Great Britain. Grade Thoroughbreds may be used as hunters, polo ponies, stock horses, or riding horses, depending on their training.

**thoroughwort** (plant): *see* boneset.

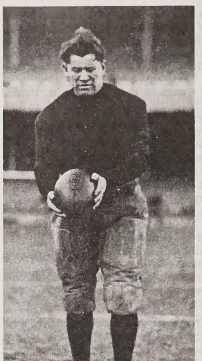
**Thorp, John** (b. 1784, Rehoboth, Mass., U.S.—d. Nov. 15, 1848, Providence, R.I.), American inventor of the ring spinning machine (1828), which by the 1860s had largely replaced Samuel Crompton's spinning mule in the world's textile mills because of its greater productivity and simplicity.

Little is known of Thorp's early life. His first patent, received at the age of 28 for a hand and water loom, demonstrated his ability. His use of a ring and traveler was entirely novel in controlling the thread twist in spinning. Thorp received little recognition during his life for his inventions and was first honoured by the National Association of Cotton Manufacturers in 1928.

**Thorpe, Jim,** byname of JAMES FRANCIS THORPE (b. May 28, 1888, near Prague, Indian Territory [now in Oklahoma, U.S.]—d. March 28, 1953, Lomita, Calif., U.S.), one of the most accomplished all-around athletes in history, who in 1950 was selected by American sports writers and broadcasters as the greatest American athlete and the greatest football player of the first half of the 20th century.

Predominantly of American Indian (Sauk and Fox) descent, Thorpe attended Haskell Indian School, Lawrence, Kan., and Carlisle (Pa.) Indian Industrial School. While playing football for Carlisle under coach Glenn Scobey ("Pop") Warner, he was chosen as halfback on Walter Camp's All-America teams in 1911 and 1912. Also in 1912 Thorpe won the decathlon and the pentathlon by wide margins in the Olympic Games at Stockholm, but in 1913 an investigation by the Amateur Athletic Union showed that he had played semiprofessional baseball in 1909 and 1910, and he was deprived of his gold medals. The medals were restored to his family in 1983.

From 1913 through 1919 Thorpe was an outfielder for the New York, Cincinnati, and Boston baseball teams in the National League. He was more successful as one of the early stars of American professional football from 1919 through 1926. In 1920–21 he served as the first president of the American Professional Football Association (later the National Football League). He also excelled in such



Jim Thorpe demonstrating the drop kick
The Bettmann Archive

diverse sports as basketball, boxing, lacrosse, swimming, and hockey.

In his later years alcoholism and inability to adjust to employment outside sports reduced Thorpe to near poverty. In 1954 the communities of Mauch Chunk and East Mauch Chunk, Pa., merged to form the borough of Jim Thorpe. From 1955 the Jim Thorpe Trophy was awarded annually to the most valuable player in the National Football League. In 1973 the Amateur Athletic Union restored his amateur status, but the International Olympic Committee did not recognize his amateur status until 1982. Thorpe was subsequently restored as a "cowinner" of the decathlon and pentathlon of the 1912 Olympic Games (along with the second-place finishers in those events).

**Thorpe, Thomas B(angs),** Thorpe also spelled THORP (b. March 1, 1815, Westfield, Mass., U.S.—d. Sept. 20, 1878, New York City), American humorist and one of the most effective portrayers of American frontier life and character before Mark Twain.

Thorpe studied painting and at age 18 exhibited his "Ichabod Crane" at the Ameri-



Thomas B. Thorpe, engraving by John Chester Buttre after a portrait by Charles Loring Elliott
By courtesy of the Library of Congress, Washington, D.C.

can Academy of Fine Arts, New York City. In 1836 he moved to Louisiana, where he published successively five newspapers, chiefly in New Orleans and Baton Rouge. Thorpe's "The Big Bear of Arkansas" (published in 1841 in the New York City magazine *Spirit of the Times*) was so outstanding a tall tale that some historians have named certain southwestern contemporaries of Thorpe the Big Bear school of humorists.

Following a political defeat, Thorpe moved in 1854 to New York City and published his finest sketches as *The Hive of the Bee Hunter.* During the American Civil War he saw service in New Orleans; afterward he returned to New York City and spent his remaining years painting, working at the customhouse, and writing for *Harper's, Appleton's,* and other magazines.

**Thors, Ólafur** (b. Jan. 19, 1892, Borgarnes, Iceland—d. Dec. 31, 1964, Reykjavík), five-time Icelandic prime minister (1942, 1944–46, 1949–50, 1953–56, 1959–63).

Educated at the University of Copenhagen, Thors ran a fishing trawler with his brother after returning to Iceland in 1916. In 1925 he was elected to the Althing (parliament) as a member of the Independent Party after serving as chairman of the trawler owners' association. In 1932 he entered the government as minister of justice, becoming communications minister in 1939, and in 1942 he became foreign minister and prime minister. He held both posts in 1944 when Iceland severed all ties with Denmark and drafted its republican constitution. Leaving office in 1946, Thors once more served as prime minister in 1949–50, as minister of industries and export trade from 1950 to 1953, and then again as prime minister during the 1950s and early '60s. He retired from office because of ill health.

**Thorsteinsson, Steingrímur (Bjarnason)** (b. May 19, 1831, Snaefellsnes, Iceland—d. Aug. 21, 1913, Reykjavík), Icelandic patriotic poet and lyricist, best remembered as a translator of many important works into Icelandic.

Thorsteinsson studied classical philology at the University of Copenhagen but, more important, read widely in the continental literature of his day. After 20 years in Copenhagen, he went back to Iceland in 1872 to become a teacher and later headmaster at the Latin School in Reykjavík.

In Copenhagen Thorsteinsson had joined the group of young Icelandic nationalists who were campaigning for Iceland's independence from Denmark. Much of his poetry at that time was patriotic, and as an expatriate he wrote nostalgic lyrics in praise of Iceland's natural beauty. He also began to translate with the deliberate aim of widening the cultural horizons of his compatriots.

Thorsteinsson's poetry was of a uniformly high standard, and some of his lyrics were gems of delicacy that seemed to demand musical settings, but he showed his highest level of craftsmanship in his translations. As well as a vast number of lyrics from a variety of languages, he translated *The Arabian Nights,* William Shakespeare's *King Lear,* Daniel Defoe's *Robinson Crusoe,* and Hans Christian Andersen's *Fairy Tales.*

**Thorvaldsen, Bertel,** Thorvaldsen also spelled THORWALDSEN (b. Nov. 19, 1770, or Nov. 13, 1768, Copenhagen, Den.—d. March 24, 1844), sculptor, prominent in the Neoclassical period, who was the first internationally acclaimed Danish artist. In the 20th-century reevaluation of Neoclassicism, however, Thorvaldsen's reputation outside Denmark has declined, and works once regarded as the perfect reincarnation of the antique are now often considered cold and dry.

Thorvaldsen was the son of an Icelandic wood-carver who had settled in Denmark. He studied at the Copenhagen Academy and won a traveling scholarship to Rome, where he was to live most of his life. In Italy the prevailing enthusiasm for classical sculpture fired his imagination so much that he later celebrated the date of his arrival in 1797 as his "Roman birthday." The success of Thorvaldsen's model for a statue of Jason (1803) attracted the attention of the Italian sculptor Antonio Canova and launched Thorvaldsen on one of the most successful careers of the 19th century. When he returned to visit Copenhagen in 1819, his progress through Europe, in Berlin, Warsaw, and Vienna, was like a triumphal procession. His return from Rome in 1838, when he eventually decided to settle in Copenhagen, was regarded as a national event in Danish history. A large portion of his fortune went to the endowment of a Neoclassical museum in Copenhagen (begun in 1839), designed to house his collection of works of art, the models for all his sculptures; by his own wish, Thorvaldsen was to be buried there.

Most of Thorvaldsen's most characteristic sculptures are reinterpretations of the figures or themes of classical antiquity. The Alexander frieze of 1812 in the Palazzo del Quirinale, Rome, modeled in only three months in anticipation of a visit by Napoleon, is an example of the feverish energy with which he could at times work. Religious sculptures (for which his antique classical style was not particularly well suited) include the colossal series



"Thorvaldsen Leaning on the Statue of Hope," marble sculpture by Bertel Thorvaldsen, 1839; in the Thorvaldsens Museum, Copenhagen

By courtesy of the Thorvaldsens Museum, Copenhagen

of statues of Christ and the Twelve Apostles (1821–27) in the Vor Frue Kirke in Copenhagen. He also made numerous portrait busts of distinguished contemporaries.

**Thoth** (Greek), Egyptian DJHUTY, also spelled DJHOWTEY, in Egyptian religion, a god of the moon, of reckoning, of learning, and of writing. He was held to be the inventor of writing, the creator of languages, the scribe, interpreter, and adviser of the gods, and the representative of the sun god, Re. His responsibility for writing was shared with the goddess Seshat. The cult of Thoth was centred in the town of Khmunu (Hermopolis; modern al-Ashmūnayn) in Upper Egypt.

In the myth of Osiris, Thoth protected Isis during her pregnancy and healed the eye of her son Horus, which had been wounded by



Thoth, represented in human form with ibis's head, detail from the Greenfield Papyrus, c. 950 BC; in the British Museum

Copyright British Museum

Osiris' adversary Seth. He weighed the hearts of the deceased at their judgment and reported the result to the presiding god, Osiris, and his fellow judges. Thoth's sacred animals were the ibis and the baboon; millions of mummified bodies of these animals have been found in cemeteries near Hermopolis and Memphis. Thoth was usually represented in human form with an ibis's head. The Greeks identified Thoth with their god Hermes and termed him "Thoth, the thrice great" (Hermes Trismegistos). Important philosophical works were attributed to Hermes Trismegistos.

**Thothmes** (Egyptian kings): *see* Thutmose.

**Thou, Jacques-Auguste de,** Thou also spelled THUANUS (b. Oct. 8, 1553, Paris, France—d. May 7, 1617, Paris), French statesman, bibliophile, and historiographer whose detached, impartial approach to the events of his own period made him a pioneer in the scientific approach to history.

Born into a family noted for its statesmen and scholars, de Thou studied law at Orléans, Bourges, and Valence. He had, however, first been intended for the church and succeeded his uncle as a canon of Notre Dame (Paris). As a councillor of state, he faithfully served both Henry III and Henry IV, becoming director of the royal library in 1593. On becoming president of the Paris *parlement* in 1595, he used his authority in the interests of religious peace, negotiating the Edict of Nantes (1598) with the Protestants, while in the name of Gallicanism (a rejection of papal supremacy) opposing recognition of the Council of Trent. This attitude incurred the animosity of the Catholic hierarchy, which increased its persecution when the first edition of his history appeared in 1604. After the death of Henry IV (1610), the queen regent, Marie de Médicis, refused him the position of premier president of the *parlement,* appointing him instead a member of the *conseil de finances.*

The primary activity of de Thou's life was the writing of his history. His object was to produce a purely "scientific" and unbiased work chronicling his era. Perhaps to achieve a necessary distance, he wrote *Historia sui temporis* ("History of His Own Time") in Latin.

The first 18 books, embracing the period up to 1560, appeared in 1604, when they were immediately attacked by those de Thou called "the invidious and dissentious." The second part (dealing with the first wars of religion, 1560–72) was put on the church's index of prohibited books. When the third part (to 1574) and the fourth (to 1584) appeared in 1607–08, they caused a similar outcry, in spite of the historian's efforts to remain impartial. In answer to his detractors de Thou wrote a useful complement to the *Historia*, his series of memoranda (translated into French as *Mémoires de la vie de Jacques-Auguste de Thou*, 1711).

The first complete edition of the voluminous history, including the fifth part (to 1607), was published in 1620 by the scholars Pierre Dupuy and Nicolas Rigault. Five years later, the six volumes of memoirs were appended. The standard French translation, *Histoire universelle de Jacques-Auguste de Thou, depuis 1543 jusqu'en 1607*, 16 vol. (1734; Eng. trans., 2 vol., 1724–34), was published by the abbé Desfontaines and other scholars. Carefully researched, drawn from reliable sources, de Thou's *Historia* is a model of great erudition and exacting scholarship.

**Thoueris** (Egyptian goddess): *see* Taurt.

**thought,** covert symbolic responses to intrinsic (arising from within) or extrinsic (arising from the environment) stimuli. Thought, or thinking, is considered to mediate between inner activity and external stimuli.

A brief treatment of thought and thought processes follows. For full treatment, *see* MACROPAEDIA: Thought and Thought Processes.

Depending on the relative intensity of intrinsic and extrinsic influences, thinking can be expressive (imaginative and full of fantasy) or logical (directed and disciplined). Other terms for the two aspects of thinking are, respectively, autistic (subjective, emotional) and realistic (objective, externally directed). Both types of thinking are involved in normal adjustment.

*Realistic thinking.* Logical, or realistic, thought includes convergent thought processes, which require the ability to assemble and organize information and direct it toward a particular goal; judgment, the discrimination between objects, items of information, or concepts; problem solving, a more complex form of realistic thinking; and creative thinking, the search for entirely new solutions to problems.

*Autistic thinking.* Thought that is characterized by a high level of intrinsic influence and a low level of extrinsic influence includes free association, the giving of unconstrained verbal response to stimuli, found helpful in bringing repressed or forgotten experiences to consciousness; fantasy, characterized by sensory imagery in which a person loses contact with the environment, and ranging from vague reveries to vivid images; marginal states of consciousness, such as those experienced just before falling asleep or those induced by drugs; dreaming (*see* dream); and pathological thinking, which may be the result of antisocial behaviour disorders, neuroses (*see* psychoneurosis), or psychoses (*see* psychosis). The latter is characterized by major distortions in thinking and the lack of a realistic relation to the external environment.

Theories of thought and thought processes have concentrated on directed thinking, in which thinking is organized in order to solve a problem. Theories have been concerned with both the elements of thought and with the procession of elements.

According to one view, the elements organized by thinking are very weak nerve impulses sent to various muscles such that if the impulses were stronger, they would cause overt behaviour. At first it was thought that these impulses were primarily sent to the muscles used for speaking, so that thinking was seen as a kind of unexecuted speech; evidence that other muscles also receive very weak impulses during thinking led to the so-called peripheral theory, which holds that thinking goes on in the entire body by means of implicit muscular activities. In the last few decades psychologists have come to give more credence to so-called centralist theories, which hold that the locus of thinking is the brain, and that the implicit muscular activity is, in effect, a by-product.

There are other conceptions of the elements of thought that regard them in more mentalistic terms. The Gestalt theorists of the 1920s and 1930s believed the elements to be of the nature of patterns elicited from experience. A more contemporary approach, influenced by the development of computers, considers the elements of thought as bits of information undergoing processing.

At the beginning of this century the early behaviourists suggested that thought proceeded by association. The basic principles of association are similarity and contiguity, whereby an idea of something is followed by an idea of a similar or related thing.

A later, more sophisticated view that thinking proceeds according to the whole of a situation was emphasized by the Gestalt psychologists. They argued against the turn-of-the-century view that thinking proceeds by an internal process of trial-and-error, whereby a thinker imagines various responses to a stimulus, eliminates those that are inappropriate, and thus gradually comes to a final response. By contrast, the Gestalt theorists held that the solution to a problem comes as the result of a sudden insight into the nature of the problem as a whole. Around 1950, however, evidence was found that integrated these two views, by suggesting that the thinker must become familiar with a problem through trial-and-error before being able to grasp its structure as a whole.

Stimulated by advances in computer science, researchers have become concerned not simply with which thought element follows which, but also with operations that shift one element to the next. It is argued that these operations exploit a kind of controlled trial-and-error: in what is called a heuristic approach, the most promising avenues of solution to a problem are attempted first. Another topic of current interest concerns the motivations for thinking.

According to the Gestalt (*see* Gestalt psychology) theorists, the motivation arises when a person experiences a "gap" in his or her overall conception of a situation. A similar view is held by neobehaviourists, who note that there are affective (emotional) rewards for resolving inconsistencies between thoughts.

**thought, laws of,** traditionally, the three fundamental laws of logic: (1) the law of contradiction, (2) the law of excluded middle (or third), and (3) the principle of identity. That is, (1) for all propositions $p$, it is impossible for both $p$ and not $p$ to be true, or symbolically, $\sim(p \cdot \sim p)$, in which $\sim$ means "not" and $\cdot$ means "and"; (2) either $p$ or $\sim p$ must be true, there being no third or middle true proposition between them, or symbolically $p \vee \sim p$, in which $\vee$ means "or"; and (3) if a propositional function $F$ is true of an individual variable $x$, then $F$ is indeed true of $x$, or symbolically $F(x) \supset F(x)$, in which $\supset$ means "formally implies." Another formulation of the principle of identity asserts that a thing is identical with itself, or $(\forall x)\,(x = x)$, in which $\forall$ means "for every"; or simply that $x$ is $x$.

Aristotle cited the laws of contradiction and of excluded middle as examples of axioms. He partly exempted future contingents, or statements about unsure future events, from the law of excluded middle, holding that it is not (now) either true or false that there will be a naval battle tomorrow, but that the complex proposition that either there will be a naval battle tomorrow or that there will not is (now) true. In the epochal *Principia Mathematica* (1910–13) of A.N. Whitehead and Bertrand Russell, this law occurs as a theorem rather than as an axiom.

That the laws of thought are a sufficient foundation for the whole of logic, or that all other principles of logic are mere elaborations of them, was a doctrine common among traditional logicians. It has been shown, however, that these laws do not even comprise a sufficient set of axioms for the most elementary branch of logic, the propositional calculus, nor for the traditional theory of the categorical syllogism or the logic of terms.

The law of excluded middle and certain related laws have been rejected by L.E.J. Brouwer, a Dutch mathematical intuitionist, and his school, who do not admit their use in mathematical proofs in which all members of an infinite class are involved. Brouwer would not accept, for example, the disjunction that either there occur ten successive 7's somewhere in the decimal expansion of $\pi$ or else not, since no proof is known of either alternative; but he would accept it if applied, for instance, to the first $10^{(10)}$ digits of the decimal, since these could in principle actually be computed.

In 1920 Jan Łukasiewicz, a leading member of the Polish school of logic, formulated a propositional calculus that had a third truth-value, neither truth nor falsity, for Aristotle's future contingents, a calculus in which the laws of contradiction and of excluded middle both failed. Other systems have gone beyond three-valued to many-valued logics—*e.g.*, certain probability logics having various degrees of truth-value between truth and falsity.

**Thoune** (Switzerland): *see* Thun.

**Thousand, Expedition of the,** Italian SPEDIZIONE DEI MILLE, campaign undertaken in 1860 by Giuseppe Garibaldi that overthrew the Bourbon Kingdom of the Two Sicilies (Naples) and permitted the union of southern Italy and Sicily with the north. The expedition was one of the most dramatic events of the Risorgimento (movement for Italian unification) and was the archetype modern insurrection and popular war.

By 1860 Garibaldi had established a reputation as a successful military leader. He was totally committed to the cause of Italian unification, and, although sympathetic to democratic ideas, he was willing, for the sake of the nation, to work for Victor Emmanuel II, the king of Piedmont-Sardinia. But Garibaldi became impatient with the cautious, diplomatic tactics of Piedmont's prime minister, Count Cavour, and was ready to act on his own initiative to help unite Italy. A revolt in Sicily, beginning on April 4, 1860, caused Garibaldi to make the decision to begin with an attack on the Bourbon kingdom in the south. On the night of May 5–6, he embarked from Quarto (a suburb of Genoa) with more than 1,000 men, mostly idealistic young northerners. Narrowly missing contact with the Bourbon Navy, the expedition landed at the western Sicilian port of Marsala on May 11.

Garibaldi was faced with the problem of defeating more than 20,000 Neapolitan troops of the Bourbon king Francis II in Sicily with an untrained force armed only with rusty rifles. After proclaiming himself dictator of Sicily in the name of Victor Emmanuel, he led his men across the island toward Palermo. He defeated a Neapolitan force at Calatafimi (May 15), and many Sicilians then joined him to help overthrow their hated Neapolitan rulers. Aided also by the incompetence of the Bourbon command, Garibaldi captured Palermo



Garibaldi with his Thousand landing at Marsala on May 11, 1860; etching
De Antonis, Rome

(June 6) and, with the Battle of Milazzo (July 20), won control of all Sicily except Messina.

Garibaldi now hoped to take Naples and even to complete Italy's unification by a march on papal Rome. On August 20 he crossed the strait of Messina and landed in Calabria. His advance to Naples became a triumphal march as Bourbon rule totally collapsed; he was welcomed as a hero on entering Naples on September 7. The regrouped forces of King Francis made a final effort at the Volturno River (October 1–2) and, although Garibaldi defeated them, his march to Rome was checked. But Garibaldi was also blocked by political maneuvering. Cavour decided to take the initiative, fearful that the Risorgimento was being turned into a popular movement by the radical followers of Garibaldi and that France would intervene if Rome were attacked. To insure that Piedmont kept the leadership of the unification movement, Cavour ordered Piedmontese troops to invade the papal territories of Umbria and Marche and to join Garibaldi at Naples. Realizing that completion of unification was impossible in the existing situation, Garibaldi agreed to hold a plebiscite in the south, which resulted in an overwhelming victory for annexation under Piedmont (October 21). On October 26 Garibaldi met with Victor Emmanuel and relinquished his dictatorship over the south into the king's hands.

**Thousand and One Nights, The,** also called THE ARABIAN NIGHTS' ENTERTAINMENT, Arabic ALF LAYLAH WA LAYLAH, collection of Oriental stories of uncertain date and authorship whose tales of Aladdin, Ali Baba, and Sindbad the Sailor have almost become part of Western folklore.

As in much medieval European literature, the stories—fairytales, romances, legends, fables, parables, anecdotes, and exotic or realistic adventures—are set within a frame story. Its scene is Central Asia or "the islands or peninsulae of India and China," where King Shahryar, after discovering that during his absences his wife has been regularly unfaithful, kills her and those with whom she has betrayed him. Then, loathing all womankind, he marries and kills a new wife each day until no more candidates can be found. His vizier, however, has two daughters, Shahrazad (Scheherazade) and Dunyazad; and the elder, Shahrazad, having devised a scheme to save herself and others, insists that her father give her in marriage to the king. Each evening she tells a story, leaving it incomplete and promising to finish it the following night. The stories are so entertaining, and the king so eager to hear the end, that he puts off her execution from day to day and finally abandons his cruel plan.

Though the names of its chief characters are Iranian, the frame story is probably Indian, and the largest proportion of names is Arabic. The tales' variety and geographical range of origin—India, Iran, Iraq, Egypt, Turkey, and possibly Greece—make single authorship unlikely; this view is supported by internal evidence—the style, mainly unstudied and unaffected, contains colloquialisms and even grammatical errors such as no professional Arabic writer would allow.

The first known reference to the *Nights* is a 9th-century fragment. It is next mentioned in 947 by al-Mas'ūdī in a discussion of legendary stories from Iran, India, and Greece, as the Persian *Hazar Afsanak,* "A Thousand Tales," "called by the people 'A Thousand Nights'." In 987 Ibn an-Nadīm adds that Abū 'Abd Allāh ibn 'Abdus al-Jashyarī began a collection of 1,000 popular Arabic, Iranian, Greek, and other tales but died (942) when only 480 were written.

It is clear that the expressions "A Thousand Tales" and "A Thousand and One. . ." were intended merely to indicate a large number and were taken literally only later, when stories were added to make up the number.

By the 20th century, Western scholars agreed that the *Nights* is a composite work consisting of popular stories originally transmitted orally and developed during several centuries, with material added somewhat haphazardly at different periods and places. Several layers in the work, including one originating in Baghdad and one larger and later, written in Egypt, were distinguished in 1887 by August Müller. By the mid-20th century six successive forms had been identified: two 8th-century Arabic translations of the Persian *Hazar Isfana,* called *Alf khurafah* and *Alf laylah;* a 9th-century version based on *Alf laylah* but including other stories then current; the 10th-century work by Ibn 'Abdus; a 12th-century collection, including Egyptian tales; and the final version, extending to the 16th century and consisting of the earlier material with the addition of stories of the Islāmic counter-crusades and Oriental tales brought to the Middle East by the Mongols.

The first European translation of the *Nights,* also the first published edition, was made by Antoine Galland as *Les Mille et Une Nuits, contes arabes traduits en français,* 12 vol. (vol. i to vol. x, 1704–12; vol. xi and xii, 1717). Galland's main text was a four-volume Syrian manuscript, but the later volumes contain many stories from oral and other sources. His translation remained standard until the mid-19th century, parts even being retranslated into Arabic. The Arabic text was first published in full at Calcutta, 4 vol. (1839–42). The source for most later translations, however, was the so-called Vulgate text, an Egyptian recension published at Bulaq, Cairo, in 1835, and several times reprinted.

Meanwhile, French and English continuations, versions, or editions of Galland had added stories from oral and manuscript sources, collected, with others, in the Breslau edition, 5 vol. (1825–43) by Maximilian Habicht. Later translations followed the Bulaq text with varying fullness and accuracy. John Payne's little-known full English translation, 13 vol. (9 vol., 1882–84; 3 supplementary vol., 1884; vol. xiii, 1889) was used by Sir Richard Burton for *The Thousand Nights and a Night,* 16 vol. (10 vol., 1885; 6 supplementary vol., 1886–88), with notes and commentary based on experience of the seamy side of Eastern life. Burton's version has become the most famous English translation.

**Thousand Days, The War of a,** Spanish LA GUERRA DE LOS MIL DÍAS (1899–1903), Colombian civil war between Liberals and Conservatives that resulted in between 60,000 and 130,000 deaths, extensive property damage, and national economic ruin.

The Liberal Party represented coffee plantation owners and import-export merchants who favoured a laissez-faire economic policy. Largely excluded from participation in government after the Conservative victory of 1885, they were further distressed by the drastic downturn in the international price of coffee; by 1899 many coffee growers were operating at a loss.

The Conservative government, suffering from reduced customs revenues, responded by issuing unbacked paper currency, causing the value of the peso to drop precipitously. War broke out in the coffee-growing regions in 1899; and the first phase, lasting about seven months, ended with the defeat of Liberal forces at Palonegro on May 25, 1900. During the next two and a half years disorganized but highly disruptive guerrilla-style warfare raged in the rural areas, with great destruction of property and loss of life both in combat and from disease. Unable to pacify the countryside through military tactics, imprisonment, fines, and expropriation of property, the Conservatives offered amnesty and political reform on June 12, 1902. By November the two most important Liberal leaders, Rafael Uribe Uribe and Benjamín Herrera, surrendered after negotiating peace treaties promising amnesty, free elections, and political and monetary reform. Panama seceded soon after the war.

**Thousand Islands,** group of more than 1,500 small isles in the St. Lawrence River, North America, extending for a distance of 80 miles (128 km) from the Prince Edward Peninsula to Brockville, Ont., Can. Those on the west side, including Amherst, Wolfe (49 square miles [127 square km], the largest), Howe, Simcoe, and Grenadier, are mostly Canadian; those on the east, including Grindstone, Wells, and Carleton, are in New York, U.S. They form a traditional recreational area. Some are privately owned. The St. Lawrence Islands National Park embraces several of the Canadian islands and part of the Ontario shoreline. Surveyed in 1818, many were given names associated with the War of 1812. Thousand Islands International Bridge (1938) spans the river between Collins Landing, N.Y., and Ivy Lea, Ont., east of Gananoque.

**Thrace,** Modern Greek THRÁKI, Latin THRACIA, ancient and modern region of the southeastern Balkans.

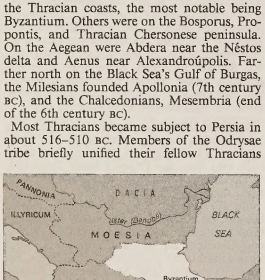
The historical boundaries of Thrace have varied. To the ancient Greeks it was that part of the Balkans between the Danube River to the north and the Aegean Sea to the south, being bounded on the east by the Black Sea and the Sea of Marmara and on the west by the mountains east of the Vardar River. The Roman province of Thrace was somewhat smaller, having the same eastern maritime limits and being bounded on the north by the Balkan Mountains; the Roman province extended west only to the Néstos River. Since Roman times, Greek Macedonia to the west has been separated from Greek Thrace by the Néstos. Modern Thrace is bounded by the Néstos River to the west, the Rhodope Mountains to the north, and the Maritsa River to the east and corresponds to the southern part of Bulgaria, the Greek province of Thrace, and European Turkey, including the Gallipoli Peninsula. About one-fourth of Thrace lies in Turkey, about one-tenth in Greece, and the remainder in Bulgaria.

Topographically, Thrace alternates between mountain-enclosed basins of varying size and deeply cut river valleys. A wide plateau extends southward from the Rhodope Mountains and separates the lowlands along the Maritsa River from the plains of western Thrace. A Mediterranean climate prevails in southern Thrace and is modified by continental influences in the Rhodope Mountains. The range of temperatures is greater in Thrace than in the southern Greek mainland; average temperatures in Alexandroúpolis range from 43° F (6° C) in January to 80° F (27° C) in July. Rivers are reduced to trickles during the summer months, and they drain toward the Aegean.

Ancient Greek and Roman historians agreed that the Thracians, who were of Indo-European stock and language, were superior fighters; only their constant political fragmentation prevented their overrunning the lands around the northeastern Mediterranean. Although these historians characterized the Thracian tribes as primitive partly because they lived in simple, open villages, the Thracians in fact had a fairly advanced culture that was especially noted for its poetry and music. Their soldiers were valued as mercenaries, particularly by the Macedonians and Romans.

The Greeks founded several colonies on the Thracian coasts, the most notable being Byzantium. Others were on the Bosporus, Propontis, and Thracian Chersonese peninsula. On the Aegean were Abdera near the Néstos delta and Aenus near Alexandroúpolis. Farther north on the Black Sea's Gulf of Burgas, the Milesians founded Apollonia (7th century BC), and the Chalcedonians, Mesembria (end of the 6th century BC).

Most Thracians became subject to Persia in about 516–510 BC. Members of the Odrysae tribe briefly unified their fellow Thracians




The Roman province of Thrace (white area) in the 2nd century AD

into an empire that in 360 BC split three ways and was quite easily assimilated (356–342) by Philip II of Macedon. The Thracians provided Philip's son, Alexander the Great, with valuable light-armed troops during his conquests. In 197, Rome assigned much of Thrace to the kingdom of Pergamum, though the coastal area west of the Maritsa was annexed to the Roman province of Macedonia. In the 1st century BC, Rome became more directly involved in the affairs of the whole region, and dynastic quarrels among the local Thracian rulers, who had by then become client kings of Rome, prompted the emperor Claudius I to annex the entire Thracian kingdom in AD 46. Thrace was subsequently made into a Roman province. The emperor Trajan and his successor, Hadrian, founded cities in Thrace, notably Sardica (modern Sofia) and Hadrianopolis (modern Edirne). In about AD 300, Diocletian reorganized the area between the Lower Danube and the Aegean into the diocese of Thrace.

From the 3rd to the 7th century the population of Thrace was altered greatly by repeated Gothic, Visigothic, and Slavic invasions and immigrations. In the 7th century the Bulgarian state was founded, and Byzantium consequently lost all Thrace north of the Balkan Mountains to the Bulgarians. Racked by Byzantine civil wars in the 14th century, Thrace fell piece by piece, up to 1453, to the Ottoman Turks, who ruled it for four centuries thereafter. Russian encroachments in the eastern Balkans culminated in the Russo-Turkish Wars (1828–29 and 1877–78), but Russia failed to create a "Greater Bulgaria" that would include the northern portions of Thrace at the expense of Turkey. The whole of Thrace therefore remained under Turkish domination. During the Balkan Wars (1912–13) Thrace suffered terribly. After World War I the boundaries of Greece, Bulgaria, and Turkey in Thrace were established by the treaties of Neuilly (1919), Sèvres (1920), and Lausanne (1923), and after World War II they remained unchanged.

As a result of wars and both forced and voluntary population migrations, the ethnic character of Thrace has become more homogeneous during the 20th century, although there are still large Turkish minorities in both Greek and Bulgarian Thrace. The Turks in Greek (Western) Thrace were excluded from the Greek-Turkish population exchange of 1923, while many of the resettled Greeks from Anatolia were settled in Western Thrace. A relatively small number of Turks from Bulgaria were resettled in Eastern Thrace. The Muslim population was exempted from repatriation to Turkey by the Treaty of Lausanne in 1923, but many emigrated after the appropriation of their land in 1924 and subsequently continued to emigrate because of deteriorating relations between Greece and Turkey. The Greek population of Thrace has grown rapidly since 1923 and is now the dominant population group, generally enjoying a higher standard of living than the Muslim minority. Greek is gradually supplanting Turkish as the language of instruction even in Muslim schools. Tensions between Greeks and the remaining Muslims have led to occasional outbursts of intercommunal violence. Most Thracian Muslims are of Turkish ancestry and speak Turkish. The Pomak people, a Turkicized Muslim group speaking a Bulgarian dialect, are concentrated along the border with Bulgaria. There is also a small group of sedentary Gypsies who speak Romany and Turkish.

High-quality Turkish tobacco, cultivated primarily by Muslims, is the chief cash crop of the region. Corn (maize) and rice are grown on the lowlands of the Evros River and the plains of western Thrace. Vineyards are found around Alexandroúpolis, where wine is produced. Oyster farming around Keramotí and eel fishing at Komotiní provide exports to central Europe. The manufacturing industries of Thrace consist chiefly of the processing of agricultural crops, tobacco curing, and wine production.

Archaeological sites, including Abdera, home of Democritus, the 5th-century philosopher who developed an atomic particle theory, and of Protagoras, a counselor of Alexander the Great, and the course of the Roman highway called the Via Egnatia attract tourists. Komotiní has a large museum with objects from throughout Thrace. Komotiní also is the site of Democritus University (1973) and of a Muslim secondary college.

*Consult the* INDEX *first*

**Thracian language,** language spoken by the inhabitants of Thrace primarily in pre-Greek and early Greek times. Generally assumed to be an Indo-European language, Thracian is known from proper names, glosses in Greek writings, and a small number of inscriptions, some of which appear on coins; these sources date from as early as the 6th century BC. Thracian is thought by many scholars to be related to the ancient Phrygian language spoken in Asia Minor. *Compare* Phrygian language.

**Thrale, Harriet Lynch,** byname MRS. THRALE: *see* Piozzi, Hester Lynch.

**Thrane, Marcus Møller** (b. Oct. 14, 1817, Christiania [now Oslo], Nor.—d. April 30, 1890, Eau Claire, Wis., U.S.), teacher, journalist, and socialist leader who was the initiator of the Thrane movement in Norway that sought to better the condition of urban and rural labourers.

Educated in France, where he became an exponent of utopian socialism, Thrane began his career as a teacher but then turned to journalism. Dismissed from his position in 1848 for attacks on capitalism, he set about to organize local workmen's associations in the same year. By 1850 the organizations were numerous, a national coordinating body had been formed, and a national convention held. In its petition to the king and the Storting (parliament), the Thrane movement, supported mainly by urban and rural workers, as well as by some impoverished peasants, called for mass education, universal suffrage, an investigation of the conditions of crofters (tenant farmers), and an end to protective tariffs. While the movement's demands were rejected, its growing popularity so frightened the middle and upper classes that Thrane and 132 others were arrested. Thrane was convicted of sedition in 1851 because of the revolutionary rhetoric of certain individuals in the movement, although it was clearly established that he opposed revolution.

After four years of imprisonment, during which the Thrane movement collapsed, Thrane emigrated to the United States, where he published a series of Norwegian-language socialist newspapers in Chicago.

**Thrasea Paetus, Publius Clodius** (d. AD 66), Roman senator who was famous for his opposition to the emperor Nero.

Thrasea was consul in 56 and took an independent line on various occasions in Nero's reign; he walked out when the Senate congratulated Nero on his mother's death (59); out of disgust with Nero's immoralities, he retired altogether from public life from 63 to 66. In 66 his enemies persuaded Nero to order Thrasea's death on the ground that he had become almost the head of a rival party in the state; in fact there is no evidence that he ever would have carried opposition to the point of conspiracy. He spent his last hours in a discussion of the immortality of the soul.

**thrasher,** any of numerous New World birds with downcurved bills, noted for noisy foraging on the ground in dense thickets and for loud varied songs. The 17 species, of the family Mimidae (order Passeriformes), range from the Canadian northwest to central Mexico and east to New England and the Caribbean. Best known is the brown thrasher (*Toxostoma rufum*) of North America east of the Rockies—a 30-centimetre (12-inch) red-brown bird with streaked underparts. In the arid southwestern United States and in Mexico are long-tailed



Brown thrasher (*Toxostoma rufum*)
Thase Daniel

drab forms, such as the California thrasher (*T. redivivum*), with sicklelike bills.

**Thrasybulus** (d. 388 BC), Athenian general and democratic leader.

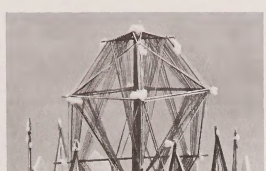
Thrasybulus' public career began in 411 BC, when he frustrated the oligarchic rising in Samos. Elected general by the troops, he effected the recall of Alcibiades, a former general accused of having profaned the *hermae* (small sacred statues) of Athens, and assisted him in several successful naval campaigns. In 404, when exiled by the Thirty (the oligarchy at Athens), he retired to Thebes. In the following winter, with 70 men, he seized Phyle, a hill fort on Mt. Parnes near Athens. His supporters soon increased, and with 1,000 men he repelled an attack by the oligarchs. In autumn 403, following skirmishes with a Spartan expedition under King Pausanias, a reconciliation was effected and democracy was restored. Thrasybulus was now the hero of the people; but a decree by which he secured the franchise for all his noncitizen followers was rescinded as illegal.

In 395 Thrasybulus induced Athens to join the Theban League against Sparta. He effected a democratic revolution at Byzantium and renewed the toll on the Bosporus trade. After a successful attack on Lesbos in 389/8, he sailed south and was killed at Aspendus, where his financial exactions had made him unpopular.

**thread,** tightly twisted ply yarn having a circular cross section and used in commercial and home sewing machines and for hand sewing. Thread is usually wound on spools, with thread size, or degree of fineness, indicated on the spool end.

Cotton thread is compatible with fabrics made from yarn of plant origin, such as cotton and linen, and for rayon, made from cellulose, a plant substance. Silk is suitable for silks and wools, both of animal origin; and nylon and polyester are appropriate for synthetics and for knits having a high degree of stretch.

**thread cross,** object made usually of two sticks bound together in the shape of a cross, with coloured threads wound around their ends to resemble a cobweb, used in Tibetan magical rituals to entrap evil spirits. Similar thread crosses have been encountered in areas



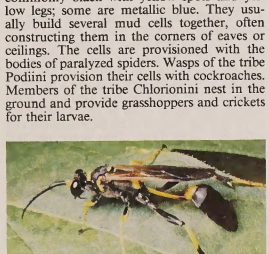
Thread cross made by the monks of Enchay Monastery, Sikkim, 20th century; in the collection of the Newark Museum, New Jersey
By courtesy of the Newark Museum, New Jersey

bordering Tibet and in South Africa, Peru, Australia, and Sweden.

In Tibet the thread crosses vary from simple diamond-shaped structures to complex wheel- or box-shaped combinations of structures up to 11 feet (3 metres) high and may be decorated with wool, feathers, and bits of paper according to the purpose and the deity for which they are intended. They are most probably pre-Buddhist, or Bon, in origin but are used by Buddhist priests, also, as a protective device or as a net to catch and destroy unspecified evil spirits. The crosses used in purification ceremonies during the New Year celebrations or for persons suffering from illness or misfortune are broken up and burned.

**thread-waisted wasp,** any insect of the subfamily Sphecinae belonging to the family Sphecidae (order Hymenoptera). They are large, common, solitary (nonsocial) wasps, usually more than 2.5 centimetres (about 1 inch) long. The common name derives from the stalklike anterior (front) end of the abdomen. Thread-waisted wasps are parasitic on insects and spiders. The host, paralyzed by the wasp's sting, is often numbed by malaxation—a pinching or crushing of the neck by the wasp's pincer-like jaws. The wasp seals the host's body in a mud cell with an egg.

Members of the tribe Sphecini, often black with partly orange or yellow abdomens, nest in burrows and provision their cells with caterpillars, which are eaten by the wasp larva. The mud daubers (tribe Sceliphronini) are commonly black with yellow spots and yellow legs; some are metallic blue. They usually build several mud cells together, often constructing them in the corners of eaves or ceilings. The cells are provisioned with the bodies of paralyzed spiders. Wasps of the tribe Podiini provision their cells with cockroaches. Members of the tribe Chlorionini nest in the ground and provide grasshoppers and crickets for their larvae.



Thread-waisted wasp (*Sceliphron*)
William E. Ferguson

**threadfin,** any of about 24 species of marine fishes of the family Polynemidae (order Perciformes), widely distributed along warm seashores, often over sand. Threadfins have two well-separated dorsal fins and a forked tail, and are usually silvery in colour. Their name refers to their pectoral fins, each of which is divided into an upper, normally shaped fin and a lower section consisting of four to seven long, threadlike rays that serve as sensory devices; they are especially long in the young. Most threadfins are 30–60 centimetres (1–2 feet) long; one species, *Eleutheronema tetradactylum* of India, is about 1.8 metres (6 feet) long.

The name threadfin, or threadfish, may also be applied to the cosmopolitan, warm-water, marine fishes of the genus *Alectis* and the family Carangidae, which also have long, filamentous fin rays, but on the dorsal and anal,



Threadfin (*Polynemus quadrifilis*)
Painting by C.M. Richardson

rather than pectoral, fins. These rays, also, are more pronounced in the young.

**threadworm** (*Strongyloides stercoralis*), worm of the class Nematoda (phylum Aschelminthes) that is parasitic in the human intestine but is able to live freely and breed in the soil. It is especially common in the moist tropics.

Larvae are passed out of the host's body in the feces. They usually reenter through the skin of the host's feet and are carried by the bloodstream to the region of the lungs. They break through the tracheal passages, migrate into the digestive tract, and become localized in the large intestine, maturing and producing eggs there.

The name threadworm is sometimes also applied to other threadlike nematodes, including the species known as the pinworm (*q.v.*).

**three-body problem,** in astronomy, the problem of determining the motion of three celestial bodies moving under no influence other than that of their mutual gravitation. No general solution of this problem (or the more general problem involving more than three bodies) is possible.

As practically attacked, it consists of the problem of determining the perturbations (disturbances) in the motion of one of the bodies around the principal, or central, body that are produced by the attraction of the third. Examples are the motion of the Moon around the Earth, as disturbed by the action of the Sun, and of one planet around the Sun, as disturbed by the action of another planet. The problem can be solved for some special cases; for example, those in which the mass of one body, as a spacecraft, can be considered infinitely small, and in the Lagrangian and Eulerian cases.

**three-cushion carom,** game played with three balls (red, white, and white with a spot) on a table without pockets, probably the most popular variety of billiards. The object of the game is to score caroms, playing a cue ball so that it strikes an object ball and three or more cushions (not necessarily different cushions) in any order before striking the second object

ball. Each carom completed counts one point.

The first player may select either white ball as cue ball to begin and, if he scores, may do the same on his second shot. Subsequently, however, he must cue the ball used on that second shot and his opponent must cue the other. Shooting the wrong cue ball incurs a penalty of one point and loss of turn. Other rules are the same as in billiards (*q.v.*).

**three-day event,** also called HORSE TRIALS, equestrian competition, testing the overall abilities of horse and rider in competition at dressage, cross-country and endurance riding, and stadium show jumping.

The first day's competition, at dressage, tests the horse's obedience and the rider's ability. It consists of a series of movements at the trot, walk, and canter; performance is judged on a point system of from 0 to 6 points for each required gait. "General impression" is also judged, and points are deducted for performing movements in the wrong order.

The second day's competition, considered the most difficult and important part of the three-day event, is a test of speed, endurance, and jumping ability on a course divided into steeplechase, cross-country, and two road and track sections. The length of the course varies according to the significance of the competition, the longest championship courses being 20 miles (32.3 km).

The final day of the three-day event is devoted to a show jumping competition designed to demonstrate a horse's ability to perform after the severe endurance test of the second day. In this competition, which is not considered a difficult test of jumping ability, the horse hurdles 10 to 12 obstacles over a distance of 820 to 984 yards (750 to 900 m) at an average speed of 15 miles (24 km) an hour. As in the second day's competition, penalty marks are given for failing to clear obstacles and for exceeding the time limit. During the three-day event, both team and individual scores are recorded, team scores by totaling the points of the best three of the four team members.

Originally a cavalry test for officers' chargers, the three-day event is still called the *militaire* on the Continent. The Fédération Équestre Internationale (International Equestrian Federation), which supervises international competition, calls the event *Concours Complet d'Équitation* ("Complete Competitive Examination in Horsemanship"). *See also* Olympic Games.

**three-day fever:** *see* pappataci fever.

**Three Emperors' League:** *see* Dreikaiserbund.

**three-field system,** method of agricultural organization introduced in Europe in the Middle Ages. In the old two-field system half the land was sown to crop and half left fallow each season; in the three-field system, however, only a third of the land lay fallow. In the autumn one third was planted to wheat, barley, or rye, and in the spring another third of the land was planted to oats, barley, and legumes to be harvested in late summer. The legumes (peas and beans) strengthened the soil by their nitrogen-fixing ability and at the same time improved the human diet.

Because spring planting required summer rains, it was principally effective north of the Loire and the Alps. By providing two harvests a year it reduced the risk of crop failure and famine. It also made plowing more effective by two means. First, by doing slightly more plowing than under the two-field system, a community of peasants could roughly double their crop yield, though in practice the fallow was usually plowed twice to turn under the green manure. Secondly, the cultivation of a surplus of oats in the spring planting provided feed that made possible the substitution of the swifter gaited horse for ox power, after the introduction of the padded horse collar.

**Three Forest Cantons, League of the:** *see* Everlasting League.

**Three Great Principles** (Sun Yat-sen): *see* Three Principles of the People.

**Three Henrys, War of the** (1587–89), the last of the Wars of Religion in France in the late 16th century, fought between the moderate but devious King Henry III, the ultra-Roman Catholic Henri I de Lorraine, 3e duc de Guise, and the Huguenot leader Henry of Bourbon, king of Navarre and heir to the French throne (the future Henry IV).

At first the balance of successes was somewhat in favour of the Holy League, the Catholic faction led by the Guises; but Henry of Navarre, with English financial aid, did win the Battle of Coutras (1587), in which the duc de Joyeuse, one of the favourites of Henry III, was defeated and killed. The duc de Guise, on the other hand, was too strong for the Protestant Germans, who had marched into France to join the Huguenots, and he defeated them at Vimory and Auneau, after which he marched in triumph to Paris, in spite of the orders and opposition of the king, who, finding himself powerless, withdrew to Chartres. Once more Henry III was obliged to accept such terms as the Leaguers chose to impose; and he signed the Edict of Union (1588), in which he named Guise lieutenant general of the kingdom and declared that no heretic could succeed to the throne. Unable to endure the humiliation, Henry III that same winter had the duke and the cardinal of Guise assassinated and many leaders of the League arrested. The power of the League party, however, seemed as great as ever; its new leader, the duc de Mayenne, entered Paris and declared open war on Henry III, who, after some hesitation, threw himself under the protection of his cousin Henry of Navarre in the spring of 1589. The Germans once more entered northeastern France; the Leaguers were unable to make headway either against them or against the armies of the two kings; they fell back on Paris, and the allies hemmed them in. All looked as if the royalists would soon reduce the last stronghold of the League, when Henry III was suddenly slain by a priestly assassin. Before he died the king had time only to commend Henry of Navarre to his courtiers as his heir and to exhort him to become a Catholic. Within a few years Henry of Navarre had allowed himself to be converted to Catholicism and had become the national sovereign as Henry IV.

**Three Kingdoms,** Chinese (Wade–Giles romanization) SAN-KUO, Pinyin SANGUO (AD 220–280), trio of warring Chinese states that followed the demise of the Han dynasty.

By the end of the 2nd century AD, the great Han empire had disintegrated into a period of chaos. Its last emperor had become a mere puppet, and finally (220) he ceded the throne to Ts'ao P'eir, the son of his generalissimo and protector, Ts'ao Ts'ao. Thus began the Wei kingdom, but its effective influence was confined to the North. Two other Han generals shortly installed themselves as emperors and took over regions of the West and South; the Shu-Han empire was proclaimed in what is now Szechwan Province, and the Wu empire was declared south of the Yangtze at present Nanking. The Sinicizing of the southern regions by the Wu was an important contribution to the future of China, and Nanking was to become a future Chinese capital for more than two centuries.

The Wei conquered the Shu-Han in 263/264, but two years later one of the Wei generals usurped the throne and proclaimed the Chin dynasty, which in 280 conquered the Wu and reunited the country. This dynasty soon fell apart, and the country disintegrated into chaos.

The Three Kingdoms survived for too short a period to contribute much to the arts in any conventional sense, although during their time the use of clay puppets to act out dramas did arise. But the period is important to the arts as subject matter. This short and bloody era of warfare and political intrigue was one of the most interesting and romantic in China's long history; and, ever since, it has been a favourite subject of historical fiction and other art forms. One of the most celebrated examples is the novel *San Kuo chih yen-i* (*Romance of the Three Kingdoms*).

**Three Kingdoms period,** in Korean history, the period (from *c.* 57 BC to AD 668) when the country was divided into the kingdoms of Silla, Koguryŏ, and Paekche (*qq.v.*).

**Three Kings, Battle of the,** also called BATTLE OF THE WĀDĪ AL-MAKHĀZIN (Aug. 4, 1578), defeat dealt the invading Portuguese armies of King Sebastian by the Sa'dī sultan of Morocco, 'Abd al-Malik.

Sebastian, a religious zealot, wished to subject Muslim Morocco to Christian rule. Allied with the deposed Moroccan sultan, al-Mutawakkil, he landed at Tangier weighed down by much artillery and an army of 20,000 men. At the Wādī al-Makhāzin near Ksar el-Kebir (Alcazarquivir), between the Loukkos River and one of its tributaries, Sebastian struck at 'Abd al-Malik and his brother Aḥmad. The Muslim forces, though not as well equipped as the Portuguese, numbered 50,000 men—infantry and cavalry. They forced the Christians to retreat to Larache on the coast, but in crossing the Wādī al-Makhāzin, which was then in high tide, many drowned or surrendered. Both Sebastian and al-Mutawakkil, the deposed sultan, were drowned, and 'Abd al-Malik, seriously ill from the beginning of the encounter, died the next morning; hence the European name of the battle.

The victory provided the Muslim soldiery with a rich booty and the country with a new sultan, Aḥmad, now known as Aḥmad al-Manṣūr (Aḥmad the Victorious); it further accorded Morocco a new prestige in Europe, which furthered its diplomatic and commercial status. The death of the young Sebastian without heir, on the other hand, brought the Portuguese empire under Spanish control for the next 60 years.

**Three Mile Island,** nuclear power station and the island on which it is situated, in the Susquehanna River near Harrisburg, Pa., U.S. The most serious accident in the history of the American nuclear power industry occurred there in 1979. At 4:00 AM on March 28, an automatically operated valve in the Unit 2 reactor mistakenly closed, shutting off the water supply to the main feedwater system (the system that transfers heat from the water actually circulating in the reactor core). This caused the reactor core to shut down automatically, but a series of equipment and instrument malfunctions, human errors in operating procedures, and mistaken decisions in the ensuing hours led to a serious loss of water coolant from the reactor core. As a result, the core was partially exposed, and hydrogen gas escaped from the core into the containment vessel of the reactor building. Very little of this and other radioactive gases actually escaped into the atmosphere.

The accident at Three Mile Island, though miniscule in its health consequences, had widespread and profound effects on the American nuclear power industry. It resulted in the immediate (though temporary) closing of seven operating reactors like those at Three Mile Island. A moratorium on the licensing of all new reactors was also temporarily imposed, and the whole process of approval for new plants by the Nuclear Regulatory Commission

was significantly slowed for years after the accident. No new reactors were ordered by utility companies in the United States from 1979 through the mid-1980s. The accident increased public fears about the safety of nuclear reactors and strengthened public opposition to the construction of new plants. The unharmed Unit 1 reactor at Three Mile Island did not resume operation until 1985. The cleanup of Unit 2 continued until 1990; damage to the unit was so severe, however (52 percent of the core melted down), that it remained unusable.

**Three Pagodas Pass,** Thai PHRA CHEDI SAM ONG, mountain pass in the Tenasserim Mountain Range on the Myanmar (Burma)-Thailand border, 100 miles (160 km) southeast of Moulmein, Myanmar. The pass, at an elevation of 925 feet (282 m), links southeastern Myanmar and western Thailand. For centuries it was the chief link between Myanmar and the fertile plain of the Chao Phraya River, used both for trade and for military invasions. During World War II the Japanese built the Thanbyuzayat–Ban Pong railroad (commemorated in the book and movie *The Bridge on the River Kwai*) through the pass (*see* Kanchanaburi).

**Three Principles of the People,** also called THREE GREAT PRINCIPLES, Chinese (Wade–Giles) SAN MIN CHU-I, or (Pinyin) SAN MIN ZHUYI, the ideological basis of the political program of Chinese national leader Sun Yat-sen (1866–1925), championing the principles of nationalism, democracy, and socialism.

The principles were originally formulated as slogans for Sun's revolutionary student group, the United League, one of the chief forces behind the 1911 Republican Revolution, which ended the Manchu rule of China. After the failure of this revolution to establish democracy in China, Sun formed a new party, the Kuomintang, or Nationalist Party, utilizing his principles as fundamental doctrine. In 1922 the Kuomintang formed an alliance with the Chinese Communist Party. The following winter, Sun, in response to Communist demands for a more formal party ideology, gave a series of lectures in which he sharpened and defined his three principles.

The first principle, *min-tsu chu-i,* or nationalism, earlier had meant opposition to the Ch'ing (Manchu) dynasty and to foreign imperialism; now Sun explained the phrase as denoting self-determination for the Chinese people as a whole and also for the minority groups within China. The second principle, *min-ch'üan chu-i,* or the "rights of the people," sometimes translated as "democracy," could be achieved, Sun explained, by allowing the Chinese people to control their own government through such devices as election, initiative, referendum, and recall. The last principle was *min-sheng chu-i,* or "people's livelihood," which is often translated as "socialism." This is the most vague of the three proposals, but by it Sun seemed to have in mind the idea of equalization of land ownership through a just system of taxation.

**Three Rivers** (Canada): *see* Trois-Rivières.

**Three Rivers,** district, administrative and historic county of Hertfordshire, southeast England, in the southwestern corner of the county. Three Rivers district is a dormitory suburban area on the northwest border of Greater London. The district's gently rolling countryside is traversed by the wooded valley of the River Colne. Rickmansworth is the district seat. Sands and gravels in the district have been extensively worked, and the resulting series of flooded pits are used now for recreation or for water storage. Rickmansworth and Croxley Green have paper mills; other industries include printing and asbestos sheet and truck manufacturing. Area 34 square miles (88 square km). Pop. (1998 est.) 86,500.

**Three Stooges, The,** American comedy team noted for violent, anarchic slapstick and comedy routines rooted in the burlesque tradition. Six men were members of the team throughout the years, the best known being Shemp Howard (original name SAMUEL HORWITZ; b. March 17, 1895, New York, N.Y., U.S.—d. Nov. 23, 1955, Los Angeles, Calif.); Moe Howard (original name MOSES HORWITZ; b. June 19, 1897, New York—d. May 4, 1975, Los Angeles); Larry Fine (original name LOUIS FEINBERG; b. Oct. 5, 1902, Philadelphia, Pa.—d. Jan. 24, 1975, Woodland Hills, Calif.); and Curly Howard (original name JEROME HORWITZ; b. Oct. 22, 1903, New York—d. Jan. 18, 1952, San Gabriel, Calif.).

Brothers Moe and Shemp Howard, along with vaudeville comic Larry Fine, joined Ted Healy in the early 1920s to form an act that came to be known as Ted Healy and His Stooges. After several years in vaudeville, the team achieved success on Broadway as stars of Earl Carroll's *Vanities.* Shemp left the act in the early '30s and was replaced by younger brother Jerry, who shaved his head upon joining the act and was thereafter known as "Curly."

The Three Stooges left Healy in 1934 and signed a long-term contract with Columbia Pictures. During the next 24 years, the team appeared in nearly 200 short subjects and a handful of feature films. Their comic style was brash, brazen, and characterized by cartoonish violence, and they exhibited expert comic timing and a mastery of burlesque-style humour. Moe was the bully of the act, Curly (always the most popular member among audiences and critics) was the hapless patsy and the recipient of much of Moe's abuse, and Larry was the passive middleman. The team made 97 short comedies before Curly was felled by a stroke that forced his retirement in 1946. Shemp returned to the act and appeared in 78 films with the team until his death in 1955. Joe Besser (1907–88) next filled the role of the "third stooge" until 1958, and Joe DeRita (1909–93) replaced Besser for the team's feature films of the 1960s.

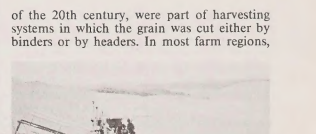
The Stooges had a major resurgence in popularity when their old films were syndicated on national television during the late 1950s. They remained as popular as ever at the turn of the 21st century.

**Three Weeks,** Hebrew BEIN HAMETZARIM ("Between the Straits"), in Judaism, a period of mourning running from the 17th day of Tammuz, the fourth month of the Jewish religious year, to the 9th day of AV (Tisha be-Av), the fifth month (variously, about June to August). The observance commemorates the days between the first breaching of the walls of Jerusalem in 586 BC by Babylonian troops under Nebuchadrezzar to the subsequent destruction of the First Temple of Jerusalem. Marriages and haircuts are forbidden during the Three Weeks. The nine days of AV are observed with special intensity: meat and wine are forbidden except on the Sabbath, the blessing of the New Moon is omitted, and prophecies of doom from Jeremiah and Isaiah are read in the synagogue on the three Sabbaths that fall within this period. The period ends with a 24-hour fast.

**Threefold Refuge** (Buddhism): *see* Triratna.

**3M:** *see* Minnesota Mining & Manufacturing Company.

**thresher,** farm machine for separating wheat, peas, soybeans, and other small grain and seed crops from their chaff and straw. Primitive threshing methods involved beating by hand with a flail or trampling by animal hooves. An early threshing machine, patented in 1837 by Hiram A. and John A. Pitts of Winthrop, Maine, U.S., was operated by horsepower. Large stationary threshers powered by steam engines or tractors, common in the early part of the 20th century, were part of harvesting systems in which the grain was cut either by binders or by headers. In most farm regions,

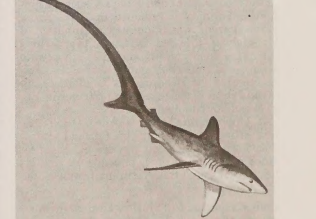


Horse-drawn thresher in the western United States
Brown Brothers

threshers, binders, and headers were all superseded by combines during the 20th century.

**Thresher,** first of a class of U.S. nuclear-powered attack submarines, launched on July 9, 1960. During sea trials in April 1963, it sank about 200 miles (300 km) off the New England coast, killing all 129 persons on board. In August 1963, wreckage of the vessel was spotted by the bathyscaphe *Trieste* at a depth of about 8,500 feet (2,600 m). Photographs taken by the *Trieste* indicated that the submarine had broken into several pieces. A court of inquiry later issued the opinion that faulty casting, piping, or welding caused the engine room to flood. The onrush of water resulted in a loss of electricity, which in turn caused a shutdown of the nuclear reactor and the loss of the submarine. *Thresher* displaced 3,750 tons and was 279 feet (about 85 m) long. It was armed with Subroc antisubmarine missiles that could be fitted with either high explosives or a nuclear warhead. Thirteen other submarines of the Thresher class were launched between 1961 and 1966.

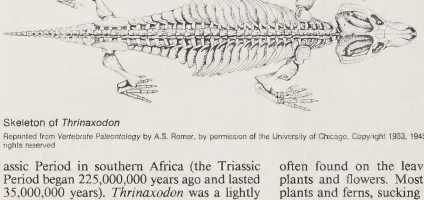
**thresher shark** (genus *Alopias*), any of five species of sharks of the family Alopiidae noted for their long, scythelike tails that may constitute almost one-half their total length. Thresher sharks are found in tropical and temperate seas throughout the world. They



Long-tailed thresher (*Alopias vulpinus*)
Painting by Richard Ellis

feed on squid and schooling fishes, attacking after circling and herding their prey into small groups. They sometimes use their tails to stun their prey or, by thrashing the water, to frighten it. They are not generally considered dangerous to man. The best-known species is the long-tailed thresher, or fox shark (*A. vulpinus*), a big, dark fish that grows about 6 m (20 feet) long and is found in the Atlantic and eastern Pacific oceans.

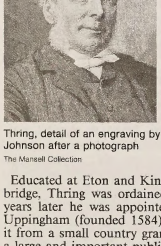
**Thrinaxodon,** extinct genus of advanced mammal-like reptiles, found as fossils in continental deposits formed during the Early Triassic Period in southern Africa (the Triassic Period began 225,000,000 years ago and lasted 35,000,000 years). *Thrinaxodon* was a lightly built animal about ½ metre (1½ feet) long. The limbs and limb girdles were strongly built; the body was raised well off the ground. *Thrinaxodon* was probably a quckly moving predator. It is not certain whether *Thrinaxodon* possessed a reptilian skin or hair, whether it cared for its young, or even whether it laid eggs or gave birth to live offspring.



Skeleton of *Thrinaxodon*

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**Thring, Edward** (b. Nov. 29, 1821, Alford, Somerset, Eng.—d. Oct. 22, 1887, Uppingham, Rutland), schoolmaster whose reorganization of Uppingham School influenced public school education throughout England.



Thring, detail of an engraving by T. Johnson after a photograph

The Mansell Collection

Educated at Eton and King's College, Cambridge, Thring was ordained in 1846. Seven years later he was appointed headmaster of Uppingham (founded 1584). He transformed it from a small country grammar school into a large and important public school. In 1868 he founded the Headmasters' Conference, an organization that had a great influence in English public school education.

At Uppingham Thring opened (1859) the first school gymnasium in England, introduced wood and metal workshops, and provided a swimming pool. In academic matters he stressed sound training in mathematics, the classics, and music.

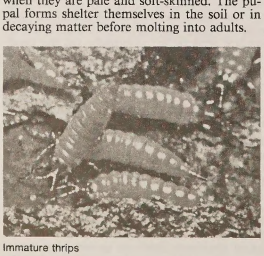
**thrips** (singular), plural THRIPS, a member of one of some 5,000 species of tiny winged insects, of the order Thysanoptera, that feed chiefly on plants. Thrips are well known to the gardener as pests, for grasshopper thrips, pear thrips, orange thrips, and onion thrips are destructive to cultivated plants, while other types of thrips are transmitters of viral diseases to tomatoes, pineapples, beans, sugar cane, and other plants.

A brief treatment of thrips follows. For full treatment, *see* MACROPAEDIA: Insects.

Thysanoptera are among the smallest of all insects; most range from 0.5 to 3 millimetres (0.02 to 0.12 inch) in length, although a few are as much as 15 millimetres (0.6 inch) long. They are distinguished by their long and narrow wings (although not all species possess them), which have fringes of tiny hairs. Thrips are distributed throughout the tropical and temperate zones of the world. They are often found on the leaves and blossoms of plants and flowers. Most feed on the sap of plants and ferns, sucking the sap out with the aid of their specialized mouth structures. A few are predators; one species ingests spores instead of sap, and another has been reported to ingest human blood on occasion. Some feed on only one type of plant, while others feed on many types. The evolution of thrips is poorly recorded. Specimens have been found preserved in amber dating from the Oligocene Epoch (12,000,000 to 38,000,000 years ago) and for one family from the Cretaceous Period (71,000,000 to 136,000,000 years ago).

The bodies of thrips are slender and elongated and often exhibit elaborate designs, spines, or bristles. The body is composed of head, thorax, and abdomen. The head is quadrangular and contains the eyes, antennae, and mouth. The compound eyes are small but prominent, while the antennae are usually longer than the head and have four to nine segments. The mouth is asymmetrical, lacking a right mandible. It is midway in structure between the biting and piercing mouth of a predator and a sucking mouth. The two pairs of wings and three pairs of legs are borne on the thorax. Some species, and particularly the male of some species, have lost their wings entirely. The legs are equipped with protrusible bladders that aid in climbing. The abdomen has 10 segments and is elongated and tapered.

The females of some species have a sawlike ovipositor (an egg-laying organ) with which they cut into the outer tissues of plants to deposit their eggs. In other species the females lack an ovipositor and lay their eggs in secluded places. In a few species the eggs hatch inside the body of the female. Parthenogenesis, reproduction without fertilization by males, is occasionally observed. After the bean-shaped eggs are laid, they hatch in 3 to 16 days. The young resemble the adults in general form, although their heads are disproportionately large and their bodies are more richly coloured. The young pass through two larval stages, when they are pale and soft-skinned. The pupal forms shelter themselves in the soil or in decaying matter before molting into adults.



Immature thrips

E. S. Ross

Thrips are of economic interest primarily because they are often destructive to commercially grown plants. The damage inflicted by thrips infestation may range from disfigurement to the spread of disease. Thrips may help in the control of certain insects and in pollinating certain types of flowers, but how large a role they play is not known. Other insects, reptiles, and birds prey on Thysanoptera, but the largest toll is probably taken by wind, dust, and rainstorms.

**throat:** *see* pharynx.

**Throckmorton, Francis,** Throckmorton also spelled THROGMORTON (b. 1554—d. July 20, 1584), English conspirator, the central figure in the unsuccessful Throckmorton Plot to overthrow Queen Elizabeth I.

Throckmorton came from a staunch Roman Catholic family and was the nephew of Sir Nicholas Throckmorton, a diplomat for Elizabeth. After receiving his education at the University of Oxford, he traveled to the Continent in 1580, where he met Catholic exiles from England who were plotting against Elizabeth's Protestant regime. He returned in 1583 as an agent for a conspiracy involving France and Spain. Under the plan England was to be invaded by a French force under Henri, duc de Guise, who would free Elizabeth's prisoner Mary, Queen of Scots, and restore papal authority.

In London, Throckmorton occupied a house that served as a centre of communication between Mary and foreign agents. But Francis Walsingham, Elizabeth's principal secretary, uncovered the conspiracy and Throckmorton was arrested in November 1583. Tortured on the rack, he made a full confession. Throckmorton was tried in May 1584 and executed several months later. One of his chief contacts, the Spanish ambassador to England, Bernardino de Mendoza, was expelled from the country.

**Throckmorton, Sir Nicholas,** Throckmorton also spelled THROGMORTON (b. 1515—d. Feb. 12, 1571, London), English diplomat in the reign of Elizabeth I.

The son of Sir George Throckmorton of Coughton, Warwickshire, and the uncle of Francis Throckmorton, he was a member of the household of Catherine Parr, the last wife of Henry VIII, and was favourable to the reformers in religion. He was a member of Parliament from 1545 to 1567. During the reign of Edward VI, in which he was knighted (1547), he at first supported Protector Somerset but later went over to the party of the Earl of Warwick (afterward duke of Northumberland).

When, on the death of Edward (1553), an attempt was made to place Lady Jane Grey on the throne instead of Mary Tudor, Throckmorton contrived to appear the friend of both parties; but on Mary's accession he was able to secure her favour. He was, however, suspected of complicity in the rebellion of Sir Thomas Wyat (January–February 1554). Acquitted at his trial in April, he was detained in the Tower of London until January 1555. He went abroad in 1556 but made his peace with Queen Mary in 1557.

Under Elizabeth I he became chamberlain of the exchequer, and from May 1559 to April 1564 he was ambassador in France. In May 1565 he was sent as ambassador to Scotland but failed to prevent Mary Stuart's marriage with Henry, Lord Darnley. In 1569, he fell under suspicion during the intrigue to marry Thomas Howard, 4th duke of Norfolk, to Mary and was imprisoned for a time at Windsor Castle, but he was not further proceeded against.

Throckmorton's daughter Elizabeth became the wife of Sir Walter Raleigh.

**thromboangiitis obliterans** (medicine): *see* Buerger's disease.

**thrombocytasthenia** (medicine): *see* thrombocytopathy.

**thrombocyte,** a small, nucleated, spindle-shaped cell of nonmammalian vertebrates that plays a role in the clotting of blood; or a blood platelet, a small, non-nucleated, cytoplasmic body found in the blood of mammals, which similarly plays a role in the clotting of blood. *See also* platelet.

**thrombocytopathy,** also called THROMBOCYTASTHENIA, any of several blood disorders characterized by abnormal blood platelets but normal numbers of platelets, prolonged bleeding time, defective clot formation, and a tendency to hemorrhage. Inherited thrombocytopathies include von Willebrand's disease (*q.v.*); thrombasthenia (also called Glanzmann's disease), characterized by abnormal clot retraction and defective platelet aggregation; and Bernard–Soulier syndrome, characterized by unusually large platelets. In addition, thrombocytopathy is sometimes seen in cases of Down's syndrome and Wiskett–Aldrich syndrome.

Acquired thrombocytopathy has been known to be associated with clinical disorders, including cirrhosis, leukemia, pernicious anemia, scurvy, and uremia. Temporary platelet dysfunction is sometimes induced by such drugs as antihistamines, aspirin, indomethacin, phenothiazines, phenylbutazone, and tricyclic antidepressants.

The only known treatment for congenital thrombocytopathy is platelet transfusion to control bleeding. For acquired thrombocytopathies, cure of the underlying disease usually brings improved platelet function.

**thrombocytopenia,** abnormally low number of blood platelets in the circulation. Thrombocytopenia may occur as a result of decreased platelet production, when the bone marrow is malfunctioning or not functioning (*e.g.,* in leukemia; from excess of certain drugs or irradiation; in certain anemias; from congenital lack of megakaryocytes, cells in the bone marrow that give rise to platelets), or as a result of increased platelet destruction (causes include malfunctioning spleen, congestive heart failure, massive bank blood transfusion after hemorrhage, incompatible blood transfusion). Symptoms of thrombocytopenia include small hemorrhages into the skin and easy bruising; sometimes gastrointestinal bleeding, excess menstrual bleeding, or other hemorrhage is observed. Treatment includes rest, protection from injury, and sometimes platelet transfusion, glucocorticoid therapy, or removal of the spleen (splenectomy).

**thrombophlebitis,** inflammation of a vein coupled with formation of a blood clot that adheres to the wall of the vessel. The inflammation may precede or follow formation of the clot. Because movement of the blood through veins is not brought about by the pumping of the heart, as in the case of the arterial blood, but depends upon contractions of the muscles, prolonged inactivity, such as bed rest after an operation or during convalescence from a serious illness, may lead to insufficient movement of the blood through the veins, with resultant formation of clots and inflammation. The condition most often affects the legs. There may be pain at the site of the occlusion or throbbing pain throughout the leg. If the affected vein is near the surface, it feels like a cord to the touch. If the blood clot is in a principal vein and grows to the point that it blocks the vessel, the condition is known as milk leg (*q.v.*).

Treatment of thrombophlebitis is primarily by administration of anticoagulants (heparin), slight elevation of the affected leg, application of heat, elastic supports, and brief periods of walking to encourage circulation. Occasionally surgical removal of the clot may be necessary. *See also* phlebothrombosis.

**thrombosis,** formation of a blood clot in the heart or in a blood vessel. Factors that play a role in the formation of clots (thrombi) include injury to a blood vessel and alterations from normal blood flow; changes in the coagulability of the blood may also cause clot formation. Injury to the lining of a blood vessel or of the heart that results, for example, from inflammation or from the formation of fatty plaques (atherosclerosis) may lead to clot formation. Normally the formed elements of the blood—the red and white blood cells and the platelets—move along in the centre of the stream in a blood vessel; if there is turbulence or other alteration from normal flow, the platelets and blood cells may scrape along the blood vessel lining. Such a situation may arise at the site of an aneurysm—an abnormal widening of the vessel. Confinement in bed also may result in more sluggish blood flow in the veins and consequent formation of a clot. Abnormally large numbers of platelets may cause an increased tendency of the blood to coagulate, as may abnormally high levels of fats in the blood.

Effects of thrombosis may be blockage of the blood vessel at the point of clot formation or blockage of a vessel at some other point by a clot that has broken free from its point of origin. Such a clot is called an embolus. *See also* embolism.

**throne,** chair of state set on a dais and often surmounted by a canopy, representing the power of the dignitary who sits on it and sometimes conferring that power. The extent to which seats of this kind have become symbolically identified with the status of their occupiers is suggested by the fact that in monarchies the office of the ruler is often referred to as The Throne and that at Papal conclaves, when an election has been made, the canopies are lowered from the thrones of all participating cardinals except the successful one.



So-called throne of King Dagobert I, bronze, from the treasury of Saint-Denis, Paris, probably 8th century with 12th-century additions
By courtesy of the Bibliotheque Nationale, Paris

From the very beginning of Greek history, thrones were identified as seats of the gods. Soon the meaning of the word included the symbolic seats of those who held secular or religious power—a meaning common to virtually all cultures, ranging from Benin to the empires of South America. In the ancient world, especially in the East, thrones almost invariably had symbolic magnificence. Solomon's throne, for instance, is thus described in II Chron. 9:

> The king also made a great ivory throne, and overlaid it with pure gold. The throne had six steps and a footstool of gold, and on each side of the seats were arm rests and two lions standing beside the arm rests, while twelve lions stood there, one on each end of a step on the six steps. The like of it was never made in any kingdom.

The throne of the Byzantine emperors was modelled on Solomon's, with the added refinement that the lions were mechanical. In the British Museum there is a fragment encrusted with gold, ivory, lapis lazuli, and carnelian believed to have come from the throne of Sargon II of Assyria (died 705 BC).

The oldest surviving throne is one that was built into the walls of Knossos (*c.* 1800 BC), and probably the most splendid of thrones was the Peacock throne of the rulers of Delhi, set with jewels and raised on a dais with silver steps. The appearance of Christianity stimulated the production of thrones in Europe, for not only were they seen as part of the process of endowing kingship with a magical aura through the use of elaborate coronation rites but also many ecclesiastical dignitaries—cardinals, bishops, and mitred abbots—had a right to a throne. Some of the early thrones were incorporated into the stonework of the church, as at Torcello outside Venice; but the oldest, that of St. Peter, which became a symbol of the papacy and which dates from the 4th century AD, is built of oak and ivory and has iron carrying rings (it is now incorporated in a massive structure designed by the architect and sculptor Gian Lorenzo Bernini in the 17th century). The magnificent ivory throne of Archbishop Maximian (AD 546–556), at Ravenna, is covered with elaborate bas-relief carvings and reflects the structure of late-Roman furniture. The so-called throne of King Dagobert, in the treasury of Saint-Denis in Paris, is a folding stool of bronze, probably of the 8th century but with 12th-century additions made by the churchman and statesman Abbot Suger. The design of the Coronation Chair in Westminster Abbey has been attributed to Adam, the goldsmith of Edward I; it seems that the original intention was to cast the chair in bronze, but an oak version was made instead, apparently without any alteration to a design intended for execution in metal. In the late 17th and 18th centuries, thrones were frequently made of silver, but later versions tended to be of gilded wood.

**throughway:** *see* expressway.

**throwing stick** (weapon): *see* spear thrower.

**thrush,** any of about 300 members of the songbird family Turdidae, treated by many modern authorities as a subfamily of the Old World insect eaters, family Muscicapidae. The thrushes are sometimes divided into two groups, the chat-thrushes (subfamily Saxicolinae) and the true, or typical, thrushes (Turdinae). Thrushes are widely considered closely related to the Old World warblers (Sylviidae) and flycatchers (Muscicapidae), with which they intergrade through several genera.

Generally, thrushes are slender-billed songbirds with the tarsus (lower leg) "booted"; *i.e.,* covered in front with a single long scale instead of many short ones. The young are usually spotted in the first plumage, and there is a single annual molt.

The chat-thrushes, *e.g.*, the western bluebird (*Sialia mexicanus*), are generally smaller, with slenderer legs, thinner bill with fewer bristles at its base, and more colourful plumage (*see* chat-thrush).

Thrushes vary from 13 to 30 centimetres (5 to 12 inches) in length. They are usually not brightly coloured; but many have patches of bright yellow, red, or blue on otherwise plain plumage.

Thrushes occur virtually worldwide but are most diverse in the Old World, especially in Africa. The northern species are strong mi-

grants. Occupying a wide range of arboreal and terrestrial habitats, thrushes eat insects and fruit; a few take snails or earthworms. They build open cup-shaped nests (or, in the case of a few of the chat-thrushes, occupy cavities), in which they lay three to six pale, often bluish eggs.

Representative true thrushes are species of the genus *Turdus,* which include the blackbird, fieldfare, ouzel, and redwing of Europe, as well as the American robin. Other true thrush groups are called ground thrush and nightingale thrush.

A number of unrelated birds are called thrushes by reason of resemblance to turdids, including the antthrush (*see* antbird); babbling thrush (*see* babbler); jay thrush and Chinese thrush (*see* laughing thrush); jewelthrush (*see* pitta); and wrenthrush (*q.v.*).

**thrush,** also called ORAL CANDIDIASIS, MYCOTIC STOMATITIS, OR WHITE MOUTH, fungus infection characterized by raised white patches on the tongue that resemble milk curds. When gently scraped off, these patches reveal inflamed tissue that tends to bleed easily. Beginning on the tongue, the creamy white spots can spread to the gums, palate, tonsils, throat, and elsewhere. The causative organism, the yeastlike fungus *Candida albicans,* is ubiquitous and needs only favourable conditions in the mouth and a weakened host to flourish. Although most common among infants, thrush sometimes occurs in the elderly, immune-suppressed patients, or others in whom the normal balance of microorganisms in the mouth has been upset. The spread of the infection in the oral cavity usually produces only slight symptoms of fever and gastrointestinal irritation, however. Thrush is generally cured by the antibiotics nystatin or clotrimazole taken as mouthwashes.

**thrust stage:** *see* open stage.

**thruway:** *see* expressway.

**Thu Dau Mot,** formerly PHU CUONG, city, southern Vietnam. It is located on the Saigon River (Song Sai Gon) at the head of a branch of the Mekong delta inland waterway and on a spur railway line from Ho Chi Minh City (formerly Saigon), 14 miles (23 km) to the south. There are clay pits, asbestos mines, and stone-crushing works nearby, but the city is best known for its lacquerware factories. Pop. (2001 est.) 9,400.

**Thuan Hoang De:** *see* Le Thanh Tong.

**Thuanus, Jacques-Auguste de:** *see* Thou, Jacques-Auguste de.

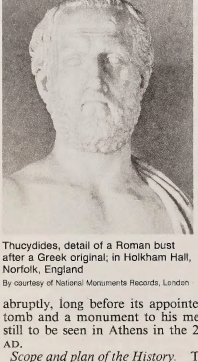
**Thucydides** (b. 460 BC or earlier?—d. after 404 BC?), greatest of ancient Greek historians and author of the *History of the Peloponnesian War,* which recounts the struggle between Athens and Sparta in the 5th century BC. His work was the first recorded political and moral analysis of a nation's war policies.

*Life.* All that is certainly known (perhaps all that ancient scholars knew) of Thucydides' life is what he reveals about himself in the course of his narrative. He was an Athenian, old enough when the war began to estimate its importance and judge that it was likely to be a long one and to write an account of it, observing and making notes from its beginning. He was probably born, therefore, not later than 460—perhaps a few years earlier since his detailed narrative begins, just before 431, with the events which provoked the war. He was certainly older than 30 when he was elected *strategos,* a military magistrate of great importance, in 424. Hence, he belongs to the generation younger than that of the Greek historian Herodotus.

His father's name was Olorus, which is not known as an Athenian name; Olorus was probably of Thracian descent on his mother's side. Thucydides was related in some way to the great Athenian statesman and general Miltiades, who had married the daughter of a Thracian prince of this name. He himself had property in Thrace, including mining rights in the gold mines opposite the island of Thasos, and was, he tells us, a man of influence there.

He was in Athens when the great pestilence of 430–429 raged; he caught the disease himself and saw others suffer. Later, in 424, he was elected one of the 10 *strategoi* of the year and, because of his connections, was given command of the fleet in the Thraceward region, based at Thasos. He failed to prevent the capture of the important city of Amphipolis by the Spartan general Brasidas, who launched a sudden attack in the middle of winter. Because of this blunder, Thucydides was recalled, tried, and sentenced to exile. This, he says later, gave him greater opportunity for undistracted study for his *History* and for travel and wider contacts, especially on the Peloponnesian side—Sparta and its allies.

He lived through the war, and his exile of 20 years ended only with the fall of Athens and the peace of 404. The time and manner of his death are uncertain, but that he died shortly after 404 is probable, and that he died by violence in the troubled times following the peace may well be true, for the *History* stops abruptly, long before its appointed end. His tomb and a monument to his memory were still to be seen in Athens in the 2nd century AD.



Thucydides, detail of a Roman bust after a Greek original; in Holkham Hall, Norfolk, England

By courtesy of National Monuments Records, London

*Scope and plan of the History.* The *History,* which is divided into eight books, probably not by Thucydides' design, stops in the middle of the events of the autumn of 411 BC, more than six and a half years before the end of the war. This much at least is known: that three historians, Cratippus (a younger contemporary), Xenophon (who lived a generation later), and Theopompus (who lived in the last third of the 4th century), all began their histories of Greece where Thucydides left off. Xenophon, one might say, began the next paragraph nearly as abruptly as Thucydides ended his.

So it is certain that Thucydides' work was well known soon after publication and that no more was ever published other than the eight books that have survived; it may reasonably be inferred from the silence of the available sources that no separate section of the work was published in his lifetime. It may also be inferred that parts of the *History,* and the last book in particular, are defective, in the sense that he would have written at greater length had he known more and that he was trying still to learn more—*e.g.,* of internal Athenian politics in the years of "uneasy truce." His existing narrative is in parts barely understandable without some imaginative guesswork.

It may be assumed, then, that there are three fairly definable stages in his work: first, the "notes" he made of events as they occurred; secondly, the arrangement and rewriting of these notes into a consecutive narrative, as a "chronicle," but by no means in the final form that Thucydides intended; thirdly, the final, elaborated narrative—of the preliminaries of the war (Book i), of the "Ten Years' War," and of the Athenian expedition to conquer Sicily. Thucydides supplemented his note stage throughout the project; even the most elaborated parts of the *History* may have been added right up to the time of his death—certainly many additions were made after the war was over.

All this is significant because Thucydides was writing what few others have attempted—a strictly contemporary history of events that he lived through and that succeeded each other almost throughout his adult life. He endeavoured to do more than merely record events, in some of which he took an active part and in all of which he was a direct or indirect spectator; he attempted to write the final history for later generations, and, as far as a man can and as no other man has, he succeeded.

It is obvious that he did not rush his work; the last of the complete narrative (stage three, above) took him to the autumn of 413, eight and a half years before the end of the war, the last of stage two, to six and a half years before. During these last years he was observing, inquiring, writing his notes, adding to or modifying what he had already written; at no time before the end, during all the 27 years of the war, did he know what that end would be nor, therefore, what would be the length and the final shape of his own *History.* It is evident that he did not long survive the war since he did not leave any connected account, even at stage two, of the last six years. But in what he lived to complete, he wrote a definitive history.

*Character studies.* Besides the political causes of the war, Thucydides was interested in and emphasized the conflict between two types of character: the ever-active, innovating, revolutionary, disturbing Athenians and the slower-moving, more cautious Peloponnesians, especially the Spartans, "not excited by success nor despairing in misfortune," but quietly self-confident. Thucydides was not really concerned with individuals but rather with the actions, sufferings, and the characters of states ("the Athenians," "the Syracusans," etc.); but he did understand the significance of personalities. Besides depicting by their words and deeds the characters of those who influenced events—such as Cleon, the harsh demagogue of Athens; Hermocrates, the would-be moderate leader in Syracuse; the brave Nicostratus; and the incompetent Alcidas—he goes out of his way to give a clear picture of the characters and influence of four men: Themistocles (in a digression, the Athenian hero of the Second Persian War), Pericles, Brasidas, and Alcibiades. All four of them were of the active, revolutionary type. Pericles of Athens was indeed unique for Thucydides in that he combined caution and moderation in action and great stability of character with a daring imagination and intellect; he was a leader of the new age. During the war each of them—Pericles and Alcibiades in Athens, Brasidas in Sparta—was in conflict with a conservative, quietist opposition within his own community.

The conflict between the revolutionary and the conservative also extended between the generally daring Athenian state and the generally cautious Peloponnesians. It is a great loss that Thucydides did not live to write the story of the last years of the war, when Lysander, the other great revolutionary Spartan, played a larger part than any other single man in the defeat of Athens. This defeat was,

in one aspect, the defeat of intellectual brilliance and daring by "stolidity" and stability of character (this last the quality most lacking in Alcibiades, the most brilliant Athenian of the second half of the war); but it was largely brought about by Brasidas and Lysander, the two Spartans who rivaled the Athenians in daring and intellect.

*Study of the war's technical aspects.* Thucydides was also interested in the technical aspect of the war. The most important problems in the war, besides protecting food supplies during land fighting, centred around the difficulties and possibilities of war between an all-powerful land force (Sparta and its allies) and an all-powerful naval force (Athens). Thucydides also studied the details of siege warfare; the difficulties of the heavily armed combat in mountain country and of fighting against the fierce but unruly barbarians of the north; an army trying to force a landing from ships against troops on shore; the one great night battle, at Syracuse; the skill and the daring maneuvers of the Athenian sailors and the way these maneuvers were overcome by the Syracusans; the unexpected recovery of the Athenian fleet after the Sicilian disaster—in all these aspects of the war he took a keen professional interest.

In Thucydides' introductory pages on the early history of Greece he lays much stress on the development of sea trading and naval power and on the accumulation of capital resources; they help to explain the great war between a land power and a sea power.

*Style and historical aims.* Thucydides was himself an intellectual of the Athenian kind; markedly individualistic, his style shows a man brought up in the company of Sophocles and Euripides, the playwrights, and the philosophers Anaxagoras, Socrates, and the contemporary Sophists. His writing is condensed and direct, almost austere in places, and is meant to be read rather than delivered orally. He explains in a scientific and impartial manner the intricacies and complexities of the events he observed. Only in his speeches does he sometimes fall short of the lucidity of the narrative prose; his fondness for abstract expressions and the obscurity of his rhetorical antithesis often make the passages difficult to understand.

In a prefatory note near the beginning of the *History,* Thucydides speaks a little of the nature of his task and of his aims. It was difficult, he says, to arrive at the truth of the speeches made—whether he heard them himself or received a report from others—and of the actions of the war. For the latter, even if he himself observed a particular battle, he made as thorough an enquiry as he could—for he realized that eyewitnesses, either from faulty memory or from bias, were not always reliable.

He wrote the speeches out of his own words, appropriate to the occasion, keeping as closely as possible to the general sense of what had actually been said. He could never have omitted them, for it is through the speeches that he explains the motives and ambitions of the leading men and states; and this, the study of the human mind in time of war, is one of his principal aims. (The omission of speeches from the last book is a great loss and is caused, no doubt, by the difficulty he had in getting information about Athens at this period.) He avoided, he says, all "storytelling" (this is a criticism of Herodotus), and his work might be the less attractive in consequence;

> but I have written not for immediate applause but for posterity, and I shall be content if the future student of these events, or of other similar events which are likely in human nature to occur in after ages, finds my narrative of them useful.

This is all that he expressly tells of his aim and methods. Moreover, in the course of his narrative (except for the pestilence of 430 and his command in 424) he never gives his authority for a statement. He does not say which of the speeches he actually heard, which of the other campaigns he took part in, what places he visited, or what persons he consulted. Thucydides insisted in doing all the work himself; and he provides, for the parts he completed, only the finished structure, not the plans or the consultations.

*Authority of his work.* He kept to a strict chronological scheme, and, where it can be accurately tested by the eclipses that he mentions, it fits closely. There are also a fair number of contemporary documents recorded on stone, most of which confirm his account both in general and in detail. There is the silent testimony of the three historians who began where he left off, not attempting, in spite of much independence of opinion, to revise what he had already done, not even the last book, which he clearly did not complete. Another historian, Philistus, a Syracusan who was a boy during the Athenian siege of his city, had little to alter or to add to Thucydides' account in his own *History of Sicily.* Above all, there are the contemporary political comedies of Aristophanes—a man about 15 years younger than Thucydides with as different a temper and writing purpose as could be—which remarkably reinforce the reliability of the historian's dark picture of Athens at war. The modern historian of this war is in much the same position as the ancient: he cannot do much more than translate, abridge, or enlarge upon Thucydides.

For Thucydides kept rigidly to his theme: the history of a war—that is, a story of battles and sieges, of alliances hastily made and soon broken, and, most important, of the behaviour of peoples as the war dragged on and on, of the inevitable "corrosion of the human spirit." He vividly narrates exciting episodes and carefully describes tactics on land and sea. He gives a picture, direct in speeches, indirect in the narrative, of the ambitious imperialism of Athens—controlled ambition in Pericles, reckless in Alcibiades, debased in Cleon—ever confident that nothing was impossible for them, resilient after the worst disaster. He shows also the opposing picture of the slow steadiness of Sparta, sometimes so successful, at other times so accommodating to the enemy.

His record of Pericles' speech on those killed in the first year of the war is the most glowing account of Athens and Athenian democracy that any leading citizen could hope to hear. It is followed (in, of course, due chronological order) by a minutely accurate account of the symptoms of the pestilence ("so that it may be recognized by medical men if it recurs") and a moving description of the demoralizing despair that overtook men after so much suffering and such heavy losses—probably more than a quarter of the population, most of it crowded within the walls of the city, died.

Equally moving is the account of the last battles in the great harbour of Syracuse and of the Athenian retreat. In one of his best-known passages he analyzes by a most careful choice of words, almost creating the language as he writes, the moral and political effects of civil strife within a state in time of war. By a different method, in speeches, he portrays the hard fate of the town of Plataea due to the long-embittered envy and cruelty of Thebes and the faithlessness of Sparta, and the harsh brutality of Cleon when he proposed to execute all the men of the Aegean island city of Mytilene. Occasionally, he is forced into personal comment, as on the pathetic fate of the virtuous and much-liked Athenian Nicias.

He had strong feelings, both as a man and as a citizen of Athens. He was filled with a passion for the truth as he saw it, which not only kept him free from vulgar partiality against the enemy but served him as a historian in the accurate narrative of events—accurate in their detail and order and also in their relative importance. He does not, for example, exaggerate the significance of the campaign he himself commanded, nor does he offer a self-defense for his failure. Characteristically, he mentions his exile not as an event of the war but in his "second preface"—after the peace of 421—to explain his opportunities of wider contacts.

*Subsequent fame.* The story of his later fame is a curious one. It has been mentioned above that in the two generations after his death three historians began their work where he had left off; but, apart from this silent tribute and late stories of his great influence on the orator Demosthenes, Thucydides is nowhere referred to in surviving 4th-century literature, not even in Aristotle, who, in his *Constitution of Athens,* describes the revolution in Athens in 411 and diverges in many ways from Thucydides' account.

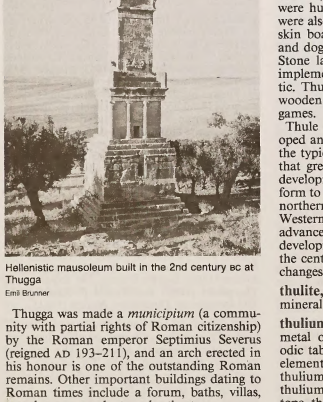
It was not until the end of the 4th century that the philosopher Theophrastus coupled Thucydides with Herodotus as a founder of the writing of history. Little is known of what the scholars of Alexandria and Pergamum did for his book; but copies of it were being made in considerable numbers in Egypt and so, doubtless, elsewhere, from the 1st to the 5th century AD. By the 1st century BC, as is clear from the writings of Cicero and Dionysius (who vainly disputed his preeminence), Thucydides was established as the great historian, and since that time his fame has been secure. (A.W.Ge.)

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**thug,** Hindī THAG, Sanskrit STHAGA ("thief," "rogue"), member of a well-organized confederacy of professional assassins who traveled in gangs throughout India for several hundred years. (The earliest authenticated mention of the thugs is found in Ẓiyā'-ud-Dīn Baranī, *History of Fīrūz Shāh,* dated about 1356.) The thugs would insinuate themselves into the confidence of wayfarers and, when a favourable opportunity presented itself, strangle them by throwing a handkerchief or noose around their necks. They then plundered and buried them. All this was done according to certain ancient and rigidly prescribed forms and after the performance of special religious rites, in which the consecration of the pickax and the sacrifice of sugar formed a prominent part. Although the thugs traced their origin to seven Muslim tribes, Hindus appear to have been associated with them at an early period; at any rate, their religious creed and practices as worshipers of Kālī, the Hindu goddess of destruction, showed no influence of Islām. The fraternity possessed a jargon of its own (Ramasi) and signs by which its members recognized each other.

Though sporadic efforts were made toward the extinction of the gangs, it was not until Lord William Bentinck (British governor-general of India, 1833–35) took vigorous steps that the system was seriously attacked. His chief agent, Captain William Sleeman, with the cooperation of the authorities in a number of princely states, succeeded so well in eliminating the evil that from 1831 to 1837 no fewer than 3,266 thugs had been captured, of whom 412 were hanged, 483 gave evidence for the state, and the remainder were transported or imprisoned for life. The fraternity presumably thereafter became extinct.

**Thugga,** modern DOUGGA, the best-preserved ancient Roman city in modern Tunisia, located near modern Tabursuq, west of the ancient road between Carthage and Theveste (modern Tébessa, Algeria). Thugga's most notable pre-Roman ruin is a 2nd-century-BC mausoleum, built in honour of a Numidian prince. A three-storied building topped by a pyramid, the mausoleum contained a bilingual Phoenician and Numidian inscription and represented a fusion of the Egyptian pyramidal funerary building and the Hellenistic Greek temple. It was probably an ancestor of the tower tombs with slender pyramids that were characteristic of Roman Africa.



Hellenistic mausoleum built in the 2nd century BC at Thugga
Emil Brunner

Thugga was made a *municipium* (a community with partial rights of Roman citizenship) by the Roman emperor Septimius Severus (reigned AD 193–211), and an arch erected in his honour is one of the outstanding Roman remains. Other important buildings dating to Roman times include a forum, baths, villas, temples, an aqueduct, and a theatre.

**thugyi** (Burmese: "headman"), in Myanmar (Burmese) history, the title of either of two local royal officials: the *myothugyi,* or township chief, most common in the south, and the *thaikthugyi,* or regional chief, exclusive to the north.

A *myothugyi* performed as a government official within special service areas (*asu,* or *athin*). As an appointed arbitrator, he took responsibility for settling disputes among his followers and ensured the performance of their duties, whether civilian or military, in the several types of regional *asu.* The governing authority of the *myothugyi* differed in extent and in kind from that of royally appointed officials: as a local hereditary leader of the people, the *myothugyi* held office for life; if his line died out, a new *myothugyi* could be designated by the Hlutdaw (ministerial council). A *myothugyi* tended to identify himself with the interests of his own people, in contrast to the essentially arbitrary and often predatory authority of the appointed royal officials. *Myothugyis* were basically the protecting police officers, public-works commissioners, justices of the peace, apportioners and collectors of taxes, and recruiters for the armed forces.

The *thaikthugyi,* similar to the *myothugyi* in duties and privileges, operated in areas where the population was more alien (*athi*) and imperfectly assimilated. A *thaikthugyi* could acquire genuine authority locally through election by the villages and authentication by the Hlutdaw. In addition to other duties, a *thaikthugyi* kept census records and helped conscript men for the army.

**Thule** (Greenland): *see* Dundas.

**Thule culture,** prehistoric Eskimo (Inuit) culture that developed along the Arctic coast in northern Alaska and possibly as far east as the Amundsen Gulf. It spread rapidly eastward, starting about 900 and reaching Greenland (Kalâtdlit-Nunât) by the 12th century. It continued to develop in the central areas of Arctic Canada, and there was a feedback movement from the Eastern Thule to the Western Thule of Alaska from about 1300 to 1700.

Thule culture was oriented toward whaling. Settlements of permanent winter houses built of whale bones, skin, and sod, some of them semisubterranean, were located on the seashore. Snowhouses were built during winter journeys, and skin tents probably were used in summer. Whales, seals, walrus, polar bears, caribou, musk-oxen, and smaller mammals were hunted. Birds, fish, mussels, and plants were also collected. Kayaks (one-man covered skin boats), umiaks (large, open skin boats), and dog-drawn sleds provided transportation. Stone lamps and cooking pots, ground-slate implements, and whalebone were characteristic. Thule art includes small carved ivory or wooden figures, possibly used for magic or for games.

Thule culture is considered a highly developed and specialized Eskimo culture, with all the typical Eskimo implements and weapons, that greatly influenced later Eskimo cultural development. It probably survives in modified form to the present in parts of eastern Canada, northern Greenland, and northwestern Alaska. Western Thule culture, influenced by eastern advances, forms the basis for Alaskan cultural development. Thule culture disappeared from the central areas, possibly because of climatic changes, in the 15th century.

**thulite,** pink, manganese-rich variety of the mineral zoisite (*q.v.*).

**thulium** (Tm), chemical element, rare-earth metal of transition Group IIIb of the periodic table. One of the rarest of the rare-earth elements, though more abundant than silver, thulium has few commercial uses. Natural thulium is wholly composed of the stable isotope thulium-169. Bombarded by neutrons, it becomes radioactive thulium-170 (128-day half-life), which ejects soft gamma radiation (0.084 million electron volts) resembling an X ray. It is useful in small portable X-ray units suitable for photographing bony tissues and for examining thin-walled machine parts and has been used by archaeologists to examine markings and symbols on ancient metallic artifacts.

Thulium was discovered (1879), along with holmium, by Per Teodor Cleve, who named the oxide thulia after an ancient name for Scandinavia. It is found in small amounts in such rare-earth minerals as xenotime and euxenite and in the products of nuclear fission. Commercial production involves ion exchange from the important mineral monazite (only about 0.007 percent thulium).

Thulium can be prepared in the divalent state, as in the dark-coloured diiodide $TmI_2$. The $Tm^{2+}$ ion is not stable in water; it momentarily gives a violet-red colour before being oxidized to the predominant +3 state. Trivalent thulium forms a series of pale-green salts.

| | |
|---|---|
| atomic number | 69 |
| atomic weight | 168.934 |
| melting point | 1,545° C |
| boiling point | 1,727° C |
| specific gravity | 9.314 (25° C) |
| valence | 2, 3 |
| electronic config. | 2-8-18-31-8-2 or $(Xe)4f^{13}5d^{0}6s^{2}$ |

**thuluth script,** in calligraphy, medieval Islāmic style of handwritten alphabet. Thuluth (Arabic: "one-third") is written on the principle that one-third of each letter slopes. It is a large and elegant, cursive script, used in medieval times on mosque decorations. It took on some of the functions of the early Kūfic script; it was used to write surah (or sura; Qur'ānic chapter) headings, religious inscriptions, and princely titles and epigraphs. It was also used for many of the large copies of the Qur'ān produced from the 13th century.

**thumb,** also called POLLEX, short, thick first digit of the human hand and of the lower-primate hand and foot. It differs from other digits in having only two phalanges (tubular bones of the fingers and toes). The thumb also differs in having much freedom of movement and being opposable to tips of other digits. The corresponding first digit (most medial digit) in other vertebrates is also called the thumb, especially if it has some manipulative or special ability (*e.g.,* in the raccoon and the bat).

**Thumb, Tom:** *see* Stratton, Charles.

**thumb piano** (musical instrument): *see* lamellaphone.

**Thun** (German), French THOUNE, city, Bern *canton,* central Switzerland, on the Aare River, which there issues from Lake Thun (Thuner See). It is the gateway and principal centre of the Berner Oberland (highland), just southeast of Bern city. Lakes Thun and Brienz occupy an ancient terminal basin of the Aare glacier.

Founded in the 12th century, the town belonged to the kingdom of Burgundy until it



Thun, Switz., on the Aare River with the Zähringen-Kyburg Castle in the background
Paolo Koch from Rapho/Photo Researchers

passed to the dukes of Zähringen in 1190, to the counts of Kyburg in 1218, and to the city-state of Bern in 1384. Notable landmarks are the Zähringen-Kyburg Castle (tower 1186–91, living quarters 1429), now a museum; the Protestant church (rebuilt 1738); the town hall (1589); and the Scherzligen Church (12th century). Cheese, machinery, watches, and pottery are produced. Pop. (1991 est.) 37,950.

**Thun und Hohenstein, Franz Anton, Prince** (Fürst) **zu** (b. Sept. 2, 1847, Tetschen, Bohemia, Austrian Empire [now Děčín, Czech Republic]—d. Nov. 1, 1916, Tetschen), Austrian administrator, prime minister, and gov-

ernor of Bohemia, who favoured compromise with Czech nationalists but was defeated by extremist Czech and German opposition.

Franz Anton was the son of Friedrich, Count von Thun und Hohenstein, and he shared the moderate pro-Czech views of his uncle Leo, Austrian minister for religious affairs and education. As governor of Bohemia from 1889, Franz supported a language compromise between Czechs and Germans. Disturbances by the nationalistic Young Czechs contributed to his resignation in 1895. Serving as Austrian prime minister from 1898 to 1899, he was ousted by German nationalists. Created a prince in 1911, he again held the governorship of Bohemia (1911–15).

**Thun und Hohenstein, Friedrich, Count** (Graf) **von** (b. May 8, 1810, Tetschen, Bohemia, Austrian Empire [now Děčín, Czech Republic]—d. Sept. 24, 1881, Tetschen), Austrian diplomat and administrator who served as president of the German federal diet at Frankfurt in 1850, where he repeatedly clashed with Prussia's representative Otto von Bismarck.

After the suppression of the 1848–49 revolutions in Germany and Austria, Thun, an astute politician, headed the Austrian delegation to the reestablished German diet at Frankfurt. As president of that body and spokesman for the conservative Austrian faction, he opposed Prussia's proposals—forcefully presented by Bismarck—for a more tightly centralized German confederation led by Prussia. Thun served as minister to Prussia (1852–54) and as minister to Russia (1859–63). After retiring from the diplomatic service he was active in Bohemian and Austrian internal politics.

**Thun und Hohenstein, Leo, Count** (Graf) **von** (b. April 7, 1811, Tetschen, Bohemia, Austrian Empire [now Děčín, Czech Republic]—d. Dec. 17, 1888, Vienna, Austria-Hungary), pro-Czech Austrian statesman and administrator who improved the educational establishments of the Austrian Empire, sought to resolve the antagonisms between Czechs and Germans in Bohemia, and favoured the conversion of the Habsburg monarchy into a federal state.

Leo was the younger brother of Friedrich, Count von Thun und Hohenstein. He was basically conservative but was much affected by the Romantic movement and sympathetic to the national aspirations of the Czechs, Poles, and Hungarians in the Habsburg empire. As Austrian minister for religious affairs and education (1849–60), he allowed instruction in some primary schools to be conducted in the regional languages and raised the quality of higher education by bringing in scholars from Germany. The 1855 concordat between Austria and the papacy, however, reestablished Roman Catholic control over education. Thun served as governor of Bohemia in 1848 and was again active in Bohemian politics after 1861. He favoured greater rights for Czechs and became a spokesman of the "feudal" party of Bohemian aristocrats, working toward the federalization of the Habsburg empire.

**thunder,** sound caused by a lightning discharge. The discharge heats and expands the air around it and forms a compression wave that is heard as thunder. The return stroke of the lightning flash produces a much louder sound than does the leader, because it transmits a more powerful electric current. Because the lightning channel is usually quite long, the thunder from the more distant portions arrives later than that from the nearer portions; this accounts for its duration. The distance to the flash may be roughly estimated by measuring the time lag between it and the thunder and allowing about five seconds per mile (three seconds per kilometre). Thunder is seldom heard at distances greater than about 15 miles (24 km). *See also* thunderstorm.

**Thunder Bay,** also called LAKEHEAD, city, seat of Thunder Bay district, west-central Ontario, Canada, on Lake Superior's Thunder Bay, at the mouth of the Kaministiquia River.



Grain storage depot at Thunder Bay, Ont.
National Film Board of Canada Phototheque

Probably first occupied by French fur traders as early as 1678, its site was permanently settled only after the birth of the towns Port Arthur and Fort William in the 19th century. Fort William originated shortly after 1800, when the North West Company built a fur-trapping fort at the mouth of the Kaministiquia River. Port Arthur, the "Hill City," developed in the 1850s as a silver-mining settlement on the hummocks a few miles to the north. Both communities prospered in the early 1870s from silver strikes in the vicinity and again with the arrival of the Canadian Pacific Railway in the 1870s and '80s. An intense rivalry that existed between the two for some time was resolved with the unification of their harbour facilities in 1906. Plans to amalgamate the twin cities began in the 1950s, and the merger created the city of Thunder Bay in 1970.

As a major transportation centre on main rail, highway, and lake steamer routes, Thunder Bay is one of Canada's busiest ports and one of the world's largest grain storage and transshipment depots. It lies in the heart of a rich mining (gold, copper, silver, and iron ore), fur-farming, lumbering, and fishing region, served by the nearby hydroelectric plants of Silver and Kakabeka falls. Among the industries found in the area are shipbuilding and repair; flour, pulp, and paper milling; woodworking; brewing; and the manufacture of bricks, buses, trucks, and aircraft. Thunder Bay is the site of Lakehead University (founded in 1965). Pop. (1991) city, 113,746; metropolitan area, 124,427.

**Thunder Bay,** inlet of northwestern Lake Superior, indenting the coast of west-central Ontario, Canada. The bay is 35 miles (55 km) long and 15 miles (24 km) wide; it receives the Kaministiquia and Current rivers. Pie Island lies at the entrance to the bay, and Sibley Provincial Park, 94 square miles (243 square km), is located on the peninsula that forms the bay's eastern shore. The important port city of Thunder Bay is situated on the western shore.



Thunder Bay, near the city of Thunder Bay, Ont.
Ron Winch—Photo Researchers

**thunder cult,** prehistoric beliefs and practices that at times seem directed toward one aspect of the supreme sky god and at other times appear to be concerned with a separate thunder deity. Although beginning perhaps much earlier, the thunder cult became especially prominent in western Europe during the Neolithic Period. In the cult, the ax appears to have been regarded as the symbol of the thunderbolt hurled by the sky god. Numerous representations of the ax have been discovered on painted rocks and the walls of Neolithic tombs; in addition, both large and small stone and clay axes with cuplike borings in them have been found, the smaller ones having been used as charms or votive objects.

**thunderbird,** in North American Indian mythology, a powerful spirit in the form of a bird. By its work, the earth was watered and vegetation grew. Lightning was believed to flash from its beak, and the beating of its wings was thought to represent the rolling of thunder. It was often portrayed with an extra head on its abdomen.

The thunderbird was frequently accompanied by lesser bird spirits, often in the form of eagles or falcons. Although it is best known from North America, evidence of similar figures has been found throughout Africa, Asia, and Europe (where it is associated with the woodpecker).



Wooden thunderbird of the Haida Indians, northwest coast of North America, 19th century; in the British Museum
By courtesy of the trustees of the British Museum

**Thunderbolt** (U.S. aircraft): *see* P-47.

**Thunderer,** in Baltic religion, a sky deity usually known as Perkūnas (Lithuanian) or Pērkons (Latvian). *See* Pērkons.

**thunderstorm,** any violent, short-lived atmospheric disturbance almost always associated with cumulonimbus clouds (dense rain clouds of great vertical extent) and accompanied by thunder and lightning. In most cases, such storms generate strong, gusty winds, heavy rain, and, occasionally, hail or tornadoes.

A brief treatment of thunderstorms follows.

For full treatment, *see* MACROPAEDIA: Climate and Weather.

A deep layer of moist air and a vertical temperature distribution favourable to the development of intense local overturning are essential for thunderstorm formation. The rate of decrease of air temperature with height is known as the temperature lapse rate. In general, steep lapse rates (*i.e.*, rapid decreases of temperature with height) are most favourable for thunderstorms, because it is under these conditions that an air parcel made warmer than its environment is capable of rising through the atmosphere by virtue of buoyancy forces. After any given parcel of air is lifted to the point of condensation at the cloud base, the released latent heat of condensation will be added to the parcel. This will assist further ascent. In the upper parts of the thundercloud, where snow and ice crystals are found, the latent heat of fusion will also contribute to sustaining the updraft currents.

The average thunderstorm consists of three to five convective cells, each of which undergoes a life cycle characterized by changes in the direction and magnitude of the strong, nearly vertical air currents. Three stages in this life cycle are recognized. In the initial, or cumulus, stage, the cell contains strong upward-moving air currents that extend from below the cloud base to the cloud top. The updrafts average speeds of about 4 to 8 m (13 to 26 feet) per second. If the air is sufficiently unstable, there will be a continual supply of energy for the updraft and the cell will continue to develop in size and intensity. With increase in size comes an increase in total cloud-water content. After the establishment of an active updraft, precipitation particles will grow to a size at which they become important both in the further development of the cell and in the formation of electrical-charge centres. The precipitation usually will be in the form of snow and snow pellets in the upper, colder parts of the cell and of raindrops in its lower, warmer regions. At this time the cell passes into the mature stage of development.

The centres of electrical charge become well established during the mature stage. The lightning that invariably accompanies a thunderstorm is a crash discharge between an upper positive centre and a lower negative centre or between one of these and the ground. Each lightning flash generally consists of several strokes in rapid sequence, with time separations of a few hundredths of a second. The sound of thunder originates in a compression wave formed along the highly heated path of a lightning stroke. Each portion of the path of a stroke releases intense sound waves, which travel different paths to the observer.

In the mature stage, both upward- and downward-moving air currents are present within a component cell. The updraft of the initial stage gives way to downdraft as the size and number of precipitation particles increase. This reversal of the updraft is also aided by evaporational cooling, which occurs as clear air from outside the cloud is mixed into the cloud by the turbulent motions. At first, the downdraft is small and located on one side of the updraft. Gradually, however, it works its way across the cell and squeezes off the updraft, at which time the cell goes into the final, or dissipating, stage.

At the ground, the onset of heavy rain marks the beginning of the mature stage. The downdraft, which coincides closely with the rain area, reaches the surface a few minutes after the first rain. Because of the continued evaporation, air in the downdraft is cold, which accounts for its great downward speed. As the downdraft nears the ground, it is diverted and spreads outward in all directions as a cold, gusty wind blowing from the rain area.

A thunderstorm cell in the dissipating stage is filled throughout by weak subsiding air and light precipitation. Rain at the Earth's surface is much less intense than was the case during the mature stage. The cold outflow gradually subsides as a result of the waning downdraft.

The time duration of a thunderstorm is somewhat variable, but observations indicate that the first two stages of development usually last about 15 to 20 minutes each. During these stages, the visual cloud will frequently reach heights of 11,000 to 20,000 m (36,000 to 66,000 feet) and horizontal dimensions of several kilometres. The duration of a cell in the final stage varies over wide limits. Some storms end abruptly, whereas others may linger for several hours as a gentle rain from a large, formless cloud mass. These differences result from different conditions of the air masses in which the clouds form. The anvil-shaped, upper region so characteristic of thunderclouds is formed when the rising cloud air encounters a thermally stable layer in the troposphere—the portion of the atmosphere below the stratosphere, extending about 11 to 16 km (7 to 10 miles) from the Earth's surface.

Thunderstorms have been known to occur in almost every part of the world. They are, however, rare in the polar regions and infrequent poleward of latitudes 50° N and 50° S. In the United States the areas of maximum thunderstorm activity are the Florida peninsula and the coast of the Gulf of Mexico (70–80 days per year) and the mountains of New Mexico (50–60 days). Central Europe and Asia average 20 to 60 thunderstorm days annually. It has been estimated that at any one moment there are about 1,800 thunderstorms in progress throughout the world.

**Thünen, Johann Heinrich von** (b. June 24, 1783, Jever, Oldenburg [Germany]—d. Sept. 22, 1850, Tellow, Mecklenburg [Germany]), German agriculturalist best known for his work on the relationship of the costs of commodity transportation to the location of production.



Thünen, lithograph by J.H. Funcke after a portrait by W. Ternite

By courtesy of Bildarchiv Preussischer Kulturbesitz BPK, Berlin

In 1810 Thünen began gathering data for the book for which he is remembered, *Der isolierte Staat* (1826; "The Isolated State"). In this work he imagined an isolated city, set in the middle of a level and uniformly fertile plain without navigable waterways and bounded by a wilderness. In this model he showed concentric zones of agricultural production. Heavy products, in proportion to value, and perishables would be produced close to the town; lighter and durable goods, on the periphery. As transport costs to the city increased with distance, the returns to the land would diminish until, at a certain distance, land rent would become zero. Moreover, methods of cultivation would vary—with land cultivated more intensively near the city, where it was more valuable. Subsequent writers have often built upon Thünen's model.

**Thurber, James (Grover)** (b. Dec. 8, 1894, Columbus, Ohio, U.S.—d. Nov. 2, 1961, New York, N.Y.), American writer and cartoonist, whose well-known and highly acclaimed writings and drawings picture the urban man as



Self-portrait, drawing by James Thurber from *Thurber and Company* by Helen Thurber, 1966

Copyright © 1966 Helen Thurber, from *Thurber & Company* published by Harper and Row, New York

one who escapes into fantasy because he is befuddled and beset by a world that he neither created nor understands. Walter Mitty, the henpecked, daydreaming hero in the short story "The Secret Life of Walter Mitty" (from *My World—and Welcome to It*, 1942), is Thurber's quintessential urban man.

Thurber attended Ohio State University from 1913 to 1918 and left without taking a degree. He held several newspaper jobs before going in 1926 to New York City, where he was a reporter for the *Evening Post*. In 1927 he joined Harold Ross's newly established magazine, *The New Yorker*, as managing editor and staff writer, making a substantial contribution to setting its urbane tone. He was later to write an account of his associates there in *The Years with Ross* (1959).

His first published drawing in the magazine appeared in 1931. He considered himself primarily a writer and had been offhand about his sketches. But his friend, the essayist E.B. White, noticed their worth and had them used as illustrations for their jointly written *Is Sex Necessary?* (1929), a spoof on the then-popular earnest, pseudoscientific approach to sex. Thurber's stock characters—the snarling wife, her timid, hapless husband, and a roster of serene, silently observing animals—have become classics of urban mythology.

After Thurber left *The New Yorker* staff in 1933, he remained a leading contributor. In 1940, failing eyesight, the result of a boyhood accident (he had lost use of his left eye at age 6), forced him to curtail his drawing, and by 1952 he had to give it up altogether as his blindness became nearly total.

*My Life and Hard Times* (1933) is a whimsical group of autobiographical pieces; a similar collection of family sketches appeared later in *The Thurber Album* (1952). His *Fables for Our Time* (1940) are deceptively simple and charming in style, yet unflinchingly clear-sighted in their appraisal of human foibles. A play, *The Male Animal* (1941), written with Elliott Nugent, is a plea for academic freedom as well as a comedy. His fantasies for children, *The 13 Clocks* (1950) and *The Wonderful O* (1957), are among the most successful fairy tales of modern times. *The Thurber Carnival* (1945), a collection of his writings and drawings, was adapted for the stage in 1960, with Thurber playing himself. A further collection, *Credos and Curios,* was published posthumously in 1962.

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**Thurgau** (German), French THURGOVIE, *Kanton* ("canton"), northeastern Switzerland. It is bordered on the north by Lake Constance (Bodensee), by the Rhine River on the northwest, and by the cantons of Sankt Gallen on the south and Zürich and Schaffhausen on the west. With an area of 391 square miles (1,013 square km), it is divided into three hill masses: one stretching along the lake; another inland, bounded north by the Thur River and south by its affluent, the Murg; and the third at the southern extremity of the canton, merging into the pre-Alpine zone of Mount Hörnli. Frauenfeld (*q.v.*) is the capital.

Inhabited by lake dwellers (the Pfyn culture) in prehistoric times, it was later part of the Roman province of Raetia for several centuries until AD 450, after which it passed to the Alamanni, a Germanic tribe. From the 8th century on, it appeared as a political unit, extending as far west as the Reuss River and as far south as the foot of the Alps. In the later European Middle Ages the county of Thurgau, already much reduced in size, belonged successively to the dukes of Zähringen and the counts of Kyburg. With the extinction of the Kyburg line in 1264, the county passed to the Habsburgs, from whom it was seized by the confederated Swiss states in 1460 and thenceforth ruled as a subject district. In 1798 it became a canton of the Helvetic Republic and in 1803 a full member of the Swiss Confederation. Its cantonal constitution dates from 1869.

Thurgau is a prosperous agricultural area known for apples and pears and for cider making. There are vineyards along the lake and in the Thur valley. Industries include printing, handicrafts, and the manufacture of textiles, shoes, and motor vehicles. The canton is traversed by two railways with several branch lines. The population is mostly German-speaking and about two-thirds Protestant and one-third Roman Catholic. Pop. (1989 est.) 198,371.

**thurible,** also called CENSER, vessel used in the Christian liturgy for the burning of aromatic incense strewn on lighted coals. Censers of terra-cotta or metal were widely used in Egypt, in the ancient Middle Eastern civilizations, including the Jewish, and in the classical world. Because they were destined chiefly for religious worship, above all in funeral rites, they were often the object of artistic effort. The shapes varied. Both an open bowl with a handle or with chains for carrying and a closed receptacle with openings for smoke to escape were known.

The earliest evidence of the thurible in Christian usage is found in the 4th century, when the Roman emperor Constantine is said to have donated several to the Church of San Giovanni in Laterano (St. John Lateran) in Rome. Their purpose, however, was only to add fragrance to the church. The first strictly liturgical use in the West dates from the 7th century, when thuribles were employed in ritual gestures of honour for the bishop and the book of Gospels. In the course of the centuries, the Christian thurible assumed various artistic and often highly ornate shapes. Whether in the earlier open or the subsequent more closed form, it has generally been carried by means of three or four chains attached to a central ring. In the Eastern liturgies the thurible plays a far more prominent role than it does in those of the West.

**Thuringia,** German THÜRINGEN, historic region and *Land* (state) of Germany. Thuringia *Land* was re-created just prior to the unification of East with West Germany in 1990. It was constituted from the former East German *Bezirke* (districts) of Suhl, Erfurt, and Gera and from small parts of Leipzig and Halle *Bezirke*. The *Land* occupies the southwestern portion of what was formerly East Germany and covers an area of 6,275 square miles (16,251 square km). The capital is Erfurt.

Thuringia extends eastward from the Werra River (a headstream of the Weser) into the country beyond the Saale River as far as the Pleisse and northward from the mountains of the Thuringian Forest and the Franconian Forest to the foothills of the Harz mountains. Eisenach, Gotha, Erfurt, Weimar, Jena, Gera, and Altenburg are towns on the west-east axis; Meiningen and Suhl stand in the southwest, Sonderhausen and Nordhausen in the north.

The Germanic Thuringians appeared after about AD 350 and were conquered by the Huns in the second quarter of the 5th century; but by 500 they had established a large kingdom stretching from the Harz mountains to the Danube. As a result of the defeat of their king, Irminfrid, at Burgscheidungen on the Unstrut River by the Frankish kings Theodoric I and Chlotar I in 531, their territory was reduced to the Harz mountains and Thuringian Forest region and was governed by Frankish dukes. In the early 8th century the duchy was divided into countships to reassert royal authority, and St. Boniface converted the Thuringians to Christianity. In 908 the Thuringian March (frontier district), set up by Charlemagne against the Slavs, was seized by Otto, duke of Saxony, whose son, Henry I, duke and German king, halted a Magyar invasion of Thuringia at Riade in 933 and strengthened the defenses of the region. After the Saxon royal dynasty had died out in 1024, the Ludowing family, through Louis the Bearded, controlled Thuringia. Louis' grandson was made landgrave of Thuringia by King Lothair III in 1130.

Landgrave Henry Raspe was elected German antiking (against Conrad IV) in 1246; he died the next year. After a war over the long-disputed succession (1256–63), Henry III the Illustrious, margrave of Meissen, of the house of Wettin, made good his claim and invested his son Albert with Thuringia in 1265. It thereafter remained a possession of the Wettins, and in the 15th century it was divided between Ernestine Saxony, Hesse-Kassel, and several smaller states. Prussia also received sections of Thuringia at the Congress of Vienna (1814–15) and after the Seven Weeks' War (1866).

In 1920, under the Weimar Republic, several old Thuringian territories (chiefly the Ernestine Saxon duchies) were merged in a new Thuringia, a *Land* of republican Germany, with Weimar as its capital. The frontiers remained anomalous: Erfurt was still attached to the Prussian province of Saxony; there were enclaves belonging to Prussian Saxony or to Prussian Hesse-Nassau surrounded by Thuringian territory; and conversely parts of Thuringia were enclaved within Prussian Saxony. After World War II all Thuringia fell to the Soviet-occupied zone of Germany. With the administrative dissolution of Prussia, an enlarged Thuringia *Land* was constituted within the German Democratic Republic, with rationalized frontiers, including the southwest of the former province of Saxony and all the former enclaves; the capital was Erfurt. In 1952, however, when the East German *Länder* were dissolved, Thuringia was divided between the *Bezirke* of Erfurt, Suhl, Gera, Halle, and Leipzig. Thuringia was reconstituted as a *Land* in 1990 with boundaries similar to those of its post-World War II predecessor.

Much of southern Thuringia is occupied by the picturesque rounded hills of the Thuringian Forest. The northern slopes of this forest reach elevations of about 3,000 feet (900 m). The Harz mountains mark the *Land*'s northern border. Lying between the Harz (north) and Thuringian Forest (south) ranges is the Thuringian Basin, a fertile agricultural region whose eastward-flowing streams are tributaries of the Saale River. Wheat, barley, sugar beets, and market vegetables predominate in the basin's agriculture, and orchards and vineyards cover the slopes overlooking the Ilm River. Deposits of lignite and potash are worked in the northern part of the Thuringian Basin. Extreme eastern Thuringia is traversed by the westerly offshoots of the Erzgebirge, while the Rhon Mountains extend into western Thuringia. The southeastern portion of the *Land* belongs to the bleak, mountainous region of the Franconian Forest and the Vogtland. The principal river in Thuringia is the Saale, which runs basically northward.

Thuringia's economy is largely industrial, with the principal manufactures being metal-working, precision machinery, electrical equipment, textiles, and chemicals. Glass, wood, and toy industries are found in some towns of the forest valleys. Erfurt, Jena, Gera, and Weimar are the main urban centres in the *Land*. Pop. (1990 est.) 2,684,000.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Thuringian Basin,** German THÜRINGER BECKEN, fertile agricultural region of Germany, between the Harz mountains on the north and the Thuringian Forest range on the south. It extends westward from the Saxon lowland. The basin's eastward-flowing streams, tributaries of the Saale River, swell—and sometimes flood—with snowmelt in the spring. The climate and soil are favourable to agriculture. Grains and root crops predominate. Orchards and vineyards cover the slopes overlooking the Ilm River. Industry is well developed in the major cities of Gotha, Erfurt, and Weimar. Lignite and potash are worked in the north.

**Thuringian Forest,** German THÜRINGERWALD, a range of forested hills and mountains in Germany, extending in an irregular line from the neighbourhood of Eisenach in west-central Thuringia southeastward to the Bavarian frontier, where it merges with the Franconian Forest. Its breadth varies from 6 to 22 miles (10 to 35 km). It nowhere rises into peaks, and, of its rounded summits, the highest, Beerberg, rises only 3,222 feet (982 m). This range encloses many charming valleys and glens; the most prominent feature of its scenery is formed by the forests, chiefly of pines and firs. The northwest part of the system is the loftier and the more densely wooded as well as the more beautiful. The southeast part is the more populous and industrial.

The crest of the Thuringian Forest, from the Werra to the Saale rivers, is traversed by the Rennsteig, or Rainsteig, a broad path of unknown antiquity. The name probably means "frontier path," and the path marked in fact the historical boundary between Thuringia and Franconia. It may be also regarded as part of the boundary line between north and south Germany, for dialect, customs, local names, and native costume have traditionally been different on the two sides. The area was once an iron-mining centre (until the 16th century) but is now largely given over to small industries (toymaking, wood carving, and glass and china manufacturing) and to tourism in such resorts as Eisenach, Friedrichroda, Giessübel, and Oberhof.

**Thurles,** Irish DURLAS ("Strong Ring Fort"), town, County Tipperary, Ireland, on the banks of the River Suir. The seat of the Roman Catholic archbishopric of Cashel and Emly, the town is a marketing centre for a large agricultural area; it has a sugar beet factory, and it

is a well-known sporting centre. The Knights Templars held a 13th-century castle there and founded a preceptory. A Carmelite priory existed from 1300 to 1540; the cathedral (1857–75) was built in Romanesque style on the priory site. Bridge and Black castles are all that remain of the Butler family castles. The Abbey of Holy Cross, founded for the Benedictines and transferred to the Cistercians about 1182, has been much restored; and its ruins are well preserved. Pop. (1981) 7,352.

**Thurloe, John** (b. June 1616—d. Feb. 21, 1668, London), English secretary of state during Oliver Cromwell's Protectorate. His voluminous correspondence provides one of the chief historical sources for the Cromwellian era.



Thurloe, detail of a portrait by an unknown artist; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Thurloe entered politics as secretary to the Parliamentary leader Oliver St. John and in March 1652 was appointed secretary to Cromwell's Council of State. Soon he became head of a vast intelligence service that operated throughout Europe, gathering information about Royalist plots to overthrow Cromwell's government. He played a key role in the succession of Richard Cromwell as Lord Protector in 1658 and sat in the Parliament of 1659, but his influence waned after Cromwell's fall the same year.

Upon the Restoration of Charles II in May 1660, he was arrested for high treason; his release was granted on condition that he provide the new government with information on the current state of England's foreign policy.

**Thurlow (of Ashfield and Thurlow), Edward Thurlow, 1st Baron** (b. Dec. 9, 1731, Bracon Ash, Norfolk, Eng.—d. Sept. 12, 1806, Brighton, Sussex), lord chancellor of England from June 1778 to April 1783 and from December 1783 to June 1792, who gained that office and continued to hold it under a variety of prime ministers by supporting the extreme conservatism of King George III. He was noted more for his great (though often venomous) oratory than for his legal wisdom.

Called to the bar in 1754, Thurlow became king's counsel in 1762, a member of the House of Commons in 1765, solicitor general in 1770, and attorney general in 1771. The post of attorney general was a reward for his prosecution of the publisher and printers of the pseudonymous "Junius" letters (1769–72) attacking George III and several leading politicians. Later he defended the British slave trade and absolutist rule of the North American colonies. Thurlow made many political enemies, among them Charles James Fox, who secured his temporary removal from the lord chancellorship in 1783, and William Pitt, the Younger, who came to regret restoring him to office. As lord chancellor, he incurred Prime Minister Pitt's hatred by his conservative obstructionism in the House of Lords; Pitt finally compelled him to retire in 1792 and thereupon strengthened the principle of Cabinet solidarity. From his student days Thurlow was a friend of the poet William Cowper, and he provided financial aid to two other men of letters, George Crabbe and Samuel Johnson. *Chancellor Thurlow,* by Robert Gore-Browne, appeared in 1953.

**Thurmond, (James) Strom** (b. Dec. 5, 1902, Edgefield, S.C., U.S.), American politician, a prominent states' rights and segregation advocate who ran for the presidency in 1948 on the Dixiecrat ticket and afterward became a longtime member of the U.S. Senate.

Thurmond graduated from Clemson College, Clemson, S.C., in 1923. He taught school for six years and was admitted to the bar in 1930. He then served as a city and county attorney until 1938 and was also a state senator (1933–38) and a circuit court judge (1938–41). Thurmond emerged from his military service in World War II a highly decorated lieutenant colonel. He was elected governor of South Carolina in 1946 and proceeded to initiate several liberal reforms, including a notable expansion of the state educational system. At the Democratic National Convention of 1948, however, Thurmond led the bolt of Southern delegates angry over the civil rights plank in the party platform. The Southerners formed the States' Rights Democratic Party—popularly known as the Dixiecrats—and nominated Thurmond as their presidential candidate. He won 39 electoral votes.

Elected by write-in vote to the Senate in 1954, Thurmond quickly established himself in the Southern conservative mold as a vigorous champion of increased military power and spending and an archfoe of civil rights legislation. He was reelected in 1960, but in 1964 he again left the Democratic Party in support of the conservative Republican presidential nominee, Barry Goldwater. Reelected as a Republican to six more consecutive terms, he continued to seek Southern conservative support for the GOP. In 1997 Thurmond became the longest-serving senator in U.S. history.

**Thurn and Taxis postal system,** imperial and, after 1806, private postal system operated in western and central Europe by the noble house of Thurn and Taxis. At least two early ancestors of the family, then called Tassis, had operated courier services in the Italian city-states from about 1290, but the family's important postal activities began with Franz von Taxis, who served as postmaster to the Holy Roman emperor Maximilian I from 1489 and to Philip I of Spain from 1504. Von Taxis secured the right to carry both government and private mail throughout the Holy Roman Empire and in Spain for a fee and thereby founded the first public-access mail service. Taxis hired many relatives to operate his vast network, and the family was granted a patent of nobility by Maximilian I in 1512. For the next 355 years, branches of the family operated local and national postal services in Spain, Germany, Austria, Italy, Hungary, and the Low Countries (now The Netherlands, Belgium, and Luxembourg), working both with and against other couriers. The family employed up to 20,000 messengers not only to carry mail but also to deliver newspapers. From 1852 they issued postage stamps. The last Thurn and Taxis postal system was purchased and nationalized by the Prussian government in 1867. A coiled horn, part of the family's coat of arms, remains a symbol of many European postal services.

**Thurneysen, Rudolf** (b. March 14, 1857, Basel, Switz.—d. Aug. 9, 1940, Bonn), German linguist and Celtic scholar who was one of the first to use the principles of modern historical linguistics in the field of Celtic studies. He was also an excellent Latinist.

Thurneysen taught at the universities of Jena (1885–87), Freiburg (1887–1913), and Bonn (1913 until the end of his academic career). He is known for a wide range of contributions to the study of Old Irish linguistic, literary, and legal history; and indeed he is usually considered to have been the greatest scholar ever in these fields. His best known work is *Handbuch des Altirischen,* 2 vol. (1909; *A Grammar of Old Irish*). Other major works include *Die irische Helden- und Königssage bis zum 17.ten Jahrhundert* (1921; "The Irish Sagas of Heroes and Kings Until the 17th Century") and *Das Keltische Recht* (1935; "Celtic Law").

**Thurnwald, Richard** (b. Sept. 18, 1869, Vienna—d. Jan. 19, 1954, Berlin), German anthropologist and sociologist known for his comparative studies of social institutions.

Thurnwald's views on social anthropology grew out of his intimate knowledge of various societies gained during field expeditions to the Solomon Islands and Micronesia (1906–09 and 1932), New Guinea (1912–15), and East Africa (1930). Among his earlier ethnographic works is *Bánaro Society* (1916), dealing with kinship and social organization in a New Guinea tribe. Though he taught briefly at several prominent U.S. universities, his principal post from 1924 was at the University of Berlin, where he taught anthropology and sociology. In 1925 he founded, and for many years edited, the *Zeitschrift für Völkerpsychologie und Soziologie* ("Journal of Popular Psychology and Sociology"), later retitled *Sociologus.* He also edited journals of anthropology and comparative law.

Thurnwald rejected the influential views on social anthropology of the German psychologist Wilhelm Wundt and the French anthropologist Lucien Lévy-Bruhl and generally remained apart from the main currents of German social anthropology. He believed that comparisons of social institutions in different societies would reveal their differences and thus lead to a better understanding of the essential function of each institution. To establish sequences of historical development, he made comparisons of functional social structures.

Thurnwald also explored the interrelation of technology with social structure and economy. One of his most fruitful concepts, superstratification, deals with changes resulting from the introduction of a new group forming the lowest stratum of a society. That concept led him into studies of feudalism, the early development of kingship, cities, and states, and Western colonial expansion. His works include *Die menschliche Gesellschaft in ihren ethnosoziologischen Grundlagen* (5 vol., 1931–35; "Human Society in its Ethnosociological Foundations"), *Economics in Primitive Communities* (1932), *Black and White in East Africa* (1935), and *Aufbau und Sinn der Völkerwissenschaft* (1948; "Structure and Meaning of Popular Knowledge").

**Thurrock,** seaport and unitary authority, geographic and historic county of Essex, England, lying on the north bank of the Thames estuary. Its southern part was largely reclaimed from the Thames marshes by immigrant Dutch workers. Thurrock's chief town and administrative centre, Grays, was originally a fishing village but became a river port for London's hay and grain market. At West Tilbury, Elizabeth I made her well-known speech to her troops in 1588 at the time of the threatened invasion by the Spanish Armada. The nearby Tilbury Docks were built on what was marshland. Industry now stretches along the Thames and includes soap and margarine works, cement works, and timber yards. The unitary authority includes rural sections and suburbs. At its eastern end are huge oil refineries at Shell Haven and Coryton. Pop. (1998 est.) 135,000.

**Thursday,** fifth day of the week (*q.v.*).

**Thursday Island,** island in the Torres Strait off northern Queensland, Australia. It is surrounded by Prince of Wales, Friday, Good's, Hammond, Wednesday, and Horn islands, and it is the administrative centre for the area. The principal town is Port Kennedy, on the eastern shore. The mixed population of Malays, Chinese, Japanese, and Melanesians are engaged mainly in pearling and trochus and bêche-de-mer (sea cucumber) fishing. The island has an area of 1¼ square miles (3 square km) and a maximum elevation of 374 feet (113 m). With its neighbours, it was annexed to Queensland in the 1870s and was proclaimed a municipality in 1912. Pop. (1981) 2,283.

**Thurso,** town ("burgh") and Atlantic Ocean seaport, Caithness district, Highland region, Scotland, and the most northerly town on the Scottish mainland. It was the centre of Norse power on the mainland before the Norse invaders were defeated (Battle of Largs, 1263). It was made a free burgh in 1633. To the west are the ruins of the palace of the bishop of Caithness, and at Dounreay is a nuclear power station, work at which was responsible for a considerable influx of population after 1954. Thurso is the northern terminus of the Scottish railway system. Pop. (1981) 8,896.

**Thurston, Howard** (b. July 20, 1869, Columbus, Ohio, U.S.—d. April 13, 1936, Miami), American magician who led the largest magic show in history.

Thurston was originally a card manipulator and toured the world (1904–07) with a full-evening show. He returned to the United States to become successor to Harry Kellar, the leading American magician. For more than 20 years he toured with a three-hour show and became best-known for his large stage illusions, such as the "floating lady." In 1931 he shortened his program to appear as the stage attraction at motion-picture theatres. He wrote *My Life of Magic* (1929).

**Thurston, Lorrin A(ndrews)** (b. July 31, 1858, Honolulu—d. May 11, 1931, Honolulu), leader of Hawaiians who opposed the monarchy and favoured U.S. annexation of the islands.

Thurston was the son of American missionaries in Hawaii. He attended Oahu College and then studied law with the attorney general of Hawaii. In 1880 Thurston went to the U.S. mainland to complete his legal education at Columbia University. He returned to Hawaii in 1883 and established a law practice there.

Thurston began his long involvement with Hawaiian politics in 1886, when he was elected to the Hawaiian legislature. He quickly became an outspoken proponent of reform; he advocated a reduction in monarchical power and an end to official corruption. When the reform efforts failed, he became a leader in the 1887 revolution. He helped draft a new constitution, and he joined the powerful reform Cabinet as minister of the interior.

In 1890, as native Hawaiians rallied around King Kalakaua, Thurston and other reformers were forced out of office. He retained his seat in the legislature until 1892, when he went to Washington in an effort to facilitate U.S. annexation. Back in Hawaii in 1893, he was a central figure in the revolution that toppled Queen Liliuokalani. Thurston helped set up a provisional government and then returned to the U.S. mainland to win support for the new government and to continue his work for annexation. In May 1893 Thurston was appointed envoy to the United States.

Back in Hawaii the following year, Thurston helped draft the constitution of the Republic of Hawaii. The remainder of his political career—until 1898—was highlighted by his successful efforts on behalf of annexation and his support for Hawaiian backing of the United States during the Spanish–American War. From 1898 to his death, Thurston devoted himself to business. He owned and operated the *Honolulu Advertiser* and worked energetically to develop the tourist and pineapple industries.

**Thurstone, L(ouis) L(eon)** (b. May 29, 1887, Chicago—d. Sept. 29, 1955, Chapel Hill, N.C., U.S.), American psychologist who was instrumental in the development of psychometrics, the science that measures mental functions, and who developed statistical techniqués for multiple-factor analysis of performance on psychological tests.

Thurstone was originally interested in mathematics and engineering. He studied electrical engineering at Cornell University, Ithaca, N.Y., and worked briefly as an assistant to Thomas Edison before taking a teaching post at the University of Minnesota in Minneapolis (1912). He became interested in the psychology of learning and received his Ph.D. in psychology from the University of Chicago in 1917. He held a position as chairman of the department of psychology at the Carnegie Institute of Technology until 1924, when he returned to the University of Chicago as associate professor of psychology and became a full professor three years later. In 28 years at the University of Chicago, he established the Psychometric Laboratory there, helped found the Psychometric Society, and produced many important articles and books.

Thurstone was especially concerned with the measurement of people's attitudes and intelligence. His criticisms of existing testing methods appeared in *The Reliability and Validity of Tests* (1931). He attacked the concept of an ideal "mental age," then commonly used in intelligence testing, advocating instead the use of percentile rankings to compare performance. He also developed a rating scale for locating individual attitudes and opinions along a continuum between extremes.

His principal work, *The Vectors of Mind* (1935), presented Thurstone's method of factor analysis to explain correlations between results in psychological tests. Thurstone rejected the idea that any one factor had more general application than others and evaluated all factors influencing performance on a given test at one time, devising new statistical techniques to perform the factor analysis. His studies of intelligence using these techniques led to the Primary Mental Abilities Test (1938), which measured such components of human intelligence as reasoning ability, word fluency, verbal comprehension, facility with numbers, spatial visualization, and rote memory. *Multiple-Factor Analysis* (1947), his other major work, was an extensive rewriting of *Vectors*.

In 1952 Thurstone moved his laboratory for psychological measurement from Chicago to the University of North Carolina, Chapel Hill, where he served as professor of psychology until his death.

**Thusuros** (Tunisia): *see* Tawzar.

**Thutmose,** also spelled THOTHMES, or TUTHMOSIS, name of the kings of Egypt grouped below chronologically and indicated by the symbol •.

• **Thutmose I** (fl. 2nd millennium BC), 18th-dynasty king of Egypt (reigned 1493–*c.* 1482 BC) who expanded Egypt's empire in Nubia (the modern Sudan) and also penetrated deep into Syria.

Although Thutmose was the son of a non-royal mother, he strengthened his claim to the throne by marrying his predecessor's daughter, probably some time before his accession. He also possibly was associated with his predecessor as coregent for an unspecified period, as is attested by a chapel found at Thebes. On his accession day, he communicated his new titulary and coronation in a letter to the viceroy of Nubia.

In his second year Thutmose led a river-borne expedition deep into Nubia, beyond his predecessor's frontier. As shown by inscriptions carved along the way, he thrust past the Fourth Nile Cataract and set up a new boundary at Kanisa Kurgus. The venture is attested by the biographies of two Upper Egyptians who were among the forces that made the campaign. One reason for the deep thrust into Nubia was the land's rich gold deposits, which were intensely exploited during the 18th dynasty. Another motivation was the fact that a hostile Kushite kingdom, centred near the Third Cataract, had seriously menaced Egypt during the 17th dynasty.

After his Nubian war Thutmose penetrated to the Euphrates River in the vicinity of Carchemish in Syria as he continued the pursuit of the Hyksos, Asiatic invaders who had recently dominated Egypt. One of the texts from Nubia states that already before the Syrian foray, Thutmose claimed the Euphrates as his border. Although no evidence of earlier campaigns survives, the Nubian text implies that deep penetration of Syria had already occurred.

Within Egypt, Thutmose thoroughly renovated the Middle Kingdom temple of Amon at Thebes. He erected an enclosure wall and two pylons at the western end, with a small pillared hall in between. Two obelisks were added in front of the outer pylon. Thutmose created the axial temple, which became standard for the New Kingdom.

Two crown princes predeceased the king. One had become commander of the armies and was assigned to Memphis, near modern Cairo, which in the New Kingdom became a military operations centre. Thutmose set the example for later kings, who likewise assigned their crown princes to Memphis, where they were schooled in the military arts.

Thutmose also was the first king to cut his tomb in the Valley of the Tombs of the Kings at Thebes, probably to obtain greater security for it. It was also he who built the cemetery workers' village at Dayr al-Madīnah, in western Thebes, and who probably completed the organization of the necropolis staff begun by his predecessor. The length of Thutmose's reign is still uncertain, and his highest attested date is year nine.

• **Thutmose II** (fl. 2nd millennium BC), 18th-dynasty king of Egypt (reigned *c.* 1482–1479 BC) who suppressed a revolt in Nubia, Egypt's territory to the south, and also sent a punitive expedition to Palestine against some Bedouins.

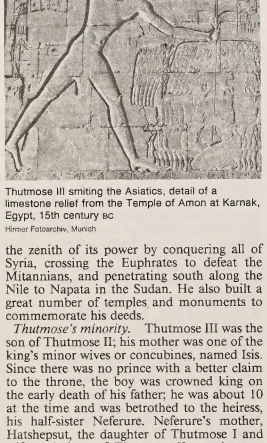
Thutmose was born to Thutmose I, his predecessor, by a sister of his father's queen. He married his fully royal half-sister, Hatshepsut, to solidify his claim to the throne. According to an inscription from Aswān dated year one, a chief from northern Kush, around the Second Nile Cataract, fomented a revolt against Egyptian suzerainty and threatened the garrisons stationed in Nubia. The king dispatched a force with orders to quell the rebels and execute their males. One of the chief's sons was brought captive to Egypt, probably to be Egyptianized and returned to his country as a client ruler. Some time later, as shown by the biography of one of the soldiers who had accompanied his father, Thutmose II sent forces against some Bedouins in southern Palestine.

Besides these references, little is known of Thutmose II's reign. His name appears on a few Upper Egyptian and Nubian monuments, but it perhaps was ordered cut by his son, Thutmose III. In western Thebes he built a small funerary temple, which his son later enlarged. No tomb has been positively identified as belonging to Thutmose II, although his mummy was discovered reburied in the royal cache.

By a woman of his harem, Thutmose II left a son who was still very young at his father's death. As indicated by the king's chief architect, although the young prince was elevated to the throne, it was his stepmother and regent, Hatshepsut, who governed Egypt.

There is doubt concerning the length of Thutmose III's reign. Only his first year is positively attested, although around 1900 a scholar claimed to have seen an inscription dated year 18. This text has never again been seen, however, and most modern scholars doubt its validity.

• **Thutmose III** (d. 1426 BC), Egyptian king of the 18th dynasty (reigned 1479–26 BC), often regarded as the greatest of the rulers of ancient Egypt. Thutmose III was a skilled warrior who brought the Egyptian empire to



Thutmose III smiting the Asiatics, detail of a limestone relief from the Temple of Amon at Karnak, Egypt, 15th century BC
Hirmer Fotoarchiv, Munich

the zenith of its power by conquering all of Syria, crossing the Euphrates to defeat the Mitannians, and penetrating south along the Nile to Napata in the Sudan. He also built a great number of temples and monuments to commemorate his deeds.

*Thutmose's minority.* Thutmose III was the son of Thutmose II; his mother was one of the king's minor wives or concubines, named Isis. Since there was no prince with a better claim to the throne, the boy was crowned king on the early death of his father; he was about 10 at the time and was betrothed to the heiress, his half-sister Neferure. Neferure's mother, Hatshepsut, the daughter of Thutmose I and wife and sister of Thutmose II, acted as regent. In the second year of his reign this strong-minded and ambitious woman herself assumed the attributes, dress, and insignia of a king and to all intents and purposes reigned in his stead. As one of her courtiers says, "she directed the affairs of the whole land according to her wishes." Still, Thutmose was given an education befitting his royal station. He was taught all military skills, especially archery, which he demonstrated in public display, and horsemanship, in which he showed considerable prowess. He was later to boast that none among his followers could equal him in physical strength and in marksmanship.

As he grew up, Thutmose may even have been entrusted with command of the army on campaign in Nubia; whether he also fought in Palestine is doubtful. His grandfather Thutmose I had penetrated into northern Syria; Thutmose II, though far from a weakling, had not followed this success, and Hatshepsut, as a woman, may have been unwilling to send an army into the field. Thus, through inaction, Egyptian influence in Syria and Palestine had declined. The sons and grandsons of the Syrian princes who had surrendered to Thutmose I no longer sent tribute, and the king of Mitanni, a powerful Mesopotamian kingdom with its capital beyond the Euphrates, was able to extend his control westward to the Mediterranean.

In the 22nd year of Thutmose's reign, a formidable coalition was formed against Egypt, led by the king of Kadesh in northern Syria, and no doubt supported by the Mitanni. At this moment of crisis Hatshepsut died. Her death was opportune; whether her nephew was responsible is a matter of surmise only, but later in his reign he decreed that her name be obliterated on all her monuments, her statues smashed, and her figure erased from reliefs.

*Military campaigns.* After a few months' preparation the king was ready to march at the head of his army. The first campaign is recorded in some detail on the walls of the temple he built at Karnak in Thebes, which depict the march to Gaza and thence to Yahmai south of the Carmel Range, the council of war, and the king's bold decision to surprise the enemy encamped at Megiddo, northeast of Carmel and about 18 miles (29 km) southeast of the modern city of Haifa. Thutmose's approach was by the route least expected—a narrow defile over the mountain. It was successful. The enemy was defeated, and Megiddo was taken after a siege of eight months. In subsequent campaigns, which are less fully described in the annals, ports on the Phoenician coast were converted into Egyptian supply bases, and Kadesh and other cities in the al-Biqāʿ (Bekaa) Valley were taken.

In the 33rd year of Thutmose's reign, the time was at last ripe for his most audacious move, an attack on the kingdom of Mitanni itself, which had grown stronger since the day when Thutmose I had taken its army by surprise. Thutmose planned the campaign well; pontoon boats were transported across Syria on oxcarts for the crossing of the Euphrates River. The ensuing encounter, which must have taken place on the eastern bank, is not described by the annalist; it resulted in the precipitate flight of the Mitannian king and the capture of 30 members of his harem and some hundreds of his soldiers. Triumphantly, Thutmose set up his commemorative inscription by the river's edge, next to that of his grandfather Thutmose I. It was his farthest point of advance. On the homeward journey he also hunted elephant in the land of Niy, in the Orontes Valley, and on his return he celebrated a great triumph at Thebes and dedicated prisoners and booty to the temple of the state god Amon.

In later campaigns (there were 17 in all), Thutmose III was content to consolidate what he had won and to lay the foundations of an imperial organization of his Asian possessions. Native rulers, members of local ruling dynasties, were henceforward set to govern their own territories as vassals of Egypt and were bound by solemn oath to keep the peace, render annual tribute, and obey the Egyptian representative in the region, the "overseer of foreign lands." Their sons were sent as hostages to Egypt and educated at court, so that in due course they might return to rule their inheritance, Egyptianized in outlook and sympathies. Fortresses were built, and Egyptian garrisons were stationed at key points along the coastal and in the highlands.

To the south, Thutmose reaffirmed the southern boundary of Egyptian domination over Nubia as far as Kanisa Kurgus, and at Napata, near the Gebel Barkal, he built a temple to Amon. He thoroughly subdued the turbulent Nubian tribes and employed many of them in the gold mines, which from his reign on became the basis of Egyptian wealth in foreign exchange with the princes of western Asia. For the last 12 years of his reign, he was content to enjoy the fruits of his victories. The tribute of Syria and Palestine and of the Sudan poured into his treasury; the annals list huge quantities of timber and metal ores, cattle, and grain delivered by the conquered. Minoan Crete and Cyprus, Babylonia, Assyria, and the Hittites sent gifts. The tombs of high officials of the reign are decorated with scenes depicting the reception of foreign envoys coming from places as far away as the Aegean and the Greek mainland to lay their rich and exotic gifts at the feet of the pharaoh. The prestige of Egypt had never been so high.

*Adornment of Egypt.* The new prosperity was reflected in the remarkable program of building undertaken by the king's architects. The Temple of Amon at Karnak in particular was enlarged and enriched by many new buildings and a number of obelisks. Two of the splendid granite obelisks that he erected there are now in Istanbul and Rome; of the two, now known as Cleopatra's Needles, with which he adorned the temple of the sun-god at Heliopolis, one is in New York City's Central Park and the other on the Thames embankment in London. During his reign art and craftsmanship received new impetus from his patronage. The exotic birds, beasts, and plants that he brought back from his campaigns in Asia are depicted on the walls of his Festival Hall at Karnak; among the gifts sent him from abroad were a live bear, an elephant, a giraffe, and "birds that give birth every day"—probably domestic hens, which were rare in the Middle East at that time.

During the last year of his life, feeling his strength failing, Thutmose appointed his son Amenhotep II, the son of his second wife, Hatshepsut's daughter Meryetre, as coregent. When he died, in 1426 BC, he was laid to rest in a remote corner of the Valley of the Tombs of the Kings in western Thebes. Along with many other royal burials, this tomb was later looted by robbers; the mummy of the pharaoh was one of those discovered in 1889, in a hiding place where the priest-kings of the 21st dynasty had hidden them for safety. Of the rich furniture that must originally have been placed in the tomb, only a few fragments were found. His mortuary temple, which was built on a terrace at Dayr al-Baḥri beside that of Hatshepsut, was discovered in 1962.

Nearby, the burial place of three members of his harem was found; judging by their names, they were Syrian princesses, and though of minor rank their jewelry and equipment were extremely lavish.

Of all the kings of ancient Egypt, Thutmose III is perhaps the one who, for the modern historian, most clearly comes to life. His records, though couched in the boastful and extravagant terms thought befitting a pharaoh's exploits, leave little doubt not only of his ability as a soldier and a statesman but also of his abilities as an athlete and a hunter of lion, wild cattle, and elephant. From his mummy it is known that he was a small man, not above five feet three inches in height. His statues show a resolute face with a large, high-bridged nose and pleasantly smiling mouth.

His fame lived after him. His name, inscribed on countless amulets, was thought to bring power and protection to the wearers. A popular hymn celebrating his triumphs became a model for later paeans of victory; in it the god Amon-Re says:

> I set thy glory and the fear of thee in all lands, and the terror of thee as far as the four supports of the sky. . . , the rulers of all foreign countries are gathered together within thy grasp. I stretch out my hands to bind them for thee.

(M.S.D.)

BIBLIOGRAPHY. There is no separate life of Thutmose III. His career and achievements are described in some detail in general histories such as

J.H. Breasted, *A History of Egypt from the Earliest Times to the Persian Conquest* (1905, reprinted many times); and, more recently, A.H. Gardiner, *Egypt of the Pharaohs* (1961). The newly revised edition of *The Cambridge Ancient History*, vol. 2, part 1 (1971), contains chapters by William C. Hayes on the early part of the 18th dynasty; and by Margaret S. Drower on the Egyptian Challenge and Egypt in Asia. The bibliographies to these chapters are very full. The text of Thutmose's annals and other inscriptions may be found in J.H. Breasted (ed.), *Ancient Records of Egypt*, vol. 2 (1906, reissued 1962). For a better translation of the more important texts, see J.B. Pritchard, *Ancient Near Eastern Texts Illustrating the Old Testament*, 3rd ed. with suppl. (1969).

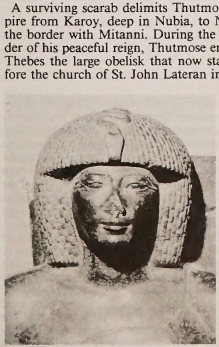
**•Thutmose IV** (fl. 2nd millennium BC), 18th-dynasty king of Egypt (reigned 1400–1390 BC), who secured an alliance with the Indo-European-led Mitanni Empire of northern Syria and ushered in a period of peace at the peak of Egypt's prosperity.

Thutmose IV was the son of his predecessor's chief queen. As prince, he was assigned to the military operational base at Memphis, near modern Cairo, where he spent his leisure time in hunting and sports near the pyramids on the western desert. During a rest near the great Sphinx, he dreamed that the god Horus, whom the sphinx was believed to represent, asked him to free it of sand which had drifted around it, in return for which he would become pharaoh. Based upon this dream, it has been suggested that Thutmose was not the heir apparent and that he succeeded after an elder brother's death, using the dream as divine sanction of his rule.

As king, Thutmose made an armed tour of Syria-Palestine, during which he quelled some minor uprisings. Sensing the growing menace of the Hittite Empire in Asia Minor, he initiated lengthy negotiations with the Mitanni Empire, Egypt's former foe in Syria, which culminated in a peace treaty between the two powers, cemented by a royal marriage between a Mitanni princess and the king. Gifts also were exchanged and the city of Alalakh (modern Açana in southern Turkey), was ceded to Mitanni. A long peace marked by friendly relations ensued between the two states.

In the eighth year of his reign, Thutmose learned of a revolt by a desert chieftain in Lower Nubia (in the modern Sudan). He swiftly gathered and led his army with a river-borne force and defeated the rebels, who probably had endangered the rich gold country of eastern Nubia.

A surviving scarab delimits Thutmose's empire from Karoy, deep in Nubia, to Naharin, the border with Mitanni. During the remainder of his peaceful reign, Thutmose erected at Thebes the large obelisk that now stands before the church of St. John Lateran in Rome.



Thutmose IV, detail of a gray granite sculpture, 15th century BC; in the Egyptian Museum, Cairo
By courtesy of the Egyptian Museum, Cairo; photograph, Hirmer Fotoarchiv, München

In western Thebes, he built a small but fine mortuary temple, and he also left memorials at Memphis, the residence of his youth.

During his reign Thutmose showed some personal devotion to the Aten, which featured in his grandson's religious revolution, but there is no evidence of any hostility between the king and the priesthood of Amon. The art of his reign likewise reveals the start of tendencies which later led to the Amarna style of his grandson.

Thutmose died after a reign of about nine years and was succeeded by his son, Amenhotep III. His tomb was found in 1903, with some of its furniture in place.

**Thy** (region, Denmark): *see* Vendsyssel-Thy.

**Thyatira** (Turkey): *see* Akhisar.

**Thylacosmilus,** extinct genus of carnivorous marsupials found as fossils in Pliocene deposits in South America (the Pliocene epoch began 5.3 million years ago and ended 1.6 million years ago). *Thylacosmilus* was as large as a jaguar, and the short skull supported a pair of very long and powerfully developed canine teeth that fit into a well-developed flange in the chin region of the lower jaw and were used for stabbing prey. *Thylacosmilus* became



*Thylacosmilus* skull
By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

extinct when the land connection between North and South America was reestablished, providing a bridge for the more advanced large North American carnivores, with which *Thylacosmilus* could not compete. To a remarkable degree, *Thylacosmilus* paralleled the evolution of the sabretoothed tigers.

*Consult the* INDEX *first*

**thyme** (*Thymus vulgaris*), pungent herb of the mint family (Lamiaceae, or Labiatae), the dried leaves and flowering tops of which are used to flavour a wide range of foods, including poultry, stuffings, fish, eggs, meats, butter, sauces, soups, sausages, salads, vegetables, cottage and cream cheeses, fresh tomatoes, and pastas. It is one of the herbs used to flavour Benedictine liqueur. Thyme is a characteristic seasoning in the traditional English dish jugged hare. Bees are fond of thyme, and thyme honey of Sicily has been famous for hundreds of years. In ancient Greek temples, thyme was burned as incense. Pliny the Elder referred to it as a fumigant.

The plant is a small, low-growing shrub with curled leaves. Thyme is native to southern Europe, the Mediterranean region, Asia Minor, and Central Asia and is also cultivated in North America. Dried thyme leaves are greenish brown in colour and have a fragrant odour when crushed. The taste is warm and pungent.

Thyme contains about 1 percent essential oil, the principal component of which is thymol, or thyme camphor. Thymol is used in the manufacture of perfumes and dentifrices.



Thyme (*Thymus vulgaris*)
Walter Chandoha

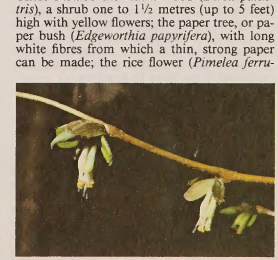
It has antiseptic and anesthetic properties and is used as an internal medicine.

**Thymelaeales,** the mezereum order of dicotyledonous flowering plants, comprising the family Thymelaeaceae, with 40 genera of shrubs, some trees, and a few herbs, of nearly worldwide distribution.

The order is distinguished by bisexual or separate male and female flowers apparently without petals but with a petallike, tubular calyx (sepals) with four or five spreading lobes. Actually, there are 4 to 12 petals in some, but they are usually reduced to scales at the mouth of the calyx tube. There are usually as many stamens (male pollen-producing structures) as calyx lobes, attached to the inner surface of the calyx tube in alternate positions with the calyx lobes, or there are twice as many stamens as lobes in some. The ovary is positioned above the attachment point of the calyx, and it has one internal chamber (or rarely two) with one ovule per chamber.

The largest genera are *Pimelea* (80 species), *Daphne* (70 species), *Wikstroemia* (70 species), *Lasiosiphon* (50 species), *Gnidia* (100 species), *Daphnopsis* (46 species), *Struthiola* (40 species), *Dicranolepis* (30 species), *Gonystylus* (25 species), *Phaleria* (20 species), *Peddiea* (20 species), *Aquilaria* (15 species), and *Passerina* (15 species). The nearest relatives of the order appear to be the myrtle (Myrtales) and protea (Proteales) orders; its origin stems distantly from the rose order (Rosales).

A few species are of horticultural interest. These include the leatherwood (*Dirca palustris*), a shrub one to 1½ metres (up to 5 feet) high with yellow flowers; the paper tree, or paper bush (*Edgeworthia papyrifera*), with long white fibres from which a thin, strong paper can be made; the rice flower (*Pimelea ferru-*



Leatherwood (*Dirca palustris*)
John Kohout from Root Resources—EB Inc.

*ginea*), a much-branched, small shrub about one metre high, often grown as a greenhouse plant; and several species of *Daphne* (*q.v.*), the most important ornamental genus.

**thymine,** organic compound of the pyrimidine family that is a constituent of deoxyribonucleic acid (DNA). DNA, along with RNA (ribonucleic acid), regulates hereditary characteristics in all living cells. Like the other nitrogenous components of nucleic acids, thymine is part of thymidine, a corresponding nucleoside (a structural unit composed of a nitrogen compound and a sugar), in which it is chemically linked with the sugar deoxyribose. It is also part of thymidylic acid, a nucleotide (a larger structural unit composed of a nucleoside and phosphoric acid), which is a phosphate ester of thymidine. The nucleotide, the nucleoside, or thymine itself may be prepared from DNA by selective techniques of hydrolysis.

**thymus,** pyramid-shaped lymphoid organ that, in humans, is immediately beneath the breastbone at the level of the heart. The organ is called thymus because its shape resembles that of a thyme leaf.

Unlike most other lymphoid structures, the thymus grows rapidly and attains its greatest size relative to the rest of the body during fetal life and the first years after birth. Thereafter, it continues to grow, but more slowly than the other organs. At the onset of puberty, the thymus begins a slow process of shrinking. This gradual diminution in size continues for the rest of the individual's life.

The thymus is divided into two lobes, lying on either side of the midline of the body, and into smaller subdivisions called lobules. It is covered by a dense connective-tissue capsule, which sends fibres into the body of the thymus for support. The thymus tissue is distinguishable into an outer zone, the cortex, and an inner zone, the medulla.

The organ is composed principally of two types of cells, called, respectively, lymphocytes (*see* lymphocyte) and reticular cells. The reticular cells form a loose meshwork, as in a lymph node, while the spaces between them are packed with lymphocytes. The cortex, characterized by its heavy lymphocyte concentration, is the site of much lymphocytic proliferation. Proliferation of lymphocytes in the thymus is distributed evenly throughout the cortex, instead of in germinal centres, as occurs in other lymphoid tissue. Some of the daughter cells—called T (thymus-derived) cells—that are produced in the cortex migrate to the medulla, where they enter the bloodstream through the medullary veins, adding to the lymphocytes seen in the peripheral blood and the lymphoid organs.

During the involution, or shrinking, of the thymus the cortex becomes thin. Lymphocytes disappear and are replaced by fat tissue from the partitions between the lobules. The process of involution is never complete, and the bits of thymus tissue that remain are probably sufficient to maintain its function.

The functions of the thymus that have so far been observed relate chiefly to the newborn. Removal of the organ in the adult has little effect, but when the thymus is removed in the newborn, T cells in the blood and lymphoid tissue are depleted, and failure of the immune system causes a gradual, fatal wasting disease. The animal whose thymus has been removed at birth is less able to reject foreign-tissue grafts or to make antibodies to certain antigens. Moreover, certain parts of the white pulp of the spleen and lymph nodes are much reduced in size. These results demonstrate that the T cells produced in the thymus and transported to the lymphoid tissues are crucial elements in the development of immunity.

It is known that most of the lymphocytes that are produced in the thymic cortex die without leaving the organ. Since those T cells that do leave the thymus are equipped to react against foreign antigens, it is assumed that the thymus destroys lymphocytes that would engage in an autoimmune reaction—that is, would react against the individual's own tissues.

The thymus differs structurally from other lymphoid organs in that it does not have lymphatic vessels draining into it. It is not a filter like the lymph nodes, which are situated so that microorganisms and other antigens are exposed to their cells. The thymic lymphocytes are sealed off from the rest of the body by a continuous layer of epithelial (covering) cells that entirely surround the organ. While thus sequestered, the lymphocytes differentiate, or acquire the capabilities to perform specialized tasks. (It has been suggested that hormonal functions of the thymus aid in this differentiation.) Of these specialized lymphocytes, helper T cells work synergistically with the thymus-independent lymphocytes (B cells) to produce antibodies. Cytotoxic T cells directly attack invading microorganisms and foreign tissue, such as organ transplants.

**Thynne, Thomas:** *see* Bath, Thomas Thynne, 1st marquess of.

**Thyolo,** formerly CHOLO, town, southern Malaŵi, in the Shire Highlands. The town is an administrative and trade centre and processes tea, the principal cash crop of the surrounding agricultural area. Tung and coffee are grown locally, and there is experimental, diversified contour farming at nearby Konsalendo. Pop. (1998 est.) 5,300.

**thyratron,** gas-filled, three-element, hot-cathode tube in which the grid controls only the starting of a current and thus provides a trigger effect. The normal grid potential is negative with respect to the cathode, which prevents electrons from flowing to the plate and exciting a discharge. At a chosen instant the grid potential is raised enough to start a discharge (*i.e.,* the grid signal "triggers" the discharge), initiating a large flow of current through the tube. The discharge stops when the anode voltage is sufficiently lowered. Thyratron tubes are useful in devices, such as rectifiers and inverters, that convert ac (alternating current) to dc (direct current) or vice versa.

**thyristor,** any of several types of transistor having four semiconducting layers and therefore three *p–n* junctions; the thyristor is a solid-state analogue of the thyratron (*q.v.*) vacuum tube. A common form of thyristor is the silicon-controlled rectifier (SCR), widely used as a component of devices that control motor speeds, liquid levels, temperatures, and pressures.

**thyrocalcitonin:** *see* calcitonin.

**thyroid function test,** any clinical and laboratory procedure that assesses the efficiency of the thyroid gland in synthesizing the two most active thyroid hormones, thyroxine ($T_4$) and triiodothyronine ($T_3$). Nonspecific thyroid tests measure the metabolic effects of the thyroid hormones (*see* basal metabolic rate); more specific tests measure one aspect or another of the synthesis, release, and transport of the thyroid hormones. The latter tests are generally based on the fact that thyroid tissue selectively concentrates iodine from the bloodstream, to incorporate it into the synthesis of its hormones. By administering radioactive iodine and following it at various steps in its metabolic pathway, thyroid activity can be determined.

In the radioactive-iodine-uptake test, the proportion of ingested iodine that is accumulated by the thyroid gland is measured. The individual tested is usually given an oral dose of iodine-131 in capsule form, and the fraction of this that accumulates in the neck region, where the thyroid gland is located, is measured 24 hours later by a Geiger counter. Uptakes of less than 15 percent of the given dose tend to be associated with a deficiency of the thyroid gland.

To detect possible hyperactivity of the thyroid gland, the thyroid-suppression test is useful. The test is based on the fact that the administration of a thyroid hormone will normally cause a decrease in the uptake of radioactive iodine by the thyroid gland (negative-feedback principle). When the thyroid is overactive and enlarged, however, as in Graves' disease, high uptake is maintained. If administration of 150 micrograms of triiodothyronine daily for a week fails to suppress uptake in any one subject, Graves' disease is usually present. *See also* protein-bound iodine test.

**thyroid gland,** endocrine gland that is situated in the throat below the larynx (voice box); the thyroid secretes hormones vital to metabolism and growth. The gland consists of two oblong lobes lying on either side of the windpipe and connected by a narrow band of tissue. The lobes of the gland, as well as the band, consist of numerous tiny sacks called follicles. The shell of each follicle is built of cells closely packed together and is wrapped in a thin membrane covered with a dense mesh of blood capillaries, which ensure a steady and abundant supply of fresh plasma through the membrane to the cells. The space inside the follicle is filled with a viscous fluid called colloid, in which thyroid hormones are stored bound to a protein called thyroglobulin.

Every follicle of the thyroid gland makes thyroid hormone and secretes it into the bloodstream. Thyroid hormone consists of two closely related chemical substances, L-thyroxine ($T_4$, or L-tetraiodothyronine) and L-triiodothyronine ($T_3$). Under normal conditions, most of the hormone is made up of thyroxine. The raw materials necessary to form thyroid hormone are iodine and the amino acid tyrosine, both of which are normally found in a person's diet. The iodine is actively pumped out of the body fluids into the thyroid's follicle cells, which retain and concentrate it before secreting both it and thyroglobulin into the colloid. The thyroid hormones are then formed by the progressive and orderly addition of iodine atoms to tyrosine residues found on the molecules of thyroglobulin. The process takes place at the edge of the follicle cells next to the colloid. This reaction is followed by the condensation of two of the iodinated residues to form thyroxine and triiodothyronine, which are then stored in the colloid.

In addition to transporting the raw materials for thyroid hormone synthesis to the colloid, the thyroid cells also remove triiodothyronine and thyroxine from the colloid and secrete these substances into the bloodstream. They do this by detaching the hormones from the thyroglobulin proteins that they are bound to. The thyroxine and triiodothyronine molecules thus freed are small enough to cross the cell wall and to enter the blood capillaries around the follicle, after which they become distributed throughout the entire body.

The thyroid hormones have a number of different effects, but their primary action in adults is to regulate the oxygen consumption of cells (*i.e.,* the metabolic rate of tissues). The hormones also lower circulating cholesterol levels, an effect for which they have been used therapeutically. They are necessary, too, for the normal growth and development of children, and their deficiency is associated with dwarfism and mental retardation.

The secretion of thyroxine and triiodothyronine is under the control of thyroid-stimulating hormone (TSH), which is released from the anterior lobe of the pituitary gland. Under

normal conditions, the appropriate level of thyroid hormone in the body is readily established; this induces the pituitary to stop releasing TSH. Thus, the level of thyroid hormone in the body is kept within a constant range by a mechanism in which the effects of thyroid hormone and of thyroid-stimulating hormone work in closed cycle (feedback mechanism), each hormone controlling the secretion of the other.

The thyroid gland is also the site of the production of calcitonin, a hormone that buffers against undue increases in serum calcium. Hyperthyroidism is an abnormal condition characterized by the excessive secretion of thyroid hormone; it is usually accompanied by overgrowth of thyroid tissue. The most common type of hyperthyroidism is Graves' disease (*q.v.*).

For a depiction of the thyroid gland in human anatomy, shown in relation to other parts of the body, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

**thyroid tumour,** any of various benign tumours (adenomas) or cancerous tumours of the thyroid gland. Most thyroid tumours are adenomas; these have a wide variation of cellular patterns, usually having well-developed follicles; thus, they are collectively known as follicular adenomas. Cancerous thyroid tumours are relatively rare—only about 0.5 percent of all cancer deaths are from this cause. Peak incidence occurs at about age 50 and affects women twice as frequently as men. It is speculated that both large doses of radiation to the neck area and prolonged hypersecretions of thyroid-stimulating hormone from the anterior pituitary predispose to thyroid cancer.

**thyroiditis,** any of many inflammatory diseases of the thyroid gland. Several nonspecific types of thyroiditis, both acute and chronic, may be caused by any of a number of bacterial and viral organisms. There are, however, two specific, noninfectious types of thyroiditis: (1) Hashimoto's disease (*q.v.*), or struma lymphomatosa, and (2) granulomatous thyroiditis (*q.v.*), sometimes referred to as giant cell thyroiditis, pseudotuberculous thyroiditis, or de Quervain's thyroiditis. A less common form of chronic thyroid inflammation is Riedel thyroiditis (*q.v.*), or struma fibrosa.

**thyroxine,** also called 3,5,3′,5′-TETRAIODOTHYRONINE, or $T_4$, one of the two major hormones secreted by the thyroid gland (the other is triiodothyronine). Thyroxine's principal function is to stimulate the consumption of oxygen and thus the metabolism of all cells and tissues in the body. Thyroxine is formed by the molecular addition of iodine to the amino acid tyrosine while the latter is bound to the protein thyroglobulin. Excessive secretion of thyroxine in the body is known as hyperthyroidism, and the deficient secretion of it is called hypothyroidism.

**thyrsus,** in Greek religion, staff carried by Dionysus, the wine god, and his votaries (Bacchae, Maenads). In early Greek art the Bacchae were usually depicted as holding branches of vine or ivy, but after 530 BC the staff to which the name thyrsus properly applied began to be shown as a stalk of giant fennel (*narthēx*) segmented like bamboo, sometimes with ivy leaves inserted in the hollow end. Bacchae were depicted and described using them as weapons. Scholars differ on the extent to which these staffs can be explained as symbols of fertility.

**Thysdrus,** modern AL-JAMM, or EL-DJEM, ancient Roman city south of modern Sūsah in Tunisia. Although it was originally a native community influenced by Carthaginian civilization, Thysdrus probably received Julius Caesar's veterans as settlers in 45 BC and ultimately became a Roman *colonia* (settlement with full rights of citizenship). The wealth of its territory is shown by a vast amphitheatre built there, the largest Roman monument in Africa and second in impressiveness only to the Colosseum at Rome.

**Thyssen** FAMILY, one of the world's wealthiest families, its fortune based on a vast iron and steel empire established in the late 19th century.

August Thyssen (b. May 17, 1842, Eschweiler, Westphalia—d. April 4, 1926, Kettwig, Ger.), variously called "King" and "Rockefeller of the Ruhr," was a self-made millionaire. Born to a poor family in the Rhineland, Thyssen nonetheless managed to save 20,000 marks by his early 20s and bought a rolling mill. In 1871 he established the firm of Thyssen & Co. KG at Mülheim. Recognizing the vast natural resources of the Ruhr for iron and steel production, he literally transformed the region. By the outbreak of World War I he was employing 50,000 workers and producing 1,000,000 tons of steel and iron a year.

A firm believer in vertical organization, Thyssen had his own railroads, ships, and docks. His holdings extended from Germany to France, Belgium, The Netherlands, and even India, Russia, and South America. He was the biggest coal operator in Germany, owned cement and allied industries, and broke the Krupp monopoly on heavy armaments manufacturing during World War I.

Despite his enormous wealth—estimated at $100,000,000 at his death—Thyssen was noted for his simple, unostentatious life-style. He wore cheap suits, drove an old car, worked in a dingy office overlooking his steelworks, and often drank beer and ate wurst with his workmen. He was a thoroughgoing republican with a deep dislike of the Kaiser and all hereditary power. His credo was unrelenting work, and the motto on the Thyssen coat of arms was "If I rest I rust." He died of pneumonia at the age of 84, following complicated eye surgery.

Fritz Thyssen (b. Nov. 9, 1873, Mülheim, Ger.—Feb. 8, 1951, Buenos Aires) was a leading German industrialist and a major financial backer of Adolf Hitler's rise to power. Trained as an engineer, Fritz Thyssen entered the family iron, steel, and coal business created by his father, August. After World War I Fritz Thyssen was arrested for refusing to accede to the demands of French authorities occupying the Ruhr. Then, in 1921, the German government charged him with betraying the Ruhr district to the French during the war. It would not be the last time that he would run afoul of his nation's leadership.

In 1926, at the age of 53, Fritz Thyssen inherited his father's fortune and industrial empire. His brothers Heinrich and August, Jr., had proved disappointments to their father—Heinrich married a noblewoman and settled down to the comfortable life of a Hungarian baron, and August, Jr., became a spendthrift who fought for his mother's dowry in a legal battle with his father. Fritz, on the other hand, was a shrewd businessman who combined the family holdings into a trust (Vereinigte Stahlwerke AG [United Steelworks Co.]) that controlled more than 75 percent of Germany's ore reserve and employed 200,000 workers.

Distressed at what he viewed as the socialistic drift of Germany into economic chaos during the 1920s, Fritz Thyssen became an early backer of Adolf Hitler and the Nazi Party, and he helped organize the meeting of German industrialists on Jan. 26, 1933, at which Hitler outlined his program. During Hitler's drive for the German Chancellery, Thyssen contributed 3,000,000 marks. Hitler then rewarded his financial sponsor by making Thyssen a member of the German Economic Council and a Prussian state counselor.

But Thyssen backed Hitler solely as a nationalist and anti-Communist, viewing Fascism as the only bulwark against Bolshevism. When Hitler led Germany into war and began persecuting Jews and Catholics (Thyssen was a Catholic), the industrialist broke with the Nazis and in 1939 fled to Switzerland. Hitler promptly confiscated the Thyssen fortune (about $88,000,000) and stripped Fritz Thyssen of German citizenship. Thyssen later wrote a scathing denunciation of Nazism entitled "I Paid Hitler."

Thyssen moved to France in 1940, but in 1941 the Vichy government picked him up as he was about to leave for South America. He was reportedly sent to Dachau and was found in a detention camp in the Italian Tirol at war's end. Tried and convicted by a German denazification court of being a "minor Nazi," Fritz Thyssen was ordered to turn over 15 percent of his property to a restitution fund for victims of Nazi persecution. A bitter man, he left Germany in 1950 to visit his daughter, Countess Zichy, in Argentina. It was at her Buenos Aires home that he died of a heart attack at the age of 77.

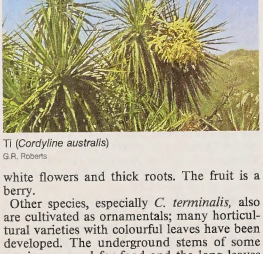
Amelia zur Helle Thyssen (b. 1878?—d. Aug. 25, 1965, Puchhof, Bavaria, W.Ger.) inherited the Thyssen steel and coal empire upon the death of her husband, Fritz, in 1951. During World War II Frau Thyssen had voluntarily joined her husband at the Dachau concentration camp and later was held at Buchenwald as well. Following her husband's death, she returned to Germany, but she never reclaimed her citizenship. She ran the family enterprises from her Bavarian castle (Puchhof), which was filled with valuable paintings and rare porcelain. Under her, Thyssen Steel merged with another large producer, creating the biggest steel company in western Europe and the third largest company (behind Volkswagen and Krupp) in Germany. For her role in launching the Fritz Thyssen Foundation to help advance German science, Mrs. Thyssen received West Germany's highest civilian medal—the Federal Service Cross.

**Thyssen Aktiengesellschaft** (German: Thyssen Limited-liability Company), formerly (1953–77) AUGUST THYSSEN-HÜTTE AKTIENGESELLSCHAFT, German steel manufacturer founded in 1953 as one of the successor companies of Vereinigte Stahlwerke AG (United Steelworks Co.); its present name was adopted in 1977. One of the largest steel producers in Europe, Thyssen has subsidiaries and investments not only in Germany but also in several other European nations, the United States, Canada, Mexico, Brazil, Argentina, Liberia, and South Africa. It operates ironworks, steelmaking plants, rolling mills, mines, transport companies, processing companies, and trading companies. Headquarters are in Duisburg, Ger.

August Thyssen (1842–1926) founded his first rolling mill in 1867 in Duisburg and then in 1871 formed Thyssen & Co. KG in Mülheim. In the succeeding decades, more plants were established (notably the iron and steel works at Hamborn), and by 1914 the company had become Germany's largest iron and steel manufacturer and was also a major coal producer. In 1926 it and seven other companies were merged into the giant Vereinigte Stahlwerke AG, which became the world's largest mining and steel cartel. In the decartelization following World War II, the Vereinigte Stahlwerke was liquidated by the Allied High Commission, and Thyssen was one of the 18 companies created from the remains.

**ti,** in botany, any of the tropical trees and shrubs of the genus *Cordyline* of the family Liliaceae, native to Asia and some Pacific islands. Many are grown as ornamental plants. Ti, or ti tree (*C. australis*), is sometimes sold as *C. indivisa* or *Dracaena australis.* In the wild it is a tree up to about 12 metres (40 feet) tall with a crown of long leaves, but it

is much shorter when grown as a houseplant. It also is known as tuft tree, or cabbage tree, because of its rosette of leaves. It has green or



Ti (*Cordyline australis*)
G.R. Roberts

white flowers and thick roots. The fruit is a berry.

Other species, especially *C. terminalis,* also are cultivated as ornamentals; many horticultural varieties with colourful leaves have been developed. The underground stems of some species are used for food and the long leaves for roofing material and clothing.

**ti,** Pinyin DI, also called TI-TZU, Pinyin DIZI, in music, transverse (or side-blown) bamboo flute of the Han Chinese. The name once applied to end-blown (*hsiao*) flutes as well but is now used strictly for transverse flutes. *Ti* traditionally have a membrane of bamboo or reed tissue covering the hole that is located between the mouth hole and the six finger holes. This membrane creates a distinctive sound characteristic of much Chinese flute music. An additional two or more end holes act as an aid for the expulsion of air.

The *ti* probably dates from about the 3rd century BC, though some form of transverse flute is believed to have existed as early as the 9th century BC. *Ti* have a two-octave range, and

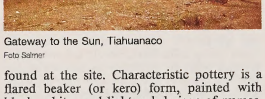


A group of *ti;* in the Musée Instrumental du Conservatoire Royal, Brussels
By courtesy of the Musée Instrumental, Brussels; photograph, © A.C.L., Brussels

complete modern sets can be purchased in Western tunings. There are many varieties of traditional lengths and construction.

**Tiahuanaco,** also spelled TIWANAKU, or TIWANACU, major pre-Columbian civilization known from ruins of the same name that are situated near the southern shore of Lake Titicaca, near the modern town of Tiahuanacu (local official spelling) in Bolivia. Some scholars date the earliest remains found at the site to the early part of the Early Intermediate period (*c.* 200 BC–AD 200); others suggest that the culture is evident in artifacts from the second millennium BC. Probably much of the site, including many of the major buildings, dates from the latter half of the Early Intermediate period (AD 200–600); some construction, however, must have continued into the Middle Horizon (AD 600–1000), for during this period Tiahuanaco influences are seen at Huari and elsewhere in the central and southern Andes.

The principal buildings of Tiahuanaco include the Akapana Pyramid, a huge platform mound or stepped pyramid of earth faced with cut andesite; a rectangular enclosure known as the Kalasasaya, constructed of alternating tall stone columns and smaller rectangular blocks; and another enclosure known as the Palacio. A notable feature of the Kalasasaya is a monolithic gateway adorned with the carved central figure of a staff-carrying Doorway God and other subsidiary figures, sometimes referred to as winged messengers. A great number of free-standing carved stone figures have also been



Gateway to the Sun, Tiahuanaco
Foto Salmer

found at the site. Characteristic pottery is a flared beaker (or kero) form, painted with black, white, and light red designs of pumas, condors, and other creatures on a dark red ground colour. It has been speculated that the people who built the splendid Tiahuanaco complex, whose culture had vanished by AD 1200, were the ancestors of the present-day Aymara Indians of highland Bolivia, who are among the poorest peoples in the Western Hemisphere.

In the late 20th century, archaeologists discovered new information concerning the Tiahuanaco site. Formerly thought to have been largely a ceremonial site, the area has been revealed as a once-bustling metropolis, the capital of one of the greatest and most enduring of ancient empires. Its influence was in great measure a result of its remarkable agricultural system. This farming method, known as the raised-field system, consisted of raised planting surfaces separated by small irrigation ditches, or canals. This system was designed in such a way that the canals retained the heat of the intense sunlight during frosty nights on the Altiplano and thus kept the crops from freezing. Algae and aquatic plants that accumulated in the canals were used as organic fertilizer on the raised fields. The resulting agricultural abundance enabled conquest, and, during the height of its power, the Tiahuanaco empire covered large portions of what are now the states of eastern and southern Bolivia, northwestern Argentina, northern Chile, and southern Peru. The revived use of the raised-field system by some Bolivian farmers in the late 20th century resulted in greatly increased agricultural production.

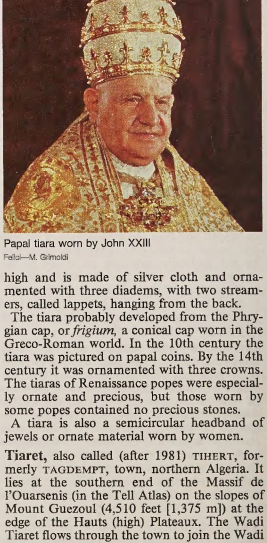
**Tiananmen Square,** Chinese (Pinyin) TIANANMEN GUANGCHANG, or (Wade-Giles) T'IEN-AN MEN KUANG-CH'ANG, open square in the centre of Peking (Beijing), China, one of the largest public squares in the world.

Tiananmen Square was originally designed and built in 1651. It was enlarged to four times its original size and cemented over in 1958; it covers an area of 40.5 hectares (100 acres), and each flagstone is numbered for ease in assembly of parades. The square derives its name from the massive stone Tiananmen ("Gate of Heavenly Peace")—once the main gate of the former Imperial Palace—situated at its northern end. In the centre of the square, on a two-tiered marble terrace, is the Monument to the People's Heroes (completed 1958). A monumental museum complex (opened 1961) lying to the east of the square includes the Museum of the Chinese Revolution (dedicated to Chinese history since 1919) and the Museum of Chinese History (dedicated to Chinese history before 1919). To the south of the Monument to the People's Heroes is the Mao Zedong Memorial Hall (completed 1977), in which the body of Mao lies in state. Farther south is the Front Gate, constructed during the reign (1402–24) of the Ming emperor Yung-lo. Lying on the western side of the square is the Great Hall of the People. It is the site of the annual meetings of the National People's Congress and contains a meeting hall with more than 10,000 seats and a banquet hall capable of seating 5,000.

A well-planned site for massive gatherings, Tiananmen Square has been the rallying point for student demonstrations since 1919. A particularly dramatic series of prodemocracy student demonstrations there was forcibly repressed by the government on June 3–4, 1989, with the loss of hundreds of lives.

**Tianjin** (China): *see* Tientsin.

**tiara,** in Roman Catholicism, a triple crown worn by the pope or carried in front of him at nonliturgical functions such as processions. Beehive-shaped, it is about 15 inches (38 cm)



Papal tiara worn by John XXIII
Felici—M. Grimoldi

high and is made of silver cloth and ornamented with three diadems, with two streamers, called lappets, hanging from the back.

The tiara probably developed from the Phrygian cap, or *frigium,* a conical cap worn in the Greco-Roman world. In the 10th century the tiara was pictured on papal coins. By the 14th century it was ornamented with three crowns. The tiaras of Renaissance popes were especially ornate and precious, but those worn by some popes contained no precious stones.

A tiara is also a semicircular headband of jewels or ornate material worn by women.

**Tiaret,** also called (after 1981) TIHERT, formerly TAGDEMPT, town, northern Algeria. It lies at the southern end of the Massif de l'Ouarsenis (in the Tell Atlas) on the slopes of Mount Guezoul (4,510 feet [1,375 m]) at the edge of the Hauts (high) Plateaux. The Wadi Tiaret flows through the town to join the Wadi Mîna.

Tiaret's citadel stands on the site of Roman Tingartia, capital of western Algeria during the Byzantine period. Nearby on Mount Hadjar are the Djedar, groups of step pyramids on square foundations, probably monuments

to Berber princes of the 6th and 7th centuries. It was an Arab town of note in the 7th century, known as Tahart (meaning "the lioness"). Taken by 'Abd ar-Raḥmān ibn Rustam in 761, it became the capital of his Ibāḍiyah kingdom. Tahart was attacked by the Fāṭimids and the Ibāḍis withdrew to the Sahara to found M'zab. The town then passed through Tlemcen and Turkish control and was taken by the French in 1843. The modern sector was founded by Gen. C.L.L.J. de Lamoricière in 1863, north of the old walled town.

Located in a cool climate, Tiaret is a major agricultural centre of the Plateau du Sersou, dealing in cereals and livestock, and is noted for its purebred Arabian horses. Pop. (1987) mun., 100,100.

**Tibaldi, Pellegrino,** also called PELLEGRINO PELLEGRINI, PELLEGRINO DA BOLOGNA, or PEREGRINUS DE PEREGRINIS (b. 1527, Puria, Duchy of Milan—d. May 27, 1596, Milan), Italian painter, sculptor, and architect who spread the style of Italian Mannerist painting in Spain during the late 16th century.

Tibaldi grew up in Bologna in a family of Lombard stonemasons. He was trained as a painter under minor Emilian artists who imitated the style of Raphael; in 1547, however, he went to Rome and worked with Perino del Vaga. "The Adoration of the Shepherds" (Borghese, Rome), Tibaldi's earliest known painting, shows the influence of Michelangelo. Later works were to reveal the influence of Parmigianino and Niccolo dell' Abbate.

After his return to Bologna in 1553, Tibaldi revealed his talent in decorative painting with a series of frescoes at the Palazzo Poggi (now the University of Bologna). He then completed several architectural projects in Bologna, Paria, Milan, and other Italian cities.

In 1587 Tibaldi answered the summons of Philip II of Spain to supervise the decorating of the Escorial Library near Madrid. While there, he painted 46 frescoes in the cloister alone, executed many sculptural projects, and superintended the architectural details. He returned to Milan shortly before his death, rich and ennobled.

Tibaldi's use of figures in violent and artificial poses is similar to that of Giulio Romano. The decorative, audacious, and absurd poses of his earlier figures are repeated in his frescoes for the Escorial. Tibaldi's architectural work is regarded as competent but unoriginal.

**Tibbett, Lawrence,** Tibbett originally spelled TIBBET (b. Nov. 16, 1896, Bakersfield, Calif., U.S.—d. July 15, 1960, New York City), American baritone renowned for his success in both opera and motion pictures.

Tibbett began his performing career as an actor and church singer in Los Angeles, where he studied voice with Basil Ruysdael. In 1923, after moving to New York City and beginning vocal study with Frank La Forge, he made his operatic debut at the Metropolitan Opera as Lovitsky in Modest Mussorgsky's *Boris Godunov*. His first major success came in 1925 at the Metropolitan, when he played Ford in Giuseppe Verdi's *Falstaff*. His performance completely overshadowed that of Antonio Scotti, the well-known Italian baritone, who was playing the title role. Over the next several years he sang most of the leading baritone roles at the Metropolitan, continuing with the company for 27 seasons.

Tibbett sang in the premiere performances of several native American operas at the Metropolitan, creating the title role in Louis Gruenberg's *The Emperor Jones* (the first world premiere to be broadcast live from the Metropolitan) in 1933, Eadgar in Deems Taylor's *The King's Henchman* (1926) and Colonel Ibbetson in Taylor's *Peter Ibbetson* (1930), and Wrestling Bradford in Howard Hanson's *Merry Mount* (1933). He also played Guido in the first Metropolitan performance of Richard Hageman's *Caponsacchi* (1937) and created the title role in Sir Eugene Goossens' *Don Juan de Mañara* at Covent Garden, London, in that same year. Films in which he appeared include *The Rogue Song, New Moon, The Southerner,* and *Cuban Love Song.* He also did considerable work in radio and recording. He appeared at the Metropolitan for the last time in 1950 in the role of Ivan in Mussorgsky's *Khovanschina,* and his last stage appearance was in the musical comedy *Fanny* on Broadway in 1956. Tibbett's autobiography, *The Glory Road,* was published in 1933.

**Tiber River,** Italian FIUME TEVERE, historic river of Europe and the second longest Italian river after the Po, rising on the slope of Monte Fumaiolo, a major summit of the Appennino Tosco-Emiliano. It is 252 mi (405 km) long. Twisting in a generally southerly direction through a series of scenic gorges and broad valleys, the Tiber flows through the city of Rome and enters the Tyrrhenian Sea of the Mediterranean near Ostia Antica. Its major tributaries are the Chiascio, Nestore, Paglia, Nera, and Aniene. Below Rome, the Tiber branches out into a delta, the main channel being the Fiumara, with the Fiumicino functioning as a distributary branch on the north side. Some ancient writers allege that it was known originally as Albula—a reference to the whiteness of its waters—but it was renamed Tiberis after Tiberinus, a king of Alba Longa (an area centred on Lago Albano, south of Rome) who was drowned in it.

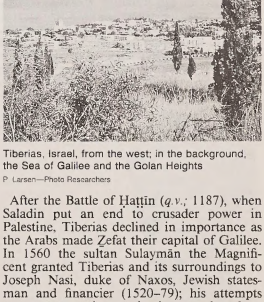
Although the Romans made some effort to control the river's lower course, their ignorance of hydraulic principles prevented the development of adequate protection against floods. It is only in modern times that the Tiber has flowed through Rome between high stone embankments. Though the river varies in depth between 7 and 20 ft, there is some evidence that navigation upstream to the Val Tiberina was significant for the grain trade as long ago as the 5th century BC. Later, the shipment of building stone and also of timber became important. In its zenith, classical Rome was supplied with vegetables grown in the gardens of riverside villas.

The importance of the Lower Tiber was first recognized in the 3rd century BC, when Ostia was made a naval base during the Punic Wars. It later became a commercial centre for the import of Mediterranean wheat, oil, and wine. Successive attempts to maintain Ostia, on the Fiumara, and the port of the emperors Claudius and Trajan, on the Fiumicino, were defeated by the processes of silting and by the deposition of sandbars at the river mouths. In later centuries, several popes tried to improve navigation on the Lower Tiber, and ports were built at Rome in 1692, 1703, and 1744. Navigation and trade upon the Lower Tiber flourished again between the late 18th and mid-19th centuries, when further dredging took place on the lower course. Silting continued, however, with such persistence that, within another century, the Tiber was only navigable at Rome itself. The Tiber Delta, meanwhile, had advanced about two miles seaward since Roman times.

**Tiberias,** Hebrew TEVERYA, city, northeastern Israel, on the western shore of the Sea of Galilee; one of the four holy cities of Judaism (Jerusalem, Hebron, Tiberias, Ẓefat [Safed]).

Tiberias was founded by Herod Antipas (ruled 4 BC–AD 39), tetrarch of Galilee under the Romans, in AD 18, and named for the reigning emperor Tiberius. Some traditions hold that it is built on the site of the biblical Rakkath, mentioned in Joshua 19. After the destruction of the Temple and the despoliation of Judaea by the Romans, Galilee became the chief Jewish centre of Palestine, and Tiberias, its principal city, grew in importance. The Sanhedrin, or supreme rabbinical tribunal, moved there, as did the important *yeshivot* (academies of Jewish scholarship). Much of the compilation of the Mishna was done there (3rd century); the Palestine, or Jerusalem, version of the Gemara was edited in Tiberias about 200 years later. Both are parts of the Talmud.

The city later came under Byzantine rule and, in 636, was taken by the Arabs. The Jewish community continued to flourish. The presently accepted system of vocalization of the Hebrew language, the proper cantillation of the Scriptures for public reading, and the application of the above to preserve the text of the Old Testament in substantially the form known today were all developed in Tiberias in the 8th and 9th centuries. *See* Masoretes.



Tiberias, Israel, from the west; in the background, the Sea of Galilee and the Golan Heights
P. Larsen—Photo Researchers

After the Battle of Ḥaṭṭīn (*q.v.*; 1187), when Saladin put an end to crusader power in Palestine, Tiberias declined in importance as the Arabs made Ẓefat their capital of Galilee. In 1560 the sultan Sulaymān the Magnificent granted Tiberias and its surroundings to Joseph Nasi, duke of Naxos, Jewish statesman and financier (1520–79); his attempts to promote settlement in the area, based on silkworm cultivation and sheepherding, failed. Tiberias was damaged by an earthquake in 1837; rebuilt, it grew steadily after the beginning of Jewish agricultural settlement in Galilee (1882). At the inception of the British Mandate (1922), the city already had a Jewish majority.

Early in 1948, before Israel became independent, the Arabs of Tiberias cut the main road linking the Jewish settlements of Upper Galilee with those of the Jordan Valley and besieged the ancient Jewish quarter on the lakeshore within the walled city. Accordingly, the Haganah (Jewish defense forces) launched a successful attack on the Arab section, which was taken on April 18, 1948. The Arab population was evacuated by British troops at its own request. Tiberias was the first mixed (Arab–Jewish) city to be taken by the Haganah. In the years after the Arab–Israeli War, Tiberias absorbed many new immigrants to Israel.

Among interesting sites are the tomb of Maimonides, renowned philosopher, codifier of Jewish law, and physician, who died in Egypt in 1204; and those of the Talmudic sages Yoḥanan ben Zakkai and Akiba ben Joseph. Just south of the city are the hot springs of Tiberias (Hebrew Ḥammat or Ḥamei Teverya; from *ḥam*, "hot"), known for over 2,000 years for their supposed medicinal qualities, and the adjacent tomb of Rabbi Meir, 2nd-century Talmudic authority, known as Rabbi Meir

Ba'al ha-Nes (Rabbi Meir the Miracle-Worker). The combination of warm winter climate, thermal baths, and scenic views of lake and mountains make Tiberias Israel's most popular resort city. Hotels are found both along the lakeshore and on the slopes of Qiryat Shemuel (City of Samuel). Tiberias' upper residential quarter, laid out after 1920 and named for Sir Herbert (later Viscount) Samuel, the first British high commissioner for Palestine. There are textile industries and flour milling; fishing remains important.

At the shores of the Sea of Galilee, Tiberias is about 689 ft (210 m) below sea level; it is one of the lowest lying cities of its size in the world. During archaeological excavations of 1975–76, the southern gate of the city built by Agrippa II and a network of sewerage and drainage pipes built in traditional Roman fashion were uncovered. Pop. (1982 est.) 29,000.

**Tiberias, Lake** (Israel): *see* Galilee, Sea of.

**Tiberius** (ancient Roman personal name, or praenomen): *see under* gens or family name or honorific (*e.g.,* under Gracchus for Tiberius Sempronius Gracchus), except as below.

**Tiberius,** in full TIBERIUS CAESAR AUGUSTUS, or TIBERIUS JULIUS CAESAR AUGUSTUS, original name TIBERIUS CLAUDIUS NERO (b. Nov. 16, 42 BC—d. March 16, AD 37, Capreae [Capri], near Naples), second Roman emperor (AD 14–37), adopted son of Augustus, whose imperial institutions and imperial boundaries he sought to preserve. In his last years he became a tyrannical recluse, inflicting a reign of terror against the major personages of Rome.



Tiberius as a young man, marble bust found in Egypt in 1896; in the Ny Carlsberg Glyptotek, Copenhagen
By courtesy of the Ny Carlsberg Glyptotek, Copenhagen

*Background and youth.* Tiberius' father, also named Tiberius Claudius Nero, a high priest and magistrate, was a former fleet captain for Julius Caesar. His mother, the beautiful Livia Drusilla, was her husband's cousin and may have been only 13 years old when Tiberius was born. In the civil wars following the assassination of Julius Caesar, the elder Tiberius gave his allegiance to Mark Antony, Caesar's protégé. When Augustus, Caesar's grandnephew and heir, fell out with Antony and defeated him in the ensuing power struggle, the elder Tiberius and his family became fugitives. They fled first to Sicily and then to Greece, but by the time Tiberius was three years old an amnesty was granted and the family was able to return to Rome.

In 39 BC Augustus had the power, if not yet the title, of emperor. Attracted by the beauty of Livia, who was at that time pregnant with a second son, Augustus divorced his own wife, who was also pregnant, and, forcing the elder Tiberius to give up Livia, married her. The infant Tiberius remained with his father, and, when the younger brother, Drusus, was born a few months later, he was sent to join them. At the death of his father, Tiberius was nine years old, and, with Drusus, he went to live with Livia and the Emperor. The two boys and the Emperor's daughter, Julia, between them in age, studied together, played together, and took part in the obligatory ceremonials of temple dedication and celebration of victories. They were joined by their cousin Marcellus, the son of Augustus' sister, Octavia.

In the absence of a clear law designating Augustus' successor as emperor, all three boys were trained accordingly. They were instructed in rhetoric, literature, diplomacy, and military skills, and soon they also began taking a ceremonial role in the affairs of state. As oldest, Tiberius was the first to do so. In the triumph following Augustus' victory over Cleopatra and Antony at Actium, the 13-year-old Tiberius rode the right-hand horse of Augustus' chariot in the procession. Though not a striking figure, he conducted himself well.

Serious by nature, he had become a shy youth, though he was sometimes called sullen. His great talent was application. With the best teachers in the empire at his disposal and, above all, as a participant in life at the palace, the centre of the civilized Western world, he learned rapidly. By the age of 14, Tiberius was used to dining with kings of the empire, to conducting religious services over the heads of powerful men five times his age, and even to seeing his own form in marble statues.

*Years in the shadow of Augustus.* He was not handsome. As a teenager he was tall and broad-shouldered, but his complexion was bad. His nose had a pronounced hook, but that was typically Roman. His manner was disconcerting. He had a slow, methodical way of speaking that seemed intended to conceal his meaning rather than make it plain. But he was diligent. He may not have known he would be emperor, but he cannot have doubted that he would be at least a general at a rather early age and thereafter he would be a high official in the government of Rome. In 27 BC, when Tiberius was 15 years old, Augustus took him and Marcellus to Gaul to inspect outposts. They experienced no fighting, but they learned a great deal about how to rule the marches, keep fortifications intact, and keep garrisons alert. When they returned, Augustus gave Marcellus his daughter Julia as wife.

Then Tiberius himself married. Love matches were infrequent in imperial Rome, but Tiberius' marriage to Vipsania Agrippina was one. She was the daughter of Marcus Agrippa, Augustus' son-in-law and lieutenant. Besides his love for his wife, and for his brother, Drusus, now growing into manhood, he was occupied with important work. His first military command at the age of 22, resulting in the recovery of standards of some Roman legions that had been lost decades before in Parthia, brought him great acclaim. As a reward he asked for another active command and was given the assignment of pacifying the province of Pannonia on the Adriatic Sea. Tiberius not only conquered the enemy but so distinguished himself by his care for his men that he found himself popular and even loved. When he returned to Rome, he was awarded a triumph.

Tiberius' happy years were coming to an end, however. His beloved brother, Drusus, broke his leg in falling from a horse while campaigning in Germany. Tiberius was at Ticinum, on the Po River, south of what is now Milan, 400 miles away. Riding day and night to be with his brother, he arrived just in time to see Drusus die. Tiberius escorted the body back to Rome, walking in front of it on foot all the way. He also had to give up his wife, Vipsania, the other person he loved. Augustus' daughter Julia had become a widow for the second time. Her first husband, Marcellus, had died, and the Emperor had married her to Agrippa (who, as Vipsania's father, was Tiberius' father-in-law). When Agrippa died in 12 BC, Augustus wanted her suitably married at once and chose Tiberius as her third husband. Tiberius had no more choice than his father had had when Augustus decided to marry Livia. Tiberius was as obedient as his father. He divorced Vipsania and married Julia.

Tiberius' new wife has come down in history with a reputation for licentiousness. It is not certain how much of the reputation she deserved. Roman historians often dealt in gossip, inventing scandal when there was none; but in Julia's case they had good reason for their opinion. When Julia married Tiberius, he was 30. She was 27, twice a widow, the mother of five children (not all surviving). She was pretty and light-minded and liked the society of men. She did not get along with her mother-in-law (who was also her stepmother), Livia, and after the first few months she tired of Tiberius. It is certain that she committed adultery, and this presented Tiberius with an immense problem, not only personal but also political. A law of Augustus himself required a husband to denounce a wife who committed adultery. But Julia was the Emperor's beloved child, and, as Augustus knew nothing of her vices, to denounce her would be to wound him, and that was dangerous.

With no good course of action to follow, Tiberius asked for and received fighting commands away from Rome. When once in Rome between battles, he chanced to see Vipsania at the home of a friend. She had, at Augustus' orders, been remarried to a senator. Tiberius was so overcome with sorrow that he followed her through the streets, weeping. Augustus heard of it and ordered Tiberius never to see her again. Although Augustus heaped honours on Tiberius, they did not compensate for Julia's behaviour. In 6 BC Tiberius was granted the powers of a tribune and shortly thereafter went into a self-imposed exile on the island of Rhodes, leaving Julia in Rome.

Tiberius was now 36 years old and at the pinnacle of his power. He was capable of ruling an empire, conducting a great war, or governing a province of barbarians. In Rhodes he had nothing to do, and all of his ability and strength appear to have turned inward, into strange and unpleasant behaviour. The histories of Tiberius' reign—written either by flatterers, like his old war comrade Velleius Paterculus, or by enemies—are not wholly trustworthy.

Yet there can be no question that a change took place in Tiberius at this time. What emerged was a man who seemed interested only in his own satisfactions and the increasingly perverse ways to find them. On Rhodes Tiberius became a recluse—unassuming and amiable at first, resentful and angry later on. Though Tiberius had left Rome of his own free will, daring the Emperor's wrath, he could not return without Augustus' permission. Augustus withheld that permission for the better part of a decade.

Eventually, Livia secured proofs of Julia's many adulteries and took them to Augustus, who was furious. Under his own law she should have been executed, but he did not have the heart for that; instead, he exiled her for life to the tiny island of Pandateria. But even then Tiberius was not recalled. There were three young men whom the Emperor appeared to favour as heirs, all sons of Julia. One of them, Postumus, reportedly no more than a boor, fell into disfavour with Augustus and was sent into exile with his mother. The other two, Lucius and Gaius, were clearly candidates to succeed. But in 2 BC Lucius died,

in Massilia (Marseille), and the Emperor relented. He called Tiberius back to Rome. By AD 4 Tiberius was in possession of all his honours again, and in that year Gaius was killed in a war in Lycia. Tiberius had become the second man in Rome. Augustus did not like him, but he adopted him as his son. He had no choice, and he was growing old. Tiberius was the least objectionable successor left.

Tiberius became proud and powerful. His statues had been torn down and defaced while he was in Rhodes. Now they were rebuilt. He was given command of an army to quell Arminius, who had destroyed three Roman legions in Germany in AD 9; he succeeded wholly. He was succeeding at everything now, and in AD 14, on August 19, Augustus died. Tiberius, now supreme, played politics with the Senate and did not allow it to name him emperor for almost a month, but on September 17 he succeeded to the principate. He was 56 years old.

*Reign as emperor.* Although the opening years of Tiberius' reign seem almost a model of wise and temperate rule, they were not without displays of force and violence, of a kind calculated to secure his power. The one remaining possible contender for the throne, Postumus, was murdered, probably at Tiberius' orders. The only real threat to his power, the Roman Senate, was intimidated by the concentration of the Praetorian Guard, normally dispersed all over Italy, within marching distance of Rome.

Apart from acts such as these, Tiberius' laws and policies were both patient and far-seeing. He did not attempt great new conquests. He did not move armies about or change governors of provinces without reason. He stopped the waste of the imperial treasury, so that when he died he left behind 20 times the wealth he had inherited, and the power of Rome was never more secure. He strengthened the Roman navy. He abandoned the practice of providing gladiatorial games. He forbade some of the more outlandish forms of respect to his office, such as naming a month of the calendar after him, as had been done for Julius Caesar and Augustus.

There were, to be sure, occasional wars and acts of savage repression. Tiberius' legions put down a provincial rebellion with considerable bloodshed. In Rome itself, on the pretext that four Jews had conspired to steal a woman's treasure, Tiberius exiled the entire Jewish community. The most ominous and least defensible aspect of Tiberius' first years as emperor was the growth of the practice called "delation." Most crimes committed by well-to-do citizens were, under Roman law, punished in part by heavy fines and confiscations. These fines contributed in large part to the growth of the imperial treasury, but the money did not all go to the fisc. Because there were no paid prosecutors, any citizen could act as a volunteer prosecutor, and, if the person he accused was convicted, he could collect a share of the confiscated property. These volunteers, called *delatores,* made a profitable career of seeking out or inventing crime. Many of the prosecutions were based on rumour or falsified evidence, and there were few Romans who were so honoured or so powerful that they did not need to fear the attack of the *delatores* on any suspicion, or on none at all.

In AD 23 Tiberius' son Drusus died. He had not been particularly loved by his father, but his death saddened Tiberius. From then on he spared less and less thought to the work of empire. More and more he delegated his authority in the actual running of affairs over to the man he had entrusted with the important command of the Praetorian Guard, Sejanus. Before long Tiberius was emperor only in name.

Ironically, the death of Drusus, the event that brought Sejanus to power, may have been Sejanus' own doing. Apparently Sejanus had seduced the wife of the younger Drusus, Livilla, and induced her to become his accomplice in murdering her husband. The evidence is not absolute and has been questioned by many historians, but it was not questioned by Tiberius. In AD 27, at the age of 67, Tiberius left Rome to visit some of the southern parts of Italy. En route he paused to go to the island of Capri. His intention appears to have been only to stay for a time, but he never returned to Rome. It is the remaining decade or so of Tiberius' life that has given rise to the legend of Tiberius the monster. It seems probable, to begin with, that Tiberius, never handsome, had become repulsively ugly. First his skin broke out in blotches, and then his complexion became covered with pus-filled eruptions, exuding a bad smell and causing a good deal of pain. He built himself a dozen villas ringing Capri, with prisons, underground dungeons, torture chambers, and places of execution. He filled his villas with treasure and art objects of every kind and with the enormous retinue appropriate to a Caesar: servants, guards, entertainers, philosophers, astrologers, musicians, and seekers after favour. If the near-contemporary historians are to be believed, his favourite entertainments were cruel and obscene. Even under the most favourable interpretation, he killed ferociously and almost at random. It is probable that by then his mind was disordered.

He had not, however, lost touch with the real world. He came to realize just how strong he had made Sejanus and how weak he had left himself. In AD 31 he had allowed himself to be elected consul of Rome for a fifth time and had chosen as his co-consul Sejanus. He gave Sejanus permission to marry Livilla, the widow of Tiberius' son. Now Sejanus not only had the substance of power but its forms as well. Golden statues were erected to him and his birthday was declared a holiday. But Tiberius had come to fear and mistrust him. With the aid of Macro, Sejanus' successor as commander of the Praetorians, Tiberius smuggled a letter to the Senate denouncing Sejanus and calling for his execution. The Senate was shocked and taken aback by the swift change, but it complied instantly—perhaps moved by the justice of Tiberius' charges or by the strength of the Praetorian Guard.

Apparently Tiberius now reached a peak of denunciation and torture and execution that lasted for the remaining six years of his life. In the course of this reign of terror his *delatores* and torturers found evidence for him of the murder of his son, Drusus, by Livilla and Sejanus. Many great Roman names were implicated, falsely or not, and while that inquisition lasted no one on Capri was safe. Tiberius' chief remaining concern for the empire was who would rule it when he was gone. There were few living successors with any real claim, and Tiberius settled, as Augustus had done before him, on the least offensive of an undesirable lot. His choice was Gaius Caesar, still a young boy and known by the nickname the Roman legions had given him when he was a camp mascot, Caligula, or Little Boots. Caligula, a great-grandson of Augustus through Julia and her daughter, had a claim to the throne as good as any. If his morals and habits were less than attractive, Tiberius did not seem to mind. "I am nursing a viper in Rome's bosom," Tiberius observed, and named Caligula his adopted son and successor.

In the spring of AD 37, Tiberius took part in a ceremonial game that required him to throw a javelin. He wrenched his shoulder, took to his bed, became ill, and lapsed into a coma. His physicians, who had not been allowed to examine him for nearly half a century, now studied his emaciated body and declared that he would die within the day. The successor, Caligula, was sent for. The Praetorian Guard declared their support for the new emperor. The news of the succession was proclaimed to the world. Then Tiberius recovered consciousness, sat up, and asked for something to eat. The notables of Rome were thrown into confusion. Only the Praetorian commander, Macro, kept his head, and on the next day he hurried to Tiberius' bed, caught up a heap of blankets, and smothered Tiberius with them.

*Assessment.* As an infant Tiberius had been a fugitive and then a pawn. As a man he had been a popular and victorious general and then an exile. He came to supreme power already growing old. When he died, he left the Roman Empire prosperous and stable, and the institution of the principate was so strong that for a long time it was able to survive the excesses of his successors. Without him the later history of Rome might have been less colourful, but probably it would also have been far shorter. (F.Po./Ed.)

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**Tiberius II** CONSTANTINUS (b. Thrace—d. Aug. 14, 582, Constantinople), Byzantine emperor from 578 who succeeded in defending the empire against the Persians to the east but suffered reverses in conflicts with the Avars and the Slavs to the north and west.

Tiberius served in campaigns against the Avars in the Balkans under Justin II. About the year 574, Justin became subject to fits of insanity; the empress Sophia and Tiberius then took over control of the government. Justin adopted Tiberius as his son, named him co-emperor on Dec. 7, 574, and crowned him emperor (Sept. 26, 578). Justin died soon after (October 4), leaving Tiberius sole ruler.

Meanwhile, in 578, Byzantium and Persia had entered into peace negotiations to settle the Armenian question. The Persian king Khosrow I seemed about to make a settlement on Byzantium's terms when he died in the early spring of 579. His successor, Hormizd IV, however, rejected Tiberius' proposals, and hostilities resumed, continuing throughout Tiberius' reign. On the northern frontier, Tiberius attempted to pacify the Avars by an annual tribute; but, after a two-year siege by the Avars, he was forced (582) to surrender Sirmium (now Sremska Mitrovica, Yugos.). Meanwhile, the Slavs poured into Thrace, Thessaly, Illyricum, and other regions of Greece.

The mortally ill Tiberius in 582 recognized Maurice, his commander in the Persian War, as his successor and crowned him emperor on August 13, one day before his own death.

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**Tibesti,** also called TIBESTI MASSIF, OF TIBESTI MOUNTAINS, part of the Mid-Sahara Rise of the central Sahara. Mostly in northwestern Chad, the mountains extend into northeastern Niger and southern Libya. The formation is about 300 mi (480 km) long and up to 175 mi wide. The volcanic summit of Emi Koussi rises to 11,204 ft (3,415 m) above sea level and is the highest point in the Sahara.

The mountains are formed of eruptive rocks that forced their way through a substratum of crystalline rocks covered by sandstone; the sandstone scarp rises steeply above the surrounding plains. Three great, dry watercourses that cut deeply into the mountains are indications of a formerly more humid climate. The Teda and Daza inhabitants, numbering about 8,000, are chiefly nomadic.

Tibesti is an area rich in minerals, including tungsten, tin, and oil. It is the site of a desert research station affiliated with the Free University of (West) Berlin. In Tibesti's northern section the Aozou strip, an area of about 27,000 square miles (70,000 square km), is believed to have large deposits of uranium; it has been held by Libya since 1973.

**Tibet,** Tibetan BOD, in full TIBET AUTONOMOUS REGION, Chinese (Wade–Giles) HSI-TSANG TZU-CHIH-CH'Ü, or (Pinyin) XIZANG ZIZHIQU, historic region and autonomous region of China that is often referred to as "the roof of the world." It is bounded by the Chinese provinces of Szechwan to the east, Yunnan to the southeast, and Tsinghai to the northeast; the Sinkiang Uighur autonomous region of China to the northwest; the disputed state of Jammu and Kashmir to the west; and India, Nepal, Bhutan, and Myanmar (Burma) to the south.

A brief treatment of Tibet follows. For full treatment, *see* MACROPAEDIA: China.

Tibet is situated on a high plateau surrounded by enormous mountain ranges. The relatively level northern part of the plateau is called the Northern Plain, and it extends more than 800 miles (1,300 km) from west to east at an elevation of 15,000 feet (4,600 m). It is bordered on the north by the Kunlun Mountains. The western and southern border of the Plateau of Tibet is formed by the Himalayan mountain ranges, which include Mount Everest, the world's highest known peak, rising to 29,035 feet (8,850 m) on the Nepal border. North of Lake Mapam and stretching eastward is the Trans-Himalaya range, several of whose peaks exceed 20,000 feet (6,100 m). These are separated from the Himalayas by the Brahmaputra River, which flows across southern Tibet and then cuts south through the mountians to India.

Tibet's climate is generally dry and has a low humidity. Temperatures in the high elevations are cold, but those in the lower valleys are mild. The greatest temperature differences occur during a 24-hour period, with bitter cold in early morning and night aggravated by gale winds that blow throughout the year. However, because of the cool dry air, grain can be safely stored for 50 to 60 years, dried raw meat can be preserved for more than a year, and epidemics are rare.

The majority of Tibetans have the same ethnic origin, practice the same religion, and speak the same language. The basic economic groups have been the nomads, seminomads, agriculturalists, and forest dwellers. There are also traders, craftsmen, government officials, monks, and nuns. In Lhasa there was a special caste group that earned its living by begging and by disposing of corpses. These castes were not rigid; monks, for example, could also be government officials. Social divisions existed between the peasantry and the nobility, the latter's status being based on heredity. The overwhelming majority of the population were peasants.

Before the 1950s Tibet was a unique entity that sought isolation from the rest of the world. It had its own culture and its own religion, encompassed by Tibetan Buddhism and the Tibetan language. Economic development, in Western terms, was minimal.

In 1950 China invaded and occupied Tibet. China attempted to modernize Tibet by undermining the authority of the Tibetan Buddhist church hierarchy and by building roads, bridges, hospitals, and schools. Tibetan resentment exploded in a popular uprising in 1959 at the region's capital city of Lhasa, and after this was suppressed the Chinese forcibly attempted to remake Tibetan society, confiscating the property of the nobility and the church, collectivizing agriculture, and completely suppressing the public practice of Buddhism. Some relaxation in China's rule was evident in the mid-1980s.

Although Tibet is rich in mineral resources, its economy has remained underdeveloped. Because of the difficult terrain and severe climate, agricultural activity has also been hampered. Staple crops include barley, wheat, millet, buckwheat, beans, hemp, and mustard. Butter from the yak or the *mdzo-mo* (a cross-breed of the yak and the cow) is the main dairy product. Tibetans supplement their diet with garden produce, including radishes, turnips, carrots, potatoes, peas, parsley, lettuce, tomatoes, cabbage, garlic, onions, mint, celery, cauliflower, pumpkins, squash, and eggplant. Imported foods include tea, sugar, and rice, although some rice is raised in the southeast. Forests, because they are inaccessible, are largely unexploited.

Before 1951, most Tibetans traveled on foot or on the backs of animals. Coracles (small boats made of wicker and hides) were used to cross the larger rivers. After the Chinese took over, a network of motor roads was constructed, notably the Tsinghai and Szechwan highways. There has been air service between Tibet and Peking since 1956. Postal and telegraphic service is limited. Area 471,700 square miles (1,221,600 square km). Pop. (1999 est.) 2,560,000.

**Tibet, Plateau of,** also called TIBETAN HIGHLANDS, or TSINGHAI–TIBET PLATEAU, Chinese (Wade–Giles) CH'ING-TSANG KAO-YUAN, or (Pinyin) QING ZANG GAOYUAN, vast, high plateau in central Asia and part of China in which the Tibet autonomous region, Tsinghai province, western Szechwan province, and southern Sinkiang Uighur autonomous region are located. It lies between the Kunlun Mountains (north) and the Himalayas (south) and is a region of tangled mountains that rise 13,000 to 15,000 feet (4,000 to 5,000 m). The plateau has an area of about 850,000 square miles (2,200,000 square km). Mount Everest on the China–Nepal border, rising 29,028 feet (8,848 m) above sea level, is the world's highest peak. The northern section of the plateau, called Ch'iang-t'ang, is dotted with many brackish lakes; its southern section contains the headwaters of the Upper Indus and Brahmaputra rivers. Other rivers that have their headwaters in the highlands are the Yangtze, the Huang Ho, the Mekong, the Salween, and the Tarim. Grassland, used for pasturage, is found, and barley is grown on the plateau; forests are found on the slopes of valleys (particularly in the south). The most extensive farming area in Tibet is the fertile plains of the Brahmaputra River and its tributaries. Lhasa, the capital of the Tibet autonomous region, is the major centre of population on the plateau.

**Tibetan,** member of either of two physical types of people who inhabit Tibet or nearby regions and speak Tibetan. Tibetans are sometimes distinguished by physical type, notably (1) a round-headed group found mostly in the cultivated river valleys of central and western Tibet, who resemble the Chinese and Myanmar (Burmese), and (2) a long-headed group who tend to be tall and angular in build, with aquiline noses, found among the noble families in central Tibet and generally among the nomads of the east and northeast.

All Tibetans share the same language. It is highly stylized, with an honorific and an ordinary word for most terms of reference. The honorific expression is used when speaking to equals or superiors and the ordinary word when addressing inferiors or referring to oneself. There is an additional set of higher honorifics to be used when addressing the highest lamas and nobles.

The number of Tibetans in Tibet proper (and other areas in western China) is estimated at around 4.2 million, with perhaps an additional 2 million in the Tibetan ethnic areas of Bhutan, India, northern Nepal, and the Ladakh region of Jammu and Kashmir.

Prior to the Chinese annexation of Tibet in 1959, social classes among the Tibetans could be defined in terms of opposition: cleric versus lay, noble versus peasant, merchant versus labourer, agriculturalist versus nomad, and trader versus townsman. The agriculturalists traditionally formed the peasantry of Tibet, most of them working as tenants or hired labourers on land owned by the monasteries or the nobility. The herdsmen and shepherds pastured their flocks on the high steppes; some of them remained in the lowlands during the winter and migrated upward in summer. Before 1959 it was estimated that about one-quarter of the population belonged to the clerical order. The monasteries were the main seats of learning. Tibetan Buddhism is an admixture of Buddhist teachings and the pre-Buddhist religion, Bon (*see also* Bon; Tibetan Buddhism).

Most marriages are monogamous, although both polygyny and polyandry have been practiced under certain circumstances, usually in order to keep an estate intact and within the paternal line of descent. Thus, the eldest son of a noble family would take a bride; and, if any of his younger brothers so desired, they were included in the marriage contract as junior husbands.

Dwellings are commonly one- or two-story buildings with walls of stone or brick and flat clay roofs. The nomadic pastoralists live in tents of yak hair, rectangular in shape and ranging from 12 to 50 feet (3.5 to 15 m) in length. Most of the noble families traditionally maintained town houses in the capital city, Lhasa. These were built of stone around a rectangular courtyard, on three sides of which were stables and storehouses. On the fourth side, opposite the gate, was the mansion itself, usually three stories high.

The staple diet of most Tibetans is barley flour, yak meat, mutton, cheese, and tea. These basic items may be supplemented by rice, fruit, vegetables, chicken, and sometimes fish. The main beverage is tea mixed with butter and salt.

**Tibetan bear:** *see* Asiatic black bear.

**Tibetan Buddhism,** also called (incorrectly) LAMAISM, distinctive form of Buddhism that evolved from the 7th century AD in Tibet. It is based mainly on the rigorous intellectual disciplines of Mādhyamika and Yogācāra philosophy and utilizes the symbolic ritual practices of Vajrayāna (Tantric Buddhism). Tibetan Buddhism also incorporates the monastic disciplines of early Theravāda Buddhism and the shamanistic features of the indigenous Tibetan religion, Bon. Characteristic of Tibetan Buddhism is the unusually large segment of the population actively engaged in religious pursuits (up until the Chinese communist takeover of the country in the 1950s an estimated one-quarter of the inhabitants were members of religious orders); its system of "reincarnating lamas"; the traditional merger of the spiritual and temporal authority in the office and person of the Dalai Lama; and the vast number of divine beings (each with its own family, consort, and pacific and terrifying aspects), which are considered symbolic representations of the psychic life by the religiously sophisticated and accepted as realities by the common people.

Buddhism was transmitted into Tibet mainly

during the 7th to 10th centuries. Notable early teachers were the illustrious 8th-century Tantric master Padmasambhava and the more orthodox Mahāyāna teacher Śāntirakṣita. With the arrival from India in 1042 of the great teacher Atiśa, a reform movement was initiated, and within a century the major sects of Tibetan Buddhism had emerged. The Dge-lugs-pa, or One of the Virtuous System, commonly known as the Yellow Hats, the order of the Dalai and the Paṇchen Lamas, has been the politically predominant Tibetan sect from the 17th century until 1959, when the hierocratic government of the Dalai Lama was abolished by the People's Republic of China.

By the 14th century the Tibetans had succeeded in translating all available Buddhist literature in India and Tibet; many Sanskrit texts that have since been lost in the country of their origin are known only from their Tibetan translations. The Tibetan canon is divided into the *Bka'-'gyur*, or Translation of the Word, consisting of the supposedly canonical texts, and the *Bstan-'gyur*, or Transmitted Word, consisting of commentaries by Indian masters.

In the second half of the 20th century Tibetan Buddhism spread to the West, particularly after the subjugation of Tibet to Chinese Communist rule sent many refugees, including highly regarded "reincarnated lamas," or *tulkus*, out of their homeland. Tibetan religious groups in the West include both communities of refugees and those consisting largely of occidentals drawn to the Tibetan tradition.

**Tibetan calendar,** dating system based on a cycle of 60 Tibetan years, each of which usually has 354 days (12 cycles of the phases of the Moon). Adjustment to the solar year of about 365 days is made by intercalation of an extra month every three years. The 60-year cycle appears to be a 9th-century adaptation from the Chinese calendar (*q.v.*).

The written Tibetan calendar calls for an ideal month of 30 days; to reconcile this with the 29½-day cycle of phases of the Moon, the number of days in six of the months is reduced to 29. The first day of each month coincides with the New Moon and the 15th day with the Full Moon.

**Tibetan Highlands:** *see* Tibet, Plateau of.

**Tibetan language,** Tibetic (or Bodic) language belonging to the Tibeto-Burman group of the Sino-Tibetan language family; it is spoken in Tibet, Bhutan, Nepal, and in parts of northern India (including Sikkim). The language is usually divided by scholars into four dialect groups: Central, Southern, Northern (in northern Tibet), and Western (in western Tibet). The widely used dialect of Lhasa, the capital of Tibet, belongs to the Central group, while the Southern group is found primarily in Sikkim, Bhutan, and Nepal. The Western dialects are more conservative in their sound systems, having best preserved the initial consonant clusters and the final stops (sounds formed with complete closure in the vocal tract) of Old Tibetan and having less development of tones than the other dialects.

Tibetan is written in a very conservative script of Indian origin, its present form having been used since the 9th century. The orthography reflects the pronunciation of the language as it was in about the 7th century and therefore does not adequately represent present-day standard Tibetan pronunciation.

**Tibetan literature,** body of largely religious and occult writings that has developed since the 7th century, when Tibetan became a written language. Until the 13th century most Tibetan literary works were skillfully methodical translations from Sanskrit of Buddhist texts, on which Indian scholars and Tibetan translators worked side by side. There is also an early indigenous literature based on oral tradition that consists mainly of annals, chronicles, legends, liturgies, and compendiums of occult practices.

The official Tibetan Buddhist canon was closed in the 13th century. By that time, however, there already existed some orthodox Buddhist works of Tibetan origin, and from the 13th century onward there were produced such lengthy and numerous collections of religious histories, biographies, dramas, and treatises and commentaries on Buddhist doctrine that Tibetan literature must be considered one of the most extensive in the world. With the exception of the great epic *Rgyal-po Ge-sar dgra-'dul gyi rtogs-pa brjod-pa* ("The Great Deeds of King Gesar, Destroyer of Enemies"), there is little secular literature.

**Tibeto-Burman languages,** a class of languages that includes all Sino-Tibetan languages (*q.v.*) except those classified as Chinese. (It also excludes the Tai, Karen, and Miao-Yao languages, when these are sometimes classified as Sino-Tibetan.) The validity of the classification Tibeto-Burman is debated by scholars.

**Tibeto-Chinese languages:** *see* Sino-Tibetan languages.

**Tibetot, John:** *see* Worcester, John Tiptoft, 1st earl of.

**tibia,** also called SHIN, inner and larger of the two bones of the lower leg in vertebrates—the other is the fibula. In humans the tibia forms the lower half of the knee joint above and the inner protuberance of the ankle below. The upper part consists of two fairly flat-topped prominences, or condyles, that articulate with the condyles of the thighbone, or femur, above. The attachment of the ligament of the kneecap, or patella, to the tibial tuberosity in front completes the knee joint. The lateral condyle is larger and includes the point at which the fibula articulates. The tibia's shaft is approximately triangular in cross section; its markings are influenced by the strength of the attached muscles. It is attached to the fibula throughout its length by an interosseous membrane. In prehistoric man the shaft was frequently flattened from side to side.

At the lower end of the tibia there is a medial extension (the medial malleolus), which forms part of the ankle joint and articulates with the talus (anklebone) below; there is also a fibular notch, which meets the lower end of the shaft of the fibula.

**tibia** (musical instrument): *see* aulos.

**Tibullus, Albius** (b. *c.* 55 BC—d. *c.* 19 BC), Roman poet, the second in the classical sequence of great Latin writers of elegiacs that begins with Cornelius Gallus and continues through Tibullus and Sextus Propertius to Ovid. Quintilian considered Tibullus to be the finest of them all.

Apart from his own poems, the only sources for the life of Tibullus are a few references in ancient writers and an extremely short *Vita* of doubtful authority. He was of equestrian rank (according to the *Vita*) and inherited an estate but seems to have lost most of it in 41 BC, when Mark Antony and Octavian confiscated land for their soldiers. As a young man, however, Tibullus won the friendship and patronage of Marcus Valerius Messalla Corvinus, the statesman, soldier, and man of letters, and became a prominent member of Messalla's literary circle. This circle, unlike that of Gaius Maecenas, kept itself aloof from the court of Augustus, whom Tibullus does not even mention in his poems. Tibullus seems to have divided his time between Rome and his country estate, strongly preferring the latter. The Albius addressed by Horace in *Odes*, i, 33, and *Epistles*, i, 4, is generally identified with Tibullus.

Tibullus' first important love affair, the main subject of Book i of his poems, was with the woman whom he calls Delia. Sometimes he presents her as unmarried, sometimes as having a husband (unless the term *conjunx* is meant to mean "protector"). It is clear, however, that Tibullus took advantage of the "husband's" absence on military service in Cilicia to establish his relationship with Delia and that this relationship was carried on clandestinely after the soldier's return. Tibullus ultimately discovered that Delia was receiving other lovers as well as himself; then, after fruitless protests, he ceased to pursue her.

In Book ii of his poems, Delia's place is taken by Nemesis (also a fictitious name), who was a courtesan of the higher class, with several lovers. Though he complains bitterly of her rapacity and hardheartedness, Tibullus seems to have remained subjugated to her for the rest of his life. He is known to have died young, very shortly after Virgil (19 BC). Ovid commemorated his death in his *Amores* (iii, 9).

The character of Tibullus, as reflected in his poems, is an amiable one. He was a man of generous impulses and a gentle, unselfish disposition. He was not attracted to an active life; his ideal was a quiet retirement in the countryside with a loved one by him. Tibullus was loyal to his friends and more constant to his mistresses than they would seem to have deserved. His tenderness toward women is enhanced by a refinement and delicacy rare among the ancients.

For idyllic simplicity, grace, tenderness, and exquisiteness of feeling and expression, Tibullus stands alone among the Roman elegists. In many of his poems, moreover, a symmetry of composition can be discerned, though they are never forced into any fixed or inelastic scheme. His clear and unaffected style, which made him a great favourite among Roman readers, is far more polished than that of his rival Propertius and far less loaded with Alexandrian learning, but in range of imagination and in richness and variety of poetical treatment, Propertius is the superior. In his handling of metre, Tibullus is likewise smooth and musical, whereas Propertius, with occasional harshness, is vigorous and varied.

The works of Tibullus, as they have survived, form part of what is generally known as the *Corpus Tibullianum*, a collection of poetry that seems most probably to have been deliberately put together to represent the work of Messalla's circle. The first two of the four books in the *Corpus* are undoubtedly by Tibullus. In its entirety the collection forms a unique and charming document for the literary life of Augustan Rome.

**Tibur** (Italy): *see* Tivoli.

**tic** (from the 17th-century French *tic* or *ticq*, "a twitching"), a sudden rapid, recurring contraction in a muscle or group of muscles, occurring more often in the upper parts of the body. The movement is always brief, irresistible, and limited to one part of the body. It does not interfere with the use of the part involved and may be halted voluntarily, but only for a time. If the tic movement becomes ingrained, it is looked upon as a habit; the possessor becomes relatively unaware of its occurrence. Then a tic may be considered to be involuntary. These characteristics of tic help to differentiate it from other involuntary movements, such as spasm or cramp, or the capricious, uninhibitable movements that may occur in the afflictions chorea (St. Vitus' dance) or epilepsy.

While most tics are probably of psychological origin, similar repetitive movements have been observed in physical disorders, as in the late stages of encephalitis. The movements that accompany brain disease may persist for years but tend to cease eventually.

Nervous children between five and twelve years of age are those most likely to have

tics, but no age group is immune. The movement appears when the subject is tense, and distraction will reduce it. The sufferer knows that he has a certain control of the movement but feels impelled to go through with it in order to feel better.

According to psychoanalytic interpretation, tics are the involuntary motor expression of emotional activity, and they depend primarily upon the subject's early psychological and sexual development.

Tics frequently involve the face and air passages. The most common tics are a repetitive grimace, blink, sniff, snort, or click in the nose or throat, a twitch, or a shrug. Tics occur in decreasing frequency from head to foot. Psychotherapy, relaxation training, and biofeedback training have had some success in treating tics.

*Consult the* INDEX *first*

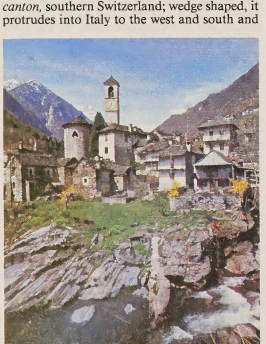
**Tichatschek, Joseph (Aloys),** also spelled JOSEF TICHÁČEK (b. July 11, 1807, Ober-Weckelsdorf, Bohemia, Austrian Empire [now in Czech Republic]—d. Jan. 18, 1886, Blasewitz, near Dresden, Ger.), Bohemian operatic tenor praised by composers such as Richard Wagner, Hector Berlioz, and Franz Liszt for the power and beauty of his voice.

Tichatschek studied music with his father and sang in the choir of the Broumov Gymnasium as a child, and later, while studying medicine in Vienna, he began serious vocal training. In 1830 he joined the chorus at the Kärntnerthor Theatre, and in 1837 he made his solo debut in Graz, Austria.

Tichatschek's first Dresden performance (1837) was in the title role of Daniel-François-Esprit Auber's *Gustave III.* A year later he was appointed to the Dresden Court Opera where he remained until his retirement in 1870. He made a tour of England in 1841, singing at Drury Lane in London, in Manchester, and in Liverpool. His robust voice made him particularly suited for Wagner's heldentenor ("heroic tenor") roles; he created the title roles of Wagner's *Rienzi* (1842) and *Tannhäuser* (1845), and his performance in *Lohengrin* (1867) was highly praised.

**Tichoretsk** (Russia): *see* Tikhoretsk.

**Ticino** (Italian), French and German TESSIN, *canton,* southern Switzerland; wedge shaped, it protrudes into Italy to the west and south and



Lavertezzo village in the Verzasca valley, Ticino canton, Switzerland
Shostal

is bounded by the cantons of Valais and Uri to the north and Graubünden to the northeast. About three-fourths of its area is reckoned as productive and forests cover another one-third. The remainder consists of lakes, chiefly parts of Maggiore and Lugano, and glaciers. The Lepontine Alps rise in the north, reaching heights of 11,161 feet (3,402 m) at the Rheinwaldhorn and 10,738 feet (3,273 m) at the Basodino. The canton is dominated physically by three river systems occupying steep-sided valleys extending from the mountain frontier southward to Lake Maggiore. The chief system is that of the Ticino River, which rises in the northwest, flows east through the Bedretto valley and then southeast through the Leventina valley, receiving the left-bank tributaries Brenno (from the Blenio valley) and Moesa (from the Mesolcina valley) before curving westward above Bellinzona to enter the lake from the east. The wide, low valley formed by the combined Ticino and Brenno is called the Riviera. The western part of the canton is drained by the Maggia and its numerous right-bank tributaries, and the Verzasca valley lies between the Ticino and the Maggia. The remainder of the canton, a triangular fragment of broken hill country to the southeast, drains to Lake Lugano. The amount of lowland is small, occurring only in the lower river valleys and near the lakes.

Historically, Ticino represents the early, permanent Swiss conquests from the duchy of Milan and falls into three groups: the Leventina valley, conquered by Uri in 1440 (previously held 1403–22); Bellinzona (previously held 1419–22), the Riviera, and the Blenio valley, won in 1500 by Uri, Schwyz, and Nidwalden and confirmed by Louis XII of France in 1503; and Locarno, the Maggia valley, Lugano, and Mendrisio, seized in 1512 by the Confederates (Eidgenossen) when fighting for the Holy League against the French and confirmed by Francis I in the treaty of 1516. The districts formed Bellinzona and Lugano cantons of the Helvetic Republic in 1798 and were united in 1803 as Ticino canton, a full member of the Swiss Confederation. The three largest cities—Bellinzona (*q.v.*), Locarno, and Lugano—alternated as capital until 1878, when Bellinzona became the permanent political capital. The constitution dates from 1830, but later political disturbances have caused considerable modifications.

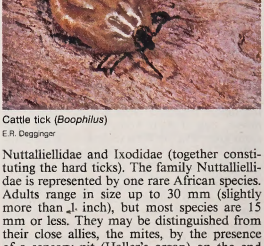
Ticino has no mineral resources, but the *canton* possesses abundant waterpower for internal use and for export. Grazing is important in the valleys of the upper part of the canton (Sopraceneri). Wine is produced in large quantity in the extensive vineyards of the warmer south; wheat, potatoes, tobacco, and vegetables are also grown. The favourable climate, especially on the lakes, and the communications offered by the St. Gotthard railway and by several light electric and mountain lines, have made tourism the most important economic factor. The population is Italian speaking and Roman Catholic, coming under the jurisdiction of the bishopric of Lugano. Area 1,085 square miles (2,811 square km). Pop. (1991 est.) 286,725.

**Ticino River,** ancient (Latin) TICINUS, river, tributary of the Po River, rising in the Swiss part of the Alpilepoutine (mountains) near Novena Pass, Switz., at about 8,000 feet (2,440 m) and draining an area of 2,790 square miles (7,226 square km), mostly in Italy. The river is 154 miles (248 km) long, flowing southeast in the Leventina valley, followed by road and rail from St. Gotthard Pass to Bellinzona (Switzerland), then west to Lake Maggiore, Italy, where it is joined by the Toce River. It then flows southeast in a floodplain 1–2 miles (1.6–3.2 km) wide and 30–50 feet (9–15 m) below the surrounding North Italian lowland into the Po River 4 miles (6 km) southeast of Pavia. The river is fullest in May and November, lowest in September and late winter. Above Lake Maggiore in the Swiss Ticino canton, the river and its tributaries are an important source of hydroelectric power for Switzerland; the Toce River and its tributaries likewise serve Italy. The Ticino River is not suitable for navigation. The two principal towns on the river are Bellinzona and Pavia.

**tick,** any of the roughly 825 species of invertebrates of the suborder Ixodida, within the order Parasitiformes, subclass Acari (sometimes Acarina, or Acarida).

A brief treatment of ticks follows. For full treatment, *see* MACROPAEDIA: Arachnids.

Ticks, worldwide in distribution, are assigned to three families: Argasidae (soft ticks) and



Cattle tick (*Boophilus*)
E.R. Degginger

Nuttalliellidae and Ixodidae (together constituting the hard ticks). The family Nuttalliellidae is represented by one rare African species. Adults range in size up to 30 mm (slightly more than 1⅓ inch), but most species are 15 mm or less. They may be distinguished from their close allies, the mites, by the presence of a sensory pit (Haller's organ) on the end segment of the first of four pairs of legs; eyes may be present or absent.

Ticks are important parasites of large wild and domestic animals; they are also significant as carriers of serious human and animal diseases. Although no species is primarily a human parasite, some occasionally attack man.

Hard ticks, such as the American dog tick, *Dermacentor variabilis,* attach to their hosts and feed continuously for several days. When engorgement is complete, the female drops from the host, finds a suitable site to rest, lays her eggs in a mass, and dies. Six-legged larvae hatch from the eggs, move up on blades of grass, and wait for a suitable host (usually a mammal) to pass by. The odour of butyric acid, emanated by all mammals, stimulates the larvae to drop onto and attach to a host. After filling themselves with the host's blood, the larvae detach and molt, becoming eight-legged nymphs. Nymphs also wait for a suitable host; after they have found one and engorged themselves, they fall off the host and molt into adult males or females. Adults may wait for a host as long as three years.

Most hard ticks live in fields and woods, but a few, such as the brown dog tick, *Rhipicephalus sanguineus,* are household pests. Soft ticks differ from hard ticks by feeding intermittently, laying several batches of eggs, passing through several nymphal stages, and carrying on their developmental cycles in the home or nest of the host rather than in fields.

Hard ticks damage the host by drawing large amounts of blood, by secreting neurotoxins (nerve poisons) that sometimes produce paralysis or death, and by transmitting disease. Such diseases include Lyme disease, Texas cattle fever, anaplasmosis, Rocky Mountain spotted fever, Q fever, tularemia, hemorrhagic fever, and a form of encephalitis. Soft ticks also are carriers of diseases.

**tickbird:** *see* oxpecker.

**Tickell, Thomas** (b. 1686, Bridekirk, near Carlisle, Eng.—d. April 23, 1740, Bath, Som-

erset), English verse writer and man of letters who is, however, best remembered for the quarrel involving his translation of the first book of Homer's *Iliad* in 1715, which appeared contemporaneously with that of Alexander Pope. Joseph Addison's reported description of Tickell's version as "the best that ever was in any language" aroused the anger of Pope, who assumed that Addison was the real author or had had a share in the work. Addison gave Tickell the responsibility of collecting and editing his works, which were printed in 1721. In 1724 Tickell became secretary to the lords justices of Ireland, retaining the post until his death.

**ticker,** high-speed teletype machine used for reporting information on stock market transactions. It prints the stock symbol, number of shares, and price of each transaction; these are transmitted to tickers at brokerage houses. Before the stock ticker was developed at the New York Stock Exchange in 1867, information had been carried by mail or messenger. Thomas A. Edison improved the machine, and in 1930 a faster ticker, printing 500 characters per minute, was developed. In 1964 a variable speed ticker printing up to 900 characters per minute and capable of handling 10,000,000 shares per day without a tape delay was put into operation. In 1965 the ticker was linked to a computer system, making it possible for a transaction to appear on the ticker tape within seconds after it is completed on the floor of the exchange.

**Ticker, Reuben** (singer): *see* Tucker, Richard.

**Ticknor, George** (b. Aug. 1, 1791, Boston—d. Jan 26, 1871, Boston), U.S. author and educator, who helped to modernize the curriculum at Harvard University.

Educated at Dartmouth College, Ticknor first practiced law but then went to Europe to study (1815–19), returning to the United States to become professor of French and Spanish languages and literatures and professor of belles-lettres at Harvard. During his 16 years at Harvard, Ticknor introduced the study of contemporary writers (the curriculum having previously been confined almost exclusively to the classics) and was the first to suggest that Harvard be organized on departmental lines, a suggestion that was adopted a few years later. From 1835 to 1838 Ticknor travelled in Europe, returning to work on his monumental *History of Spanish Literature,* which was published in three volumes in 1849, the first comprehensive study of Spanish literature. Ticknor was a founder of the Boston Public Library and on his death left to it his large and valuable collection of books on Spanish literature. He was the author of a number of other works, of which the chief was a biography (1864) of William H. Prescott, the historian.

**tickseed,** any ornamental summer-blooming plant of the genus *Coreopsis* of the family



Tickseed (*Coreopsis*)
John H. Gerard

Asteraceae, consisting of about 100 species of annual and perennial herbs native to North America. Members of the genus have flower heads with yellow disk flowers and yellow, pink, white, or variegated ray flowers. The heads are solitary or in branched clusters, and some varieties have double flowers.

Tickseed leaves often are lobed and usually are opposite each other on the stem. Golden coreopsis (*C. tinctoria*) is a popular garden plant, and swamp tickseed (*C. rosea*) is grown in wild-flower gardens.

**Ticlio,** also called ANTICONA, mountain pass of the Cordillera Central of the Peruvian Andes, about 60 mi (100 km) northeast of Lima, through the highest part of which (La Cima), at an elevation of 15,807 ft (4,818 m), passes the main line of the highest standard-gauge railway in the world. The railroad was built to service the lead and zinc mines at La Oroya and Morococha and reaches the pass from the west via the Galera Tunnel, 3,855 ft in length, which emerges at the Ticlio station.

**Ticonderoga,** village and town (township), Essex County, northeastern New York, U.S., at the north outlet (La Chute River) of Lake George where it drains into Lake Champlain. Located on an ancient Indian portage, its Iroquois name means "between two waters." The site, on the main route between Canada and the upper Hudson Valley, was of strategic importance to the French who built Fort-Carillon on Lake Champlain, in 1755. Captured by the British in 1759 (during the French and Indian War) the fort was renamed Ticonderoga. During the American Revolution the Green Mountain Boys, led by Ethan Allen, overran the fort in a surprise attack on May 10, 1775, and seized artillery that Henry Knox transported to Boston for use against the British. It was retaken (1777) by the British under General Burgoyne, who abandoned it after the Battles of Saratoga (*q.v.*). Restored according to early French plans, the fort (including a museum) is now a tourist attraction.

Dominated by an economy geared to year-round tourism, the village (incorporated 1889) has paper and pulp industries and is the headquarters of the New York State Historical Association. Nearby mines (no longer worked) were once the principal source of crystalline graphite in the United States. The summit of nearby Mt. Defiance (south) is reached by a toll road. The restored Ft. Mount Hope (originally built to guard the portage) is ½ mi east. Pop. (1990) 2,770.

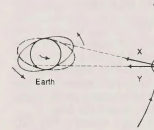
**Ticuna** (people): *see* Tucuna.

**tidal bore:** *see* bore.

**tidal flat,** level muddy surface bordering an estuary, alternately submerged and exposed to the air by changing tidal levels. The tidal waters enter and leave a tidal flat through fairly straight major channels, with minor channels serving as tributaries as well as distributaries. The minor channels meander and migrate considerably over periods of several years.

In addition to the alternating submergence and exposure, the varying influences of fresh river water and saline marine waters cause physical conditions, principally temperature, salinity, and acidity, to vary more widely than in any other marine environment. Waves are generally very small because of the shallow bottom and short fetch. The mud of a tidal flat is characteristically rich in dissolved nutrients, plankton, and organic debris, and it supports large numbers of smaller mobile and burrowing animals, notably crabs, pelecypods, gastropods, and worms. Vegetation is generally sparse; if wave erosion is minimal, however, felts and mats of blue or blue-green algae may be present.

**tidal friction,** in astronomy, strain produced in a celestial body (such as the Earth or Moon) that undergoes cyclic variations in gravitational attraction as it orbits, or is orbited by, a second body. Friction occurs between water tides and sea bottoms, particularly where the sea is relatively shallow, or between parts of the solid crust of planet or satellite that move against each other. Tidal friction on the Earth prevents the tidal bulge, which is raised in Earth's seas and crust by the Moon's pull, from staying directly under the Moon. Instead, the bulge is carried out from directly under the Moon by the rotation of the Earth, which spins almost 30 times for every time the Moon revolves in its orbit. The mutual attraction between the Moon and the material in the bulge tends to accelerate the Moon in its orbit, thereby moving the Moon farther from Earth by about three centimetres (1.2 inches) per year, and to slow Earth's daily rotation by a small fraction of a second per year. Millions of years from now these effects may cause the Earth to keep the same face always turned to a distant Moon and to rotate once in a day about 50 times longer than the present one and equal to the month of that time. This condition probably will not be stable, due to the tidal effects of the Sun on the Earth–Moon system.




*Acceleration of the Moon caused by tidal friction on the Earth*
Rotation of the Earth tends to drag the tidal bulges in the direction of the arrows; this causes the acceleration produced by one tidal bulge, X, to be greater than that produced by the other, Y

From *Elementary Astronomy* by Otto Struve, Beverly Lynds, and Helen Pillans. Copyright © 1959 by Oxford University Press, Inc. Reprinted by permission

That the Moon keeps the same part of its surface always turned toward Earth is attributed to the past effects of tidal friction in the Moon. The theory of tidal friction was first developed mathematically after 1879 by the English astronomer George Darwin (1845–1912), son of the naturalist Charles Darwin.

**tidal power,** electricity produced by turbines operated by tidal flow. Many ideas for harnessing the tides were put forward in the first half of the 20th century, but no scheme proved technically and economically feasible until the development by French engineers of the plan for the Rance power plant in the Gulf of Saint-Malo, Brittany, built 1961–67. A dam equipped with reversible turbines (a series of fixed and moving blades, the latter of which are rotated) permits the tidal flow to work in both directions, from the sea to the tidal basin on the flood and on the ebb from the basin to the sea. The Rance plant has 24 power units of 10,000 kilowatts each; about seven-eighths of the power is produced on the more controllable ebb flow. The sluices fill the basin while the tide is coming in and are closed at high tide. Emptying does not begin until the ebb tide has left enough depth of fall to operate the turbines. Conversely, the turbines are worked by the incoming tide to the basin.

The Soviet Union completed construction in 1969 of a tidal plant of about 1,000 kilowatts on the White Sea. Other sites of interest for tidal power plants include the Bay of Fundy in Canada, where the tidal range reaches

more than 15 m (49 feet). Although large amounts of power are available from the tides in favourable locations, this power is intermittent and varies with the seasons.

**tidal wave:** *see* tsunami.

**tide,** any of the cyclic deformations of one astronomical body caused by the gravitational forces exerted by others. The most familiar are the periodic variations in sea level on the Earth that correspond to changes in the relative positions of the Moon and the Sun.

A brief treatment of tides follows. For full treatment of oceanic tides, *see* MACROPAEDIA: Oceans.

At the surface of the Earth the gravitational force of the Moon is about 2.2 times greater than that of the Sun. The tide-producing action of the Moon arises from the variations in its gravitational field over the surface of the Earth as compared with its strength at the Earth's centre. The effect is that the water tends to accumulate on the parts of the Earth's surface directly toward and directly opposite the Moon and to be depleted elsewhere. The regions of accumulation move over the surface as the position of the Moon varies relative to the Earth, mainly because of the Earth's rotation but also because of the Moon's orbital motion around the Earth. There are approximately two high and two low tides per day at any given place, but they occur at times that change from day to day; the average interval between consecutive high tides is 12 hours 25 minutes. The effect of the Sun is similar and additive to that of the Moon. Consequently, the tides of largest range or amplitude (spring tides) occur at New Moon, when the Moon and the Sun are in the same direction, and at Full Moon, when they are in opposite directions; the tides of smallest range (neap tides) occur at intermediate phases of the Moon.

Although the observed tides possess the aforementioned broad features, this pattern does not correspond to a pair of bulges that move around the Earth. The inertia of the water, the existence of continents, and effects associated with the water depth result in much more complicated behaviour. For the main oceans, a combination of theory and observation indicates the existence of amphidromic points, at which the tidal rise and fall is zero: patterns of high and low tides rotate around these points (either clockwise or counterclockwise). Amplitudes are typically less than a metre.

Tides are most easily observed—and of greatest practical importance—along seacoasts, where the amplitudes are exaggerated. When tidal motions run into the shallow waters of the continental shelf, their rate of advance is reduced, energy accumulates in a smaller volume, and the rise and fall is amplified. The details of tidal motions in coastal waters, particularly in channels, gulfs, and estuaries, depend on the details of coastal geometry and water-depth variation. Tidal amplitudes, the contrast between spring and neap tides, and the variation of times of high and low tide all vary widely from place to place.

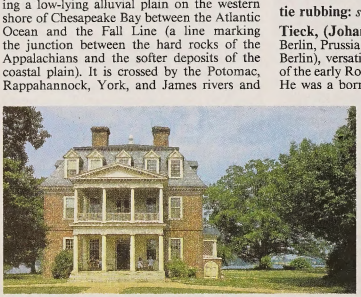
For these reasons, purely theoretical calculation of the times and heights of tides at a particular station is quite impossible. Nevertheless, tides are quite successfully predicted on the basis of accumulated observations of the tides at the place concerned. The analysis of the observations relies on the fact that any tidal pattern (in time) is a superposition of variations associated with periodicities in the motions of the Moon and the Sun relative to the Earth. The periods involved are the same everywhere, ranging from about 12 hours to a year or more, but the relative sizes of their contributions are highly variable. Observations over a sufficient time make it possible to calculate which contributions are significant at a particular location and, thus, to forecast tidal times and heights. It is common that 40 components may be significant for practical calculations at one location.

In addition to tides in the oceans (and in large lakes, where similar processes occur with smaller amplitudes), there are analogous gravitational effects on the atmosphere and on the interior of the Earth. Atmospheric tides are detectable meteorological phenomena but are a comparatively minor component in atmospheric motions. An Earth tide (*q.v.*) differs from oceanic and atmospheric ones in that the response to it is an elastic deformation rather than a flow. Observations of Earth tides contribute to knowledge of the internal structure of the Earth.

Tidal processes can, of course, also occur on other members of the solar system. As just one example, it has been suggested that the volcanic activity of Jupiter's satellite Io is the consequence of internal heating by frictional resistance to tidal deformation.

**tide, Earth:** *see* Earth tide.

**Tidewater,** also called COASTAL PLAIN, natural region in eastern Virginia, U.S., comprising a low-lying alluvial plain on the western shore of Chesapeake Bay between the Atlantic Ocean and the Fall Line (a line marking the junction between the hard rocks of the Appalachians and the softer deposits of the coastal plain). It is crossed by the Potomac, Rappahannock, York, and James rivers and their tidal estuaries. The Dismal Swamp (*q.v.*), astride the boundary with North Carolina, is a distinctive feature. In the Tidewater region were founded the first English settlements in America, beginning with Jamestown in 1607.



Shirley Plantation, built 1723–38, on the James River in the Tidewater region, Virginia
© Mary Ann Brockman

**Tidore Island,** also spelled TIDOR, Indonesian PULAU TIDORE, one of the Moluccas islands, Indonesia, 45 square miles (116 square km) in area. Tidore lies off the western coast of central Halmahera and forms part of Maluku *provinsi* ("province"). The southern part is occupied almost entirely by an extinct volcanic peak (5,676 feet [1,730 m]); the north is hilly, with some level strips along the coast. The Muslim inhabitants sell fish, cultivate garden produce, and are proficient at metalworking. Like nearby Ternate, Tidore was the seat of an ancient and powerful sultanate. The Portuguese arrived in 1521, destroyed the capital, and built (1578) a fort. The Spanish maintained a foothold well into the 17th century, aiding the Tidorese against the sultan of Ternate and the Dutch. The latter conquered the island in 1654 but recognized the sultan's nominal power. Pop. (latest est.) 28,655.

**tie-dyeing,** method of dyeing by hand in which coloured patterns are produced in the fabric by gathering together many small portions of material and tying them tightly with string before immersing the cloth in the dyebath. The dye fails to penetrate the tied sections. After drying, the fabric is untied to reveal irregular circles, dots, and stripes. Variations in the quality of a *Märchen* (fairy tale) that appeals to the emotions rather than the intellect.



Tie-dyeing pattern
Brock Palmer—Nancy Palmer Agency

coloured patterns may be produced by repeated tying and dipping in additional colours. This hand method, common in India and Indonesia, has been adapted to machines. *See also* resist printing.

**tie rubbing:** *see* t'ieh rubbing.

**Tieck, (Johann) Ludwig** (b. May 31, 1773, Berlin, Prussia [Germany]—d. April 28, 1853, Berlin), versatile and prolific writer and critic of the early Romantic movement in Germany. He was a born storyteller, and his best work

The son of a craftsman, Tieck was educated at the Berlin gymnasium (1782–92) and at the universities of Halle, Göttingen, and Erlangen (1792–94). Through friendship with W.H. Wackenroder, he began to realize his talent; together, they studied William Shakespeare, Elizabethan drama, Middle High German literature, and medieval town architecture.

Characteristic of early German Romanticism are Tieck's *Die Geschichte des Herrn William Lovell,* 3 vol. (1795–96; "The Story of Mr. William Lovell"), a novel in letter form



Tieck, detail of an oil painting by K. Vogel von Vogelstein, 1834; in the National Gallery, Berlin
By courtesy of the Nationalgalerie, Berlin

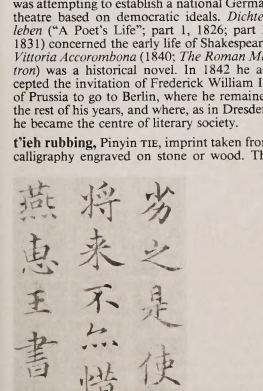
that describes the moral self-destruction of a sensitive young intellectual; *Karl von Berneck* (1797), a five-act tragedy set in the Middle Ages; and *Franz Sternbalds Wanderungen*, 2 vol. (1798), a novel of artistic life in the late Middle Ages. A series of plays based on fairy tales—including *Ritter Blaubart* ("Blue-beard") and *Der gestiefelte Kater* ("Puss in Boots")—that parodied the rationalism of the 18th-century Enlightenment were published in *Volksmärchen* (1797), under the pseudonym Peter Leberecht ("live right"). This collection includes one of Tieck's best short novels, *Der blonde Eckbert* ("Fair Eckbert"), the fantastic story of an obsessive fear; this work won the praise of August and Friedrich von Schlegel, the leading critics of the Jena Romantics.

In 1799 Tieck published a translation of Shakespeare's *The Tempest*, and he started a translation of *Don Quixote* (published 1799–1801). His early work culminated in the grotesque, lyrical plays *Leben und Tod der heiligen Genoveva* (1800; "The Life and Death of the Holy Genevieve") and *Kaiser Octavianus* (1804). *Phantasus*, 3 vol. (1812–16), a heterogeneous collection of works in a narrative framework, indicated a movement toward realism.

After 1802 Tieck's creative powers apparently became dormant. He studied Middle High German, collected and translated Elizabethan plays, published new editions of 16th- and 17th-century German plays, and acted as adviser to the Shakespeare translation begun by August von Schlegel. He also published works by such contemporary German writers as Novalis and Heinrich von Kleist.

From 1825 to 1842 Tieck served as adviser and critic at the theatre in Dresden. During those years he became the greatest living literary authority in Germany after J.W. von Goethe. His creative energies were renewed; he turned away from the fantasy of his earlier work and found his material in contemporary middle-class society or history. The 40 short novels of this period contain polemics against both the younger Romantics and the contemporary "Young Germany" movement, which was attempting to establish a national German theatre based on democratic ideals. *Dichterleben* ("A Poet's Life"; part 1, 1826; part 2, 1831) concerned the early life of Shakespeare. *Vittoria Accorombona* (1840; *The Roman Matron*) was a historical novel. In 1842 he accepted the invitation of Frederick William IV of Prussia to go to Berlin, where he remained the rest of his years, and where, as in Dresden, he became the centre of literary society.

**t'ieh rubbing,** Pinyin TIE, imprint taken from calligraphy engraved on stone or wood. The practice emerged in the T'ang dynasty (618–907) as a method of studying the style of earlier calligraphers and developed into an important related art form in itself. The rubbings served as models for copying and training. Calligraphers during the Sung dynasty (960–1279) became especially interested in the aesthetic principles guiding brushstroke and composition and their application as criteria for judging calligraphy's sister art, painting.



*T'ieh* rubbing, Sung dynasty (960–1279); in the National Palace Museum, Taipei

By courtesy of the Collection of the National Palace Museum, Taipei, Taiwan, Republic of China

**tieke** (bird): *see* saddleback.

**Tiel,** formerly THIEL, *gemeente* (commune), Gelderland *provincie*, central Netherlands, on the Waal River, west-southwest of Arnhem. Chartered in 1200, Tiel developed as a medieval port and market town and became a member of the Hanseatic League. The town now has a horticultural school, serves a fruit-growing (cherries, apples, and pears) region, and has some light industries. Pop. (1992 est.) 32,643.

**Tiele, Cornelis Petrus** (b. Dec. 16, 1830, Leiden, Neth.—d. Jan. 11, 1902, Leiden), Dutch theologian and scholar, whose influence on the comparative study of religion, which in his time was only beginning, was very great.

Educated at Amsterdam High School and at the seminary of the Remonstrant Brotherhood, Tiele served as pastor at Moordrecht and Rotterdam, then as professor at the Remonstrant Seminary. In 1877 he was appointed at the University of Leiden as professor of the history of religions, a chair that was especially created for him and that he occupied for 24 years. Among the best known of Tiele's numerous works are *Geschiedenis van den godsdienst, tot aan de heerschappij der wereldgodsdiensten* (1876; *Outlines of the History of Religion to the Spread of the Universal Religions*) and his Gifford Lectures, published as *Inleiding tot de godsdienst wetenschap*, 2 vol. (1897–99; *Elements of the Science of Religion*).

**T'ien,** Pinyin TIAN (Chinese: "Heaven"), in indigenous Chinese religion, the supreme power reigning over lesser gods and men. The term T'ien may refer to a deity, to impersonal nature, or to both.

As a god, T'ien is sometimes perceived to be an impersonal power in contrast to Shang-ti ("Supreme Ruler"), but the two are closely identified and the terms frequently used synonymously. Evidence suggests that T'ien originally referred to the sky while Shang-ti referred to the Supreme Ancestor who resided there. The first mention of T'ien seems to have occurred early in the Chou dynasty (1111–255 BC), and it is thought that T'ien assimilated Shang-ti, the supreme god of the preceding Shang dynasty (*c.* mid-16th century–mid-11th century BC). The importance of both T'ien and Shang-ti to the ancient Chinese lay in their assumed influence over the fertility of the clan and its crops; sacrifices were offered to these powers solely by the king and, later, by the emperor.

Chinese rulers were traditionally referred to as Son of Heaven (*t'ien-tzu*), and their authority was believed to emanate from heaven. Beginning in the Chou dynasty, sovereignty was explained by the concept of the Mandate of Heaven (*t'ien-ming*). This was a grant of authority that depended not on divine right but on virtue. Indeed, this authority was revocable if the ruler did not attend to his virtue. Since the ruler's virtue was believed to be reflected in the harmony of the empire, social and political unrest were traditionally considered signs that the mandate had been revoked and would soon be transferred to a succeeding dynasty.

Although, in the early Chou, T'ien was conceived as an anthropomorphic, all-powerful deity, in later references T'ien is often no longer personalized. In this sense, T'ien can be likened to nature or to fate. In many cases, it is unclear which meaning of T'ien is being used. This ambiguity can be explained by the fact that Chinese philosophy was concerned less with defining the character of T'ien than with defining its relationship to man. Scholars generally agreed that T'ien was the source of moral law, but for centuries they debated whether T'ien responded to human pleas and rewarded and punished human actions or whether events merely followed the order and principles established by T'ien.

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**T'ien-chi,** Pinyin TIANJI (reign name, or *nien-hao*), personal name (*hsing-ming*) CHU YU-CHIAO, posthumous name (*shih*) CHE-TI, temple name (*miao-hao*) (MING) HSI-TSUNG (b. 1605, China—d. 1627, China), 15th emperor (reigned 1620–27) of the Ming dynasty, under whose rule the infamous eunuch Wei Chung-hsien (1568–1627) dominated the government while the dynasty disintegrated.

Ascending the throne at the age of 15, T'ien-chi preferred carpentry to governmental affairs. He handed the powers of government to Wei, a former butler in the empress dowager's service and a friend of the young emperor's nurse. Wei became the most powerful eunuch in Chinese history, replacing hundreds of officials and creating a network of spies. He even had temples erected in his honour throughout the country.

During this time several foreign invasions took place. The Dutch attacked and occupied the island of Taiwan, a Chinese protectorate; and the Manchu tribes of Central Asia, who 20 years later were to conquer all of China, were virtually unopposed in their conquest of the northeastern part of the Ming empire around the Liao River valley.

Conditions deteriorated in every part of the empire. In the south and southwestern provinces rebellions became endemic, and the imperial treasury was too depleted to repair the dikes when the Huang Ho ("Yellow River") burst its banks. By the end of T'ien-chi's reign the dynasty had lost control of the country, and his successors were powerless to reverse the decline.

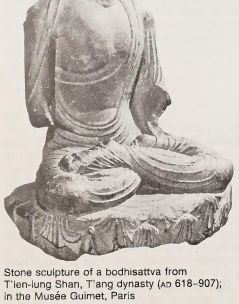
**T'ien-ching** (China): *see* Tientsin.

**Tien Giang, Song** (Asia): *see* Mekong River.

**T'ien I** (Chinese emperor): *see* T'ang.

**Tien Lake,** Wade-Giles TIEN CH'IH, also called K'UN-MING CH'IH, Pinyin DIAN CHI, or KUNMING CHI, lake lying to the south of K'un-ming in Yunnan *sheng* (province), China. Tien Lake lies in the largest group of Yunnanese lake basins, in the eastern part of the province, to the south of the Liang-wang Mountain Range, which reaches an elevation of some 8,740 feet (2,664 m). The lake is some 25 miles (40 km) from north to south, 8 miles (13 km) wide, and about 25 feet (8 m) deep. The mountains rise steeply from the eastern and western shores, but to the north is an extensive alluvial plain, which has been intensively irrigated since the Mongol occupation (1279–1368) and the early part of the Ming dynasty (1368–1644). Before this time the area was only at times under Chinese influence. The area was settled by sedentary agricultural peoples from at least as early as the 2nd century BC. It was successively the centre of the independent state of Tien, which became tributary to the Han dynasty (206 BC–AD 220) after 109 BC, and of the states of Nan-chao (8th–10th century) and Ta-li (10th–13th century).

**T'ien-lung Shan,** Pinyin TIANLONG SHAN, site in central Shansi *sheng* (province), China, where there is a series of Buddhist cave temples dating from the mid-6th century, as well as cave temples containing images in the devel-



Stone sculpture of a bodhisattva from T'ien-lung Shan, T'ang dynasty (AD 618–907); in the Musée Guimet, Paris
Giraudon—Art Resource

oped T'ang-dynasty sculptural style of the late 7th and 8th centuries. Many intact and fragmentary images of these famous T'ang sculptures are now in collections outside China.

The stone images (often painted) represent the extreme development of sensuous and voluptuous sculptural form generally considered characteristic of the T'ang period. The style represents a Chinese reworking of the standard Buddha form developed in the Gupta period (320–647) in India. The T'ang sculptural style seen at T'ien-lung Shan was succeeded by increasing fleshiness, which became a norm for debased and popular traditions of Buddhist images throughout the later history of China.

**T'ien-ming** (ruler of China): *see* Nurhachi.

**T'ien Ming** (Chinese: "Mandate of Heaven"), Pinyin TIAN MING, in Chinese Confucian thought, the notion that heaven (*t'ien*) conferred directly upon an emperor, the Son of Heaven (T'ien tzu), the right to rule. The doctrine had its beginnings in the early Chou dynasty (*c.* 1122–221 BC).

The continuation of the mandate was believed to be conditioned by the personal behaviour of the ruler, who was expected to possess *i* ("righteousness") and *jen* ("benevolence"). If the emperor's personal life became immoral or his rule tyrannical, some Confucianists taught that he had not only lost his right to rule but should be removed by revolution, if necessary. Chinese historians consequently make much of the dissolute life of the last emperor of each dynasty, thereby confirming the Confucian principle that heaven itself had withdrawn its mandate and had passed it on to another.

**Tien Shan,** Chinese (Wade-Giles) T'IEN SHAN, or (Pinyin) TIAN SHAN, Russian TYAN SHAN, great mountain system of Central Asia, straddling the border between China and several of the Central Asian republics that were part of the former Soviet Union.

A brief treatment of the Tien Shan follows. For full treatment, *see* MACROPAEDIA: Asia.

The ranges and intervening valleys and basins of the Tien Shan ("Celestial Mountains") stretch for about 1,500 miles (2,500 km) in a generally east-west direction, varying in width from 220 miles (350 km) at their centre to about 300 miles (500 km) at their eastern and western extremities. The system is bounded to the north by the Dzungarian and southern Kazakhstan plains, to the southeast by the Tarim Basin, and to the southwest by the Alay, Surkhandarya, and Gissar valleys and the Pamir mountain ranges. The mountains of the Tien Shan are of the alpine type, with steep slopes and glaciers along their crests.

The highest peaks are located in a central cluster, from which ridges extend along the boundary between China and the Central Asian republics. The Khan-Tengri (22,949 feet [6,995 m]), situated in a mountain knot on the border, was long regarded as the highest peak of the Tien Shan system. In 1943, however, a Soviet expedition discovered a peak with an elevation of 24,406 feet (7,439 m), 13 miles (21 km) south of Khan-Tengri, and named the new summit Victory Peak (Pik Pobedy) in honour of Red Army victories in World War II. From the mountain hub, subranges extend both toward the west and toward the east.

Many large rivers of the mountain system are fed by glacial meltwater, with the rivers' maximum flow occurring in late spring and summer. The rivers drain into Central Asia's major inland depressions, among them the Ili and Tarim basins. The Tien Shan region experiences a strong continental climate characterized by great extremes in temperature in summer and winter. Most of the precipitation falls on the windward western and northwestern slopes at elevations between 7,500 and 9,000 feet (2,300 and 2,750 m) to the east and in the interior regions the total precipitation decreases to less than 4 inches (100 mm) a year in places. The characteristic plants and animals of the Tien Shan reflect the region's distinct zones of elevation, which provide a diverse distribution of soils and vegetation. The most common landscape is steppe, occurring at elevations between 3,500 and 11,000 feet (1,000 and 3,350 m).

The Kyrgyz in the west and Uighur in the east are the largest of the Tien Shan's ethnic groups. The Fergana Valley is the most densely populated area, averaging more than 500 persons per square mile (190 persons per square km); it has a large number of Chinese immigrants. Irrigated agriculture has developed in the valleys and on the lower mountain slopes, and livestock herding is practiced on the higher slopes. Industry and tourism have been developed in both the Soviet and the Chinese territories.

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**T'ien-shui,** Pinyin TIANSHUI, city, southeast Kansu *sheng* (province), China. T'ien-shui is situated along the Wei River and was historically an important place along the great western route from Sian to Lan-chou and to Sinkiang province. This route is today followed by a highway and by the Lunghai Railway, which was extended to T'ien-shui in 1947 and to Lan-chou and the far west of China during the 1950s.

The area, the cradle of Chinese civilization, has been settled since Neolithic times. In ancient times it was known as Kuei, and under the Han dynasty (206 BC–AD 220) the town was known as Kuei Hsien, or Shang-kuei Hsien. In Sung times (960–1279) this was renamed Ch'eng-chi Hsien. Shang-kuei was the administrative seat of Ch'in *chou* (prefecture) from the late 3rd century onward, and this became the official name of the place under the Ming (1368–1644) and Ch'ing (1644–1911/12) dynasties.

Throughout history, T'ien-shui has been both an important transportation centre and a vital strategic position, commanding the western approach to Sian, for centuries the capital of China, via the Wei River valley. Fought over repeatedly in the 3rd and 4th centuries, it later fell into the hands of the Tibetans (from 763 to 845), the Tanguts and the Juchen (after 1127), and finally the Mongols (from 1215 to 1368).

In the period following the mid-5th century, it was on the main route by which Buddhism was introduced into China. The great complex of cave temples at Mai-chi Shan, some 15 miles (25 km) to the southeast, became a major Buddhist centre during the Sui (581–618) and T'ang dynasties.

The city stands in a small fertile basin, watered by an long-established irrigation system. Millet, corn (maize), and winter wheat, kaoliang (sorghum), some cotton, and tobacco are grown in the area. To the west of the city along the railway lie large coal deposits near the surface, still unexploited in the mid-20th century.

T'ien-shui is the centre of various consumer industries, producing cotton textiles, matches, wine, furniture, and fine lacquer ware. The city itself was once a centre of the Kansu Muslim community, which was decimated after the rebellions of 1864–75. A large Muslim minority remains in the area to the northeast. The city is a complex one, being formed of five separate walled cities—the Great City (Ta Ch'eng), the Middle City (Chung Ch'eng), the Western and Eastern Customs Barriers (Hsi Kuan Ch'eng; Tung Kuan Ch'eng), and Fuhsi's city. Pop. (1989 est.) 234,700.

**T'ien-shun** (Chinese emperor): *see* Cheng-t'ung.

**T'ien-t'ai,** Japanese TENDAI, rationalist school of Buddhist thought that takes its name from the mountain in southeastern China where its founder and greatest exponent, Chih-i, lived and taught in the 6th century. The school was introduced into Japan in 806 by Saichō (*q.v.*), known posthumously as Dengyō Daishi.

The chief scripture of the school is the *Lotus Sūtra* (Chinese: *Fa-hua Ching*; Sanskrit: *Saddharmapuṇḍarika-sūtra*), and the school is thus also known as the Fa-hua (Japanese: Hokke), or Lotus, school.

The basic philosophical doctrine is summarized as the triple truth, or *chikuan* ("perfected comprehension"): (1) all things (dharmas) lack ontological reality; (2) they, nevertheless, have a temporary existence; (3) they are simultaneously unreal and temporarily existing—being the middle, or absolute, truth, which includes and yet surpasses the others. The three truths are considered to be mutually inclusive, and each is contained within the others. Because existence is ever-changing, the phenomenal world is regarded as identical with the world as it really is.

The doctrine of the triple truth was first taught by Hui-wen (550–577); but Chih-i, the third patriarch, is regarded as the founder of the school because of his own great contributions. Chih-i organized the whole of the Buddhist canon according to the supposition that all the doctrines were present in the mind of Śākyamuni (the historical Buddha) at the time of his enlightenment but were unfolded gradually according to the mental capacities of his hearers. The *Lotus Sūtra* was considered the supreme doctrine, embodying all of the Buddha's teachings.

In 804 Saichō, a Japanese monk, was sent to China expressly to study the T'ien-t'ai tradition. The inclusiveness of the T'ien-tai school, which arranged all Buddhist learning into one grand hierarchical scheme, was attractive to Saichō. On his return to Japan he attempted to incorporate within the framework of the T'ien-tai doctrine Zen meditation, *vinaya* discipline, and esoteric cults. The Tendai school, as it is called in Japanese, also encouraged an amalgamation of Shintō and Buddhism in

the Ichijitsu ("One Truth"), or Sannō Ichijitsu Shintō.

The monastery founded by Saichō on Mount Hiei, near Kyōto, the Enryaku Temple, became the greatest centre of Buddhist learning of its time in Japan. Hōnen, and many other famous monks who later established their own schools, came there for training.

Saichō's efforts to establish a Tendai ritual of ordination that would be more in keeping with Mahāyāna teachings and independent from the *kaidan* ("ordination centre") at Nara bore results only after his death but was an important step in the Mahāyāna development in Japan.

After the death of Saichō, rivalry broke out between two factions of the school, which separated in the 9th century into the Sammon and the Jimon sects, headed by the two monks Ennin and Enchin. A third branch, the Shinsei, emphasizes devotion to the Buddha Amida.

**T'ien-t'ai Mountains,** also spelled TIENTAI MOUNTAINS, Chinese (Wade-Giles) T'IEN-T'AI SHAN, or (Pinyin) TIANTAI SHAN, mountain chain in eastern Chekiang province, China. T'ien-t'ai is also the name of a mountain in the chain. The range forms the northeastern extension of the great Hsien-hsia Mountains in southern Chekiang, which form the watershed between the Ling and Ou rivers, draining into the east coast of Chekiang, and the Yin and Ts'ao-o rivers and rivers of the Ch'ien-t'ang River system, draining to the west and eventually to the north coast of the province. The mountains are rugged, with individual peaks reaching 3,300 to 4,000 feet (1,000 to 1,200 m). The mountain known as T'ien-t'ai ("Heavenly Terrace") comprises a system of peaks—T'ung-pai, Fou-lung, Ch'ih-ch'eng, and, the highest, Hua-ting, which reaches 3,727 feet (1,136 m).

From a very early period the T'ien-t'ai mountain chain was considered holy; in early times it was associated with Taoism. Many well-known Taoist adepts and masters lived there until the 11th and 12th centuries. Its fame, however, is associated not with Taoism but with Buddhism. According to tradition, the first Buddhist community was founded there in 238–251, but the renown of T'ien-t'ai began when the monk Chih-i settled there in 576. When the Sui dynasty (581–618) unified China in 589, Chih-i played an important role in giving religious sanction to the new regime and was greatly honoured by the Sui emperor. After Chih-i's death in 597, his disciples, under imperial patronage, made T'ien-t'ai a major cult centre. The best-known temples established there were the Kuo-ch'ing, Ta-tzu, Tien-feng, Huo-kuo, Wan-nien Pao-en, and Kao-ming. Eventually there were 72 major temples as well as a great number of cloisters and shrines on the mountain, and it became a major centre of pilgrimage for both Chinese and Japanese Buddhists. It also gave its name to one of the major schools of Buddhist teaching, T'ien-t'ai, perhaps better known under its Japanese name of Tendai.

Many of the temples still remain, although the influence of the T'ien-t'ai school in Chinese Buddhism did not survive the 13th century. A good deal of building was subsequently done in the 17th and 18th centuries, and in the 17th century in particular the T'ien-t'ai area produced a number of prominent Buddhist scholars.

**T'ien-ts'ung** (ruler of China): *see* Abahai.

**Tientsin,** Chinese (Wade-Giles) T'IEN-CHIN, or (Pinyin) TIANJIN, city and province-level *shih* (municipality), eastern China. Tientsin is the country's third largest city and is the administrative centre of Tientsin *shih,* an administrative entity equivalent to a *sheng* (province) and directly subordinate to the central government of China. Located at the northeastern extremity of the North China Plain, it lies about 60 miles (100 km) southeast of Peking and about 35 miles (55 km) inland from the Po Hai (Gulf of Chihli) of the Yellow Sea. Since the Yuan (Mongol) dynasty (1279–1368) it has been a major transportation and trading centre. It is the leading port in northern China and, after Shanghai, the country's second largest manufacturing centre.

A brief treatment of Tientsin follows. For full treatment, *see* MACROPAEDIA: Tientsin (Tianjin).

Tientsin is situated at the confluence of several streams on the lower coastal plain, 30 miles (50 km) by river from the Yellow Sea. Central Tientsin is located where the Tzu-ya and Hsin-k'ai rivers and the north and south sections of the Grand Canal (Pei Yün-ho and Nan Yün-ho, respectively) converge to form the Hai River, which then flows eastward into the Po Hai. The city stands on an alluvial plain less than 15 feet (5 m) above sea level. Despite its proximity to the Yellow Sea, the city's climate is continental in nature with large daily and seasonal temperature ranges. The average January temperature is 39° F (4° C), and the July average is 84° F (29° C). Southerly breezes bring in moist summer air from the North Pacific, and cold, dry Siberian air masses influence winter weather patterns. The Hai River has long been subject to frequent flooding, and measures to control this problem have been taken since the 1890s.

Since 1949, Tientsin's economy has shifted its emphasis from trade to manufacturing. Chief among the heavy industries are machinery, shipbuilding, automobiles, chemicals, and steel. Light industries include textiles, the processing of foods and hides, and the manufacture of rubber goods, paper, and consumer goods. Commerce continues to be important, with a large proportion of north China's imports and exports passing through its port; finance and banking have also grown rapidly. Industrial parks and high-technology development zones for microelectronics, telecommunications, and pharmaceuticals have been established in and around the city.

The urban core of Tientsin extends 7 miles (11 km) from east to west and about 9 miles (14 km) from north to south. The central business district, Ho-p'ing, is located on the west bank of the Hai River and contains many large department stores, restaurants, and hotels. To the northwest is the old district, with its irregular and winding streets. Farther northwest lies the Hung-ch'iao district, a mixed residential and industrial area that is famous for its handicrafts. The newer western and southern districts of Hsin-hua, Ho-hsi, and Nan-k'ai were developed by Europeans during their dominance of the China trade. Hsin-hua remains the chief trading, shipping, and administrative area, while Ho-hsi and Nan-k'ai have extensive areas devoted to residential or recreational use. The districts east of the Hai River—Ho-pei and Ho-tung—are centres of industry and transport.

Tientsin's eclectic architecture, reflecting many foreign influences, was often built hastily and without much thought as to congruity of design. Some public buildings from the period in the 1950s of close relations with the U.S.S.R. reflect monolithic Soviet styles.

Among Tientsin's cultural institutions, the Museum of Fine Arts is noted for its collection of Yüan, Ming, and Ch'ing dynasty paintings; others are the Tientsin Library, the Tientsin Science Hall, and the City Museum of History. The Industrial Exhibition Hall and the National Minorities' Cultural Palace hold special cultural exhibits; operas, plays, and concerts are held at People's Festival Hall.

Higher-educational institutions include Nan-k'ai (founded 1919) and Tientsin (founded 1895) universities; specialized schools include the Polytechnic Institute, the Central Conservatory of Art and Music, and schools of education and medicine.

Tientsin's role as the leading port of North China has stimulated its development as a transportation centre. Railways connect the city with the northeast, northwest, and southeast of the country. Inland waterways connect Tientsin with cities in southern Hopeh province. The Peking–Tientsin–T'ang-ku Expressway links Tientsin and its port with the nation's capital. Highways crisscross the city, and public transportation is well developed, with continuing expansion of the subway system, which was first opened in 1983. Tientsin Pin-hai International Airport is an important domestic and international air transport facility. Area city, 1,651 square miles (4,276 square km); municipality, 4,400 square miles (11,300 square km). Pop. (1999 est.) city, 4,835,327; municipality, 9,590,000.

**Tientsin Massacre** (June 21, 1870), in Tientsin, China, violent outbreak of Chinese xenophobic sentiment that nearly precipitated international warfare and signaled the end of the "cooperative policy" between China and the Western treaty powers. Before the incident, rumours circulated in Tientsin that the French Sisters of Charity were kidnapping and mutilating Chinese children. Hostility mounted, and on June 21 the French consul, Henri Fontanier, fired into a crowd of locally prominent representatives, missing the district magistrate but killing his servant; immediately the consul and some 20 others, mostly French, were killed and mutilated by the mob.

Demands for harsh punishment issued from Paris and Rome. European warships were sent to Tientsin, and Chinese troops were activated at battle stations. Hostilities were averted only after the execution, under pressure from the Western powers, of 16 Chinese and the dispatch of an official mission to convey China's apologies to France.

**Tiepolo, Giovanni Battista** (b. March 5, 1696, Venice [Italy]—d. March 27, 1770, Madrid, Spain), great Italian painter of the 18th century. His luminous, poetic frescoes



"The Banquet of Anthony and Cleopatra," detail of a fresco by Giovanni Battista Tiepolo, before 1750; in the Palazzo Labia, Venice

Alinari—Art Resource

(*e.g.,* "The Banquet of Anthony and Cleopatra," before 1750), while extending the tradition of Baroque ceiling decoration, epitomize the lightness and elegance of the Rococo period.

*Early life.* Tiepolo's father, who had been engaged in the shipping business, died in 1697,

leaving his wife and five children in comfortable circumstances. His mother entrusted Giambattista to Gregorio Lazzarini, a painter of decorative, academic taste, who taught his young pupil the basic techniques of his profession. Tiepolo was drawn to a melancholic style with strong contrasts of light and shade, or chiaroscuro. Such strong shadings of light and dark, coupled with a genuine dramatic feeling, may be seen in his first public work, "The Sacrifice of Isaac" (1716), for the church of Sta. Maria dei Derelitti, or Ospedaletto. Tiepolo's name first appears on the lists of the Venetian painters' guild as an independent painter in 1717. The fact that his studio was thriving at this time is attested by his marriage to Cecilia Guardi, the sister of the painters Giovanni Antonio and Francesco.

During this period, Tiepolo was influenced by the robust plastic modelling of his Venetian contemporary Giovanni Battista Piazzetta, as in such works as the monumental "Madonna of Carmelo and the Souls of Purgatory" (*c.* 1720). His artistic education, however, was complex and varied: he examined the works of both Venetian and foreign contemporaries and studied older painters as well, as demonstrated by his large production of etchings after 16th-century subjects. Through his intense artistic activity, Tiepolo mastered a wide variety of forms and moods, ranging from the drama of such works as "The Crucifixion" (1723–24), in the oratory of Sta. Barbara Burano, to the narrative humour of the four mythological scenes now in the galleries of the Accademia in Venice. It seems unlikely that the young Tiepolo left Venice, and therefore he did not see the great decorative cycles that other Venetian painters were executing throughout Europe. Nevertheless, he understood their methods. His maturity of technique and originality of formal invention were already evident in his first frescoes, the "Glory of St. Theresa" in the church of the Scalzi and "The Force of Eloquence" on the ceiling of the Palazzo Sandi-Porto (now Cipollato). It was not, however, until the frescoes of the Palazzo Arcivescovile of Udine, executed sometime after 1726, that Tiepolo, then about 30, reached full maturity of expression. In these frescoes he gave up the chiaroscuro of his early works and greatly brightened his colour, while preserving his form intact. The decoration was commissioned by Dionisio Dolfin, the patriarch of the town of Aquileia, and Tiepolo probably began work with the ceiling above the main staircase, depicting the "Fall of the Rebelling Angels" in vigorous, dramatic forms; in the gallery, within the Baroque perspective framings of Mengozzi Colonna, his faithful collaborator, he narrated biblical episodes of varying complexity, in bright colour and with bold brush play.

At this same time, or shortly thereafter, in a melodramatic and agitated style, Tiepolo executed for the Dolfin family's Venetian palace 10 scenes of Roman history. The enrichment of his colour during this period became particularly tasteful in his smaller paintings, such as the two versions of "Apelles Painting the Portrait of Campaspe" (Montreal Museum of Fine Arts and the National Gallery, London), both of which are subtle, almost ironic reenactments of the classical episode.

By the 1730s, Tiepolo's fame had gone beyond Venice. He was called to Milan in 1731, and there he decorated the Palazzo Archinto (destroyed by bombing in World War II) with mythical scenes, of which marvellous small models remain, and the Palazzo Dugnani, for which he painted graceful episodes from history within Baroque settings. In autumn of that same year, he began the decoration of the Cappella Colleoni at Bergamo, depicting stories of John the Baptist (1732), into which he introduced airy landscape backgrounds that marked an innovation in his style. In the fall of 1734, working "day and night without rest," as he himself put it, Tiepolo decorated the Villa Loschi, now known as Zileri dal Verme, at Biron, near Vicenza, for which he prepared a famous and very beautiful series of drawings. Indeed, Tiepolo was a tireless and prodigious sketcher, capable of suggesting with pen and skillful watercolouring the rapid conception of structures and images that he would later carry out in frescoes and paintings.

In 1736, Count Tessin, who had to select a painter to decorate the royal palace in Stockholm, described Tiepolo this way: "Full of spirit . . . of infinite fire, dazzling colour, and astonishing speed." This is a fitting portrait of both the painter and the man. But Tiepolo would not leave the city of Venice, where the nobility and the clergy were by now contending for his work and where he was being praised as "the most famous of the virtuosi." Rather, he preferred to send his works abroad, as in the case of "The Adoration of the Trinity by Pope Clement" (*c.* 1735), which was sent to Nymphenburg and is now in the Alte Pinakothek in Munich, or "The Martyrdom of St. Sebastian" (1739), which was sent to the church in Diessen. Sometime toward the end of the 1730s, Tiepolo painted the "Institution of the Rosary" on the large ceiling of the church of the Gesuati (or Sta. Maria del Rosario), at Zattere, covering an enormous amount of space and reviving the triumphal taste of Roman Baroque decoration.

*Later Life.* In the decade from 1740 to 1750, Tiepolo created works based on secular themes in which he experimented with forms and appearances of the great luminosity that was rediscovered in Venetian painting from 1730 by Piazzetta, Canaletto, and Guardi. During this time he became a close friend of Count Algarotti, an important personality in the international cultural life of the time. Tiepolo's general education had been unpretentious and provincial, but his meeting with Algarotti drew him closer to the classical taste of the time. Nevertheless, the world he depicted in his works of the period on the theme of the tales of Cleopatra ("The Banquet of Cleopatra" [1744; National Gallery of Victoria, Melbourne], two canvases [1747], in Arkhangelskoye, near Moscow, and the fresco complex at the Palazzo Labia in Venice [shortly before 1750]) is a fanciful image of antiquity; formally, this image is derived from the Venetian Renaissance master Veronese and parallels the melodramas on classical themes that were popular in the 18th century.

An invitation to decorate some of the rooms of the Residenz in Würzburg came to Tiepolo at one of the happiest moments of his career, in the full maturity of his artistic genius, and he went there in 1750 with his two sons, 23-year-old Giovanni Domenico and 14-year-old Lorenzo. They painted a cycle of frescoes in marvellous accord with the style of Balthasar Neumann, the architect. The ceiling of the Kaisersaal, with its "Wedding Allegory," is the most boldly luminous work of Tiepolo's career. The wall frescoes narrate events of the Middle Ages with a supreme naturalness and a total indifference to history. The "Olympus," an assemblage of mythological and allegorical representations on the enormous ceiling of the main staircase, has been said to symbolize and exalt the humanistic aspirations of the 18th century. The rhythmic grandeur of these decorative sequences is also reflected in the solemn "Adoration of the Magi" (1753; Alte Pinakothek, Munich). (The influence of Rubens has been seen in these works, and it is possible that Tiepolo's stay in Germany did, indeed, give him the opportunity to become acquainted with artists such as Rubens and Rembrandt, neither of whom was well represented in Venetian collections.) Almost in direct contrast to the grandeur of this official production, the artist pursued an almost romantic, poetic theme, portraying episodes taken from the Italian Renaissance poet Tasso in four magnificent canvases depicting the story of Rinaldo and Armida, now in the Art Institute of Chicago. In their new treatment of landscape and their inclination toward lyric warmth, these canvases are direct precursors of his decoration for Villa Valmarana, near Vicenza (1757), in which the personality of his son Giovanni Domenico asserted itself in exotic rural scenes of carnival season. For the first time since his earliest attempts in 1748–49, Giovanni Domenico achieved something more than his previous depersonalized collaborations with his father and was able to express his own peculiar anecdotal and realistic-grotesque vein. The elder Tiepolo, on the other hand, drew on the poetry of Homer, Virgil, Ariosto, and Tasso to execute a nucleus of feelings ranging between the dramatic and the passionate, on an idyllic but sensually moving plane. This stay on dry land after his close contact with Venice gave him the magnificent new graphic observations documented in the lyrically intense landscape of the great altarpiece he executed for the cathedral of Este in Italy, "St. Tecla Freeing Este from the Plague" (1759).

Tiepolo was now on the eve of his departure for Spain, from which he would never return. Before leaving Italy for the last time, he accepted the task of celebrating the last dream of power of a noble Venetian family, the Pisani family, who had built their own belated but splendid Versailles. In Tiepolo's magnificent "Apotheosis of the Pisani Family," the most attractive section is an array of children's portraits and a frieze of male and female satyrs, which give a stamp of sensual existentialism to the decorative ensemble. Interspersed among his many decorations, Tiepolo painted many portraits. A unique example is the superb portrait of the "Procurator Giovanni Querini (?)," owned by the Galleria Querini-Stampalia of Venice; it represents not only a man but also an undermined aristocracy destined to fall.

Venice's political equilibrium was shattered in 1756 by the Seven Years' War, but Spain remained outside the conflict, and Carlos III invited Tiepolo to Madrid to enhance the glory of the Spanish monarchy at the Palacio Nacional. Tiepolo arrived in 1762 with his active collaborators, Giovanni Domenico and Lorenzo. In 1764, this team finished the decoration, in which the elder Tiepolo continued to define, and in part carry out, the complex thematic conception of the three ceilings. Unfortunately, the concepts did not fit in with the architectural environment, and the chromatic vividness of the beautiful sketches was not completely realized in the finished work. Yet, in "The Power of the Spanish Monarchy," "The Apotheosis of the Spanish Monarchy," and "Aeneas Led to the Temple of Venus," Tiepolo dared to create bold perspective inventions, sustained by rich chromatic orchestration. In contrast to the solemnity that pervaded the Spanish court, Tiepolo presented a poetic art of light and colour, based on an inner feeling of almost romantic melancholy, as may be seen in the religious canvases executed for Aranjuez and in the various sequences of the "Flight into Egypt" executed for private patrons. The ceilings were Tiepolo's last major undertaking.

*Assessment.* The hostile attitude of the official Spanish milieu seems to have resounded in the 19th century, when connoisseurs and critics rejected Tiepolo, along with the Baroque and Rococo styles, in general. He was considered an unhealthy and bizarre genius. But the change in taste brought about by Impressionism late in the century prepared the way for the rediscovery of the great Venetian. Generations of critics in Italy and elsewhere have worked to reconstruct his enormous pictorial output and to reassemble his prodigious mass

of quick sketches and brilliant etchings. Modern taste accepts him without reservation and without need for either historical perspective or cultural justification. His huge decorative works formed a perfect complement to the Rococo churches and palaces of his time. Described by one of his contemporaries as being "all spirit and fire," he worked with astonishing verve, and his output of ceilings, murals, easel compositions and portraits, sketches, and etchings is so huge as to invite the suspicion of superficiality. Yet there is an underlying melancholy in all his best works that gives them a profundity rarely found in other art of his time. Critics now rank him with the great painters of all ages. (R.Pal.)

MAJOR WORKS. *Paintings.* "The Sacrifice of Isaac" ("The Sacrifice of Abraham"; 1715–16; Sta. Maria dei Derelitti, or Ospedaletto, Venice); "Repudiation of Hagar" (1717–19; Rasini Collection, Milan); "The Madonna of Carmelo and the Souls of Purgatory" (*c.* 1720; Brera, Milan); "Glory of St. Theresa" (*c.* 1720; church of the Scalzi, Venice); "The Force of Eloquence" (*c.* 1724–25; Palazzo Cipollato, Venice); frescoes (*c.* 1726; Palazzo Arcivescovile, Udine, Italy); ceiling frescoes (1731, now destroyed; Palazzo Archinto, Milan); "The Adoration of the Christ Child" (1732; St. Mark's, Venice); frescoes (1732; Cappella Colleoni, Bergamo, Italy); frescoes, chapel of S. Vittore (1737; S. Ambrogio, Milan); vault frescoes (*c.* 1739; church of the Gesuati, Venice); frescoes (1740; Palazzo Clerici, Milan); vault frescoes (1743–44, now destroyed; church of the Scalzi); frescoes (1743; Villa Cordellina, Montecchio Maggiore, Vicenza, Italy); "Time Revealing Truth" (frescoes, 1744–45; Palazzo Barbarigo, Venice); "Allegory of Fortitude and Wisdom" (frescoes, 1744–45; Ca' Rezzonico, Venice); Story of Anthony and Cleopatra (frescoes, before 1750s; Palazzo Labia, Venice); "The Glorification of Francesco Barbaro" (fresco, *c.* 1750; Metropolitan Museum of Art, New York City); "Gifts Offered to Cleopatra" (fresco, *c.* 1750; Necchi Collection, Pavia, Italy); "Timoleia and the Thracian Commander" (fresco, *c.* 1750; National Gallery of Art, Washington, D.C.); frescoes, Kaisersaal (1750–52; Residenz, Würzburg, Ger.); "Olympus" (1753; Residenz, Würzburg); vault frescoes (1754–55; church of the Pietà, Venice); frescoes for Villa Contarini, Mira (*c.* 1756; Musée Jacquemart-André, Paris); frescoes (1757; Villa Valmarana, Vicenza); "Apotheosis of the Pisani Family" (frescoes, 1762; Villa Pisani, Stra, Italy); "Apotheosis of the Spanish Monarchy" throne room (1764; Palacio Nacional, Madrid).

*Oil sketches.* These exist in many museums, including the Isabella Stewart Gardner Museum, Boston; National Gallery, London; Frick Collection, New York City; Museum of Fine Arts, Boston; and the Cleveland Museum of Art. Tiepolo also produced a great number of drawings and etchings.

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**Tiepolo, Giovanni Domenico,** also called GIANDOMENICO TIEPOLO (b. Aug. 30, 1727, Venice—d. March 3, 1804, Venice), son of the Venetian artist Giovanni Battista Tiepolo; he was a talented genre painter, especially of scenes from contemporary life and the popular theatre (as in the decorations of his villa at Zianigo, Italy, now in the Civico Museo Correr, Venice). Notable among his early works are the paintings of the Stations of the Cross for S. Polo, Venice (1747–49), and the chinoiserie decorations of the guest wing of the Villa Valmarana (1757) in Vicenza. He worked in Madrid from 1762 until his father died in 1770. Back in Venice, he executed several frescoes and easel paintings, especially scenes from the commedia dell'arte. He produced innumerable drawings for collectors, besides nearly 100 etchings after his own and his father's designs. His brother, Lorenzo Tiepolo (1736–76), seems to have specialized chiefly in genre scenes in pastel.

**Tiergarten,** district of Berlin, Germany, on the Spree River. Before World War II the district was Berlin's diplomatic quarter and the site of the War Ministry. It includes the famous 630-acre (255-hectare) Tiergarten Park, a deer preserve until the 18th century. The park was destroyed in World War II, but it has been replanted; its new "English garden" was donated by the British. The zoological gardens in the park have also been restored and are again among the finest in Europe. The park is bisected by the Strasse des 17. Juni, commemorating the killing of protesting East German workers by Soviet tanks on June 17, 1953. Cultural institutions built since World War II include the Congress Hall, the Philharmonic Hall, the New National Gallery of modern art, and the State Library. Pop. (1986 est.) 72,000.

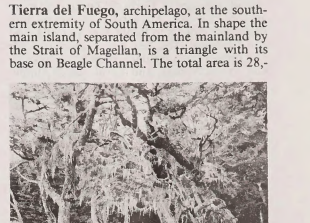
**Tierpark Berlin:** *see* Berlin Zoo.

**Tierpark Hellabrunn:** *see* Hellabrunn Zoo.

**Tierra Blanca,** city, southern Veracruz state, south central Mexico, in the Gulf of Mexico lowland, in the Río Papaloapan Valley, near the border of Oaxaca state, at an elevation of 200 ft (60 m) above sea level. Its climate is hot and humid. Tierra Blanca plays an important role in regional agriculture, industry, and transportation. The area is noted principally for its livestock and petroleum, but corn (maize), beans, bananas, rice, mangoes, and other tropical crops are grown. A rail junction on the routes linking Mexico City and Veracruz with the Yucatán, Tierra Blanca has railroad shops. It is also accessible by highway from Veracruz to the north-northeast and from the plateau cities to the northwest. Pop. (2001 est.) 46,200.

**Tierra de O'Higgins** (British Antarctic Territory): *see* Antarctic Peninsula.

**Tierra del Fuego,** archipelago, at the southern extremity of South America. In shape the main island, separated from the mainland by the Strait of Magellan, is a triangle with its base on Beagle Channel. The total area is 28,-



Rain forest on Isla Navarino, Tierra del Fuego
E. Aubert de la Rue

473 sq mi (73,746 sq km), about two-thirds of which is Chilean and one-third Argentine. The boundary, agreed upon in 1881, follows the meridian 68°36′38″ W, from Cabo (cape) Espíritu Santo on the Atlantic, and the east–west Beagle Channel. Lennox, Picton, Nueva, and several small islands at the mouth of the channel are disputed between the two republics.

The physical features of Tierra del Fuego are varied. Most of the northern portion of the main island, consisting of glacial topography, mainly lakes and moraines, is under 600 ft (180 m) in height, and the Atlantic and Strait of Magellan coasts are low-lying. In contrast, the southern and western parts of the main island and the archipelago are a prolongation of the Andes, with peaks exceeding 7,000 ft, notably Monte Sarmiento (7,550 ft [2,300 m]) and Monte Darwin (7,999 ft [2,438 m]), and mountain glaciers. The climate of Tierra del Fuego is monotonously cool in summer and cold in winter, with great contrast in annual rainfall, from 180 in. (4,600 mm) at Bahía Félix on Isla Desolación, Chile, to 20 in. at Río Grande, Arg. In the exposed southern and western areas, vegetation is limited to mosses and stunted trees. The central part of the main island has deciduous beech forests, and the northern plains have a tussock grass cover.

The archipelago was discovered by the navigator Ferdinand Magellan in 1520, when he sailed through the strait named after him and called the region Tierra del Fuego (Land of Fire). Various navigators traversed the area, but no systematic exploration was attempted until the British Admiralty undertook a thorough survey of the entire archipelago between 1826 and 1836. For 350 years after Magellan's voyage, the region was left in the undisputed occupation of its indigenous peoples, the Ona, Yahgan, and Alacaluf Indians, but after 1880 colonization by Chilean and Argentine nationals was sparked by the introduction of sheep farming and the discovery of gold. More recently, the discovery of petroleum at Manantiales in 1945 converted the northern part of Tierra del Fuego into Chile's only oil field. Pipelines have been laid to the Strait of Magellan for export of the oil to middle Chile, drilling platforms have been built in the Strait of Magellan, and a small refinery meets local needs. There is some lumbering in the forested areas of the Beagle Channel and the Strait of Magellan; fish and crayfish canning at Ushuaia, Arg., and Porvenir, Chile; and fur hunting for nutria and seal. A meat refrigera-

tion plant is located at Río Grande, but most surplus sheep are processed on the mainland.

Roads are poor in Tierra del Fuego, and there are no railways. Air services however, link major settlements to Punta Arenas, Chile, and Río Gallegos, Arg. Sea communications are also important; a regular service links Porvenir and Punta Arenas, and naval vessels supply Ushuaia and the Isla Navarino, Chile.

**Tierra del Fuego,** *provincia,* southern Argentina, consisting of the eastern half of the triangular island of Tierra del Fuego (Spanish: "Land of Fire"), lying between the Strait of Magellan (north) and Beagle Channel (south) at the southern extremity of South America. Argentina also claims as part of this province a number of South Atlantic islands and a portion of the Antarctic continent representing an additional 1,000,000 square miles (2,600,000 square km). Excluding these claims, the area of the province (8,329 square miles [21,571 square km]) presents three well-defined zones. There is a central mountain region whose highest peak is Cornú (4,888 feet [1,490 m]), with a windy, narrow, structural valley running east-west that is marked by Lake Fagnano in the Argentine sector and that continues as Almirantazgo Bay in the Chilean sector; this region has abundant vegetation. Below the mountains is a plateau and terrace region north of Lake Fagnano with excellent grazing ground for sheep and cattle. Finally, there is a plains region along the northeastern coast near the city of Río Grande, with open woodland covering the nearby mountain slopes.

The capital of Tierra del Fuego is located on the Beagle Channel at Ushuaia, the southernmost city in the world. There is little agriculture on the island, but oil and gas reserves have been developed. Many textile and electronic firms have been established at Río Grande and Ushuaia, the island's two main cities. Fishing activity centres on spider crabs and mussels and other mollusks, which are canned and exported. Krill, tiny shrimplike creatures suggested as a potential source of food for humans, are extremely abundant in adjoining ocean waters but are not yet exploited. Two popular points of interest in Tierra del Fuego are the National Park Reserve and the United States scientific research vessel *Hero,* whose home port is Beagle Channel. Pop. (1991 prelim.) 69,323.

**Tietê River,** Portuguese RIO TIETÊ, São Paulo *estado* ("state"), southeastern Brazil, rising in the Serra do Mar, just east of São Paulo city, and flowing in a northwesterly direction for about 700 miles (1,130 km) before joining the Paraná River at Ilha Grande, just above Urubupungá Falls. Its major tributaries include the Piracicaba, Jacaré, and Sorocaba, and it drains an area of 27,410 square miles (70,990 square km).

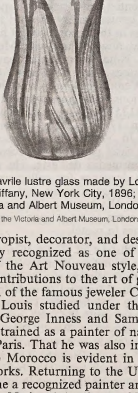
Several of the state's large cities are located on or near the Tietê, but navigation along its course is impeded by frequent falls and rapids. The latter have been harnessed for power in several places.

**Tiffany, Charles Lewis** (b. Feb. 15, 1812, Killingly, Conn., U.S.—d. Feb. 18, 1902, New York, N.Y.), American jeweler who made a specialty of importing historic gems, jewelry, and art works.

Tiffany went to New York City in 1837 and with John B. Young opened a stationery and fancy-goods store, which soon expanded to offer jewelry and silverware as well. It became Tiffany, Young, & Ellis in 1841; in 1848 the firm began to manufacture jewelry, and in 1850 they opened a branch in Paris. Tiffany adopted the standards of English silver in 1851, thereby establishing the term "sterling" in the United States. In 1853 he obtained sole control of the firm, which was thereafter known as Tiffany & Co.

In 1858 Tiffany obtained a surplus section of the newly laid Atlantic Cable, which he cut into pieces and sold as souvenirs with great success. At the beginning of the American Civil War he turned most of his capital to the manufacture of swords, medals, and other war material. In 1868 the company was incorporated and branches were established in London and Geneva. In 1887 he bought some of the crown jewels of France. He was the father of the famed Art Nouveau designer Louis Comfort Tiffany, who succeeded him as the firm's director.

**Tiffany, Louis Comfort** (b. Feb. 18, 1848, New York, N.Y., U.S.—d. Jan. 17, 1933, New York, N.Y.), American painter, craftsman,



Vase of Favrile lustre glass made by Louis Comfort Tiffany, New York City, 1896, in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

philanthropist, decorator, and designer, internationally recognized as one of the greatest forces of the Art Nouveau style, who made major contributions to the art of glassmaking.

The son of the famous jeweler Charles Lewis Tiffany, Louis studied under the American painters George Inness and Samuel Colman and also trained as a painter of narrative subjects in Paris. That he was also influenced by a visit to Morocco is evident in some of his major works. Returning to the United States, he became a recognized painter and an associate of the National Academy of Design, New York City; later he reacted against the Academy's conservatism by organizing, in 1877, with such artists as John La Farge and Augustus Saint-Gaudens, the Society of American Artists.

Tiffany's experiments with stained glass, begun in 1875, led to the establishment, three years later, of his own glassmaking factory at Corona in Queens, New York City. By the 1890s he was a leading glass producer, experimenting with unique means of colouring. He became internationally famous for the glass that he named "Favrile," a neologism from the Latin *faber* ("craftsman"). Favrile glass, iridescent and freely shaped, was sometimes combined with bronzelike alloys and other metals; such examples, some signed "L.C. Tiffany" or "L.C.T.," enjoyed widespread popularity from 1890 to 1915 and were revived again in the 1960s. His Favrile glass was admired abroad, especially in central Europe, where it created a new fashion.

Having established a decorating firm known as Tiffany Glass and Decorating Company, which served wealthy New Yorkers, Tiffany was commissioned by President Chester A. Arthur to redecorate the reception rooms at the White House, Washington, D.C., for which he created the great stained-glass screen in the entrance hall. He designed the chapel for the World's Columbian Exposition (1893) in Chicago and the high altar in the Cathedral of St. John the Divine, New York City.

Overwhelmed by the glass display of the brilliant French Art Nouveau designer Émile Gallé at the Paris Exhibition of 1889, Tiffany became interested in blown glass. From 1896 to 1900 he produced a vast amount of exquisite Favrile glass, many pieces achieving mysterious and impressionistic effects; his innovations made him a leader of the Art Nouveau movement.

Tiffany's firm was reorganized as Tiffany Studios in 1900, after which he ventured into lamps, jewelry, pottery, and bibelots. In 1911 he created one of his major achievements—a gargantuan glass curtain for the Palacio de Bellas Artes, Mexico City. Like his father, Louis was a chevalier of the Legion of Honour; he also became an honorary member of the National Society of Fine Arts (Paris) and of the Imperial Society of Fine Arts (Tokyo). In 1919 he established the Louis Comfort Tiffany Foundation for Art Students at his luxurious and celebrated Long Island estate (which he had designed in total), which in 1946 was sold to provide scholarship funds.

**Tiflis** (Georgia): *see* Tbilisi.

**tig** (game): *see* tag.

**Tigellinus, Ofonius** (d. AD 69), the Roman emperor Nero's chief adviser from 62 to 68, notorious for the influence his cruelty and debauched behaviour had upon the emperor.

A Sicilian by birth, Tigellinus was prefect of the *vigiles* ("fire brigades") before becoming prefect of the Praetorian Guard in 62. Early sources maintain that he rose to power by encouraging Nero in his vices. He actively pressed Nero's reign of terror following the abortive conspiracy of Piso in 65 and was suspected of incendiarism in the great fire that led to the first persecution of Christians. When Sulpicius Galba raised a rebellion against Nero in 68, Tigellinus gave up his power so that he would not have to risk his life in a struggle to save Nero's regime. In 69 the emperor Otho forced Tigellinus to commit suicide.

**tiger** (*Panthera tigris*), great cat of Asia, the largest member of the cat family (Felidae). Like the lion, leopard, and others, the tiger is one of the big, or roaring, cats; it is rivaled only by the lion in strength and ferocity.

The tiger is thought to have originated in northern Eurasia and to have moved southward; its present range extends from the Russian Far East through parts of China, India, and Southeast Asia. There are about seven or eight generally accepted races of tiger. Of these, the Javan tiger, Bali tiger, and Caspian tiger are believed to be extinct; the Chinese tiger is near extinction; and the Sumatran, Siberian, and Indian subspecies are endangered.

The size and the characteristic colour and striped markings of the tiger vary according to locality and race. Tigers of the south are smaller and more brightly coloured than those of the north. The Bengal tiger (*P. tigris tigris*) and those of the islands of Southeast Asia, for example, are bright reddish tan, beautifully marked with dark, almost black, transverse stripes; the underparts, inner sides of the limbs, the cheeks, and a large spot over each eye are whitish. The very large and very rare Siberian, or Amur, tiger (*P. t. altaica*) of northern China and Russia, however, has longer, softer, and paler fur. There are a few black and white tigers, and one pure white tiger has been recorded.

The tiger has no mane, but in old males the hair on the cheeks is rather long and spreading. The male is larger than the female, and the Bengal tiger may attain a shoulder height of about 1 m (3.3 feet); a length of about 2.2

m, excluding a tail of about 1 m; and a weight of about 160–230 kg (350–500 pounds). The Siberian tiger can measure 4 m in total length and weigh 300 kg.

The tiger inhabits grassy and swampy districts and forests; it also haunts the ruins of buildings such as courts and temples. A powerful, generally solitary cat, it swims well and appears to enjoy bathing. Under stress, it may climb trees. The tiger hunts by night and preys on a variety of animals, including deer, wild hog, and peafowl. Healthy large mammals are generally avoided, although there have been recorded instances of the tiger having attacked elephants and adult buffalo. Cattle are sometimes taken from human habitations. An old or disabled tiger or a tigress with cubs may find human beings an easier prey and become a man-eater.

In warm regions the tiger produces young at any time of year; in cold regions it bears its cubs in spring. Litter size is usually two or three, and gestation averages 113 days. The cubs are striped and remain with the mother until about the second year, when they are nearly adult and are able to kill prey for themselves. The tigress does not breed again until her cubs are independent. The average life span of a tiger in the wild is about 11 years.

Because it is so closely related, the tiger can be crossbred in captivity with the lion; the offspring of such matings are called tigons when the sire is a tiger, and ligers when the sire is a lion.

Next to the elephant and the lion, no wild animal is so frequently portrayed in Asian art and lore. The persistent practices of using various tiger body parts as talismans, tonics, or medicine, despite all scientific evidence contrary to their efficacy, are manifestations of beliefs that emanate from the aura of the tiger and the awe that it has inspired for millennia. Certain animist communities still worship the tiger. Every 12th year of the Chinese calendar is the year of the tiger, and children born in it are considered especially lucky and powerful.



Bengal tiger (*Panthera tigris tigris*)
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In Hindu mythology the tiger is the vahana ("vehicle") of the goddess Durga. Tigers are represented on seals from the ancient Indus civilization. The greatest of the Gupta emperors of ancient India, Samudra, minted special gold coins depicting him slaying tigers. Tippu Sultan even vented his frustration at his inability to defeat the British by ordering a special life-size toy, replete with sound, of a tiger mauling an English soldier.

At the beginning of the 20th century, the world's tiger population was estimated at 100,000, even though they had been hunted for at least a thousand years. Tigers were prized as trophies and as a source of skins for expensive coats. They were also killed on the grounds that they posed a danger to humans. As the century drew to a close, only 5,000 to 7,500 were left in the wild, and captive tigers may now outnumber wild ones. The South China tiger (*P. t. amoyensis*) is the most endangered, with only a few dozen animals remaining. The Siberian and Sumatran subspecies number less than 500 each, with the Indo-Chinese population estimated at about 1,500. Three subspecies have gone extinct within the past century: the Caspian (*P. t. virgata*) of central Asia, the Javan (*P. t. sondaica*), and the Bali (*P. t. balica*) tigers. The tiger is now legally protected throughout its range, but law enforcement is not universally effective. India accounts for half the world's tiger population.

Other animals sometimes called tigers are the clouded leopard (*q.v.*), or clouded tiger; the puma (*q.v.*), or deer tiger; and the sabre-toothed cat (*q.v.*).

**Tiger, Theobald:** *see* Tucholsky, Kurt.

**tiger beetle,** any member of the approximately 2,000 species of the insect family Cicindelidae (order Coleoptera). The name derives from their voracious eating habits. The larva lives in a vertical burrow, which is sometimes as much as 0.67 m (2 feet) deep. It waits at the top of the burrow for prey (insects), which it grasps with sicklelike mandibles



Tiger beetle (*Cicindela*)
William E. Ferguson

(jaws). A pair of hooks on the abdomen anchor the larva, so that it cannot be pulled out of its burrow by the struggling victim. The prey is then dragged to the bottom of the burrow and eaten.

The slender, long-legged adults are about 10 to 20 mm (⅖ to ⅘ inch) long and have bulging eyes. Many are iridescent blue, green, orange, or scarlet in colour. They are rapid runners and fliers. When handled, tiger beetles can inflict a painful bite with their long mandibles.

Although tiger beetles occur throughout the world, most species are subtropical or tropical and are usually seen on sunny paths and sandy areas. The wing covers (elytra) of many species of *Cicindela,* a common genus, have scroll-like marks. Species that inhabit sandy areas are often light-coloured and match the environment.

**tiger cat:** *see* margay.

**tiger-flower,** also called AZTEC CITY, or SHELL FLOWER, any of about 12 species of the genus *Tigridia,* plants native from Mexico to Chile and once prized by the Aztecs for the chestnut flavour of bulblike structures (corms). They belong to the iris family (Iridaceae).



Tiger-flower (*Tigridia pavonia*)
Derek Fell

The flowers, in a range of colours including orange-red, have three lower floral parts alternating with three much smaller petals, all with a spotted cup at the centre. They are held by 60-centimetre (2-foot) stems among sparse, swordlike leaves.

**tiger moth,** any of the nocturnal moths of the cosmopolitan family Arctiidae (order Lepidoptera), containing more than 3,500 species. Many have furry or hairy larvae (caterpillars) called woolly bears. Most adults have thick bodies and wings coloured white, orange, or green. When at rest the wings are folded rooflike over the body.

The fall webworm (*Hyphantria cunea*) is a serious pest. These caterpillars construct webs over leaves, sometimes covering large areas with silken sheets. They pupate above ground in cocoons made of larval hairs and silk.

A typical arctiid, the Isabella tiger moth (*Isia isabella*), emerges in spring and attains a wingspan of 37 to 50 mm (1.5 to 2 inches). Black spots mark its abdomen and yellow wings. The larva, known as the banded woolly bear, is brown in the middle and black at both ends. According to superstition the length of the black ends predicts the severity of the coming winter: the shorter the ends, the milder the weather.



Tiger moth (*Apantesis virgo*)
Alexander B. Klots

The bright warning coloration displayed by some arctiids is associated with distastefulness, thus protecting the moths from predation. The footman moth family Lithosiidae is sometimes considered part of the family Arctiidae.

**Tiger of Mysore:** *see* Tippu Sultan.

**tiger shark** (*Galeocerdo cuvieri*), large, potentially dangerous shark of the family Carcharhinidae. It is noted for its voracity and inveterate scavenging, as well as its reputation as a man-eater. The tiger shark is found worldwide in warm oceans, from the shoreline to the open sea. A maximum of about 5.5 m (18 feet) long, it is grayish and patterned, when young, with dark spots and vertical bars. It has a long, pointed upper tail lobe and large,

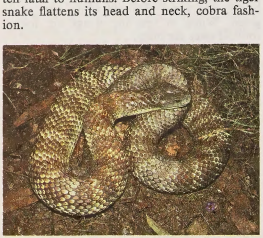


Tiger shark (*Galeocerdo cuvieri*)
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saw-edged teeth that are deeply notched along one side.

An omnivorous feeder that sometimes damages the nets and catches of fishermen, the tiger shark eats fishes, other sharks, sea turtles, mollusks, seabirds, carrion, and garbage. It has also been known to swallow coal, tin cans, bones, and clothing. It is of some commercial value as a source of leather and liver oil.

**tiger snake** (*Notechis scutatus*), Australian member of the cobra family, Elapidae. The snake's venom, which contains a blood-clotting agent as well as a nerve paralyzer, is often fatal to humans. Before striking, the tiger snake flattens its head and neck, cobra fashion.



Tiger snake (*Notechis scutatus*)
© S. Wilson/Australasian Nature Transparencies

This common serpent, most numerous in swampy places in southern regions, is variable in colour but often has brown-and-yellow bands. It averages 1.2 m (4 feet) in length.

**tigereye,** also spelled TIGER'S-EYE, semiprecious quartz gem displaying chatoyancy, a vertical luminescent band like that of a cat's eye. Veins of parallel, blue asbestos (crocidolite) fibres are first altered to iron oxides and then replaced by silica. The gem has a rich yellow to yellow-brown or brown colour and, when polished, a fine golden lustre. The best stones come from Griqualand West, S.Af. Hawk's-eye is similar to tigereye, except that the crocidolite was replaced by quartz before altering to iron oxide; it therefore retains the gray-blue or green of the asbestos. *See also* cat's-eye.

**tigerfish,** any of several fishes so named on the basis of their pugnacity when caught, their fiercely predaceous habits, or their appearance. In African freshwaters, tigerfishes of the genus *Hydrocynus* (sometimes *Hydrocyon*) are admired game fishes of the characin family, Characidae (order Cypriniformes). They are marked, depending on the species, with one or several dark, lengthwise stripes and are swift, voracious, salmon-shaped carnivores with daggerlike teeth that protrude when the mouth is closed. There are about five species; the largest (*H. goliath*) may be more than 1.8 m (6 feet) long and may weigh more than 57 kg (125 pounds). The smaller *H. vittatus* is claimed to be one of the finest game fishes in the world.

In the Indo-Pacific, marine and freshwater tigerfishes of the family Theraponidae (order Perciformes) are rather small and usually marked with bold stripes. The three-striped tigerfish (*Therapon jarbua*) is a common, vertically striped species about 30 cm (12 inches) long. It has sharp spines on its gill covers, which can wound a careless handler.

**tigerware,** also spelled TYGERWARE, 16th- and 17th-century German stoneware having a brown, mottled glaze, and made in the Rhenish centres of Cologne and Frechen, Ger. Tigerware was imported to England and imitated there in the different medium of delft, or tin-glazed earthenware; the imitations were also called tigerware. Tin-glazed jugs in this style—called Malling jugs—are among the earliest class of English delftware. Although examples were associated with Kent (where one was excavated), it seems more likely that London was their place of manufacture.



Tigerware *Bartmannkrug,* Frechen, Ger., second half of the 17th century; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

**Tighina,** also spelled TIGINA, formerly called BENDERY, Moldavian BENDER, city, Moldova. Tighina lies along the right bank of the Dniester River below its confluence with the Bâc (Byk). A settlement has existed on the site since the 2nd century BC. It came successively under the rule of Kiev, Moldavia, Genoa, Turkey, and, in 1818, after frequent attacks, Russia. Between World Wars I and II it was in Romania. Today Tighina manufactures textiles, foodstuffs, cables, and electrical equipment. A Turkish fortress dating from the 16th century still stands within the city. Pop. (1991 est.) 141,500.

**Tiglath-pileser,** Akkadian TUKULTI-APIL-ESHARRA, name of Assyrian kings grouped below chronologically and indicated by the symbol •.

• **Tiglath-pileser I** (fl. 12th-11th century BC), one of the greatest of the early kings of Assyria (reigned *c.* 1115–*c.* 1077 BC).

Tiglath-pileser ascended the throne at the time when a people known as the Mushki, or Mushku (Meshech of the Old Testament), probably Phrygians, were thrusting into Asia Minor (now Turkey). Their invasion constituted a serious threat to Middle Eastern civilization because Asia Minor was the principal source of iron, which was then coming into general use. Tiglath-pileser defeated 20,000 Mushki in the Assyrian province of Kummukh (Commagene). He also defeated the Nairi, who lived west of Lake Van, extending Assyrian control farther into Asia Minor than any of his predecessors had done. He subdued various seminomadic Aramaean tribes living along the routes to the Mediterranean and reached the Syrian coast, where the Phoenician trading cities paid him tribute. Egypt, closely linked by trade with the Syrian coast, made overtures of friendship. After 1100 Tiglath-pileser conquered northern Babylonia.

Tiglath-pileser I carried out extensive building work in Ashur, Nineveh, and other cities, and texts from his library are still extant. His territorial conquests, however, did not outlast his reign, and after his death Assyria entered a period of decline.

• **Tiglath-pileser II** (fl. 10th century BC), king of Assyria (*c.* 965–*c.* 932 BC). He apparently ruled effectively, as a successor addressed him by a title reserved for mighty monarchs. Otherwise, little is known of the period other than that Assyria was beginning to emerge from its collapse of a century before.

• **Tiglath-pileser III** (fl. 8th century BC), king of Assyria (745–727 BC) who inaugurated the last and greatest phase of Assyrian expansion. He subjected Syria and Palestine to his rule, and later (729 or 728) he merged the kingdoms of Assyria and Babylonia.

*Rise to power.* Since the days of Adad-nirari III (reigned 810–783 BC) Assyria had been politically and militarily weak, for its northern neighbour, Urartu, dominated the states controlling its principal trade routes to the Mediterranean and to the Iranian plateau. Some portions of the empire had ceased to pay the tribute required by treaties. In the spring of 745 BC a rebellion against the weak king Ashur-nirari V, a son of Adad-nirari III, brought a new ruler, who was then governor of Calah, to power. This new ruler assumed the throne name of Tiglath-pileser in what may have been a deliberate reference to an illustrious forebear, Tiglath-pileser I (reigned *c.* 1115–*c.* 1077 BC).

As king, Tiglath-pileser III, an intelligent and vigorous man, acted swiftly. He rearranged territorial governorships by subdividing the larger provinces that had tended to strive for independence from the central power. Outside the immediate home territory he appointed Assyrian officials to be directly responsible to him as well as to support their local ruler. By 738 there were 80 such provinces. The Assyrians had to report directly to the king, who thus was able to check continuously on the loyalty and efficiency of all of his civil servants. They were responsible for local taxation, the storage of military supplies, and the calling up of local forces to support the new Assyrian army, now a skilled professional force compared with its predecessor, which had relied on somewhat haphazard conscription. A new intelligence system, using reports transmitted by staging posts, was also created.

*Military campaigns.* Tiglath-pileser was thus prepared to break the stranglehold of the surrounding tribes. He first moved eastward against Zamua (modern Sulaymānīyah), then north against the Medes. Both were brought back under control of the adjacent provincial governors. The tribal lands of Puqudu, northeast of Baghdad, were joined to the Arrapkha (Kirkūk) province, thereby holding the Aramaean tribes in check. This and contiguous operations strengthened the hands of Nabonassar, the native king of Babylonia, who maintained peace until his death in 734. All this was facilitated by Tiglath-pileser's policy of mass resettlement. Groups whose loyalty was assured, since they were now dependent



Tiglath-pileser III, relief from Calah (Nimrūd), 8th century BC; in the British Museum
By courtesy of the trustees of the British Museum

on the king for protection in a foreign environment, were settled in troublesome border regions. In 742–741 alone, tens of thousands were thus resettled.

Tiglath-pileser next attacked the Urartian ruler Sarduri II and his neo-Hittite and Aramaean allies, whom he defeated in 743 BC. Advance westward was, however, barred by the capital of Arpad, which had to be besieged for three years—a technique now feasible to a standing army. The victory in 741 was far-reaching, as noted in the Bible (Isaiah 37:13), and was to stem the barbarian pressures from the north that, after Tiglath-pileser, were to threaten civilizations throughout the area. Tribute was brought to him at Arpad from Damascus, Tyre, Cilicia, and other cities and regions.

The Assyrian king's skill is best seen in his handling of affairs in Syria and Palestine. From an independent military headquarters he bypassed the rebels' ringleader at Damascus, won over most coastal cities, cut off supplies of timber from Egypt, and sent a force to Ashkelon and Gaza. In 734 the border with Egypt was sealed. The tribes of Ammon, Edom, and Moab, who, with Israel, had attacked Ahaz of Judah—a vassal of Assyria—now had to pay tribute. Over the next two years Tiglath-pileser systematically broke the power of Damascus. Israel was made subject through the assassination of Pekah (Pakaha) and his replacement by a pro-Assyrian vassal Hoshea (Ausi). Galilee was made part of an adjacent province.

The Assyrian sensed that these rebels were encouraged by Ukin-zer, the Chaldean chief who, in 734, had seized the throne of Babylon. Using consummate diplomacy, Tiglath-pileser sowed discord among other Aramaean tribes, one of whose chiefs he won over. His strategy now paid off. He could move the Assyrian army through areas held by loyal governors or vassals east of the Tigris. One force seized Babylon and another the rebel stronghold of Sapia. It proved a fitting culmination that in 729–728 Tiglath-pileser himself took over the throne of Babylon using his personal (or perhaps Babylonian) name of Pulu (II Kings 15:19; I Chronicles 5:26). He died soon afterward, having set Assyria on the road it was to follow to its end. (D.J.W./Ed.)

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**Tigrai language:** *see* Tigrinya language.

**Tigranes II** THE GREAT, Tigranes also spelled TIGRAN, OF DIKRAN (b. *c.* 140—d. *c.* 55 BC), king of Armenia from 95 to 55 BC, under whom the country became for a short time the strongest state in the Roman East.

Tigranes was the son or brother of Artavasdes I and a member of the dynasty founded in the early 2nd century by Artaxias. He was given as a hostage to the Parthian king Mithradates II, but later he purchased his freedom by ceding 70 valleys bordering on Media, in northwestern Iran.

Thereafter, Tigranes began to enlarge his kingdom, first annexing the kingdom of Sophene (east of the upper Euphrates River). He also entered into alliance with Mithradates VI Eupator of Pontus, whose daughter Cleopatra he married. The interference of the two kings in Cappadocia (in eastern Asia Minor) was successfully countered by Roman intervention in 92 BC.

Tigranes then began war with the Parthians, whose empire (southeast of the Caspian Sea) was temporarily weakened after the death of Mithradates II (about 87) by internal dissensions and invasions of the Scythians. Tigranes reconquered the valleys he had ceded and laid waste a great part of Media; the kings of Atropatene (Azerbaijan), Gordyene and Adiabene (both on the Upper Tigris River), and Osroene became his vassals. He also annexed northern Mesopotamia, and in the Caucasus the kings of Iberia (now Georgia) and Albania accepted his suzerainty. In 83 the Syrians, tired of Seleucid dynastic struggles, offered him their crown, and in 78–77 he reoccupied Cappadocia. Tigranes took the title "king of kings" and built a new royal city, Tigranocerta, on the borders of Armenia and Mesopotamia (the actual site is disputed), where he accumulated all his wealth and to which he transplanted the inhabitants of 12 Greek towns of Cappadocia, Cilicia, and Syria.

In 72 the Romans forced Mithradates of Pontus to flee to Armenia, and, in 69, Roman armies under Lucullus invaded Armenia. Tigranes was defeated at Tigranocerta on Oct. 6, 69, and again near the former capital of Artaxata in September 68. The recall of Lucullus gave some respite to Mithradates and Tigranes, but in the meantime a son of Tigranes, also called Tigranes, rebelled against him. Although the younger Tigranes was given an army by the Parthian king Phraates III, he was defeated by his father and was forced to flee to the Roman general Pompey. When Pompey advanced into Armenia, Tigranes surrendered (66 BC). Pompey received him graciously and gave him back his kingdom (in exchange for Syria and other southern conquests). Tigranes ruled about 10 years longer over Armenia, as a Roman client-king, though he lost all his conquests except Sophene and Gordyene. He was succeeded by his son Artavasdes II.

**Tigray,** also spelled TIGRAI, OF TEGRAY, people of central Eritrea and of the Tigray region of northern Ethiopia. The Tigray speak Tigrinya, a Semitic language related to Ge'ez and to Tigré, the language of a separate people (the Tigre) inhabiting northwestern Eritrea.

The Tigray are descendants of a Semitic people who intermixed with the Cushitic inhabitants of the region and founded the Christian kingdom of Aksum, which had its capital in the historic region of Tigray. The Tigray are a sedentary agricultural people. Most, along with the neighbouring Amhara people, are adherents to the Ethiopian Orthodox church. Despite the religious and cultural similarities between the Tigray and the Amhara, linguistic differences and political rivalry (often erupting into warfare) have separated the two groups.

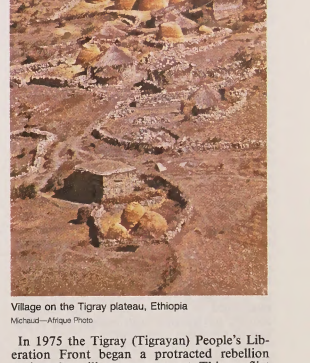
In the late 20th century the Tigray accounted for nearly half of the population of Eritrea and less than one-tenth of the population of Ethiopia. *Compare* Tigre (people).

**Tigray,** also spelled TEGRAY, TIGRAI, OR TIGRE, historic region, northern Ethiopia. Its western part rises in high-plateau country where elevations generally range between 5,000 and 11,000 feet (1,500 and 3,300 m). The region is drained by the Tekeze and Gash (Mareb) rivers. To the east lies the Denakil Plain, including the Kobar Sink (some 380 feet [116 m] below sea level).

Tigray contains the core of the ancient Aksumite kingdom and the historic settlements of Aksum, the kingdom's capital; Yeha, a ruined town of great antiquity; and Adwa (Adowa), the site of a battle in 1896 in which the Italian invading force was defeated.

Although vegetation is sparse, most of the population is engaged in agriculture (cereals, legumes, coffee, and cotton) and stock raising. Hides and skins are important exports. Salt and potash from desert deposits are also exported. The region, which has long been home to the Tigray people, also supports the Raya, Azebo, Afar, and Agew peoples.

By controlling the Red Sea ports of Massawa (Mitsiwa) and Asseb, Tigray became the region through which trading caravans reached the seat of the empire to the south. After it lost the coast to the Ottoman Empire in the 16th century, the region lost status, and thereafter, with the brief exception of Yohannes IV (reigned 1872–89), its princes were dominated by the rulers of the Gonder and Shewa regions to the south. It was also under constant threat from Egyptian, Sudanese, British, and Italian armies trying to penetrate to the interior. After occupation by Italy (1935–41), it was governed by officials appointed from the national capital in Addis Ababa.



Village on the Tigray plateau, Ethiopia
Michaud—Artique Photo

In 1975 the Tigray (Tigrayan) People's Liberation Front began a protracted rebellion against the military government. This conflict aggravated a disastrous drought and famine in 1984–85, which the government tried to ameliorate by forcibly relocating hundreds of thousands of peasants to well-watered regions in the south and west. An international outcry led to the suspension of this program, but by then it had led to the deaths of some 100,000 people, and hundreds of thousands more sought refuge from civil war and famine in The Sudan and Djibouti. Tigray forces liberated the region in 1989 and supported the overthrow of the Ethiopian national government in 1991.

**Tigre,** also spelled TIGRAY, OF TIGRAI, people inhabiting northwestern Eritrea and limited areas of neighbouring Sudan. The Tigre speak Tigré, a Semitic language related to ancient Ge'ez and to modern Tigrinya, the language of the Tigray people.

The largest federation of Tigre is that of the Amer (Beni Amer), a branch of the historically important Beja peoples. These Muslims all recognize the religious supremacy of the Mirghaniyah family of eastern Sudan. Another group, the Bet-Asgade (Bet Asgede), converted from Ethiopic Christianity to Islām. The life of the nomadic herdsman, so characteristic of neighbouring Sudan, is followed by most Tigre. The group accounted for nearly one-third of the population of Eritrea in the late 20th century. *Compare* Tigray (people).

**Tigre,** *cabecera* (county seat) and *partido* (county), on the outskirts of Greater Buenos Aires, Argentina. It lies northwest of the city of Buenos Aires, in Buenos Aires province, on the Río de la Plata estuary. An early settlement of the *partido* was centred on a chapel built in 1678 (reconstructed in 1820).

The *partido* is bordered to the north by an important branch of the Paraná River, the Paraná de las Palmas River, and to the east by the Río de la Plata. The Luján River, flow-



The fruit market, Tigre, Arg.
Eduardo Comesaño

ing southeast into the Río de la Plata, divides the *partido.* Besides the *cabecera* of Tigre, the other major localities are Carupá, Don Torcuato, General Pacheco, and Benavídez.

The *cabecera* has become a river trade centre for an area extending north from Buenos Aires city to the province of Entre Ríos. It is known for its fruit market, reminiscent of the former Les Halles market in Paris. The lands of the *partido* northeast of the Luján River are marshland interlaced with numerous rivers and canals of the Paraná River delta. These navigable waterways connect the major rivers of the region while making Tigre an attractive resort for water sports such as yachting, rowing, and fishing. Visitors to the area often enjoy cruises on tour boats or taxi launches. Each March and November, regattas are held on the Luján River. The Naval Museum was established in 1892 to exhibit ship artifacts, models, navigational instruments, and paintings of Argentine naval battles.

With the growth of the national capital, Tigre has merged into the north-northwestern suburban fringe of Greater Buenos Aires. Four railway lines serve the *partido,* as does the national highway system. Area *partido,* 139 square miles (360 square km). Pop. *partido* (1991 prelim.) 256,005.

**Tigré language,** Semitic language of the Tigre people of northwestern Eritrea and smaller areas of neighbouring Sudan. It is closely related to the ancient Ge'ez language and modern Tigrinya. A few religious texts prepared by mission societies are the only documents in the language. Tigré serves as a second language for many nearby Cushitic and Nilotic peoples. There were more than 1,000,000 speakers in the late 20th century.

**tigrillo:** *see* margay.

**Tigrinya language,** also spelled TIGRIGNA, also called TIGRAY, or TIGRAI, Semitic language of the Tigray people of northern Ethiopia and central Eritrea. Written records include religious texts prepared by mission societies and an increasing number of more recently printed textbooks and literary works. The language is closely related to Ge'ez, the ancient language of Ethiopia, and to the Tigré language. There were nearly 6,000,000 speakers in the late 20th century.

**Tigris River,** Old Persian TIGRA, Greek TRIGRES, or TIGRIS, Latin TIGRIS, Akkadian IDIKLAT, biblical HIDDEKEL, Arabic DIJLA, Turkish DICLE, river in Turkey and Iraq. It originates in the Southeastern Taurus Mountains at Lake Hazar and in several conjoint streams in the tangled hill country north of Diyarbakır, Tur. It then flows generally southeastward for about 1,180 miles (1,900 km) toward the Persian Gulf, which it enters as a joint stream, the Shaṭṭ Al-'Arab, 120 miles (193 km) long, with the Euphrates River. For 280 miles (450 km), as far as Faysh Khābūr, southeast of Cizre, it is a Turkish river (although before entering Iraq it forms a small, 20-mile [30-kilometre] section of the Syrian border); then for the remainder of its course it lies within Iraq. It discharges into the Shaṭṭ Al-'Arab at Al-Qurnah.

A brief treatment of the Tigris River follows. For full treatment, *see* MACROPAEDIA: Asia.

The Tigris in Turkey is a typical mountain stream, flowing swiftly in a narrow, well-defined valley often slotted deeply into the surface, with gorges and rapids marking its course. Southeast of Cizre, near the Syrian and Iraqi borders, it receives the eastern Al-Khābūr River. Much of the next 100 miles (160 km) of the river is impounded by a dam north of Mosul. Between Mosul and Al-Fatha the Tigris is joined on the left bank by the Great Zab and the Little Zab, two tributaries that double the river's flow during the floods of March and April. The valley walls of the Tigris recede south of the village of Tikrīt (100 miles [160 km] north-northwest of Baghdad), and the Tigris flows for the rest of its course over a wide, gently undulating plain with only a slight, almost imperceptible drop to sea level. Consequently, the river meanders extensively, with many loops, dead arms, and cutoffs.

In order to prevent flooding and shifting of the river, embankments and diversion structures have been constructed below Sāmarrā'. Southeast of Sāmarrā' the river is fed by another left-bank tributary, the Al-'Uẓaym, while the Diyālā River adds its waters south of Baghdad.

When the river reaches Al-Kūt, 200 miles downstream from Baghdad, the topography becomes extremely flat. Braided channels disperse water on either side into marshland, and streams freely flow into other parts of the valley. One of the larger distributaries, the Shaṭṭ Al-Gharrāf, breaks off southward and eventually joins the Euphrates River below An-Nāṣirīyah. On both sides of the river lie extensive marshes, fed by distributaries, which, together with irrigation canals, seepage, and evaporation, greatly diminish the flow of the Tigris during its passage from Baghdad to Al-Qurnah.

In ancient times the central Tigris was the site of urban civilizations, which were served by irrigation canals for several millennia. After the fall of the Achaemenid Empire (330 BC), this wealthy region became the political and commercial centre of Mesopotamia. Seleucia and Ctesiphon, respectively the royal cities of the Seleucid and of the Parthian and Sāsānian dynasties, and Baghdad and Sāmarrā', both 'Abbāsid capitals, all lay on the Tigris. In modern times the main effort in river control has been to maintain an effective system of diversion and storage both as a precaution against inundations during the main flood period (March–May) and also as a means of retaining the floodwaters for distribution in the hot season after May, when rainfall ceases until late autumn and temperatures may exceed 120° F (49° C).

**Tihāmat 'Asīr,** coastal plain of the Asir region, southwestern Saudi Arabia. It is the central southern section of the great Tihāmah (coastal plain), running down the west coast of the Arabian Peninsula. It is situated between the mountains of western Saudi Arabia and the Red Sea and is immediately north of Yemen. Approximately 40 miles (64 km) in width, its salty tidal plain is of limited agricultural value, but its relatively well-watered upper slopes have been transformed through irrigation and dry-farming methods into the largest and most productive agricultural area in Saudi Arabia.

**Tihāmit al-Yaman,** coastal plain in western Yemen, fronting the Red Sea. A 260-mile (420-kilometre) southern extension of the Arabian Tihāmah (coastal plain), it consists of a strip of arid coastal land stretching between Maydī, on the northern border with Saudi Arabia, and the El-Mandeb Strait, near the southern limit of the country. It occupies an area of 5,220 square miles (13,520 square km) and rises to a maximum elevation of 660 feet (200 m). In its upper reaches the terrain of Tihāmit al-Yaman changes into jagged valleys incised in low plateaus. Seven major wadis, including the Maur, Surdud, and Zabīd, allow for some agricultural activity; irrigated fields are scattered among extensive chains of sand dunes. Dates, tobacco, and cotton are major crops. Salt is mined at As-Sālif. Fishing is based at the shallow Red Sea ports of Al-Luhayyah, Al-Ḥudaydah, Al-Ghulayfigah, and Mocha, which are also the region's manufacturing centres.

**Tihert** (Algeria): *see* Tiaret.

**Tijāniyah,** an especially proselytizing order of Islāmic mystics (Ṣūfīs) widespread in northern and western Africa and the Sudan. Founded by Aḥmad At-Tijānī (1737–1815), formerly of the Khalwatī order, about 1781 in Fez, Mor., it places great emphasis on good intentions and actions rather than on elaborate or extreme ritual.

**Tijuana,** city, northwestern Baja California Norte *estado* ("state"), northwestern Mexico. The city lies along the Tecate River near the Pacific Ocean and is 12 miles (19 km) south of San Diego, Calif., U.S. It originated as a ranch settlement on part of a land grant (1862) and developed as a border resort with gambling casinos. In the 20th century it became the main entry point to Mexico from California for American tourists, and tourism remains its most important economic activity. From 1950 to the mid-1990s Tijuana's population increased more than tenfold.

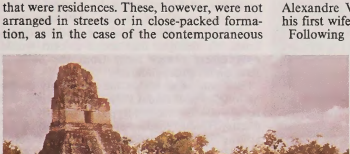
Many American-owned *maquiladoras* (assembly plants) opened in the area from the 1960s. Its manufactures include food products, soft drinks, and beer. Vast areas of surrounding farmland were opened up for the cultivation of wheat, barley, and wine grapes through irrigation schemes, which contribute to the city's shortage of potable water, much of which is supplied via aqueduct from the Colorado River. The city is easily accessible by railroad, highway, and air from the southwestern United States and from many points in Mexico. Pop. (1990) 698,752.

**Tikal,** city and ceremonial centre of the ancient Maya civilization. The largest urban centre in the southern Maya lowlands, it stood in what is now the northwestern part of the region of Petén, Guat., in a tropical rain forest. Like many Maya centres of the southern lowlands, it was first occupied as a small village in the Middle Formative Period (900–300 BC); subsequently, in the Late Formative Period (300 BC–AD 100), it became an important ceremonial centre with the construction of major pyramids and temples. Its heyday, however, came in the Late Classic Period (AD 600–900), with the planning and construction of its great plazas, pyramids, and palaces, the appearance of Maya hieroglyphic writing and complex systems of time-counting, and the flowering of Maya art as seen in monumental sculpture and vase painting.

The numerous dedicatory stelae at the site date from the 3rd century AD until the close of the 9th century. Such stelae, usually bearing the carved features of a priest or other important person, are inscribed with hieroglyphs and dates.

The main structures of Tikal, presumably temples and palaces for the upper class, cover approximately 1 square mile (2.5 square km). Surveys in a larger area, encompassing at least 6 square miles (15.5 square km), have revealed numerous outlying smaller structures

that were residences. These, however, were not arranged in streets or in close-packed formation, as in the case of the contemporaneous



The Great Plaza at Tikal, showing (foreground) stelae, (left) the Temple of the Great Jaguar, and (right) the Palace of the Nobles

Josef Muench

central Mexican city of Teotihuacán, but were rather widely separated. It is estimated that at its height (*c.* AD 700) the core of Tikal had a population of about 10,000 persons but that the centre drew upon an outlying population of approximately 50,000.

In the Early Classic Period, Tikal was an important post in the great trading network that Teotihuacán had established in southern Meso-America. Tikal continued to flourish after the decline of Teotihuacán and probably extended its hegemony over a large part of the southern lowlands in the Late Classic Period. Between AD 600 and 800, Tikal reached its architectural and artistic peak. After AD 800 a decline set in, with depopulation and a general artistic decline. The last dated stela at the site is placed at 889. Small groups continued to live at the site for another century or so, but Tikal, along with the other Maya centres of the southern lowlands, was abandoned by the 10th century.

**Tikhomirov, Vasily Dmitrievich** (b. March 30, 1876, Moscow, Russia—d. June 20, 1956, Moscow), ballet dancer and influential teacher who helped develop the vigorous style and virtuosity of the Bolshoi Ballet in Moscow. He trained such dancers as Mikhail Mordkin,



Tikhomirov and Yekaterina Geltzer in *Dance Dream*, 1911

Sovfoto

Alexandre Volinine, and Yekaterina Geltzer, his first wife and frequent dance partner.

Following his graduation in 1891 from the Imperial Ballet School, Moscow, Tikhomirov studied for two years in St. Petersburg before joining the Bolshoi and becoming premier danseur (1893). His greatest roles included Jean de Brienne in *Raymonda;* Conrad in *Le Corsaire;* and the Soviet Captain, whose role he created in his own version, in *The Red Poppy* (1927; later retitled *The Red Flower*), the first Soviet ballet incorporating communist doctrine. In addition to choreographing portions of *The Red Poppy,* Tikhomirov staged revivals of *La Bayadère* and *The Sleeping Beauty* (1924) and a new version of *Esmeralda* (1926). In 1914 he toured as Anna Pavlova's partner.

Tikhomirov began to teach soon after his return from St. Petersburg and officially joined the Bolshoi school staff in 1896. From 1924 to 1937 he served as its director. He was largely responsible for maintaining the school after the Revolution of 1917, and, with Geltzer, he helped preserve the classic technique. His own vigorous, masculine style of dancing contributed much to developing the strong technical and dramatic qualities that became characteristic of the Bolshoi Ballet.

**Tikhon,** SAINT, Russian SVYATOY TIKHON, original name VASILY IVANOVICH BELAVIN (b. Dec. 19 [Dec. 31, New Style], 1865, Toropets, near Pskov, Russia—d. April 7, 1925, Moscow; canonized Oct. 9, 1989), patriarch of the Russian Orthodox church following the Bolshevik Revolution of 1917. At first sharply resisting the new Soviet state's antiecclesiastical legislation, he refused to cooperate with a schismatic, state-supported, and politically oriented element of the clergy known as the "Living Church," but later, seeking a mitigation of government repression, he assumed a more flexible position.

The son of a Russian Orthodox priest, Vasily Belavin took a degree at St. Petersburg Theological Academy and, after becoming a monk in 1891, took the name Tikhon in the Russian Orthodox tradition. He rose quickly in the church; after a period of teaching, he became successively bishop of Lublin (now in Poland) in 1897 and of Alaska in 1898. From 1905 to 1907 he resided in New York City as bishop of the Russian Orthodox church in North America. In this capacity Tikhon adapted Russian ecclesiastical structure and worship to the local cultural milieu, decentralizing control, establishing several Russian Orthodox theological schools, and assisting with an English service book of the Russian Orthodox liturgy.

Tikhon returned to Russia in 1907 as bishop of Yaroslavl, near Moscow. He was elected metropolitan (archbishop) and patriarch of Moscow by the All-Russian Church Council assembled in August 1917 to reorganize the Orthodox church and restore the patriarchal office suppressed in 1721 by Tsar Peter I the Great. When the Bolsheviks came to power in 1917, they nationalized Orthodox church lands, took over all Orthodox schools and seminaries, withdrew all state subsidies to the church, and established exclusively civil marriages. In 1918 the Russian Orthodox church and the state were completely separated, and the church was dispossessed of its legal rights; this opened the way for many local attacks on priests and also led to the widespread looting of churches. Tikhon, who as patriarch wielded effective moral authority among the church membership, initially condemned the Soviet government's actions, but during the 1918–22 civil war he declined any partisanship.

On intransigently opposing further government confiscation of church valuables during the famine of 1921–22, and because he was suspected of having conspired with emigrant clerics, Tikhon was imprisoned in a neighbouring monastery. He was not brought to trial, possibly because of English political pressure. With the failure of the Living Church movement to rally continued support from both people and government, he was released in June 1923 and allowed limited executive activity after signing an acknowledgment of the Soviet regime's legitimacy and condemning all counterrevolutionary actions taken against it. Tikhon's remaining years were spent in consolidating his control of the church and resolving internal conflicts fomented by remnants of the Living Church faction amid severe political harassment.

**Tikhonov, Nikolay Aleksandrovich** (b. May 1 [May 14, New Style], 1905, Kharkov, Ukr., Russian Empire [now Kharkiv, Ukr.]—d. June 1, 1997, Moscow, Russia), premier of the Soviet Union from 1980 to 1985, a staunch Communist Party member closely associated with former Soviet president and Communist Party chairman Leonid Brezhnev.

Born into a middle-class Ukrainian family, Tikhonov graduated from the Metallurgical Institute in Dnepropetrovsk in 1930 and later went to work for the Nikopol Pipe Factory in the Ukraine, working his way up from engineer to plant manager. As a party member he was also successful, serving as first secretary of the local Dnepropetrovsk committee from 1947 to 1950 and later becoming first a deputy minister and then a minister in Moscow in the late 1950s, overseeing economic affairs. In 1963 he became deputy chairman of the State Planning Committee; and in 1965, after Brezhnev became party leader, he was named deputy prime minister. Although he did not become a member of the Politburo until late in 1979, he was chosen to succeed the ailing Aleksey Kosygin as premier of the Soviet Union just two months before Kosygin's death in December 1980. Regarded as a loyal and dutiful but not particularly effective premier, the ailing Tikhonov retired from his post as premier in 1985 but remained a member of the Central Committee of the Communist Party until mid-1989, when he was ousted.

**Tikhonov, Nikolay Semyonovich** (b. Nov. 22 [Dec. 4, New Style], 1896, St. Petersburg, Russia—d. Feb. 8, 1979, Moscow), Soviet poet and prose writer, notable for his heroic war ballads and for his originality and poetic experimentation.

Tikhonov was born into a middle-class family and received a rather poor formal education. He fought in a hussar regiment during World War I, later joining the Red Army and participating in the Russian Revolution of 1917 and the Russian Civil War. During the early 1920s he settled in Leningrad and

became a member of the Serapion Brothers, a literary group whose members admired the Romanticism of the 19th-century German writer E.T.A. Hoffmann. In his first two collections of poetry, *Orda* (1922; "The Horde") and *Braga* (1922; "Mead"), Tikhonov sought to express the sensations of his years of war and adventure. He drew inspiration from the Bolshevik Revolution, which he viewed as a release of tremendous energy and as an opportunity to learn and exhibit courage. These and other early poems show the influence of Acmeism in their use of concrete images, pictorial detail, and semantic precision.

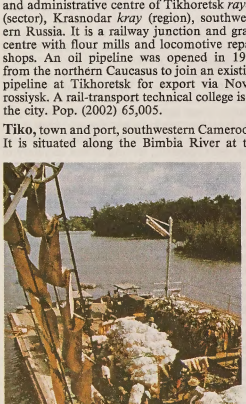
In the mid-1920s, under the influence of the poets Velimir Khlebnikov and Boris Pasternak, Tikhonov experimented in his poetry. He traveled to the East and to Central Asia, gaining new materials and new tones and colours.

In the early 1930s Tikhonov began to concern himself in his poetry more with broad social issues. His prose works, however, continued to be romantic in style and in spirit, as in his short stories depicting socialist construction projects in Central Asia. A staunch supporter of the Soviet regime and an ardent patriot, he stressed during World War II the same ideals of duty and courage that he had emphasized in his earlier writings.

Tikhonov's literary and political work (he served as a Soviet cultural ambassador on several occasions and also wrote propaganda) earned him three Orders of Lenin, three Stalin Prizes, and a Lenin Prize. He served as chairman of the Union of Soviet Writers from 1944 to 1946. During the late 1950s Tikhonov alienated many other Soviet writers because of his participation in a campaign of criticism and denunciation directed against the Soviet poet and novelist Boris Pasternak.

**Tikhoretsk**, also spelled TICHORETSK, city and administrative centre of Tikhoretsk *rayon* (sector), Krasnodar *kray* (region), southwestern Russia. It is a railway junction and grain centre with flour mills and locomotive repair shops. An oil pipeline was opened in 1969 from the northern Caucasus to join an existing pipeline at Tikhoretsk for export via Novorossiysk. A rail-transport technical college is in the city. Pop. (2002) 65,005.

**Tiko**, town and port, southwestern Cameroon. It is situated along the Bimbia River at the Gulf of Guinea, 12 miles (19 km) east of Limbe (formerly Victoria). The port's activity has declined in the face of increasing competition from Douala and Limbe, but it remains significant as a distribution and processing centre for produce grown on plantations to the north. Coffee, cocoa, hardwood, bananas, rubber, aluminum, and palm oil and kernels are exported. The town's principal industries include a rubber factory, an iron foundry, and light railway engineering. Pop. (1992 est.) 29,093.



Loading bananas onto a ship at Tiko, Cameroon

Syndication International Ltd., London

*Consult the* INDEX *first*

**Tikrīt**, also spelled TAKRIT, or TEKRIT, town, north-central Iraq. It lies on the west bank of the Tigris River about 100 miles (160 km) northwest of Baghdad. In the 10th century Tikrīt had a noted fortress and was home to a large Christian monastery. Its wealth at that time derived from its production of woolen fabrics. Saladin, the Muslim founder of the Ayyūbid dynasty, was born at Tikrīt about 1137. The town was devastated in the late 14th century in the course of Timur's Mesopotamian campaigns, and it remained a mere village until the 20th century, when it began to grow again. Modern Tikrīt is best known as the birthplace (1937) of the Iraqi leader Saddam Hussein. It was the last major Iraqi city to fall to U.S. troops during the Second Persian Gulf War (2003). Pop. (2004 est.) 30,600.

**Tikuna** (people): *see* Tucuna.

**tilak**, Sanskrit TILAKA ("mark"), in Hinduism, a mark generally made on the forehead, indicating a man's sectarian affiliation. The marks are made by hand or with a metal stamp, using ash from a sacrificial fire, sandalwood paste, turmeric, cow dung, clay, charcoal, or red lead. Among some cults the mark is made on 2, 5, 12, or 32 parts of the body as well as on the forehead. Among Śaivas (followers of Śiva), the tilak usually takes the form of three horizontal parallel lines across the forehead, with or without a red dot. Sometimes a crescent moon or trident denotes a Śaiva. Among Vaishnavas (followers of Vishnu), the many tilak variations follow a general pattern of two or more vertical lines resembling the letter *U* and representing the foot of Vishnu, with or without a central line or dot.

The marks worn by women on the forehead (most commonly a red dot for unwidowed women) may also indicate sect affiliation; more frequently, however, they vary according to the fashion prevailing in a particular part of India.

**Tilak, Bal Gangadhar** (b. July 23, 1856, Ratnāgiri, India—d. Aug. 1, 1920, Bombay), scholar, mathematician, philosopher, and militant nationalist who helped lay the foundation for India's independence. He founded (1914) and served as president of the Indian Home Rule League and, in 1916, concluded the Lucknow Pact with Mohammed Ali Jinnah, which provided for Hindu-Muslim unity in the struggle for independence.

Tilak was born into a cultured, middle-class, Brahman family. After taking his university degree, Tilak studied law but then decided to teach mathematics in a private school in Pune (Poona), which was to become the centre of his political career. He developed the school into a university college after founding the Deccan Education Society (1884), which aimed at educating the masses, especially in the English language. He then turned to the task of awakening the political consciousness of the people through two weekly newspapers: *Kesari* ("The Lion"), published in Marāthi, and *The Mahratta*, published in English. Through these newspapers Tilak became widely known for his bitter criticisms of British rule and also of those moderate nationalists who advocated social reforms along Western lines and political reforms along constitutional lines. He thought that social reform would only divert energy away from the political struggle for independence.

Tilak sought to widen the popularity of the nationalist movement (which at that time was largely confined to the upper classes) by introducing Hindu religious symbolism and by invoking popular traditions of the Marāthā struggle against Muslim rule. He thus organized two important festivals, Ganesh, in 1893, and Shivaji, in 1895. Ganeśa (Ganesh) is the elephant-headed god worshiped by all Hindus; Śivājī (Shivaji), the first Hindu hero to fight against Muslim power in India, was the founder of the Marāthā state, which in the course of time overthrew Muslim power in India. But, though this symbolism made the nationalist movement more popular, it also made it more communal and thus alarmed the Muslims.

Tilak's activities soon brought him into conflict with the British government, which prosecuted him for sedition and sent him to jail in 1897. The trial and sentence earned him the title Lokamanya ("Beloved Leader of the People"). When Lord Curzon, viceroy of India, partitioned Bengal in 1905, Tilak strongly supported the Bengali demand for the annulment of the partition and advocated a boycott of British goods that soon became a movement sweeping the nation. The following year he set forth a program of passive resistance, known as the Tenets of the New Party, that he hoped would destroy the hypnotic influence of British rule and prepare the people for sacrifice in order to gain independence. These forms of political action initiated by Tilak—the boycotting of goods and passive resistance—were later adopted by Mohandas K. Gandhi in his program of nonviolent noncooperation with the British.

Tilak's approach was strong fare for the moderate party in the National Indian Congress, which believed in making "loyal" representations to the government for small reforms. Tilak aimed at Swarajya (Independence), not piecemeal reforms, and attempted to persuade the Congress to adopt his militant program. On this issue, he clashed with the moderates at the Surat session of the Congress in 1907. Taking advantage of the split in the nationalist forces, the government again prosecuted Tilak on a charge of sedition and inciting terrorism and deported him to Mandalay, Burma (Myanmar), to serve a sentence of six years' imprisonment. In Mandalay jail, Tilak settled down to write his magnum opus, the *Bhagawadgita-Rahasya* ("Secret of the *Bhagavadgītā*"), an original exposition of the most sacred book of the Hindus. Tilak discarded the orthodox interpretation that the *Bhagavadgītā* taught the ideal of renunciation; in his view it taught selfless service to humanity.

On his release in 1914, on the eve of World War I, he once more plunged into politics and launched the Home Rule League with the rousing slogan "Swarajya is my birthright and I will have it." In 1916 he rejoined the Congress and signed the historic Lucknow Pact, a Hindu-Muslim accord, with Mohammed Ali Jinnah, the future founder of Pakistan. Tilak visited England in 1918 as president of the Indian Home Rule League. He realized that the Labour Party was a growing force in British politics, and he established firm relationships with its leaders; his foresight was justified: it was a Labour government that granted independence to India in 1947. Tilak was one of the first to maintain that Indians should cease to cooperate with foreign rule, but he always denied that he had ever encouraged the use of violence.

By the time Tilak returned home in 1919 to attend the meeting of the Congress at Amritsar, he had mellowed sufficiently to oppose

Gandhi's policy of boycotting the elections to the legislative councils established as part of the Montagu–Chelmsford reforms. Instead, Tikal advised the delegates to follow his policy of "responsive cooperation" in carrying out the reforms, which introduced a certain degree of Indian participation in regional government. But he died before he could give the new reforms a decisive direction. In their tributes, Mahatma Gandhi called him "the Maker of Modern India" and Jawaharlal Nehru, "the Father of the Indian Revolution."

BIBLIOGRAPHY. The first authoritative biography in English published outside India is D.V. Thamankar, *Lokamanya Tilak* (1956); S.L. Karandikar, *Lokamanya Bal Gangadhar Tilak: The Hercules and Prometheus of Modern India* (1957), is a chronological treatment.

**Tilapia,** genus of fishes belonging to the family Cichlidae (order Perciformes), represented by numerous, mostly freshwater species native to Africa. *Tilapia* species are perhaps best known because of their potential as an easily raised and harvested food fish. Their commercial advantages include fast growth, resistance to disease, and a diet of readily abundant algae and zooplankton. The use of *Tilapia* in warm-water aquaculture systems dates back to the early Egyptian civilization. They have since been introduced into freshwater habitats in many warm parts of the world.

**Tilburg,** *gemeente* (municipality), Noordbrabant *provincie* (province), southern Netherlands, on the Wilhelmina Canal. A small village until 1860, it grew rapidly into one of the chief industrial centres of the south; woolen textiles are of prime importance. The town hall is the former palace of King William II, who died there in 1849. Much of the surrounding area is wooded; there is a 375-acre (152-hectare) recreation and amusement park, De Efteling, 8 miles (13 km) north. Pop. (1985 est.) 153,812; metropolitan area, 222,397.

**Tilbury,** port in Thurrock district, county of Essex, England. It lies along the north bank of the River Thames, opposite Gravesend, 26 miles (42 km) downstream of London Bridge. It is famous for its docks, constructed 1884–86, which have been extensively modernized and extended by the Port of London Authority. Tilbury is now the principal container port of the Port of London: "roll-on, roll-off" facilities have been provided since 1965. The quays extend more than 4 miles (6.5 km), and the riverside landing stage, 1,142 feet (348 m) long, enables the largest ships to embark or disembark passengers at any stage of the tide. Pop. (1981) 11,468.

**Tilden, Bill,** byname of WILLIAM TATEM TILDEN II (b. Feb. 20, 1893, Philadelphia—d. June 5, 1953, Hollywood), American tennis player who dominated the game for more than a decade, winning seven U.S. championships, three Wimbledons, and two professional titles. His overpowering play and temperamental personality made him one of the most colourful sports figures of the 1920s.

Tilden learned to play tennis at the Germantown Cricket Club in Philadelphia, where his wealthy parents were members. Although he won the 1913 U.S. mixed doubles with Mary Browne, he did not reach the finals of the U.S. singles championship until 1918. Considered a late bloomer, he won the U.S. title from 1920 to 1925 and again in 1929. He also won several doubles (1918, 1921–23, 1927) and mixed doubles (1913–14, 1922–23) for a record total of 16 U.S. titles.

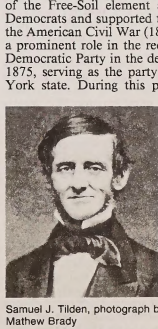
Tilden became the first American player to win the men's championship at Wimbledon in 1920 and repeated this victory in 1921 and 1930. Among his other titles were many indoor U.S. championships and Italian singles, men's doubles and French mixed doubles, all in 1930. His Davis Cup play was outstanding, and his 21 of 28 cup matches helped the United States hold the trophy from 1920 to 1926.



Bill Tilden
Culver Pictures

**Tilden, Samuel J(ones)** (b. Feb. 9, 1814, New Lebanon, N.Y., U.S.—d. Aug. 4, 1886, Greystone, N.Y.), lawyer, governor of New York, and Democratic presidential candidate in the disputed election of 1876.

Tilden attended Yale College and the University of the City of New York for brief periods and studied law. He began to practice law in New York City in 1841. Despite frequent illnesses, he soon became a corporation and railroad lawyer of great skill and a leader in Democratic politics. He was a member of the New York Assembly in 1846 and was a member of the state constitutional conventions (1846 and 1867). He was a leader of the Free-Soil element among New York Democrats and supported the Union cause in the American Civil War (1861–65). He played a prominent role in the reorganization of the Democratic Party in the decade from 1865 to 1875, serving as the party chairman of New York state. During this period he played a major role in the overthrow of the notorious Tweed Ring, a circle of corrupt politicians who had defrauded New York City of an estimated $30,000,000–$200,000,000, and in the removal of several corrupt judges. Elected governor (1874) on a reform platform, he won national recognition for his efficient administration and for exposing the Canal Ring, a conspiracy of politicians and contractors engaged in defrauding the state.



Samuel J. Tilden, photograph by Mathew Brady
By courtesy of the Library of Congress, Washington, D.C.

In 1876 Tilden was the Democratic nominee for the presidency. The bitterly fought campaign ended in a disputed election in which Florida, Louisiana, South Carolina, and Oregon reported two sets of returns. To settle the controversy, an Electoral Commission (*q.v.*) was created by Congress. Tilden reluctantly consented to the formation of the commission but failed to provide vigorous and direct leadership in the crisis. The commission decided all questions by a strictly partisan vote, thus giving the presidency to the Republican candidate, Rutherford B. Hayes. There is evidence that the Republicans entered into a secret deal with Southern Democratic leaders to withdraw Federal troops from the South (where they were safeguarding Reconstruction) if the disputed electoral votes could be counted for Hayes. Tilden, who had received a clear majority of the popular vote, nevertheless accepted the verdict to avoid possible violence.

Tilden was a distant, secretive, dilatory, and cautious man who possessed marked intellectual ability. His frail health and characteristic indecision forced him into the background of politics after 1877, though he retained great influence in the Democratic Party. His law practice and investments had brought him great wealth, and he left the bulk of his estate in trust for the establishment of a free public library for New York City. An authoritative biography is A.C. Flick and G.S. Lobrano's *Samuel Jones Tilden* (1939).

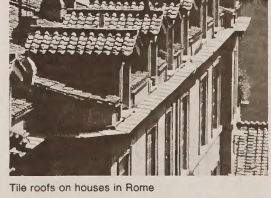
**Tilden–Hayes affair,** disputed U.S. presidential election of 1876, resolved by a special Electoral Commission (*q.v.*).

**Tildy, Zoltán** (b. Nov. 18, 1889, Mosonmagyaróvár, Hung., Austria-Hungary—d. Aug. 3, 1961, Budapest), non-Communist statesman who was president of Hungary for a short time after World War II and a member of the 1956 anti-Soviet revolutionary government.

Trained as a Protestant reformed minister, Tildy studied theology in Belfast, Ire. After his return to Hungary, he taught at a high school and later became pastor of a parish. He entered politics after World War I and helped to found the middle-of-the-road Smallholders' Party. He was elected to Parliament in 1936.

After World War II he became president of his party and premier (1945). In 1946–48 Tildy served as president of the Hungarian Republic, resigning ostensibly because of his son-in-law's conviction for treason, but more because of the increasing Sovietization of Hungarian life. For several years Tildy was held under house arrest, but he was rehabilitated in August 1956. From October 28 to November 4 of that year, he joined Imre Nagy's revolutionary government as minister of state. After the suppression of the government by Soviet troops, Tildy was sentenced to a prison term of six years but was released three years later.

**tile,** thin, flat slab or block used structurally or decoratively in building. Traditionally, tiles have been made of glazed or unglazed fired clay, but modern tiles are also made of plastic, glass, asphalt, or asbestos cement. Acoustical tiles are manufactured from fibreboard or



Tile roofs on houses in Rome
B. Pellegrini—M. Grimoldi

other sound-absorbing materials. Glass blocks are used in partitions. Hollow, ceramic-glazed structural tile is used for partitions in public buildings.

Roof tiles of some Greek temples were made of marble; in ancient Rome, of bronze. Stone slabs used for roofing in parts of England are called tiles. Many rough forms of terra-cotta are called tiles when used structurally. The steel forms for casting certain types of reinforced concrete floors are referred to as steel tiles.

Modern ceramic roofing tile, similar to brick, is substantially the same in form as the classic ancient types; improvements have been made only in manufacturing methods, not in design. The most common type of covering for a small house roof in England and parts of France is flat tile designed to hook over roof battens or boards. In Italy, Spain, Greece, and Turkey, pitched roofs are covered with a layer of concave tiles, with convex over-tiles. Around the Mediterranean, tiles of S-shape section are commonly used. Curved tiles are almost always laid in overlapping rows in heavy, waterproof mortar, with the roof's ridges and hips covered by courses of similarly bedded tiles. With flat tiles, the use of mortar is restricted to the convex or pointed tiles covering the hips and ridges.

Floor tiles are usually made in small geometric shapes. They are machine-pressed, made of fine clays, thoroughly vitrified, and very hard. A gritty substance such as silicon carbide may be added to prevent slipping, even when the tile is wet.

Wall tiles were first made in ancient Syria, the Tigris-Euphrates valley, and Persia. By the 13th century the manufacture of wall tiles for both exterior and interior use was well established in Persia. By the 14th century a tile developed in Germany and used principally for stoves, with ornament in relief and a glaze of green, yellow, or brown, was in widespread use in northern Europe; blue-painted tiles made in Delft, Neth., from 1600 on were especially renowned. Modern wall tiles may be highly glazed and semivitreous or structural ceramic tile made of fireclay or shale.

**tilefish,** also called BLANQUILLO, any of two dozen species of elongated marine fishes in the family Branchiostegidae (order Perciformes), with representatives occurring in tropical and warm temperate seas. The family Malacanthidae is used synonymously for Branchiostegidae by some taxonomists.

The most commercially important species, known specifically as the tilefish (*Lopholatilus chamaeleonticeps*), is the largest, often attaining lengths of more than 90 cm (3 feet). The tilefish has a peculiar history as a commercial fish. Living at depths of 60–365 m (200–1,200 feet), the species was not known until 1879, when it became commercially attractive because of its abundance in the western Gulf Stream. Then, in 1882, hundreds of millions of dead tilefish were brought to the surface after a series of severe storms. No living specimens were seen for the next 10 years, although commercial harvests later resumed. The tilefish dieoff is now thought to have been caused by the upwelling of cold waters into the fishes' customary warm-water habitat.

**Tiliaceae,** linden or basswood family, consisting of about 35 genera of mostly shrubs and trees, widely distributed. The following genera are notable for ornamental species: *Tilia,* including the linden (*q.v.*) trees; *Sparmannia,* including the indoor linden, or African hemp, a shrubby greenhouse or window plant; and *Grewia,* with about 90 species of shrubs, climbers, and small trees cultivated in the tropics and subtropics.

Commercially important genera include *Corchorus,* the source of jute (*q.v.*); *Clappertonia,* with tropical African trees providing a jutelike fibre; and *Berrya* and *Luehea,* East Indian and tropical American trees, respectively, that yield wood for construction.

**Tilimsen** (Algeria): *see* Tlemcen.

**till,** in geology, unsorted material deposited directly by glacial ice and showing no stratification. Till is sometimes called boulder clay because it is composed of clay, boulders of intermediate sizes, or a mixture of these. The rock fragments are usually angular and sharp rather than rounded, because they are deposited from the ice and have undergone little water transport. The pebbles and boulders may be faceted and striated from grinding while lodged in the glacier. Some till deposits show limited organization of the fragments: large numbers of stones may lie with their long axes parallel to the flow direction of the glacier. This could provide more accurate information about flow direction than other glacial indicators. Although difficult to distinguish by appearance, there are two types of till, basal and ablation. Basal till was carried in the base of the glacier and commonly laid down under it. Ablation till was carried on or near the surface of the glacier and was let down as the glacier melted.

*Consult the* INDEX *first*

**till-less agriculture,** also called NO-TILL AGRICULTURE, cultivation technique in which the soil is disturbed only along the slit or in the hole into which the seeds are planted; reserved detritus from previous crops covers and protects the seedbed. The practice is one of several primitive farming methods that have been revived as conservation measures in the 20th century.

In the absence of tillage, which stimulates weed growth, fewer weeds vie with a farmer's crop for available nutrients, thus decreasing chemical fertilizer requirements. The vegetation canopy protects seedlings when they are most vulnerable to the ravages of nature, but it also lowers the soil surface temperature and limits the practicality of using the till-less system in some areas to varieties suited to cooler seedling-growing conditions.

A primary benefit of the protection and minimal disturbance of topsoil is a decreased rate of soil erosion. The till-less technique reduces equipment, fuel, and fertilizer needs and, significantly, the time required for tending crops. The method improves soil-aggregate formation, microbial activity in the soil, and water infiltration and storage, while enabling cultivation on slopes of up to 15 percent. Crops suited to the technique include corn (maize), pigeon pea, cowpea, and soybean. Some resistance to till-less agriculture and its variations has come from machinery manufacturers and from farmers themselves, to many of whom the debris-laden fields required by the procedure connote inferior farming.

**tillage,** in agriculture, the preparation of soil for planting and the cultivation of soil after planting. *See* cultivator; harrow; plow.

**Tillandsia,** the most widely distributed genus of the pineapple family (Bromeliaceae), containing about 500 species of tropical American plants. They are mainly perennial herbs that are epiphytic (supported by other plants and having aerial roots exposed to the humid atmosphere).

The leaves of some members grow in rosettes; others hang loosely from their aerial perches. Those in rosettes often are flared and overlap at the base, forming a cup that holds rainwater. The leaves often are coloured or are grayish or silvery. The flowers are showy in some species, inconspicuous in others. Spanish moss (*q.v.; T. usneoides*) is sometimes used for packing or upholstery; *T. xiphoides,* a South American species, has strongly scented flowers that are sometimes used locally in medicines for respiratory diseases.

**Tillemont, Sébastien Le Nain de,** in full LOUIS-SÉBASTIEN LE NAIN DE TILLEMONT (b. Nov. 30, 1637, Paris, France—d. Jan. 10, 1698, Tillemont), French ecclesiastical historian who was one of the earliest scholars to provide a rigorous appraisal of preceding historical writing. His works were objective and among the first of modern historical works to include a critical discussion of the principal sources for each period.

The son of a wealthy lawyer, Tillemont attended Port-Royal, the famous school of the Jansenists, who advocated an austere form of Roman Catholicism. He began his researches early (1655), scrupulously collecting literary and historical information concerning early Christianity. After entering the seminary at Beauvais (1661), Tillemont collaborated in publishing an edition of the writings of the Church Fathers (1669). In 1667 he took up residence at Port-Royal, becoming chaplain (1675) and later priest (1676). The Jansenist persecutions of 1679 forced him to settle on the family estate of Tillemont, where he remained, continuing his studies in church history until his death.

Tillemont's writings began to appear during his lifetime; the *Mémoires pour servir à l'histoire ecclésiastique des six premiers siècles,* 16 vol. (1693–1712; "Memoirs Useful for the Ecclesiastical History of the First Six Centuries"), and *Histoire des empereurs,* 6 vol. (1690–1738; "History of the Emperors"), were originally conceived as one work but were published separately. These books deal with the history of the Christian church and the Roman Empire to about AD 515, giving highly objective accounts as well as citing original sources. They were among the chief sources used by the English historian Edward Gibbon in his *Decline and Fall of the Roman Empire.*

**Tiller, Terence,** in full TERENCE ROGERS TILLER (b. Sept. 19, 1916, Truro, Cornwall, Eng.—d. Dec. 24, 1987, London), English playwright, translator, and gifted metaphysical poet whose best verse is noted for its perfect form and intense emotional content.

Until the outbreak of World War II, Tiller was a research scholar and eventually lecturer in medieval history at the University of Cambridge. From 1939 to 1946 he lectured in English history and literature at Fu'ād I University, Cairo, and from 1946 to 1976 he was employed by the British Broadcasting Corporation (BBC) as a radio writer and producer, first in the features department (1946–65) and then in the drama department (1965–76). From 1976 Tiller worked as both a freelance writer and broadcaster.

Of his major poetry collections, *The Inward Animal* (1943) and *Unarm, Eros* (1947) are his most highly acclaimed. Strong formal pattern, heraldic imagery, and striking sensuousness are combined to produce a masterly and genuinely witty effect. His later volumes, *Reading a Medal and Other Poems* (1957), *Notes for a Myth and Other Poems* (1968), and *That Singing Mesh and Other Poems* (1979), contain many outstanding poems; however, on the whole, the collections lack the tension and concreteness that give *The Inward Animal* and especially *Unarm, Eros* their immediacy.

In addition to his poetry and the hundreds of radio plays and feature broadcasts he wrote for the BBC, Tiller wrote several prose pieces and edited and translated a number of books.

**Tillett, Benjamin** (b. Sept. 11, 1860, Bristol, Gloucestershire, Eng.—d. Jan. 27, 1943, London), English trade union leader who directed successful dock strikes in 1889 and 1911. Tillett was also an alderman of the London County Council (1892–98) and a Labour

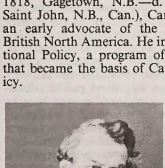


Tillett, c. 1880
BBC Picture Library

member of Parliament (for North Salford, Lancashire, in 1917–24 and in 1929–31).

The son of a railway labourer, Tillett settled in the East End of London when he was in his early 20s. There he helped to organize, and became general secretary of the Dock, Wharf, Riverside, and General Workers' Union, about which he later wrote *A Brief History of the Dockers' Union* (1910). The dock strike of 1889 secured a minimum wage (*6d.* an hour, called the "dockers' tanner") and a great increase in union membership. In 1921 Tillett's union joined others in forming the Transport and General Workers' Union, after which his importance diminished somewhat.

**Tilley, Sir Samuel Leonard** (b. May 8, 1818, Gagetown, N.B.—d. June 25, 1896, Saint John, N.B., Can.), Canadian politician, an early advocate of the confederation of British North America. He introduced the National Policy, a program of trade protection that became the basis of Canadian fiscal policy.



Samuel Leonard Tilley, 1869
By courtesy of the Public Archives of Canada

Tilley acquired considerable wealth in the pharmaceutical business and entered politics in 1850 as a member of the New Brunswick legislature, becoming provincial secretary in 1854 and premier in 1861. He represented New Brunswick in the confederation conferences of 1864, and his defeat in an 1865 general election over the confederation question delayed the progress of negotiations.

Returning to power in 1866, Tilley attended the London conference that passed the British North America Act (1867), creating the Dominion of Canada. He was first minister of customs and excise for the dominion, and he served as minister of justice in Sir John Macdonald's administration in 1873. After five years as lieutenant governor of New Brunswick (1873–78) Tilley was elected to the Dominion Parliament for Saint John and was again minister of finance in Macdonald's government, in which office he introduced and applied the National Policy. He was knighted in 1879. In 1885–93 he was once again lieutenant governor of New Brunswick.

**Tilley, Vesta,** original name MATILDA ALICE POWLES, married name LADY DE FRECE (b. May 13, 1864, Worcester, Worcestershire, Eng.—d. Sept. 16, 1952, London), English singing comedienne who was the outstanding male impersonator in music-hall history.

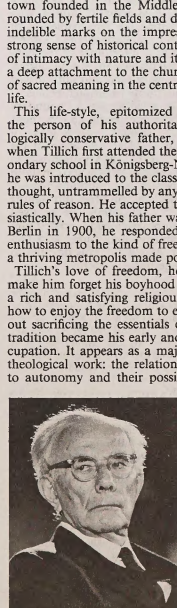
The daughter of a music-hall performer, she appeared on the stage at three and first played in male attire two years later. Before she was 14, she was playing in two different London music halls each evening. From then until her retirement in 1920, Tilley headed the variety bill as a male impersonator in London, in the English provinces, and in the United States. In 1890 she married Walter de Frece (later Sir Walter), the composer of many of her songs. Two songs for which she was famous are "The Piccadilly Johnny with the Little Glass Eye" and "Following in Father's Footsteps."

**Tillich, Paul (Johannes)** (b. Aug. 20, 1886, Starzeddel, Brandenburg, Ger.—d. Oct. 22, 1965, Chicago), German-born U.S. theologian and philosopher whose discussions of God and faith illuminated and bound together the realms of traditional Christianity and modern culture. Some of his books, notably *The Courage to Be* (1952) and *Dynamics of Faith* (1957), reached a large public audience not usually concerned with religious matters. The three-volume *Systematic Theology* (1951–63) was the culmination of his rigorous examination of faith.

*Early life and education.* Born in Starzeddel, a village in the province of Brandenburg, Paul Tillich spent his boyhood years in Schönfliess, a small community east of the Elbe, where his father served as minister and diocesan superintendent in the Prussian Territorial Church. Life in Schönfliess—a walled town founded in the Middle Ages and surrounded by fertile fields and dark forests—left indelible marks on the impressionable boy: a strong sense of historical continuity, a feeling of intimacy with nature and its processes, and a deep attachment to the church as the bearer of sacred meaning in the centre of community life.

This life-style, epitomized for Tillich in the person of his authoritarian and theologically conservative father, was challenged when Tillich first attended the humanistic secondary school in Königsberg-Neumark, where he was introduced to the classical ideal of free thought, untrammelled by anything except the rules of reason. He accepted that ideal enthusiastically. When his father was transferred to Berlin in 1900, he responded with the same enthusiasm to the kind of freedom that life in a thriving metropolis made possible.

Tillich's love of freedom, however, did not make him forget his boyhood commitment to a rich and satisfying religious tradition; and how to enjoy the freedom to explore life without sacrificing the essentials of a meaningful tradition became his early and lifelong preoccupation. It appears as a major theme in his theological work: the relation of heteronomy to autonomy and their possible synthesis in theonomy. Heteronomy (alien rule) is the cultural and spiritual condition when traditional norms and values become rigid, external demands threatening to destroy individual freedom. Autonomy (self-rule) is the inevitable and justified revolt against such oppression, which nevertheless entails the temptation to reject all norms and values. Theonomy (divine rule) envisions a situation in which norms and values express the convictions and commitments of free individuals in a free society. These three conditions Tillich saw as the basic dynamisms of both personal and social life.



Tillich, 1965
Henri Dauman—LIFE Magazine, © Time Inc.

His early attempts to solve the problem took the form of working out an independent position in relation to his conservative father; in this context he learned to examine personal experiences in terms of philosophical categories, for the elder Tillich loved a good philosophical argument. But the decisive, seminal encounter with the problem came during his theological studies at the University of Halle (1905–12), where he was forced to match the doctrinal position of the Lutheran Church, based on the established confessional documents, against the theological liberalism and scientific empiricism that dominated the academic scene in Germany at that time.

*Development of his philosophy.* In his search for a solution Tillich found help in the writings of the German philosopher F.W.J. von Schelling (1775–1854) and the lectures of his theology teacher Martin Kähler. Schelling's philosophy of nature, which appealed to Tillich's own feeling for nature, offered a conceptual framework interpreting nature as the dynamic manifestation of God's creative spirit, the aim of which is the realization of a freedom that transcends the dichotomy between individual life and universal necessity. Kähler directed his attention to the doctrine of justification through faith, laid down by St. Paul and reiterated by Martin Luther.

Tillich now concluded that this doctrine, which he called the "Protestant principle," could be given a far wider scope than previously had been thought. Not limited to the classical religious question of how sinful man can be acceptable to a holy God, it could be understood to encompass man's intellectual life as well, and thus all of man's experiences. As the sinner is declared just in the sight of God, so the doubter is possessed of the truth even as he despairs of finding it, and so cultural life in general is subject both to critical negation and courageous affirmation. The rigid formulas of the Lutheran Church could thus be rejected while their essential content was affirmed.

Tillich's first attempts to work out the details of this insight were in the form of Schelling studies, dissertations for a doctorate in philosophy (1911) and a licentiat in theology (1912). In the latter work especially, *Mystik und Schuldbewusstsein in Schellings philosophischer Entwicklung* ("Mysticism and Consciousness of Guilt in Schelling's Philosophical Development"), one can discern a probing of the implications of the Protestant principle for the very nature and structure of reality, especially in his explication of Schelling's view of sin and redemption as a cosmic event embracing all existence.

Ordained a Lutheran clergyman on the conclusion of his university studies, Tillich served as a military chaplain during World War I. The war was a shattering experience to him, not only for its carnage and physical destruction but as evidence of the bankruptcy of 19th-century humanism and the questionableness of the adequacy of autonomy as sole guide. The chaotic situation in Germany after the armistice made him certain that Western civilization was indeed nearing the end of an era.

His practical response to this crisis was to join the Religious-Socialist movement, whose members believed that the impending cultural breakdown was a momentous opportunity for creative social reconstruction, a time that Tillich characterized by the New Testament term *kairos,* signifying a historical moment into which eternity erupts, transforming the world into a new state of being. But ideas, rather than political activity, were his main interest. At teaching posts in the universities of Berlin, Marburg, Dresden, Leipzig, and Frankfurt he participated eagerly in discussion groups searching for a new understanding of the human situation. He also wrote extensively, publishing more than 100 essays, articles, and reviews in the period 1919–33.

In most of these writings Tillich was using the insight he had gained at Halle as a norm in analyses of religion and culture, the meaning of history, and contemporary social problems. The remarkable work, *Das System der Wissenschaften nach Gegenständen und Methoden* ("The System of the Sciences According to Their Subjects and Methods," 1923), was his first attempt to render a systematic account of man's spiritual endeavours from this point of view. As early as 1925, in Marburg, he was also at work on what was to become his major opus, *Systematic Theology,* 3 vol. (1951–63).

*Departure from Nazi Germany.* Tillich's passionate concern for freedom made him an early critic of Hitler and the Nazi movement, and in retaliation he was barred from German universities in 1933—the first non-Jewish academician "to be so honoured," as he wryly put it. He then accepted an invitation to join the faculty at Union Theological Seminary in New York, and, despite initial difficulties with a new language and adapting his thought pattern to pragmatic American mental habits, he emerged as an "apostle to the skeptics" in his new homeland during the years following World War II. At Union Seminary (1933–55), Harvard University (1955–62), and the University of Chicago (1962–65), he engaged graduate and undergraduate students in searching dialogue concerning the meaning of human existence. His public lectures and books reached large audiences who did not usually show an interest in religious questions. In his most widely read books, *The Courage to Be* and *Dynamics of Faith,* he argued that man's deepest concern drives him into confrontation with a reality that transcends his own finite existence. Tillich's discussion of the human situation in these books shows a profound grasp of the problems brought to light by modern psychoanalysis and existentialist philosophy.

*Principal work.* The publication of his *Systematic Theology* made available the results of a lifetime of thought. The most novel feature of this work is its "method of correlation," which makes theology a dialogue relating questions asked by man's probing reason to answers given in revelatory experience and received in faith—theonomy's answers to autonomy's questions. The dialogue of *Systematic Theology* is in five parts, each an intrinsic element in the system as a whole: questions about the powers and limits of man's reason prepare him for answers given in revelation; questions about the nature of being lead to answers revealing God as the ground of being; questions about the meaning of existence are answered by the New Being made manifest in Jesus Christ; questions about the ambiguities of human experience point to answers revealing the presence of the Holy Spirit in the life process; and questions about human destiny and the meaning of history find their answers in the vision of the Kingdom of God. Readers of this and other works by Tillich have been impressed by the broad reach of his thought but also baffled by the philosophical terminology that he used in discussing God and faith. Those who see him as an advocate of agnosticism or atheism, however, may have misunderstood his intent. He rejected the anthropomorphic "personal God" of popular Christianity, but he did not deny the reality of God, as the conventional atheist has done. Modern "Christian atheists" who cite Tillich in support of their "God is dead" claim overlook the fact that for Tillich the disappearance of an inadequate concept of God was the beginning of a grander vision of God. Like Spinoza, he was a "God-intoxicated man" who wanted to help his fellow human beings recapture a relevant and dynamic religious faith.

In his last years Tillich expressed some doubts about the viability of any systematic account of man's spiritual quest. But he never abandoned the insight that came to him at the University of Halle—that all of man's cultural and spiritual life could be illuminated by the "Protestant principle" of justification by faith; he was still working out its implications at his death in 1965.

*Assessment.* Tillich was a central figure in the intellectual life of his time both in Germany and the United States. It is generally held that the 20th century has been marked by a widespread breakdown of traditional Christian convictions about God, morality, and the meaning of human existence in general. In assessing Tillich's role in relation to this development, some critics have regarded him as the last major spokesman for a vanishing Christian culture, a systematic thinker who sought to demonstrate the reasonableness of the Christian faith to modern skeptics. Others have viewed him as a forerunner of the contemporary cultural revolution, whose discussions of the meaning of God and faith served themselves to undermine traditional beliefs.

Tillich himself believed he was a "boundary man," standing between the old and the new, between a heritage imbued with a sense of the sacred and the secular orientation of the new age. He asserted that his vocation was to mediate between the concerns voiced by faith and the imperatives of a questioning reason, thus helping to heal the ruptures threatening to destroy Western civilization. He believed that from the beginning life had prepared him for such a role, and his long career as a theologian, educator, and writer was devoted to this task with single-minded energy.

(A.U.)

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The *Gesammelte Werke,* 11 vol. (1959–69), a collection of Tillich's writings, makes available his early and mostly untranslated works, including in vol. 1, *Frühe Hauptwerke. Systematic Theology,* 3 vol. (1951–63), is Tillich's major statement of the meaning of Christian faith, together with *The Courage to Be* (1952), and *The Dynamics of Faith* (1957).

Two important critical studies are Christoph Rhein, *Paul Tillich: Philosoph und Theologe* (1957), with emphasis on Tillich's early development; and J.L. Adams, *Paul Tillich's Philosophy of Culture, Science, and Religion* (1965), the best overall view of Tillich's thought published in English. Other studies include: C.W. Kegley and R.W. Bretall (eds.), *The Theology of Paul Tillich* (1952); D.H. Kelsey, *The Fabric of Paul Tillich's Theology* (1967); W.L. Rowe, *Religious Symbols and God: A Philosophical Study of Tillich's Theology* (1968); R.P. Scharlemann, *Reflection and Doubt in the Thought of Paul Tillich* (1969); and Wilhelm and Marion Pauck, *Paul Tillich, His Life and Thought* (1976), the first of a comprehensive 2-vol. study.

**tillite,** sedimentary rock that consists of consolidated masses of unweathered blocks (large, angular, detached rock bodies) and glacial till (unsorted and unstratified rock material deposited by glacial ice) in a rock flour (matrix or paste of unweathered rock). The matrix, which comprises a large percentage of the rock, usually is dark gray to greenish black in colour and consists of angular quartz and feldspar grains and rock fragments in a very fine-grained paste. The widespread tillites in the geologic record provide evidence of former intense and widespread glaciation; Recent tillites (less than 10,000 years old) can be directly connected with glaciation, and Pleistocene tillites (10,000 to 2,500,000 years old) can be convincingly related to glaciation, but many earlier till-like bodies cannot. Only tillites formed from the till deposited by continental ice sheets have a good chance of being preserved in the geologic record.

**Tillman, Benjamin R(yan),** byname PITCHFORK BEN TILLMAN (b. Aug. 11, 1847, Edgefield Co., S.C., U.S.—d. July 3, 1918, Washington, D.C.), outspoken U.S. populist politician who championed agrarian reform and white supremacy. Tillman served as governor of South Carolina (1890–94) and was a member of the U.S. Senate (1895–1918).

A farmer for many years prior to his entry into politics, Tillman, a Democrat, emerged during the 1880s as a spokesman for poor rural whites in South Carolina in their conflict against both the ruling white aristocracy and the impoverished Negro population. The rise of Tillman marked the decline of the former Confederate general Wade Hampton as a political force in the state. Elected governor in 1890, Tillman translated his populist rhetoric into concrete reforms. He shifted the tax burden to the wealthy, improved public education, founded the agricultural college later to be known as Clemson University, and regulated the railroads. He also helped write the state constitution to disfranchise Negroes and circumvent the Fifteenth Amendment with a patchwork of Jim Crow laws (*i.e.,* laws enforcing racial segregation). An unabashed bigot, he considered lynching an acceptable law-enforcement measure.

Elected to the U.S. Senate in 1894, Tillman served until his death, continuing to press for agrarian reform on the national level. He bitterly assailed Pres. Grover Cleveland for his hard-money policy, supporting instead the free-silver program of William Jennings Bryan. In most instances he opposed the administration of Pres. Theodore Roosevelt. In fact, the two became such bitter enemies that at one point the President barred Tillman from the White House. They put aside their differences long enough, however, to collaborate in securing passage of the Hepburn Act (1906), extending the Interstate Commerce Commission's regulatory powers over the railroads. Tillman was floor leader for the bill. He generally supported Pres. Woodrow Wilson and, as chairman of the Senate Naval Affairs Committee, promoted the administration's program to strengthen the Navy. His vituperative and often profane attacks on his political opponents earned him the nickname "Pitchfork Ben."

*Articles are alphabetized word by word, not letter by letter*

**Tilly, Johann Tserclaes, Graf von** (count of) (b. February 1559, Tilly, Brabant, Spanish Netherlands—d. April 30, 1632, Ingolstadt, Bavaria), outstanding Bavarian general who was the principal commander of the Catholic League in Germany during the Thirty Years' War.

Reared by Jesuits, Tilly gained military experience fighting in a Walloon regiment and



Tilly, detail from an engraving by G. Kŏlez, 1631

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd

at the siege of Antwerp (1585), serving under the Spanish Netherlands general Alessandro Farnese. In 1594 Tilly joined the Holy Roman emperor Rudolf II's army campaigning against the Turks.

Appointed by Duke (later Elector) Maximilian I of Bavaria to reorganize the Bavarian army (1610), Tilly created such an efficient army that it later became the backbone and spearhead of the Catholic League. At the outbreak of the Thirty Years' War (1618), he was made commander in chief of the field forces for the Catholic League. In 1620 he conducted the first campaign of the war and, after a series of successes, he marched on Prague to win the decisive Battle of the White Mountain (November 8) against the Bohemian Protestants. In the following years Tilly conquered the Upper and the Rhenish Palatinates and made himself the master of northwestern Germany.

In the war against Denmark (1625–29), Tilly, with the army of the Catholic League, crushed the Swedes at the Battle of Lutter (Aug. 27, 1626). After Gustav II Adolf invaded Germany (1630) and after General Albrecht von Wallenstein, the imperial commander, had fallen from power, Tilly acquired command of the imperial as well as the League forces (1630).

In 1631 Tilly laid siege to Magdeburg, strategically the most important point on the Elbe River and the base from which he hoped to check Gustav Adolf's advance into central Germany. On May 20, 1631, Magdeburg fell and went up in flames. The destruction of the city proved disastrous: it deprived Tilly of a base and of a source of food and shelter for his army, gave Swedish propaganda a powerful weapon, and branded Tilly as the "butcher of Magdeburg."

Tilly, as commander in chief of both imperial and League armies, was seriously hampered by the political differences between the emperor and Elector Maximilian. Finally, acting on the emperor's orders, he invaded Saxony and was completely defeated at Breitenfeld (Sept. 17, 1631), thus opening up southern Germany to the Swedes. Gustav Adolf marched into the heart of Germany, and Tilly, in an effort to prevent the Swedes from crossing the Lech River into Bavaria at Rain, was fatally wounded.

**Tilsit** (Russia): *see* Sovetsk.

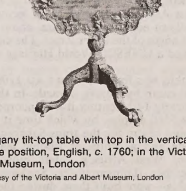
**Tilsit, Treaties of** (July 7 [June 25, Old Style] and July 9 [June 27], 1807), agreements that France signed with Russia and with Prussia (respectively) at Tilsit, northern Prussia (now Sovetsk, Russia), after Napoleon's victories over the Prussians at Jena and at Auerstädt and over the Russians at Friedland.

Under the terms of the treaty, France and Russia became allies and divided Europe between them, reducing Austria and Prussia to helplessness. Alexander I of Russia accepted the reduction of Prussia from 89,120 to 46,032 square miles (230,820 to 119,223 square km); the creation from the Polish provinces detached from Prussia of a new Grand Duchy of Warsaw for Napoleon's ally, the king of Saxony; and the establishment of the Kingdom of Westphalia in northern Germany. Westphalia, too, was in part composed of former Prussian lands. Napoleon's hegemony in western and central Europe was thus established. Prussia was to be occupied by French troops until a war indemnity, fixed at 120,000,000 francs, had been paid.

In secret provisions Napoleon agreed to help Russia "liberate" most of European Turkey if Turkey rejected French mediation in its conflict with Russia. Similarly, Alexander promised to join the Continental System against British trade if Britain rejected Russian mediation in its conflict with France. Russia was given a free hand to conquer Finland from Sweden. Prussia was forced to join the Continental System and close its ports to British trade.

Because the Treaties of Tilsit came so close to creating a continental blockade that excluded British trade, Napoleon sought in the next few years to enlarge and enforce the blockade. This led to the collapse of the peace on the continent. The period of Franco-Russian collaboration lasted until Dec. 31, 1810, when the tsar, finding that the alliance to the Continental System seriously hurt Russian trade, opened Russian ports to neutral ships. The threat to Russia from Napoleon's satellite, the Grand Duchy of Warsaw, on Russia's border, also contributed to the eventual failure of the Franco-Russian alliance. Napoleon invaded Russia in June 1812.

**tilt-top table,** table, the top of which is hinged to a central pedestal in such a way that it can be turned from a horizontal to a vertical position and, thereby, when not in use, take up less space. Originally the idea was applied mainly to occasional (*e.g.*, light, movable) tables of the kind used for tea and similar occasions.



Mahogany tilt-top table with top in the vertical storage position, English, *c.* 1760; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London

By the 19th century, elaborate tilting devices were used so that quite large, circular dining tables could be made to tilt and, when not in use, could be placed against the wall. The fact that the tabletop was thus exposed to view stimulated the application of elaborate patterns in veneer and other techniques.

**Timaeus** (b. *c.* 356 BC, Tauromenium, Sicily [Italy]—d. *c.* 260), Greek historian whose writings shaped the tradition of western Mediterranean history.

Expelled from Sicily by Agathocles, the tyrant of Syracuse, Timaeus went to Athens, where he studied rhetoric under Isocrates' pupil Philiscus and passed 50 years of his life. Whether he ever returned home is uncertain. The 38 books of his *History* covered events up to Agathocles' death in 289, but a separate work on Pyrrhus of Epirus seems to have extended the historical treatment to the Roman crossing into Sicily in 264. Books 1–5 contained the early history of Italy and Sicily, books 6–33 the history of Sicily from the foundation of the Greek colonies to Agathocles' accession, with digressions sometimes touching on Greece, and books 34–38 form a separate account of Agathocles. The *Olympionikai* ("Victors at Olympia") was probably a chronological study.

Timaeus was bitterly attacked by later historians, especially Polybius. Some of his faults, such as the composition of artificial rhetorical speeches, are common to the historiography of the age; but a somewhat naïve attitude toward marvels reflects a genuine feeling for folklore. He was spiteful to those he disliked, such as Dionysius and Agathocles, and he exaggerated the virtues of the Corinthian general Timoleon. Above all, he showed the faults of the armchair historian. But his interests were wide; he was assiduous in assembling material, including inscriptions; and Polybius' charge of ignorance and willful dishonesty is unjust. Timaeus' system of reckoning by Olympiads furnished a valuable chronological tool for his successors, including Polybius. He also employed a pleasing "Asiatic" style, of which Cicero approved.

**Timan Ridge,** Russian TIMANSKY KRYAZH, ridge of high land situated in northeastern European Russia, oriented in a roughly north-south direction and stretching for about 470 miles (750 km) from the Barents Sea to the source of the Vychegda River. The ridge was formed by an upwarping of the underlying Russian Platform and consists of very ancient schists and other materials. The northern part is higher and consists of four hilly massifs, with heights up to 1,519 feet (463 m). The southern portion has a plateau character.

**timar,** in the Ottoman Empire, grant of lands or revenues by the sultan to an individual in compensation for his services, essentially similar to the *iqṭāʿ* (*q.v.*) of the Islāmic empire of the Caliphate. *See also* sipahi.

**Timaru,** city ("district") and port, Canterbury local government region, east-central South Island, New Zealand, on Canterbury Bight. Although the settlement's boundaries were delineated as early as 1856, the actual founding did not take place until 1859, when the first ship taking immigrants directly from Britain to New Zealand arrived. Made a borough in 1868 and a city late in the 1940s, Timaru derives its name from Maori terms meaning either "shady cabbage tree" or "place of shelter."

The city, on the South Island Main Trunk Railway to Christchurch (102 miles [163 km] northeast), is the chief port of the southern Canterbury Plains, a region of sheep, cattle, grain, and fruit farming. Its industries include the manufacture of agricultural implements, footwear and brickworks, and freezing and general engineering works. The port is artificial, and its extensive system of moles and breakwaters, constructed from 1864 to 1906, has caused the deposition of sandbars to form Caroline Bay, capable of handling ships up to 18,000 tons. The harbour exports frozen meat, timber, wool, cereal products, and manufactured goods and is the base for a commercial fishing fleet. A sunny mild climate, splendid beaches, and easy access to the Southern Alps make Timaru a popular resort. Pop. (1992 est.) urban area, 27,100; (1991 prelim.) district, 42,505.

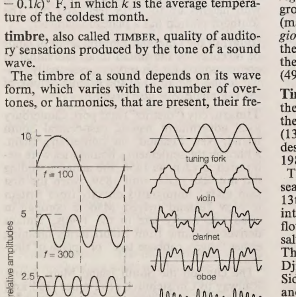
**timber framing,** wooden structural framework that forms the interior and exterior walls of half-timber work (*q.v.*).

**timberline,** upper limit of tree growth in mountainous regions or in high latitudes, as in the Arctic. Its location depends largely on temperature but also on soil, drainage, and other factors. The mountain timberline always would be higher near the Equator than near the poles if it were not for the abundant rainfall in equatorial mountainous regions, which lowers the air temperatures. The timberline in the central Rockies and Sierra Nevadas is around 3,500 metres (11,500 feet), whereas in the Peruvian and Ecuadorian Andes it is between 3,000 and 3,300 metres (10,000 and 11,000 feet). In much of the central and southern Rockies there is a double timberline: the usual high timberline below which there is a belt of normal tree growth; and then a low timberline below which no trees grow because of low precipitation and high temperatures.

Because the climatic zone in which the high-latitude timberline occurs is almost entirely over water in the Southern Hemisphere, this timberline exists only in the Northern Hemisphere. It crosses northern Siberia, Alaska, and Canada, and far-northern Scandinavia. Several climatic isopleths (imaginary lines connecting points of equal values for various climatic variables) have been proposed as quantitative approximations of this timberline. The Köppen–Supan line was devised by the Austrian geographer Alexander Supan (1879) for this purpose and was used by Köppen (1900) as the boundary between the tundra and tree climates in his first climatic classification; it connects points with an average temperature of 10° C (50° F) for the warmest month of the year. A similar isopleth, the Nordenskjöld line proposed by the Swedish geographer Otto Nordenskjöld (1928), is the line along which the warmest month's average temperature is equal to $(9 - 0.1k)°$ C, or $(51.4 - 0.1k)°$ F, in which $k$ is the average temperature of the coldest month.

**timbre,** also called TIMBER, quality of auditory sensations produced by the tone of a sound wave.

The timbre of a sound depends on its wave form, which varies with the number of overtones, or harmonics, that are present, their fre-




*Timbre*
(Left) Synthesis of complex tone; (right) wave forms of sounds from various musical instruments playing the same note

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quencies, and their relative intensities. The illustration shows the wave form that results when pure tones of frequencies 100, 300, and 500 hertz (cycles per second) and relative amplitudes of 10, 5, and 2.5 are synthesized into a complex tone. It is the resultant of the three sine curves when their ordinates are added point by point along the time scale. In equation form, the amplitude $y$ of the wave form at any time $t$ would be represented by $y = 10 \sin(2\pi\ 100t) + 5 \sin(2\pi\ 300t) + 2.5 \sin 2\pi\ 500t$. The timbre of this form would be recognizable and different from all others having a fundamental tone of 100 hertz.

In music timbre is the characteristic tone colour of an instrument or voice, arising from reinforcement by individual singers or instruments of different harmonics, or overtones (*q.v.*), of a fundamental pitch. Extremely nasal timbre thus stresses different overtones than mellow timbre. The timbre of the tuning fork and of the stopped diapason organ pipe is clear and pure because the sound they produce is almost without overtones. Timbre is determined by an instrument's shape (*e.g.*, the conical or cylindrical pipe of a wind instrument); by the frequency range within which the instrument can produce overtones; and by the pattern of onset, growth, duration, and decay (envelope) of the instrument's sound. The timbre of spoken vowels or of a singing voice varies with the openness or constriction of the head- and chest-resonating areas used. The illustration also shows waveforms of the same note (fundamental tone) for several musical instruments.

**Timbuktu,** also spelled TOMBOUCTOU, *région,* northern Mali, West Africa, bordering Mauritania on the northwest, Algeria on the northeast, and the *régions* of Gao on the east and Mopti and Ségou on the south. Timbuktu *région* was created in 1977 from the western part of Gao *région.* It is entirely within the Sahara (desert) except for the extreme southern area along the Niger River and consists of relatively flat sandy or stony plains with elevations of about 1,000 ft (300 m). Salt is mined in the north at Taoudenni and is transported by camel caravan south to the town of Timbuktu, the *région* capital. The principal irrigated crops grown in the Niger River Valley are corn (maize) and rice. Population groups in the *région* include the nomadic Tuaregs and Moors in the Sahara and Songhai and Fulani peoples in the irrigated valley. Area 191,743 square miles (496,611 square km). Pop. (1995 est.) 462,000.

**Timbuktu,** also spelled TOMBOUCTOU, city in the West African nation of Mali, located on the southern edge of the Sahara, about 8 mi (13 km) north of the Niger River. The city was designated a UNESCO World Heritage site in 1988.

Timbuktu was founded about AD 1100 as a seasonal camp by Tuareg nomads. In the late 13th or early 14th century it was incorporated into the Mali empire, by which time it was a flourishing centre for the trans-Saharan gold-salt trade and a centre of Islāmic learning. Three of West Africa's oldest mosques—Djinguereber (Djingareyber), Sankore, and Sidi Yahia—were built there during the 14th and early 15th centuries. In 1324, the Mali emperor Mansa Mūsā built the Great Mosque (Djinguereber) and a royal residence, the Madugu (the former has since been rebuilt many times, and of the latter no trace remains). The Granada architect Abū Isḥāq as-Sāḥilī was then commissioned to design the Sankore mosque, around which Sankore University was established. The mosque still stands today.

The Tuareg regained control of the city in 1433, but they ruled from the desert, exacting sizable tributes and plundering periodically. Trade and learning continued to flourish in Timbuktu, and by 1450 its population increased to about 100,000. The city's scholars, many of whom had studied in Mecca or in Egypt, numbered some 25,000.

In 1468 the city was conquered by the Songhai ruler Sonni ʿAlī. He was generally ill-disposed to the city's Muslim scholars, but his successor—the first ruler of the new Askia dynasty, Muḥammad I Askia of Songhai (reigned 1493–1528)—used the scholarly elite as legal and moral counselors. During the Askia period (1493–1591) Timbuktu was at the height of its commercial and intellectual development.

After it was captured by Morocco in 1591, the city declined. Its scholars were ordered arrested in 1593 on suspicion of disaffection; some were killed during a resulting struggle, while others were exiled to Morocco. Perhaps worse still, the small Moroccan garrisons placed in command of the city offered inadequate protection, and Timbuktu was repeatedly attacked and conquered by the Bambara, Fulani, and Tuareg.

Timbuktu was captured by the French in 1894. They partly restored the city from the desolate condition in which they found it, but no connecting railway or hard-surfaced road was built. In 1960 it became part of the newly independent Republic of Mali.

Timbuktu is now an administrative centre of Mali. Small salt caravans from Taoudenni still arrive, but large-scale trans-Saharan commerce no longer exists there. Although the city has a small airport, it is most commonly reached by camel or boat. Islāmic learning survives among a handful of aging scholars, and a language institute (Lycée Franco-Arabe) teaches Arabic and French. In the late 1990s, restoration efforts were undertaken to preserve the city's three great mosques, which are threatened by sand encroachment and by general decay. Pop. (1987) 31,962.

**time,** a measured or measurable period, a continuum that lacks spatial dimensions. Time is of philosophical interest and is also the subject of mathematical and scientific investigation.

A brief treatment of time follows. For full treatment, *see* MACROPAEDIA: Time.

"What then, is time? If no one asks me, I know what it is. If I wish to explain it to him who asks me, I do not know." In this remark St. Augustine in the 5th century AD drew attention to the fact that while time is the most familiar of concepts used in the organization of thought and action, it is also the most elusive. It cannot be given any simple, illuminating definition. In the face of this problem philosophers have sought an understanding of time by focussing on two broad questions: What is the relation between time and the physical world? And what is the relation between time and consciousness?

According to those, such as Sir Isaac Newton, who adopt an absolutist theory of time, the answer to the former question is that time is like a container within which the universe exists and change takes place. Time's existence and properties are independent of the physical universe. Time would have existed even if the universe had not. Time is held to be nonending, nonbeginning, linear, and continuous. That time has these properties is established philosophically, without reference to scientific investigation. According to the rival relationist theory, time can be reduced to change. Time is nothing over and above change in the physical universe; all hypotheses about time can be translated into hypotheses about the physical universe. Consequently the question "Has time a beginning?" becomes "Was there a first event in the history of the universe?" Also, investigating the properties of time is to be done scientifically. Relationists explore the possibility that physics could show time to have structure: it might consist of discrete particles (chronons), for instance, or it might be cyclical.

It has been realized in the 20th century that time cannot be treated in isolation from space. Consequently philosophers now tend to focus attention on space–time, conceived, after Einstein, as a continuum. While the temporal aspects of space–time remain importantly different from its spatial aspects, there is an interdependence that is shown in the case of measurement: the measure of an interval of

time assigned by a clock depends on the path and speed with which it is moved. The fundamental controversy between the absolutist and the relationist remains; some philosophers argue that Einstein's theories of relativity vindicate relationist theories, others that they vindicate the absolutist theory.

The primary issue concerning the relation between time and consciousness is the extent, if any, to which time or aspects of time depend on the existence of conscious beings. It is perhaps a commonsensical idea that, even in the absence of consciousness, events would still occur in an order that could be described using the relations of before and after. But perhaps it is not so. Normally events in time are thought of in terms of the notions of past, present, and future, which some philosophers treat as mind-dependent. They argue that to say that something is now happening (has happened, will happen) is to say that its happening is simultaneous with (earlier than, later than) one's current state of consciousness or the act of utterance itself. Thus, it is maintained, in the absence of conscious beings there is no past, present, or future. This view that the past, the present, and the future are mere subjective projections of the human mind has been supported by appeal to physics, for such notions were thought to play no role in physical theories. (Recent evidence from the subatomic realm has raised questions about the symmetry of time in physical processes.) Other philosophers, however, believe that time is independent of perception and hold that the past, present, and future are objective features of the world.

The measurement of time involves establishing a precise system of reference for specifying when any event occurs—*i.e.*, specifying the epoch and establishing a standard interval of time. Astronomy and civil affairs are concerned both with epochs and with time intervals, whereas physics deals almost entirely with time intervals. The fundamental unit of time interval is the second.

A reference time scale could be based on any phenomenon that involves change with time, such as the rotation of the Earth or the motion of a pendulum. To be generally useful it should be possible to determine the same numerical value of the time, within very close limits, anywhere on the Earth. This condition is satisfied by the rotating Earth but not by the pendulum.

Until recently, the rotation of the Earth about its axis furnished the only time scale in general use, mean solar time. Other independent time scales and systems have recently come into use, however. For a treatment of these different scales and systems, *see* in the MICROPAEDIA: atomic time; Coordinated Universal Time; dynamical time; Ephemeris Time; Greenwich Mean Time; sidereal time; solar time; standard time; Universal Time. To indicate time and to measure time intervals, various devices have been developed. For a treatment of the different types, *see* atomic clock; clock; sundial; watch.

**Time,** major American weekly newsmagazine that is published in New York City. *Time* was the creation of two young journalists, Henry R. Luce (*q.v.*) and Briton Hadden, who wanted to start a magazine that would inform busy readers in a systematic, concise, and well-organized manner about current events in the United States and the rest of the world. With Hadden as editor and Luce as business manager, they brought out the first issue on March 3, 1923. *Time*'s format, which became standard for most other general newsmagazines, consisted of dozens of short articles tersely summarizing information on subjects of importance and general interest and arranged in "departments" covering such fields as national and international affairs, business, education, science, medicine, law, religion, sports, books, and the arts. *Time* had attained a circulation of more than 175,000 by 1927, and it became the most influential newsmagazine in the United States. After Hadden's death in 1929, Luce remained the editor and guiding force behind the magazine until 1964, when he assumed the title of editorial chairman of Time Inc., the magazine's publisher. *Time* long reflected Luce's moderately conservative political viewpoint. By the 1970s, however, the magazine had assumed a more neutral, centrist stance in the tone of its reportage. *Time* now appears in several foreign-language editions.

**time-and-motion study,** in the evaluation of industrial performance, analysis of the time spent in going through the different motions of a job or series of jobs. Time-and-motion studies were first instituted in offices and factories in the United States in the early 20th century. These studies came to be adopted on a wide scale as a means of improving the methods of work by subdividing the different operations of a job into measurable elements. Such analyses were, in turn, used as aids to standardization of work and in checking the efficiency of people and equipment and the mode of their combination.

**time deposit,** also called DEPOSIT ACCOUNT, bank deposit for which advance notice of withdrawal is required or that may be withdrawn after the elapse of a specific period of time or on a specific date. There are several types of time deposits. Ordinary passbook savings accounts tend to be relatively small in value; thus, on deposits by individuals, the advance-notice requirement is usually waived. Nonnegotiable certificates of time deposit are contracts for the deposit of funds for a stated period of time at a rate of interest normally higher than that paid on regular passbook accounts. Negotiable certificates of time deposit emerged in the United States in the 1960s as a means of attracting funds in large amounts. Since 1966 the rate of interest has been higher on these than on other forms of time deposits. In the United States this rate has become a major instrument of Federal Reserve money-market control.

**time dilation,** also called TIME DILATATION, in the theory of special relativity, the "slowing down" of a clock as determined by an observer who is in relative motion with respect to that clock. In special relativity, an observer in inertial (*i.e.*, nonaccelerating) motion has a well-defined means of determining what events occur simultaneously with a given event. A second inertial observer, who is in relative motion with respect to the first, however, will disagree with him regarding which events are simultaneous with that given event. (Neither observer is wrong in his determination; rather, their disagreement merely reflects the fact that simultaneity is an observer-dependent notion in special relativity.) A notion of simultaneity is required in order to make a comparison of the rates of clocks carried by the two observers. If the first observer's notion of simultaneity is used, it is found that the second observer's clock runs slower than his by a factor of $\sqrt{(1 - v^2/c^2)}$, where $v$ is the relative velocity of the observers and $c$ equals 300,000 km (186,000 miles) per second—*i.e.*, the speed of light. Similarly, using the second observer's notion of simultaneity, it is found that the first observer's clock runs slower by the same factor. Thus each inertial observer determines that all clocks in motion relative to him run slower than his own clock.

A closely related phenomenon predicted by special relativity is the so-called clock paradox, or twin paradox. Suppose an observer carrying a clock departs on a rocket ship from an inertial observer at a certain time and then rejoins him at a later time. In accordance with the time-dilation effect, the elapsed time on the clock of the noninertial observer will be smaller than that of the inertial observer—*i.e.*, the noninertial observer will have aged less than the inertial observer when they rejoin.

The time-dilation effect predicted by special relativity has been accurately confirmed by observations of the increased lifetime of unstable elementary particles traveling at nearly the speed of light. The clock-paradox effect also has been substantiated by experiments comparing the elapsed time of an atomic clock on Earth with that of an atomic clock flown in an airplane. The latter experiments, furthermore, have confirmed a gravitational contribution to time dilation, as predicted by the theory of general relativity.

**time-lapse cinematography,** motion-picture technique by which a naturally slow process, such as the blossoming of a flower or cloud-pattern development, can be seen at a greatly accelerated rate. Normal sound cinematography reproduces movement by recording and projecting it at 24 frames per second. In time-lapse cinematography, single frames are exposed at much greater time intervals (usually minutes) and then viewed at the standard 24 frames per second. Most often the technique uses a camera that operates automatically upon the signal of a timing device.

**time perception,** experience or awareness of the passage of time.

A brief treatment of time perception follows. For full treatment, *see* MACROPAEDIA: Perception, Human.

Time is the dimension of change, and time perception, then, is the capacity to interpret changes in sensory (and bodily) stimuli with respect to their temporal relations—most basically, their order in time and the amount of time between them. Since about the middle of the 19th century, the study of time perception has been conducted empirically, with psychologists examining how and why a person's sense of the length of a period of time can differ from a precise measurement.

Two features of temporality are central to time perception: sequence and duration. A sense that one event follows another in a fairly stable sequence is developed by conditioning. The perception of duration falls into two classes. Animals can judge not only the duration between two events (called an empty duration) but also the duration of a single event, as delimited by its start and its finish (called a full duration).

Perception, strictly speaking, always occurs in the present: an individual cannot reach forward or backward in time to perceive future or past events but can only perceive what is happening now. For the purposes of measuring time, the present is supposed to have no duration. However, the present as experienced in perception does have a brief but definite duration. That is, one can take in some change in an event in one act of perception, without having to refer to memory. The length of this perceptual moment of the present can vary, depending on the nature of and organization between the events involved.

There are also lower and upper limits to the amount of time that can be perceived as a single duration. Within these limits, the perception of duration can vary according to the structure of the stimulus and the sense involved. At the lower limit the ear is more sensitive than the eye—*i.e.*, it is better able to detect that a stimulus has length and is not merely instantaneous. Above a limit, about two seconds for both ear and eye, the duration of the stimulus is no longer directly perceived but must be judged with the aid of memory.

Durations can be estimated with reference to a task being done, but here both the nature of the task and the actor's attitude toward it

become important factors. A continuous burst of activity seems to take less time than does an activity that proceeds by fits and starts, but a task for which the actor is not highly motivated will seem to last longer than it actually does. The ability to estimate durations has been found to vary with age, with children being generally less accurate than adults, theoretically because children are not yet familiar enough with various activities to use them as guides for estimates of duration.

**time reversal,** in physics, mathematical operation of replacing the expression for time with its negative in formulas or equations so that they describe an event in which time runs backward or all the motions are reversed. A resultant formula or equation that remains unchanged by this operation is said to be time-reversal invariant, which implies that the same laws of physics apply equally well in both situations, that the second event is indistinguishable from the original, and that the flow of time does not have any naturally preferred direction in the case of fundamental interactions. A motion picture of two billiard balls colliding, for example, can be run forward or backward with no clue to the proper time direction of the event.

Interactions among the subatomic particles under the operation of time reversal were thought to be invariant in the same way, but evidence to the contrary was discovered in 1964 in weak nuclear interactions (*see* CP violation). There is, however, a more general inversion operation that does leave the physical laws invariant, called in its mathematical expression the CPT theorem. It comprises time reversal T combined with interchange of antiparticles and particles, called charge conjugation C, and a mirror reflection, or inversion, of space, called parity reversal P. When all these are performed simultaneously, the resultant process or interaction is indistinguishable from the original.

**time-sharing,** in data processing, method of operation in which multiple users with different programs interact nearly simultaneously with the central processing unit of a large-scale digital computer. Because the central processor operates substantially faster than does most peripheral equipment (*e.g.,* video display terminals, tape drives, and printers), it has sufficient time to solve several discrete problems during the input/output process. Even though the central processor addresses the problem of each user in sequence, access to and retrieval from the time-sharing system seems instantaneous from the standpoint of remote terminals since the solutions are available to them the moment the problem is completely entered.

Time-sharing was developed during the late 1950s and early '60s to make more efficient use of expensive processor time. Commonly used time-sharing techniques include multiprocessing, parallel operation, and multiprogramming. Also, many computer networks organized for the purpose of exchanging data and resources are centred on time-sharing systems.

**time signature,** in musical notation, sign that indicates the metre of a composition. Most time signatures consist of two vertically aligned numbers, such as $\frac{2}{2}$, $\frac{3}{4}$, $\frac{6}{8}$, and $\frac{12}{16}$. The top figure reflects the number of beats in each measure, or metrical unit; the bottom figure indicates the note value that receives one beat (here, respectively, half note, quarter note, eighth note, and sixteenth note). When measures contain an uneven number of beats falling regularly into two subgroups, the division may be indicated as, for instance, $\frac{3+4}{4}$ instead of $\frac{7}{4}$.

Two other time signatures are common: 𝄵 (common time, or $\frac{4}{4}$) and 𝄶 (cut time, or alla breve, $\frac{2}{2}$). Both derive from symbols of mensural notation (*q.v.;* used from *c.* 1260 to 1600), the system preceding the modern one.

The mensural time signature 𝄵 indicated a basic unit (*tempus*) of two notes and the subdivision (*prolatio*) of these notes into two parts (modern $\frac{3}{4}$ time, 𝅗𝅥 𝅗𝅥 𝅗𝅥 and 𝅗𝅥 𝅘𝅥𝅘𝅥 𝅗𝅥). But 𝄵 was a proportion sign indicating that the breve (𝅜; modern double whole note) should take the time formerly occupied by the semibreve (𝅝; modern whole note), hence the name "alla breve." Other time signatures of mensural notation (and their modern equivalents) were ○ ($\frac{3}{2}$), 𝄵 ($\frac{6}{4}$), and ⊙ ($\frac{9}{4}$).

**time trial,** French COURSE CONTRE LA MONTRE ("race against the watch"), in bicycle racing, a form of competition in which individual cyclists or teams are sent out at intervals to cover a specified distance on a road course. The contestant with the fastest time for the distance wins.

The individual time trial is distinctive in that its participants ride alone and widely separated from one another, and any of the cooperative activities used by two or more riders in other kinds of bicycle racing are forbidden. However, in team time trials, members of a team of two to four riders may pace, or assist, each other. Two-person teams start at two-minute intervals, and the time is taken on the second person to cross the finish line; three- and four-person teams start at three-minute intervals, and the third person's time is recorded. In world championships, teams of four compete over a distance of 100 km (60 miles). Time trials are also part of most stage races, such as the Tour de France.

The kilometre time trial has been an Olympic event since the advent of the modern Olympic Games in 1896. At the 1996 Olympics, individual road time trials were added to the cycling program for men and women.

**Time Warner Inc.,** major component of the largest media and entertainment conglomerate in the world. In 2001 media giant Time Warner Inc. and the online company America Online, Inc. (AOL), merged to form AOL Time Warner Inc. (*q.v.*). AOL Time Warner's products encompass magazines, hardcover books, comic books, recorded music, motion pictures, online services, and broadcast and cable television programming and distribution. The company's headquarters are in New York City.

Time Inc. was founded by Yale University graduates Henry R. Luce and Briton Hadden in 1922, and the first issue of *Time,* the world's first weekly newsmagazine, appeared on March 3, 1923. Later additions to the company's magazine group were *Fortune* (1930), a business monthly; *Life* (1936–72; revived 1978), a photojournalistic weekly; *Sports Illustrated* (1954), a sports weekly; *Money* (1972), a monthly on consumer finance; and *People* (1974), a weekly focusing on personalities.

The company's magazines are part of the news and information group, which also includes Time-Life Books, the publisher Little, Brown & Company, and the Book-of-the-Month Club. Time-Life Books was launched in 1960 and now publishes book series and single titles in dozens of languages. The acquisition of TBS added the Cable News Network (CNN) to the news group.

Time Inc. first moved into the broadcast and entertainment industry in the 1950s but in 1970 announced that it was selling its broadcast holdings to focus exclusively on cable television. The next year it bought a stake in American Television and Communications Corporation, a large cable-television operator, and in 1972 it founded Home Box Office (HBO), which became one of the largest providers of pay-television programs. Time Inc. bought complete control of American Television and Communications in 1978.

In 1989 Time Inc. merged with Warner Communications Inc., a media and entertainment giant descended from the Warner Brothers (*q.v.*) motion-picture studio. Warner Communications, besides being a major motion-picture and television studio, was one of the largest American producers of music recordings and a large cable-television operator. Time Warner bought two major cable-television operators, Houston Industries Inc. and Cablevision Industries Inc., in 1995. The WB, a broadcast television network founded by Time Warner, first aired in January 1995. In 1996 Time Warner purchased TBS, which owned several cable-television networks. The resulting entertainment group included all the Warner Communications, HBO, and other Time Warner holdings along with Turner's cable networks, two professional sports franchises, New Line Cinema (a film studio), and Castle Rock Entertainment (a television and film studio). Time Warner's telecommunications group operated cable systems that had about 11 million subscribers by the mid-1990s.

**time zone,** a zone on the terrestrial globe that is approximately 15° longitude wide and extends from pole to pole and within which a uniform clock time is used. Time zones are the functional basis of standard time (*q.v.*).

**Times, The,** daily newspaper published in London, one of Britain's oldest and most influential newspapers. It is generally accounted, with *The Guardian* and *The Daily Telegraph,* one of Britain's "big three" and has long been recognized as one of the world's greatest newspapers.

Founded by John Walter on Jan. 1, 1785, as *The Daily Universal Register,* the newspaper began as a 2½-penny broadsheet whose main function was to publicize a system of typography in which Walter was then interested. It became *The Times* on Jan. 1, 1788, publishing commercial news and notices, along with some scandal. The founder's son, John Walter II, took over the newspaper in 1803. He expanded it from 4 pages to 12 large pages, and, by the time control of the paper passed to his son, John Walter III, in 1848, the foundations of *The Times*'s reputation as Britain's preeminent national journal and daily historical record had been laid.

Under its first great liberal editor, Thomas Barnes (editor from 1817 to 1841), *The Times* developed into a strong independent newspaper popularly described as the "Thunderer." By the mid-1800s it had become a widely respected influence on British public opinion, and its circulation had grown from 5,000 in 1815 to 40,000 in 1850. A companion weekly with its own editorial staff, *The Sunday Times* (*q.v.*), was established in 1822. *The Times* maintained rigorous standards of reporting and writing and strove for meticulous accuracy. It came to be ruled by tradition, although its editorial views were independent, articulate, and strong. It was also seen as the very epitome of the British establishment, yet repeatedly it introduced innovative changes. John T. Delane became editor in 1841, and in his 36-year tenure his brilliant journalistic imprint was left on every aspect of the paper. In the midst of expanding *The Times*'s national coverage, he hired the world's first war correspondent, William Howard Russell, to cover the Crimean War (1853–56)—the British government first learned of Russian peace proposals in *The Times*.

Late in the 19th century, overspending and the inadvertent publication of a forgery against the Irish hero Charles Stewart Parnell brought *The Times*'s finances, reputation, and circulation to a serious low. As part of a recovery effort, *The Times* entered into an agreement with the publishers of *Encyclopædia Britan-*

*nica* for advertising and selling the 9th and 10th editions. It was not until 1906—when the sensationalist publisher Alfred Harmsworth, 1st Viscount Northcliffe, purchased the paper—that *The Times* was financially secure, but its editorial reputation continued to deteriorate until Lord Northcliffe's death in 1922. In the 1950s, when Sir William Haley, then the director general of the British Broadcasting Corporation (BBC), became the editor (1952–67), *The Times* revived its status as a great newspaper. Editorial and design changes enlivened the paper. By 1966 the front page was dedicated to news articles, thereby displacing advertisements that had formerly occupied page one. The transition to modern typesetting and printing equipment improved production but provoked a strike that caused a one-year suspension of publication in 1978–79. The newspaper and its reputation survived, however, and *The Times* and its companion paper, *The Sunday Times,* continued to thrive. In 1981 both papers were acquired by Rupert Murdoch, an Australian newspaper publisher who became an American citizen in 1985.

**Times, The New York** (newspaper): *see* New York Times, The.

**Times Literary Supplement** (TLS), weekly literary journal founded in 1902 as a supplement to *The Sunday Times* of London, long famous for its coverage of all aspects of literature and widely considered the finest literary review in the English language. TLS sets the tone and standards for excellence in the field of literary criticism. It presents reviews of major books of fiction and nonfiction published in every language, and its essays are sophisticated and written with scholarly authority and in a lively style. It is also noted for its bibliographic thoroughness, its topical essays by the world's leading scholars, and for the brilliance and erudition of its readers' published letters to the editor.

**Times of India, The,** English-language morning daily newspaper published in Mumbai (Bombay), Ahmedabad, and Delhi, one of India's most influential papers; its voice has frequently coincided with that of the national government.

Originally called *The Bombay Times and Journal of Commerce,* the paper was founded in 1838 to serve the British residents of western India. At first published twice weekly, the paper became a daily in 1851 and changed its name to *The Times of India* in 1861.

After Indian independence, the *Times*'s insistence on accuracy, its avoidance of sensationalism, its serious tone, and its coverage of international news enhanced its prestige in India, where over the years it has become known as an intellectual newspaper. Its coverage of international news, like that of the other great Indian dailies, is thorough, accounting for a quarter of its editorial space. It circulates nationally and covers a broad range of subject matter with attractive makeup and a readable style.

**Times Square,** square in midtown Manhattan, New York City, formed by the intersection of Seventh Avenue, 42nd Street, and Broadway (*q.v.*). Early known as Longacre Square, it was renamed for the building (1903), formerly occupied by *The New York Times,* which still transmits news on a band of electric lights mounted across its facade. The square and the area around it, with legitimate theatres, movie houses, amusement centres, and a vast subway station beneath, is one of the world's major entertainment districts. It is a tradition for crowds to gather there on New Year's Eve to welcome the new year.

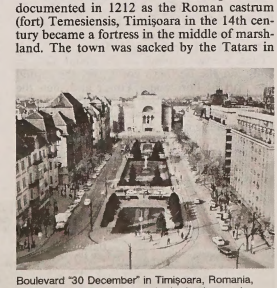
**Timiş,** *judeţ* (county), southwestern Romania, occupying an area of 3,356 square miles (8,692 square km) and bounded by Serbia and Montenegro on the southwest. The Western Carpathian Mountains lie in the eastern portion of the county, with settlement areas in the valleys and lowlands. The Timiş, Bega, and Poganiş rivers drain southwestward through the county. Timişoara, the county seat, produces machinery, textiles, chemicals, and leather goods. Deta and Mănăştur are timber centres, and other building materials are manufactured in Cărpinis and Jimbolia. Textiles and foodstuffs are produced in Lugoj, Sînnicolau Mare, and Buziaş. Lignite mines operate in Sinersig. Agricultural activities consist of livestock raising and cereal and vineyard cultivation. Cenad village was built on the site of a Roman fort. Pop. (2002) 677,744.

**Timiş-Cerna Gap,** mountain pass, southwestern Romania, located in the Transylvanian Alps (Southern Carpathians). The pass links the Tisza River plain and the city of Timişoara (northwest) with the Danubian Plain (southeast). The Banat Mountains, including the Almaj and Semenic ranges, lie west of the Timiş-Cerna Gap. The mountain ranges of Vilcan, Retezat, Tarcul, Cernei, and Mehedinţi are situated east of the gap. The Timiş River flows northwestward, and the Cerna River drains southward through the pass. A highway and railway connection between Timişoara and Bucharest also runs through the pass. Towns situated in the Timiş-Cerna Gap include Caransebeş, Slatina, and Teregova.

**Timiş River,** Hungarian TEMES, Romanian TIMIŞUL, Serbo-Croatian TAMIŠ, river, rising in the Cernei Mountains at the western end of the Southern Carpathians in Romania, and flowing north, west, then south in an arc through Caransebeş and Lugoj to enter the Danube River at Pančevo, east of Belgrade (Serbia and Montenegro), after a course of 211 miles (340 km). Its exit from the Carpathians, via the Domanešnca gap, forms part of the important Timiş-Cerna Gap (between the Western and Southern Carpathians) that links the Tisza River plain and the city of Timişoara (north) with the Danubian Plain (south). Beyond the Domanešnea gap the Timiş flows in a wide alluvial floodplain. Its major tributary is the Bîrzava. The Timiş is navigable only for small craft.

**Timişoara,** Hungarian TEMESVÁR, city, administrative seat of Timiş *judeţ* (county), western Romania. The city lies along the canalized Bega River.

Nearby archaeological finds indicate settlements of Neolithic and Roman origins. First documented in 1212 as the Roman castrum (fort) Temesiensis, Timişoara in the 14th century became a fortress in the middle of marshland. The town was sacked by the Tatars in



Boulevard "30 December" in Timişoara, Romania, with the State Opera House in the background
By courtesy of Editura Enciclopedica Romina

the 13th century, but its citadel was rebuilt and for a few years was the residence of Charles I of Hungary (1309–42). From 1552 the town was held by the Turks until the Austrians took it in 1716. After the Treaty of Passarowitz in 1718, the city and the region, known as the Banat of Temesvár, were governed from Vienna and colonized with non-Magyars, mostly Swabian Germans. The city withstood a siege by Hungarian revolutionaries, lasting 107 days, in 1848. Occupied by Serbia in 1919, it was allotted by the Treaty of Trianon (1920) to Romania.

Antigovernment demonstrations that erupted in Timişoara on Dec. 15–17, 1989, sparked the revolution that toppled the Romanian Communist leader Nicolae Ceauşescu from power a few days later. It was Ceauşescu's use of deadly force to suppress the demonstrations in Timişoara that spurred the army to defect to the side of the uprising.

The city is a cultural centre. There are several higher-educational institutions, including the University of Timişoara (founded 1948). Timişoara has a state theatre, a state opera and ballet, a philharmonic orchestra, and a library. There are parks along the navigable Bega Canal, which runs through the centre of the city. Principal buildings include the monumental Roman Catholic cathedral (1736–73), the Serbian cathedral (1748, restored 1791), and the regional museum, housed in a restored 14th-century palace.

Timişoara is also a commercial centre and has developed industrially, especially since World War II. Manufactures include electric motors and electrical apparatus, textiles, farm machinery and implements, chemicals, plastics, footwear, and foodstuffs. Pop. (2002) 317,651.

*Consult the* INDEX *first*

**Timmermans, Felix** (b. July 5, 1886, Lier, Belg.—d. Jan. 24, 1947, Lier), Flemish writer of regional and idyllic novels and stories.

Timmermans, who was also a popular painter and illustrator, established his literary reputation with the novel *Pallieter* (1916). An "ode to life" written after a moral and physical crisis, the book was warmly received by his readers as an antidote to the misery of World War I in occupied Belgium. For the characters in his books, he drew on the people of his native town. His work is marked by affectionate humour, wealth of anecdote, and observational skill. Besides many novels and short stories, he wrote romanticized biographies of Pieter Bruegel (1928) and St. Francis of Assisi (1932), as well as travel tales, autobiographical works, and plays. In 1935 he published his best work, *Boerenpsalm* ("Peasant Psalm"), a novel that reveals a deep knowledge of suffering, in which praise of nature gives way to praise of humanity.

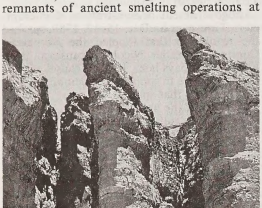
A yearbook of the Felix Timmermans Society has been published since 1973.

**Timmi** (Algeria): *see* Adrar.

**Timmins,** city, Cochrane district, east-central Ontario, Canada, on the Mattagami River, 130 miles (210 km) north of Sudbury. The region was settled after the discovery of gold there in 1905. Mining operations began in 1907, and by the time of the 1909 gold rush, the settlement at nearby Porcupine had established itself as the region's main centre. Timmins was founded in 1911 by Noah Timmins as a residential community to serve the nearby Hollinger gold mine, one of the world's largest. Rapid growth enabled Timmins to surpass Porcupine to become the primary commercial centre and largest town of the Porcupine gold-mining region. Hydroelectric power for the mining operations and for the town and its brewing and paper, pulp, and lumber milling industries is supplied from plants at Wawaitin and Sandy falls. A popular summer recreational centre, Timmins is also

a religious retreat, holding seats of Roman Catholic and Anglican bishoprics. Pop. (2001) 43,686.

**Timna'**, copper-mining site, in the southern Negev, Israel, north of Elat. The presence of copper in Palestine is mentioned in the Bible, and archaeologists have identified remnants of ancient smelting operations at



Pillars of Solomon, rock formation at King Solomon's Mines, Timna', Israel
Robert Rubic—D.P.I.

Timna', complete with crude furnaces and slag heaps, as being of the Egyptian pharaonic and Solomonic periods. The ancient mines, called Mikhrot Shelomo ha-Melekh ("King Solomon's Mines"), are at the top of a north-south-trending mesa, about 1,000 feet (305 m) long and more than 425 feet (130 m) wide at its widest point. Scenic columnar rock formations along the mesa's north wall show traces of the cuprriferous slag. The ore deposits currently exploited at the site are east of the ancient mines.

**Timni** (people): *see* Temne.

**Timoleon** OF CORINTH (d. after 337 BC), Greek statesman and general who championed the Greeks of Sicily against the rule of tyrants and against Carthage.

When, in 344, aristocrats of Syracuse appealed to their mother city of Corinth against their tyrant Dionysius the Younger, Timoleon was chosen to lead a liberation force to Sicily. Twenty years earlier he had abetted the killing of his own brother, Timophanes, who had made himself tyrant of Corinth. Landing at Tauromenium (Taormina) in the summer of 344, Timoleon faced two armies, one under Dionysius and the other under Hicetas (tyrant of nearby Leontini), who had called in Carthaginian forces. By shrewd tactics Timoleon defeated his enemies and occupied Syracuse. He introduced a mixed constitution as a safeguard against tyranny and invited new settlers from Greece. About 341 renewed warfare ended with Hicetas' final defeat and execution. A treaty was concluded confining the Carthaginians to the area west of the Halycus (Platani) River. The remaining Greek tyrannies on the island collapsed, and there followed a brief revival of prosperity for the Greek cities of Sicily. In 337 or 336 Timoleon retired to private life. He continued to attend the assembly and offer his opinion, which was usually accepted by a unanimous vote.

**Timon** OF PHLIUS (b. *c.* 320 BC, northern Peloponnese, Greece—d. *c.* 230, Athens), Greek Skeptic philosopher and man of letters.

Poor in his youth, Timon earned his living as a dancer before studying with Stilpo at Megara and with Pyrrhon of Elis. He acquired fame and fortune by lecturing and retired to Athens about 275 BC to write. Only fragments remain of his works, which included prose works, tragedies, satyr plays, comedies, and poems.

**Timor**, island of the Malay Archipelago, easternmost of the Lesser Sunda Islands, between the Savu and Timor seas. Western Timor, with an area of 6,120 square miles (15,850 square km), is administered as part of Nusa Tenggara Timur *provinsi* ("province"), Indonesia. The eastern half of the island, 5,743 square miles (14,874 square km) in area, became the sovereign nation of East Timor in 2002; it includes the enclave of Ambeno on the western half of the island, as well as the islands of Atauro (Kambing) and Jaco.

Timor is mountainous, with some coastal plains that merge into mangrove swamps. The highest point is Mount Tatamailau (Tata Mailau; 9,721 feet [2,963 m]). The climate is dry during the southeast monsoon and wet during the short, irregular west monsoon (December to March). Annual precipitation (58 inches [1,475 mm]) and the start of the wet season vary greatly. There are forests of eucalyptus, bamboo, moss-hung casuarina, and sandalwood; coconut-palm groves; tall-grass and low-tree savannas; and, at higher levels, grazing lands. Marsupials, crocodiles, cockatoos, pigeons, doves, deer, monkeys, and snakes are typical wild animals.

The coastal inhabitants are largely of Indonesian-Malay ancestry, who have driven the predominantly Melanesian aboriginal peoples to the mountains. Some Islāmic and Christian inroads have been made, but animism and ancestor worship predominate. Each village has a sacred house with a custodian priest and a surrounding taboo area. Because of former coastal warfare, villages and isolated houses are surrounded by stockades. Houses are usually raised on piles.

The Portuguese began trading with Timor, probably for sandalwood, about 1520. In 1613 the Dutch established themselves in Kupang, on a sheltered bay at the southwestern tip of the island, and the Portuguese moved to the north and east. Treaties effective in 1860 and 1914 between Portugal and The Netherlands divided the island and set the boundaries that existed until 1975, when Indonesian troops invaded and occupied East Timor. The territory subsequently became an Indonesian province. The East Timorese strongly resisted Indonesian rule, and in 1999 East Timor was granted independence as a non-self-governing territory under United Nations supervision; the territory gained full sovereignty in May 2002.

Except for a British interregnum (1812–15), western Timor was Dutch-occupied until the Japanese occupation during World War II. Briefly (1946–49) included in the Dutch-sponsored state of East Indonesia, the territory became part of Indonesia in 1950.

There are two capitals on the island. Dili, or Dilly, on the northern coast, was the capital and port of Portuguese Timor and then the seat of the Indonesian province of Timor Timur; it is now the capital of East Timor. Kupang is the provincial capital and port city of Nusa Tenggara Timur, Indonesia.

Traditional island agriculture is characterized by shifting cultivation and the production of dry rice, corn (maize), and sweet potatoes. Irrigation aids the cultivation of wet rice. The main native manufactures are cotton cloth and finely patterned baskets. Iron weapons and tools are forged, and brass ornaments are cast by the lost-wax process.

**Timor, East**, Portuguese TIMORLESTE, Tetum TIMOR LOROSA'E, in full DEMOCRATIC REPUBLIC OF EAST TIMOR, country occupying the eastern half of the island of Timor, the small nearby islands of Atauro (Kambing) and Jaco, and the enclave of Ambeno surrounding Pante Makasar on the northwestern coast of Timor. It is bounded by the Timor Sea to the southeast, the Wetar Strait to the north, the Ombai Strait to the northwest, and western Timor (part of the Indonesian province of Nusa Tenggara Timur) to the southwest. Dili is the capital and largest city.

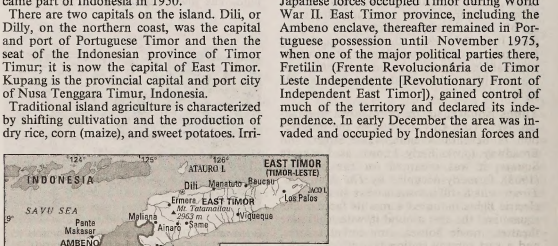
East Timor is rugged, with the mountains rising to 9,721 feet (2,963 m) at Mount Tatamailau (Tata Mailau) in the centre of a high plateau. The area has a dry tropical climate and moderate rainfall. Hilly areas are covered with sandalwood; scrub and grass grow in the lowlands, together with coconut palms and eucalyptus trees. There are hot springs and numerous mountain streams. Wildlife includes the cuscus (a species of marsupial), civets, and crocodiles.

Agriculture is the mainstay of the economy; chief products include copra, hides, coffee, cotton, rice, wheat, tobacco, wool, potatoes, and corn (maize), as well as pearls and sandalwood. Soap, perfumes, processed food, chemicals, and machine goods are produced, and coffee is processed. Crafts include pottery, wood and ivory carving, plaiting, coir production, and basket making.

Most of the people are of Papuan, Malayan, and Polynesian origin, and they are predominantly Christian. About 40 different Papuan and Malayan (Austronesian) languages or dialects are spoken, dominated by Tetum, which is Austronesian; Portuguese is spoken by a small fraction of the population.

The Ambeno area has valuable sandalwood forests, coconut groves, and rice plantations. Its chief town, Pante Makasar, is a port and has an airport. The hilly offshore island of Atauro, which also has an airport, has a population occupied mainly in fishing. The currency is the U.S. dollar.

The Portuguese settled on Timor in 1520; the Spanish arrived in 1522. The Dutch took possession of the western portion of the island in 1613. The British governed the island in 1812–15. The Dutch and the Portuguese fought for supremacy over Timor; Portuguese sovereignty over the island's eastern half was settled by treaties in 1860 and 1893, although the latter became effective only in 1914. Japanese forces occupied Timor during World War II. East Timor province, including the Ambeno enclave, thereafter remained in Portuguese possession until November 1975, when one of the major political parties there, Fretilin (Frente Revolucionária de Timor Leste Independente [Revolutionary Front of Independent East Timor]), gained control of much of the territory and declared its independence. In early December the area was invaded and occupied by Indonesian forces and




East Timor

in 1976 was made an integral part of Indonesia.

Over the next two decades tens of thousands of East Timorese died (possibly as many as 200,000) either resisting the Indonesian annexation or as a result of famine and disease. In August 1999, responding to international pressure, the Indonesian government held a referendum on independence. Almost four-fifths of the voters supported independence, and East Timor became for a few years a non-self-governing territory under United Nations supervision. The transfer of power was accompanied by violence perpetrated by anti-independence militants. Hundreds were killed, and thousands fled to the western half of the island; refugees subsequently began returning home. In April 2002 Xanana Gusmão, leader of one of the former opposition groups, was elected East Timor's first president. The territory became a fully sovereign state in May 2002. Area 5,743 square miles (14,874 square km). Pop. (2002 est.) 797,000.

**Timor Sea,** arm of the Indian Ocean, lying southeast of the island of Timor and northwest of Australia. About 300 miles (480 km) wide, it covers about 235,000 square miles (615,000 square km) and opens west into the Indian Ocean and east into the Arafura Sea, part of the Pacific Ocean. A maximum depth of more than 10,800 feet (3,300 m) is reached in the Timor Trough in the north, but more than half of the sea has a depth of less than 650 feet (200 m). The southwesterly surface current, the Timor Current, flows at an average 0.5–1 mile (0.8–1.6 km) per hour.

**Timoshenko, Semyon Konstantinovich** (b. Feb. 18 [Feb. 6, Old Style], 1895, Furmanka, Ukraine, Russian Empire—d. March 31, 1970, Moscow, Russian S.F.S.R.), Soviet general who helped the Red Army withstand German forces at the start of World War II. Having fought in World War I and the Russian Civil War, Timoshenko held several regional military commands during the 1930s. In January 1940 during the Russo-Finnish War, he was placed in command of faltering Soviet forces, and by March he had forced the Finns to sue for peace. Named a marshal of the Soviet Union and commissar for defense in May 1940, he worked to upgrade military training and tactical planning as well as to improve Soviet forces' preparedness for a defense against German invasion.

**Timotheus** (d. 354 BC, Chalcis [now in Greece]), Greek statesman and general who sought to revive Athenian imperial ambitions by making Athens dominant in the Second Athenian League (established 378–377).

Timotheus, the son of the celebrated general Conon, was elected strategus in 378 BC and was a commander in the war against Sparta. He won over the Acarnanians and Molossians as friends of Athens. Thereafter, he captured Corcyra and defeated the Spartans at sea off Alyzia (Acarnania). Upon his acquittal (373) of a charge of negligence, he served the king of Persia as a mercenary. Back in the service of Athens, he overran Samos, then occupied by a Persian garrison, after a 10-month siege (366–365), and captured a number of cities in the northern Aegean but failed in two attempts to take Amphipolis.

Such aggressive policies alienated Athens' confederates, eventually driving them to revolt in the Social War of 357–355. Many Athenian ships were lost in a battle against the rebels in the Hellespont because Timotheus and other fleet commanders had failed to coordinate their actions after a storm arose. He was impeached and fined. Unable to pay, he withdrew to Chalcis, where he died.

**timothy,** also called HERD'S-GRASS (*Phleum pratense*), perennial grass of the family Poaceae, native to Europe and widely cultivated as a hay and pasture grass in North America. The stems grow in large clumps and are 0.5 to 1 m (1.5 to 3 feet) tall, with swollen, bulblike bases. The panicles (flower clusters) are long, dense, and cylindrical.



Timothy (*Phleum pratense*)
Hartmut Noeller—Peter Arnold

Alpine, or mountain, timothy (*P. alpinum*) is about half as tall, with short, thick panicles. It occurs in wet places from Greenland to Alaska and at high altitudes in many other parts of North America and Europe.

**Timothy,** SAINT (b. Lystra, Lycaonia [now Lusna, Tur.]—d. traditionally AD 97, Ephesus [now in Turkey]; Western feast day January 24 [in Roman church January 26 with Titus], Eastern feast day January 22), disciple of St. Paul the Apostle, whom he accompanied on his missions; traditional martyr and first bishop of Ephesus.

On his second visit to Lystra in 50, Paul discovered Timothy, taking him as a colleague but first circumcising him out of respect for his Jewish mother and the custom of the Jews in whose communities they were to do mission work (Acts 16:1–3). Timothy worked with Paul and Silas and helped found churches, notably in Corinth, Thessalonica, and Philippi. He apparently accompanied Paul to Ephesus and Asia Minor (Acts 19:22; 1 Corinthians 16:10–11). As the presence of his name in the first verses of Colossians, Philemon, and Philippians indicates, he was subsequently associated with Paul's imprisonment at Ephesus. In the Pastoral Epistles he is solely in charge of the Christians at Ephesus, possibly the site of his release from prison as chronicled in Hebrews 13:23.

Tradition, probably based on New Testament inferences, made him first bishop of Ephesus, where he was allegedly martyred under the Roman emperor Nerva. One legend asserts that he was clubbed to death by a mob for protesting against the orgiastic worship of the goddess Artemis.

The two Pastoral Epistles addressed to Timothy reveal concern for his well-being, and he is praised in 1 Corinthians, Philippians, and Romans. He is also mentioned in 1 and 2 Thessalonians and 2 Corinthians. St. John of Damascus states that Timothy witnessed the death of the Virgin Mary.

**Timothy, The Letter of Paul to,** also called THE EPISTLE OF ST. PAUL THE APOSTLE TO TIMOTHY, OF PASTORAL EPISTLE, either of two New Testament writings addressed to Timothy, one of Paul's most faithful coworkers. They (and the Letter of Paul to Titus) have been called Pastoral Epistles since the end of the 18th century, because all three deal principally with church administration and the growth of heresies. The interpretation of the letters depends in part on who actually wrote them. The majority of scholars today doubt Pauline authorship but vigorously dispute to what degree the letters reflect Pauline ministry. Those who regard the epistles as not Pauline date them to between AD 80 and 100.

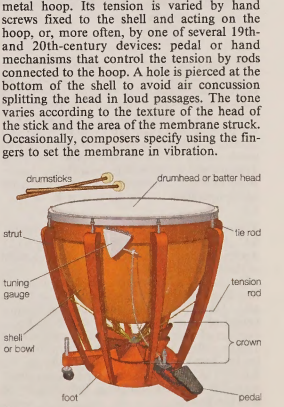
The First Letter of Paul to Timothy insists on the need to shun unorthodox teachings and dangerous speculations and reiterates the qualities expected of bishops and deacons. It exhorts Timothy to fulfill his duties faithfully and to instill in his congregation traditional beliefs, notions of proper conduct, and respect for one another.

The Second Letter of Paul to Timothy similarly urges Timothy to "guard the truth that has been entrusted to you by the Holy Spirit" and to accept his share of suffering "as a good soldier of Christ Jesus." He is further admonished to "have nothing to do with stupid, senseless controversies" and to avoid "men of corrupt mind and counterfeit faith." Toward the end, the letter mentions many individuals by name, some dear friends, others who wrought harm. Timothy is asked to visit soon, even though the writer believes he is "on the point of being sacrificed."

**Timour** (Turkish leader): *see* Timur.

**timpani,** also spelled TYMPANI (Italian: "drums"), orchestral kettledrums. The name has been applied to large kettledrums since at least the 17th century. The permanent orchestral use of timpani dates from the mid-17th century, early examples being in Matthew Locke's *Psyche* (1673) and Jean-Baptiste Lully's opera *Thésée* (1675). At first they were mainly confined to expressions of rejoicing or to supporting the brass in loud passages. Two instruments, one tuned to the tonic and the other to the dominant (first and fifth notes of the scale), were normal in 17th- and 18th-century scores. Later, more instruments were used with a variety of tunings. In the 19th century the timpani were used in more varied and expressive ways, a development stimulated in large part by the innovations of Ludwig van Beethoven. The French composer Hector Berlioz, who required 16 kettledrums in his *Grand Messe des morts* (1837; *Requiem*), even urged composers to specify the type of sticks to be used.

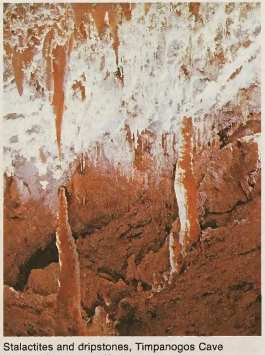
In modern timpani the bowl-shaped shell is usually of copper or brass. The membrane, of calfskin or synthetic material, is secured by a metal hoop. Its tension is varied by hand screws fixed to the shell and acting on the hoop, or, more often, by one of several 19th- and 20th-century devices: pedal or hand mechanisms that control the tension by rods connected to the hoop. A hole is pierced at the bottom of the shell to avoid air concussion splitting the head in loud passages. The tone varies according to the texture of the head of the stick and the area of the membrane struck. Occasionally, composers specify using the fingers to set the membrane in vibration.




Timpani
Encyclopædia Britannica, Inc.

The orchestral kettledrum has a practical compass of five full tones. The compass of a pair of timpani is normally an octave from F below middle C downward; for an orchestral set of three, the tuning ranges are generally c–g, G–d, and E♭–B♭ (g = the G below middle C; E♭ = the second E♭ below). Composers such as Igor Stravinsky and Gustav Mahler have extended this range. The expressive resources of the timpani include reiteration of persistent rhythms, dramatic crescendos, sudden stresses, and atmospheric rolls. Special effects include damped or muffled notes, striking a note with two sticks, pedal glissando (sliding pitch) on a roll, and muting by placing a cloth on the drumhead. *See also* kettledrum.

**Timpanogos Cave National Monument,** national monument containing a limestone cave in American Fork Canyon, north-central Utah, U.S. The monument is on the northwestern slope of Mount Timpanogos (12,008 feet [3,660 m]), the highest peak of the Wasatch Range, north of Provo. Established in 1922, the monument occupies an area of 250 acres (101 hectares). The cave, which is lighted electrically, has three connected cham-



Stalactites and dripstones, Timpanogos Cave National Monument, Utah

By courtesy of the National Park Service

bers noted for their pink and white, crystal-filigreed walls and their tinted stalagmite, stalactite, and helictite formations. One of the stalactites (the Great Heart of Timpanogos) is shaped like a human heart. Naturally excavated millions of years ago by an underground stream, it is reached by a steep foot trail that winds up the side of the mountain. The name Timpanogos is believed to be a Paiute Indian word meaning "reclining woman." The average temperature within the cave is 42° F (5.6° C).

**Timrod, Henry** (b. Dec. 8, 1828, Charleston, S.C., U.S.—d. Oct. 6, 1867, Columbia, S.C.), American poet who was called "the laureate of the Confederacy."

The son of a bookbinder, Timrod attended Franklin College (later the University of Georgia), Athens, for two years and for a short period of time read law in Charleston. For a number of years he worked as a tutor, and in 1860 a collection of his poems was published. In his best-known essay, "Literature in the South" (1859), he criticized the lack of respect accorded Southern writers in both the North and the South.

During the American Civil War he enlisted in the Confederate army but was soon discharged for reasons of health. Later he was an editor and part owner of the *South Carolinian* in Columbia. After the city was burned by Union forces, however, he suffered from poverty and chronic ill health. He died of tuberculosis.

In 1873 the Southern poet Paul Hamilton Hayne, who was Timrod's lifelong friend, edited *The Poems of Henry Timrod.* Among Timrod's poems supporting the South were "Ode Sung at the Occasion of Decorating the Graves of the Confederate Dead," "The Cotton Boil," and "Ethnogenesis." *Katie,* a lyric poem to his wife, was published in 1884 and *Complete Poems* in 1899.

*Consult the* INDEX *first*

**Timur,** also spelled TIMOUR, byname TIMUR LENK, or TIMURLENK (Turkish: "Timur the Lame"), English TAMERLANE, or TAMBURLAINE (b. 1336, Kesh, near Samarkand, Transoxania [now in Uzbekistan]—d. Feb. 19, 1405, Otrar, near Chimkent [now in Kazakhstan]), Turkic conqueror of Islāmic faith, chiefly remembered for the barbarity of his conquests from India and Russia to the Mediterranean Sea and for the cultural achievements of his dynasty.

*Life.* Timur was a member of the Turkicized Barlas tribe, a Mongol subgroup that had settled in Transoxania (now roughly corresponding to Uzbekistan) after taking part in Genghis Khan's son Chagatai's campaigns in that region. Timur thus grew up in what was known as the Chagatai khanate. After the death in 1357 of Transoxania's current ruler, Amir Kazgan, Timur declared his fealty to the khan of nearby Kashgar, Tughluq Temür, who had overrun Transoxania's chief city, Samarkand, in 1361. Tughluq Temür appointed his son Ilyas Khoja as governor of Transoxania, with Timur as his minister. But shortly afterward Timur fled and rejoined his brother-in-law Amir Husayn, the grandson of Amir Kazgan. They defeated Ilyas Khoja (1364) and set out to conquer Transoxania, achieving firm possession of the region around 1366. About 1370 Timur turned against Husayn, besieged him in Balkh, and, after Husayn's assassination, proclaimed himself at Samarkand sovereign of the Chagatai line of khans and restorer of the Mongol empire.

For the next 10 years Timur fought against the khans of Jatah (eastern Turkistan) and Khorezm, finally occupying Kashgar in 1380. He gave armed support to Tokhtamysh, who was the Mongol khan of the Crimea and a refugee at his court, against the Russians (who had risen against the khan of the Golden Horde, Mamai); and his troops occupied Moscow and defeated the Lithuanians near Poltava.

In 1383 Timur began his conquests in Persia with the capture of Herāt. The Persian political and economic situation was extremely precarious. The signs of recovery visible under the later Mongol rulers known as the Il-Khanid dynasty had been followed by a setback after the death of the last Il-Khanid, Abu Said (1335). The vacuum of power was filled by rival dynasties, torn by internal dissensions and unable to put up joint or effective resistance. Khorāsān and all eastern Persia fell to him in 1383–85; Fārs, Iraq, Azerbaijan, Armenia, Mesopotamia, and Georgia all fell between 1386 and 1394. In the intervals, he was engaged with Tokhtamysh, then khan of the Golden Horde, whose forces invaded Azerbaijan in 1385 and Transoxania in 1388, defeating Timur's generals. In 1391 Timur pursued Tokhtamysh into the Russian steppes and defeated and dethroned him; but Tokhtamysh raised a new army and invaded the Caucasus in 1395. After his final defeat on the Kur River, Tokhtamysh gave up the



Timur, miniature, 16th century; in the Topkapı Sarayı Museum, Istanbul

By courtesy of the Topkapi Sarayi Museum, Istanbul

struggle; Timur occupied Moscow for a year. The revolts that broke out all over Persia while Timur was away on these campaigns were repressed with ruthless vigour; whole cities were destroyed, their populations massacred, and towers built of their skulls.

In 1398 Timur invaded India on the pretext that the Muslim sultans of Delhi were showing excessive tolerance to their Hindu subjects. He crossed the Indus River on September 24 and, leaving a trail of carnage, marched on Delhi. The army of the Delhi sultan Mahmud Tughluq was destroyed at Panipat on December 17, and Delhi was reduced to a mass of ruins, from which it took more than a century to emerge. By April 1399 Timur was back in his own capital. An immense quantity of spoil was conveyed away; according to Ruy Gonzalez de Clavijo, 90 captured elephants were employed to carry stones from quarries to erect a mosque at Samarkand.

Timur set out before the end of 1399 on his last great expedition, in order to punish the Mamlūk sultan of Egypt and the Ottoman sultan Bayazid I for their seizures of certain of his territories. After restoring his control over Azerbaijan, he marched on Syria; Aleppo was stormed and sacked, the Mamlūk army defeated, and Damascus occupied (1401), the deportation of its artisans to Samarkand being a fatal blow to its prosperity. In 1401 Baghdad was also taken by storm, 20,000 of its citizens were massacred, and all its monuments were destroyed. After wintering in Georgia, Timur invaded Anatolia, destroyed Bayazid's army near Ankara (July 20, 1402), and captured Smyrna from the Knights of Rhodes. Having received offers of submission from the sultan of Egypt and from John VII (then coemperor of the Byzantine Empire with Manuel II Palaeologus), Timur returned to Samarkand (1404) and prepared for an expedition to China. He set out at the end of December, fell ill at Otrar on the Syr Darya west of Chimkent, and died in February 1405. His body was embalmed, laid in an ebony coffin, and sent to Samarkand, where it was buried in the sumptuous tomb called Gūr-e Amīr. Before his death he had divided his territories among his two surviving sons and his grandsons, and, after years of intestine struggles, the lands were reunited by his youngest son, Shāh Rokh.

*Assessment.* Timur began his rise as leader of a small nomad band and by guile and force

of arms established dominion over the lands between the Oxus and Jaxartes rivers (Transoxania) by the 1360s. He then, for three decades, led his mounted archers to subdue each state from Mongolia to the Mediterranean. He was the last of the mighty conquerors of Central Asia to achieve such military successes as leader of the nomad warrior lords, ruling both agricultural and pastoral peoples on an imperial scale. The poverty, bloodshed, and desolation caused by his campaigns gave rise to many legends, which in turn inspired such works as Christopher Marlowe's *Tamburlaine the Great.*

The name Timur Lenk signified Timur the Lame, a title of contempt used by his Persian enemies, which became Tamburlaine, or Tamerlane, in Europe. Timur was heir to a political, economic, and cultural heritage rooted in the pastoral peoples and nomad traditions of Central Asia. He and his compatriots cultivated the military arts and discipline of Genghis Khan and, as mounted archers and swordsmen, scorned the settled peasants. Timur never took up a permanent abode. He personally led his almost constantly campaigning forces, enduring extremes of desert heat and lacerating cold. When not campaigning he moved with his army according to season and grazing facilities. His court traveled with him, including his household of one or more of his nine wives and concubines. He strove to make his capital, Samarkand, the most splendid city in Asia, but when he visited it he stayed only a few days and then moved back to the pavilions of his encampment in the plains beyond the city.

Timur was, above all, master of the military techniques developed by Genghis Khan, using every weapon in the military and diplomatic armory of the day. He never missed an opportunity to exploit the weakness (political, economic, or military) of the adversary or to use intrigue, treachery, and alliance to serve his purposes. The seeds of victory were sown among the ranks of the enemy by his agents before an engagement. He conducted sophisticated negotiations with both neighbouring and distant powers, which are recorded in diplomatic archives from England to China. In battle, the nomadic tactics of mobility and surprise were his major weapons of attack.

Timur's most lasting memorials are the Timurid architectural monuments of Samarkand, covered in azure, turquoise, gold, and alabaster mosaics; these are dominated by the great cathedral mosque, ruined by an earthquake but still soaring to an immense fragment of dome. His mausoleum, the Gūr-e Amīr, is one of the gems of Islāmic art. Within the sepulchre he lies under a huge, broken slab of jade. The tomb was opened in 1941, having remained intact for half a millennium. The Soviet Archaeological Commission found the skeleton of a man who, though lame in both right limbs, must have been of powerful physique and tall for a Tatar.

Timur's sons and grandsons fought over the succession when the Chinese expedition disbanded, but his dynasty (*see* Timurid dynasty) survived in Central Asia for a century in spite of fratricidal strife. Samarkand became a centre of scholarship and science. It was here that Ulūgh Beg, his grandson, set up an observatory and drew up the astronomical tables that were later used by the English royal astronomer in the 17th century. During the Timurid renaissance of the 15th century, Herāt, southeast of Samarkand, became the home of the brilliant school of Persian miniaturists. At the beginning of the 16th century, when the dynasty ended in Central Asia, his descendant Bābur established himself in Kābul and then conquered Delhi, to found the Muslim line of Indian emperors known as the Great Mughals.

BIBLIOGRAPHY. A scholarly study of the evidence relating to Timur's life is in V.V. Bartold, *Four Studies on the History of Central Asia,* 2 vol. (1956–58). Based substantially on this work is the account of his life given in Hilda Hookham, *Tamburlaine, the Conqueror* (1962), which also contains the fullest available bibliography of works in English.

**Timur ruby,** jewel that is in fact not a ruby but one of the world's largest polished red magnesia spinels (*see* ruby spinel). The unfaceted, 361-carat stone is set in the imperial state crown of England. It is inscribed with the names and dates of six of its owners. The earliest is Shāh Jahāngīr, 1612, and the latest is Aḥmad Shāh Durrānī, 1754.

**Timurid** DYNASTY (*fl.* 15th–16th century AD), Turkic dynasty descended from the conqueror Timur (Tamerlane), renowned for its brilliant revival of artistic and intellectual life in Iran and Central Asia.

After Timur's death (1405), his conquests were divided between two of his sons: Mīrānshāh (d. 1407) received Iraq, Azerbaijan, Moghān, Shīrvān, and Georgia, while Shāh Rokh was left with Khorāsān.

Between 1406 and 1417 Shāh Rokh extended his holdings to include those of Mīrānshāh as well as Māzanderān, Seistān, Transoxania, Fars, and Kermān, thus reuniting Timur's empire, except for Syria and Khuzistan. Shāh Rokh also retained a nominal suzerainty over China and India. During Shāh Rokh's reign (1405–47), economic prosperity was restored and much of the damage wrought by Timur's campaigns was repaired. Trading and artistic communities were brought into the capital city of Herāt, where a library was founded, and the capital became the centre of a renewed and artistically brilliant Persian culture.

In the realm of architecture, the Timurids drew on and developed many Seljuq traditions. Turquoise and blue tiles forming intricate linear and geometric patterns decorated the facades of buildings. Sometimes the interior was decorated similarly, with painting and stucco relief further enriching the effect. The Gūr-e Amīr, Timur's mausoleum in Samarkand, is the most notable example. The tiled dome, rising above a polygonal chamber, is fluted and slightly bulbous. Of the Ak-Saray, Timur's palace built between 1390 and 1405 at Kesh, only the monumental gates remain, again with coloured-tile decoration.

The schools of miniature painting at Shīrāz, Tabrīz, and Herāt flourished under the Timurids. Among the artists gathered at Herāt was Behzād (d. *c.* 1525), whose dramatic, intense style was unequaled in Persian manuscript illustration. The Baysunqur workshops practiced leatherwork, bookbinding, calligraphy, and wood and jade carving. In metalwork, however, Timurid artistry never equaled that of earlier Iraqi schools.

Internal rivalry eroded Timurid solidarity soon after Shāh Rokh's death. The years 1449–69 were marked by a constant struggle between the Timurid Abū Sa'īd and the Uzbek confederations of the Kara Koyunlu ("Black Sheep") and Ak Koyunlu ("White Sheep"). When Abū Sa'īd was killed in 1469, the Ak Koyunlu ruled unopposed in the west, while the Timurids receded to Khorāsān. Nevertheless the arts, particularly literature, historiography, and miniature painting, continued to flourish; the court of the last great Timurid, Ḥusayn Bayqarah (1478–1506) supported such luminaries as the poet Jāmī, the painters Behzād and Shāh Muẓaffar, and the historians Mīrkhwānd and Khwāndamīr. The vizier himself, Mīr 'Alī Shīr, established Chagatai Turkish literature and fostered a revival in Persian.

Although the last Timurid of Herāt, Badī' az-Zamān, finally fell to the armies of the Uzbek Muḥammad Shaybānī in 1506, the Timurid ruler of Fergana, Ẓahīr-ud-Dīn Bābur, survived the collapse of the dynasty and established the line of Mughal emperors in India in 1526.

**Tin** (Etruscan god): *see* Tinia.

**tin** (Sn), a chemical element belonging to the carbon family, Group IVa of the periodic table. It is a soft, silvery-white metal with a bluish tinge, known to the ancients in bronze, an alloy with copper. Tin is widely used for plating steel cans used as food containers, in metals used for bearings, and in solder.

*Occurrence, properties, and uses.* The element is present in the igneous rocks of the Earth's crust to the extent of about 0.001 percent, occurring in grains of the native metal but chiefly as the oxide in the mineral cassiterite (*q.v.*), from which the metal is obtained by reduction (removal of the oxygen) with coal or coke in smelting furnaces. The oldest tin mines were those in England and Spain, but those in Indonesia, Thailand, Zaire, Nigeria, and China have surpassed them in modern production. Several processes have been devised for reclaiming the metal from scrap tin or tin-plated articles. For a full treatment of tin mining, refining, and recovery, *see* MACROPAEDIA: Industries, Extraction and Processing.

Tin is nontoxic, ductile, malleable, and adapted to all kinds of cold-working, such as rolling, spinning, and extrusion. The colour of pure tin is retained during exposure because a thin, invisible, protective film of tin(IV) oxide is formed spontaneously by reaction with the oxygen of the air. The low melting point of tin and its firm adhesion to clean surfaces of iron, steel, copper, and copper alloys facilitate its use as an oxidation-resistant coating material. Tin exists in two different forms, or allotropes: the familiar form, white (or beta) tin, and gray (or alpha) tin, which is powdery and of little use. The gray form changes to the white above 13.2° C (55.8° F), rapidly at temperatures above 100° C (212° F); the reverse transformation, called tin pest, occurs at low temperatures but is prevented by small amounts of antimony, bismuth, copper, lead, silver, or gold normally present in commercial grades of tin.

White tin has a body-centred tetragonal crystal structure, and gray tin has a face-centred cubic structure. When bent, tin makes an eerie, crackling "cry" as its crystals crush each other. Tin is attacked by strong acids and alkalies, but nearly neutral solutions do not affect it appreciably. Chlorine, bromine, and iodine react with tin, but fluorine reacts with it only slowly at room temperature.

Because pure tin is relatively weak, it is not put to structural uses unless alloyed with other metals. Numerous alloys of tin are used, including soft solder, type metal, pewter, bronze, bell metal, babbitt metal, and low-temperature casting alloys. A crystalline alloy with niobium is a superconductor at temperatures as high as 18 K (−427° F) and retains this property in very strong magnetic fields.

Tin has 10 stable isotopes, occurring in the following percentages in natural tin: tin-112, 0.97; tin-114, 0.65; tin-115, 0.36; tin-116, 14.53; tin-117, 7.68; tin-118, 24.22; tin-119, 8.58; tin-120, 32.59; tin-122, 4.63; and tin-124, 5.79.

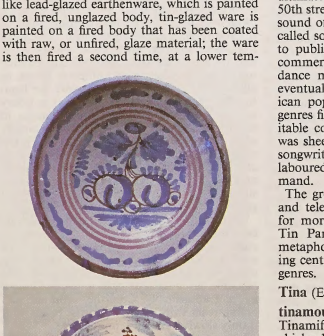
*Compounds.* Tin forms two series of compounds: stannous, or tin(II), compounds and stannic, or tin(IV), compounds. Some of the more commercially important compounds of tin(II) are stannous chloride, $SnCl_2$, used in tin galvanizing and as a reducing agent in the manufacture of polymers and dyes; stannous oxide, SnO, employed in making tin salts for chemical reagents and for plating; and stannous fluoride, $SnF_2$, a major component of toothpastes. Tin(IV) compounds of significance include stannic chloride, $SnCl_4$, widely used as a stabilizer for perfumes and as a starting material for other tin salts; and stan-

nic oxide, $SnO_2$, a useful catalyst in certain industrial processes and a polishing powder for steel.

Tin can form a bond with carbon, as in the more than 500 known organotin compounds. Organotin stabilizers are used to prevent changes in polyvinyl chloride upon exposure to light and heat. A number of organotin compounds are major ingredients in biocides and fungicides.

| | |
|---|---|
| atomic number | 50 |
| atomic weight | 118.69 |
| melting point | 231.97° C (449.54° F) |
| boiling point | 2,270° C (4,100° F) |
| density | |
| (white) | 7.28 |
| (gray) | 5.75 |
| valence | 2, 4 |
| electron config. | 2-8-18-18-4 or $4d^{10}5s^25p^2$ |

**tin-glazed earthenware,** also called TIN-ENAMELED EARTHENWARE, earthenware covered with an opaque glaze that, unless colour has been added, is white. It is variously called faience, majolica, and delftware. Essentially it is lead glaze made opaque by the addition of tin oxide; tin glaze was no doubt originally devised to conceal flaws of colour in a fired-clay body. Tin-glazed ware is usually decorated with high-temperature colours. But, unlike lead-glazed earthenware, which is painted on a fired, unglazed body, tin-glazed ware is painted on a fired body that has been coated with raw, or unfired, glaze material; the ware is then fired a second time, at a lower temperature, indelibly fusing pigments and glaze. (Sometimes a transparent lead glaze is added over the painted decoration, requiring a third firing.) The advantage of tin glaze over lead is that it does not run when fired, and thus the pigments do not blur; the disadvantage is that—as in fresco painting, which is executed on fresh plaster—the surface of the glaze is absorbent, making alterations impossible.



(Top) Delft charger, Holland, 17th century; (bottom) English delft blue-dash charger with a portrait of William III painted in underglaze colours, Bristol, c. 1700; in the Victoria and Albert Museum, London

By courtesy of (top) The Connoisseur, Winnetka, Ill. (bottom) the Victoria and Albert Museum, London

The art of tin-glazing, discovered by the Assyrians and revived in Mesopotamia in about the 9th century, spread to Moorish Spain and was conveyed to Italy by way of the island of Majorca, whence the name majolica (maiolica), by which it is known in Italy. Italian majolica, particularly that made in Faenza, was much admired, and in the early 16th century it was imitated in France. The word faience, first applied to French tin-glazed earthenware and then to wares made in Spain, Scandinavia, and Germany, was certainly derived from Faenza. In the early 17th century, tin-glazed earthenware was made in Holland, in the town of Delft, whence the art was introduced into England. Delft thus refers to tin-glazed wares produced both in The Netherlands and in England.

The word majolica is sometimes used loosely when applied to wares made in the Italian style but outside Italy, just as faience is used incorrectly when applied to Egyptian blue-glazed ware and certain kinds of Middle Eastern ware.

**Tin Pan Alley,** genre of American popular music that arose in the late 19th century from the American song-publishing industry centred in New York City.

The genre took its name from the byname of the street on which the industry was based, being on 28th Street between Fifth Avenue and Broadway in the early 20th century; around Broadway and 32nd Street in the 1920s; and ultimately on Broadway between 42nd and 50th streets. The phrase tin pan referred to the sound of pianos furiously pounded by the so-called song pluggers, who demonstrated tunes to publishers. Tin Pan Alley comprised the commercial music of songwriters of ballads, dance music, and vaudeville, and its name eventually became synonymous with American popular music in general. When these genres first became prominent, the most profitable commercial product of Tin Pan Alley was sheet music for home consumption, and songwriters, lyricists, and popular performers laboured to produce music to meet the demand.

The growth of film, audio recording, radio, and television created an increased demand for more and different kinds of music, and Tin Pan Alley was rendered actually and metaphorically dead as other music-publishing centres arose to supply melodies for these genres.

**Tina** (Etruscan god): *see* Tinia.

**tinamou,** any of 46 species belonging to the Tinamiformes, an order of ground-dwelling, chickenlike birds inhabiting Central and South America.

A brief treatment of Tinamiformes follows. For full treatment, *see* MACROPAEDIA: Birds.

Although superficially resembling guinea fowl, tinamous are actually related to the much larger rheas. All tinamous are able to fly, although most of these short-winged birds commonly move by walking or running. Frequently, to escape predators, they crouch or seek shelter in holes rather than take flight. Most species sleep on the ground.

Tinamous range in length from 15 cm (6 inches) in the dwarf tinamou (species *Taoniscus nanus*) to upwards of 50 cm (20 inches) in the larger species. They have short tails, which are all but hidden by their voluminous rump feathers. Both sexes are similar in their inconspicuous brown, gray, or rufous colouring, although females are somewhat more brightly coloured than males. The colour of the bill and legs is vivid in some species, *e.g.,* the yellow-legged tinamou (*Crypturellus noctivagus*). Tinamous have small heads, long necks, and thick legs; the female is frequently larger. As many as 12 glossy and colourful (blue-green, purple, or pinkish) eggs are laid in the nest by one or more females. The male alone incubates the eggs and raises the young, although in the Andes the female of the ornate tinamou (*Nothoprocta ornata*) defends the nesting territory. In the solitary forest-dwelling variegated tinamou (*C. variegatus*), the female courts the male with a ritual display; in this species there are four times as many males as females, and they raise only one young at a time.

Outside of breeding season, the martineta, or elegant crested, tinamou (*Eudromia elegans*) may gather in flocks of as many as 100 birds. Most tinamous, however, remain in small groups or alone. The call of the tinamou is loud and melodious, both day and night. Some tinamous are hunted for food.

**Tinbergen, Jan** (b. April 12, 1903, The Hague, Neth.—d. June 9, 1994), Dutch economist noted for his development of econometric models. He was cowinner (with Ragnar Frisch) of the first Nobel Prize for Economics, in 1969.

Tinbergen was the brother of the zoologist Nikolaas Tinbergen and was educated at the University of Leiden. From 1929 to 1945 he was a business-cycle statistician with the Dutch government's Central Bureau of Statistics and from 1945 to 1955 was director of the Central Planning Bureau. He held the post of professor of economics at The Netherlands School of Economics (now part of Erasmus University), Rotterdam, for 40 years (1933–73) and then taught for two years at the University of Leiden before his retirement in 1975.

Tinbergen was an economic adviser to the League of Nations at Geneva, 1936–38, and it was there that he completed his analysis of the economic development of the United States from 1919 to 1932. This pioneering econometric study provided much of the raw material for his later development of business-cycle theory and for the application of methods of economic stabilization. Later he also constructed an econometric model of The Netherlands, which was applied to both short-term and broader political-economic planning.

Among his major works are *Statistical Testing of Business Cycles* (1938), *Econometrics* (1942), *Economic Policy* (1956), and *Income Distribution* (1975).

**Tinbergen, Nikolaas** (b. April 15, 1907, The Hague, Neth.—d. Dec. 21, 1988, Oxford, Eng.), Dutch-born British zoologist and ethologist (specialist in animal behaviour) who, with Konrad Lorenz and Karl von Frisch, received the Nobel Prize for Physiology or Medicine, in 1973. (His brother was the economist Jan Tinbergen.)

After receiving a Ph.D. degree (1932) from the University of Leiden, The Netherlands, Tinbergen taught there until 1949. He then served on the faculty of the University of Oxford (1949–74), where he organized a research department of animal behaviour. He became a British citizen in 1955.

With Lorenz and Frisch, Tinbergen is credited with revitalizing the science of ethology. Their emphasis was on field observations of animals under natural conditions. Tinbergen emphasized the importance of both instinctive and learned behaviour to survival and used animal behaviour as a basis for speculations about the nature of human violence and aggression. He is especially well known for his long-term observations of sea gulls, which led to important generalizations on courtship and mating behaviour.

Among his more important writings are *The Herring Gull's World* (1953; rev. ed. 1961), *Social Behavior in Animals* (1953), and *Animal Behavior* (1965). Perhaps his most influential work is *The Study of Instinct* (1951), which explores the work of the European ethological school up to that time and attempts a synthesis with American ethology.

In the early 1970s Tinbergen and his wife, Elizabeth, began studying human behaviour and behavioral disorders, particularly autism.

The Tinbergens contend that infantile autism, which is characterized by extreme self-absorption and withdrawal from reality, is primarily emotional and the result of severely overstimulated anxiety. According to the Tinbergens, treatment involves an awareness of and sensitivity to the child's fears and a gradual establishment of trust through nonthreatening activities and gestures. Their major joint publications of their observations and theories are *Early Childhood Autism: An Ethological Approach* (1972) and *Autistic Children—New Hope for a Cure* (1983).

**tincal** (mineral): *see* borax.

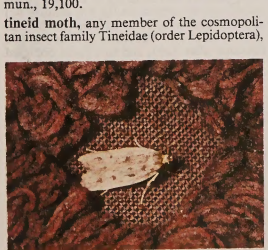
**tincalconite,** also called JEWELERS' BORAX, a borate mineral, hydrated sodium tetraborate ($Na_2B_4O_5(OH)_4 \cdot 3H_2O$), that is found in nature only as a dull, white, fine-grained powder; colourless crystals of the mineral have been made artificially. Tincalconite is common in the borax deposits of southern California, where it often occurs as a coating on kernite or borax, both of which alter to it in a dry atmosphere. For detailed physical properties, *see* borate mineral (table).

**Tinctoris, Johannes** (b. 1436, Nivelles?, duchy of Brabant [now in Belgium]—d. October 1511, Nivelles), Flemish music theorist, composer, and author of the earliest dictionary of musical terms.

Tinctoris studied law and theology at the University of Louvain, which he left before 1476 to take up a position as chaplain to Ferdinand I, king of Naples. He was a member of the Papal Chapel (1484–1500) and established a public music school in Naples. To Beatrice of Aragon, Ferdinand's daughter, he dedicated his dictionary, *Terminorum musicae diffinitorium* (*c.* 1476; printed *c.* 1495), which contains 291 definitions in alphabetical order. His other theoretical works include *Proportionale musices,* dealing with musical notation, and *Liber de arte contrapuncti,* a survey of the art of composition as practiced in the late 15th century. His best-known composition is his *Missa l'homme armé.*

**Tindouf,** town and Saharan oasis in westernmost Algeria. Rich deposits of iron ore are at Gara Djebilet, 93 miles (150 km) southeast. The town has a large population of Regeibat nomads and is strategically important owing to its location near the borders of Morocco, Mauritania, and Western Sahara. Tindouf became the headquarters of the Polisario Front guerrilla organization after the annexation of the former Spanish Sahara (now Western Sahara) by Moroccan troops in 1976. These mostly Regeibat nomads from Western Sahara received financial support from Libya and Algeria in their struggle for an independent Western Sahara. Fighting with the Moroccans continued through the 1980s, and thousands of refugees from the Western Sahara resided in camps south of Tindouf. Pop. (2000 est.) mun., 19,100.

**tineid moth,** any member of the cosmopolitan insect family Tineidae (order Lepidoptera),



Clothes moth
Michael Davies—EB Inc.

including several economically important clothes-moth species. Tineid moths generally have slender, elongated, fringed wings with a spread of 12 to 25 mm (½ to 1 inch) and dull, mottled coloration. They have erect scales or hairs on their heads and long antennae. The larvae are scavengers, feeding chiefly on fungi or things of animal origin. Discovered in early Tertiary deposits (about 50 million years old), tineid fossil remains probably represent some of the earliest lepidopteran forms.

The pale larvae of the clothes moth infest woolens, furs, and other animal products. Well-known species include the webbing clothes moth (*Tineola bisselliella*), the casemaking clothes moth (*Tinea pellionella*), and the carpet, tapestry, or white-tip clothes moth (*Trichophaga tapetzella*). The larvae of the casemaking clothes moth use silk and fragments of food to construct a small, flat, oval case in which the larvae live and pupate. Clothes-moth larvae also attack synthetic or plant-fibre fabrics soiled with grease, sweat, or other animal products. Rubbish removal, prestorage cleaning, and the use of chemicals are commonly used methods of control. The adult moths do not feed.

**tinfoil,** thin sheet of metallic tin used as a protective wrapping for food and tobacco because tin is nontoxic. Tinfoil is also used in electrical capacitors. *See* foil.

**ting** (Chinese: "tripod"), Pinyin DING, type of Chinese vessel, first produced during the Neolithic period (*c.* 3000–1500 BC). The *ting* is essentially a deep cooking vessel, usually with two handles on the rim, supported upon three columnar legs.

Two variations of the *ting* include the *li-ting,* which has a slight swelling of the bowl as it joins each of the legs (similar in effect to the *li*), and the *fang-ting,* which, however illogical, is a "square tripod," with a square or rectangular box resting on four legs. The characteristic decoration—often large *t'ao-t'ieh,* or monster masks—exploits the ample shape and surface of the bowl, with minimal ornamentation of the legs. The *ting,* with many variations of silhouette, is known in virtually all early ages of China, as Neolithic pottery ware and Shang (18th–12th century BC) and Chou (1111–255 BC) bronzes as well as the bronze and glazed pottery imitations of many later periods.

**Ting, Samuel C(hao) C(hung)** (b. Jan. 27, 1936, Ann Arbor, Mich., U.S.), American physicist who won the Nobel Prize for Physics in 1976 for his discovery of a new subatomic particle.

The son of a Chinese college professor who was studying in the United States when Ting was born, he was raised in mainland China and Taiwan and at the age of 20 emigrated to the United States. He was educated at the University of Michigan, Ann Arbor, where he received his doctorate in 1962. Ting taught briefly at Columbia University and was group leader at a nuclear facility at Hamburg, W.Ger., before joining the faculty of the Massachusetts Institute of Technology, Cambridge, in 1967, becoming a professor in 1969. In 1974 in experiments conducted at the Brookhaven National Laboratory at Upton, Long Island, N.Y., Ting discovered a new subatomic particle that he called the J-particle (also called the psi-particle), the first of a new class of very massive, long-lived mesons. The discovery of this particle, thought to be composed of a charmed quark and its antiquark, led to a significant expansion and refinement of the quark model. For this discovery Ting was awarded the 1976 Nobel Prize for Physics jointly with Burton Richter, who had made the same discovery independently at almost the same time. At the time of the award Ting was conducting research at the European Commission for Nuclear Research (CERN) at Geneva.

**Ting Ling** (Chinese writer): *see* Ding Ling.

**Ting ware,** Pinyin DING, Chinese glazed stoneware produced during the Sung dynasty (AD 960–1279) at T'ing Chou and, after the court's transfer to the south in 1127, near Ching-te-chen. Usually white in colour, Ting ware may be either plain or decorated with incised, molded, impressed, or carved designs, among which the phoenix, the lily, and the peony were favoured. The most important types of Ting ware are *pai* Ting ("white" Ting), *fen* Ting ("flour" Ting), and *t'u* Ting ("earthen" Ting). The glaze of *pai* Ting is often thickened on the outside of the ware to produce what are known as "teardrops." Characteristic forms include bowls, cups, and dishes. Fired upside down, many pieces, especially bowls, have an unglazed rim banded with metal.

**Tingo María,** city, capital of Leoncio Prado *provincia,* Huánuco *departamento,* central Peru. The city lies at an elevation of 2,133 feet (650 m) on the right bank of the Huallaga River. It is located at the head of navigation of the river's middle course in a geographic zone intermediate between the Ceja de Montaña ("Edge of the Mountains") and Selva Alta ("High Forest") regions of Peru's eastern piedmont, leading down from the Andes to the Amazonian lowlands.

Tingo María was founded in 1932 at a road crossing on the Huallaga. The settlement grew as a transportation centre for the agricultural products of the region—tea, coffee, sugarcane, and bananas—shipping them by road to either Lima on the Pacific coast or to Pucallpa, which lies to the east on the Ucayali River in the Amazon basin. The nearby Cordillera Azul, to the east, provides a scenic backdrop that separates Tingo María from the lowlands to the east; more than 100 inches. (2,540 mm) of rain falls on the area each year. The humid subtropical forests support local sawmilling, as well as wood-processing and distilling industries, and are the chief attraction of Tingo María National Park (2000 acres [800 hectares]). Cultural amenities include the University of Tingo María (opened 1968) and a botanical garden. Inc. city, 1952. Pop. (1980 est.) city, 22,400; (1987 est.) province, 108,-137.

**Tingréla** (Ivory Coast): *see* Tengréla.

**Tingsten, Herbert Lars Gustaf** (b. March 17, 1896, Jarfalla, Swed.—d. Dec. 26. 1973, Stockholm), Swedish political scientist and journalist known for his criticisms of socialism and communism.

Tingsten was the energetic editor of *Dagens Nyheter,* Sweden's widely read national newspaper, from 1946 to 1960; and in that capacity he criticized fascist, socialist, and communist governments while promoting Sweden's alliance with the Western powers.

Tingsten also held several government posts, including membership in the Royal Swedish Ministry for Foreign Affairs (1923–24) and the Standing Committee on the Constitution. He was professor of political science at the University of Stockholm from 1935 to 1946.

His writings include *Amerikansk demokrati* (1929), *Ella diktaturen* (1936), *De Konservativa Ideerna* (1939), and *The Problem of Democracy* (1965).

**tinguaite,** pale- to dark-green, very fine-grained igneous rock that may be considered the dike (tabular body injected in fissures) equivalent of phonolite. It contains alkali feldspar and nepheline, with aegirine or aegirinaugite. Tinguaite in which the amount of feldspathoid (nepheline) equals or is greater than that of feldspar has a characteristic texture: the light-coloured matrix (groundmass) is equigranular and sugary, with needles of

aegirine between and randomly crossing the other constituents to give a feltlike appearance. Notable sites of occurrence for tinguaite include Rio de Janeiro, Braz.; Hedrum, Nor.; and the Bearpaw Mountains of Montana in the United States.

**Tinguely, Jean** (b. May 22, 1925, Fribourg, Switz.—d. Aug. 30, 1991, Bern), Swiss sculptor and experimental artist, noted for his machinelike kinetic sculptures that destroyed themselves in the course of their operation.

Tinguely studied painting and sculpture at the Basel School of Fine Arts from 1941 to 1945, showing an early interest in movement as an artistic medium in his work there. Growing dissatisfied with the staid artistic climate of Basel, Tinguely moved to Paris in 1953. He then began to construct his first truly sophisticated kinetic sculptures, which he termed *metamechaniques,* or metamatics. These were robotlike contraptions constructed of wire and sheet metal, the constituent parts of which moved or spun at varying speeds. Further innovations on Tinguely's part in the mid- and late 1950s led to a series of sculptures entitled "Machines à peindre" ("Painting Machines"); these robotlike machines continuously painted pictures of abstract patterns to the accompaniment of self-produced sounds and noxious odours. The 8-foot-long "painting machine" that Tinguely set up at the first Paris Biennale in 1959 produced some 40,000 different paintings for exhibition visitors who inserted a coin in its slot.

Tinguely was meanwhile becoming obsessed with the concept of destruction as a means of achieving the "dematerialization" of his works of art. In 1960 he created a sensation with his first large self-destroying sculpture, the 27-foot-high metamatic entitled "Homage to New York," whose public suicide he demonstrated at the Museum of Modern Art in New York City. The event was a fiasco, with the complicated assemblage of motors and wheels failing to operate (*i.e.,* destroy itself) properly; it had to be dispatched by city firemen with axes after having started a fire. But Tinguely's next two self-destroying machines, entitled "Study for an End of the World," performed more successfully, detonating themselves with considerable amounts of explosives. In the 1960s and '70s he went on to create less aggressive and more playful kinetic constructions that combined aspects of the machine with those of found objects, or junk.

Tinguely's art implicitly held a wealth of ironic social commentary. His whimsical machines deftly satirized the mindless overproduction of material goods typical of advanced industrial society. They expressed his conviction that the essence of both life and art consists of continuous change, movement, and instability, and they also served to refute the static art of the past. Tinguely was an innovator in his appreciation of the beauty inherent in machines and junk and in his use of spectator participation; in many of the events he engineered, spectators were able to partially control or determine the movements of his machines.

*Consult the* INDEX *first*

**Tinia,** also called TIN, or TINA, principal Etruscan deity, god of the thunderbolt, sky, and storm. He was identified with the Greek god Zeus and the Roman god Jupiter. Tinia together with his wife Uni (identified with Greek Hera and Roman Juno) and Menerva (or Menrva, Roman Minerva) formed the supreme triad of the Etruscan pantheon.

**Tinian,** one of the Mariana Islands, part of the U.S. Commonwealth of the Northern Mariana Islands, in the western Pacific Ocean. It lies 100 miles (160 km) north of Guam. Of volcanic formation, it has a total land area of 39 square miles (101 square km) and rises to 545 feet (166 m). Tinian was administered by Japan before World War II and became a major sugarcane growing and processing centre. After its capture by U.S. forces in 1944 the island was equipped with what were then the world's longest runways; from these were launched the planes that dropped atomic bombs on the Japanese cities of Hiroshima and Nagasaki in August 1945. The economy is little developed, with some cultivation of vegetables for export to Guam and a fledgling beef-cattle industry. The village of Tinian is on the southwest coast. Pop. (1990) 2,118.

**tinikling,** popular Philippine folk dance. Its appeal has spread worldwide, and it is generally included in the folk-dance curricula in the schools of many countries.

Traditionally the fast-paced dance is executed by females who cleverly and precisely move their feet between long bamboo poles that are knocked together rhythmically by onlooking males. The females' tricky footwork is contrasted with their lyrical arm movements.

**Tinith** (goddess): *see* Tanit.

**tinkerbird,** any of several species of tiny barbets, which, at 9 cm (3.5 inches), are the smallest of the family Capitonidae (order Piciformes). Tinkerbirds constitute the genus *Pogonitulus.* They are named for their metallic call—like a tinker mending pots—repeated unendingly in African forest and bush. Among



Red-fronted tinkerbird (*Pogoniulus pusillus*)
Painting by Richard Keane

the best known is the yellow-fronted tinkerbird (*P. chrysoconus*) of east-central Africa. It is glossy black above, with yellow rump and forehead, white eye stripes, and black moustache mark; the breast is pale gray, the belly greenish yellow.

**Tinkisso River,** river, rising in the southern outliers of the Fouta Djallon mountains of Guinea, northeast of Mamou. It flows 250 miles (400 km) north-northeast and east, past Dabola and Bissikrima, across grassy plains and savannas of stunted trees, to enter the Niger River just south of Siguiri. Alluvial gold deposits have long been worked along the Tinkisso River.

**Tinné, Alexandrine-Pieternella-Françoise** (b. Oct. 17, 1835, The Hague, Neth.—d. Aug. 1, 1869, near Ghāt, Libya), Dutch explorer best known for her investigations of the course of the Nile River, made at a time when it was unusual for European women to travel in tropical Africa.

Tinné was primarily concerned with mapping the White Nile (in the Sudan) and its western tributaries. In 1861, on her first expedition up the Nile (on which she was accompanied by her mother and aunt), she traveled as far as Gondokoro (in the Sudan) and then turned west along the Baḥr al-Ghazal (Gazelle River) and the Sobat River to investigate the extent of the Nile Basin toward Lake Chad. In 1863 she again explored the upper Nile, traveling into the Azande region of northeastern Congo (now Zaire). She was murdered by Tuareg tribesmen in the Libyan Desert while traveling from Tripoli in an attempt to reach Lake Chad and then journey from it eastward to the Nile.

**Tinnevelly** (India): *see* Tirunelveli.

**Tinnit** (goddess): *see* Tanit.

**tinnitus,** ringing or buzzing in the ears. Tinnitus may be caused by any of a number of ear conditions, including the clogging of the external auditory canal with earwax (cerumen) or inflammation of the eardrum membrane, the middle ear, or the inner ear. Tinnitus may also result from an overdose of drugs such as aspirin or from excessive use of the telephone, and it may accompany hearing loss, particularly in the high-frequency range. Ringing in the ears also sometimes accompanies vertigo (dizziness).

**Tino** DI CAMAINO (b. 1280/85, Siena, republic of Siena [Italy]—d. 1337, Naples), Sienese sculptor significant for his numerous sepulchral monuments.

Tino was a follower, and possibly a pupil, of Giovanni Pisano. In 1315 he became *capomaestro* of the Cathedral of Pisa and was commissioned to make a tomb for the Holy Roman emperor Henry VII. He succeeded his father as the *capomaestro* of the Siena cathedral in 1320 and designed the tomb of Cardinal Petroni (1318), which has components of Gothic architectural structure.

Tino executed tombs in Pisa, Florence, Naples, and Siena, though he remained in Naples after 1323. His tomb of Gastone della Torre and that of Antonio degli Orso, bishop of Florence, are two major works completed in Florence between 1321 and 1323. The figures on Tino's decorative, multilayered wall tombs are characterized by a rounding of forms and simplified anatomical detail. He expanded upon the ideas of Arnolfo di Cambio and Pisano.

**Tinos,** island in the Cyclades (*q.v.*) group of Greek Aegean islands; in antiquity it was known as the "island of the winds," the modern name being derived from the Phoenician *tenok,* meaning "snake"; in ancient times it was also called Ophiousa. One of the largest of the Cyclades, it is a rugged mass of granite, schist, and limestone, about 75 square miles (194 square km) in area. It lies between Andros (northwest) and Mīkonos (southeast) islands, being separated from the former by a narrow channel. Geologically it is a continuation of Andros island but is much lower and flatter.

At the beginning of the 10th century BC the island was inhabited mainly by Ionians. It was dominated by Eretria (in the 6th century BC) and was later subject to Rhodes (in the 2nd century BC). The Venetians held it for five centuries after 1207, and the Turks occupied it in 1714, holding it until the Greeks rebelled in 1821.

In antiquity the island was well known for its cult of Poseidon and Amphitrite. With the advent of the Venetians in the 13th century, Roman Catholicism became predominant. Following the discovery of an icon of the Panayía (Virgin Mary) in 1822 by a nun named Pelagia, Tinos became a Greek Orthodox place of pilgrimage. The Church of Panayía Evangelistría (Our Lady of Good Tidings) was built in 1822 to house the icon, which is venerated for its healing powers. A road of local marble leads pilgrims for the feasts of the Annunciation and Assumption to this sanctuary.

Agriculture on the terraces found throughout the island includes cultivation of grapes for

wine, figs, and vegetables. Tínos is renowned for a bluish marble quarried locally since the second century AD; the Tinians have long had a reputation as skillful artisans in that stone. The local houses are whitewashed and often have housing pigeons for domestic consumption. The island is linked to Piraeus, Míkonos, Rafina and Andros by ferry. Pop. (1981) 7,730.

**tinplate,** thin steel sheet with a coating of tin applied either by dipping in molten metal or by electrolytic deposition; almost all tinplate is now produced by the latter process. Tinplate made by this process is essentially a sandwich in which the central core is strip steel. This core is cleaned in a pickling solution and then fed through tanks containing electrolyte, where tin is deposited on both sides. As the strip passes between high-frequency electric induction coils, it is heated so that the tin coating melts and flows to form a lustrous coat. The end product has a tin coating of about 0.00003 inch (0.00076 millimetre) on each side.

Tinplate has the strength and formability of steel combined with the noncorrosive and nontoxic properties of tin and has the additional property of easy solderability. While it is largely used for containers for food and beverages, paints, oils, tobacco, and numerous other products, its use has broadened to include toys, baking equipment, and parts for radio and other electronic equipment.

**tinstone** (mineral): *see* cassiterite.

**Tinsukia,** town, Dibrugarh district, northeastern Assam state, northeastern India. It is located in the Brahmaputra River Valley at a rail junction, about 25 mi (40 km) east of Dibrugarh, the district headquarters. It is linked by highway with Burma to the east and, via Dibrugarh, with Gauhāti and Shillong to the southwest. The town's principal industry is the processing of tea from extensive gardens nearby; there is also a can factory. Pop. (1991) 73,760.

**Tint** (goddess): *see* Tanit.

**Tintagel,** parish, North Cornwall district, on the northwestern coast of the county of Cornwall, England, north of Tintagel Head, a rugged promontory joined to the shore by a narrow isthmus. Its Norman castle, the ruins of which stretch across the isthmus, was built on the site of a Celtic monastery that appears to have existed from *c.* AD 350 to 850. Legend has it that King Arthur was born there. The earls of Cornwall occupied the castle in Norman times and built the chapel. The old post office, a 14th-century stone house, stands in the village. Pop. (latest est.) 1,372.

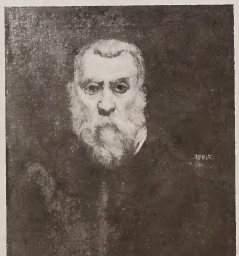
**Tintern Abbey,** ecclesiastical ruin, in the border county of Gwent, Wales, on the west bank of the River Wye. Founded for Cistercian monks in 1131, Tintern Abbey was almost entirely rebuilt and enlarged between 1220 and 1287. The building was finally completed, except for minor additions, in the early 14th century. The abbey was dissolved in 1537, and its property was granted to the lord of Chepstow; the crown bought it in 1900. Although the cruciform church is without a roof and the nave is damaged, many details of a style transitional from Early English to Decorated Gothic are preserved. Cloisters and other monastic buildings are placed unconventionally to the north of the church. The ruins of the abbey were made famous by William Wordsworth in the last poem of *Lyrical Ballads* (1798).



Ruins of Tintern Abbey, Gwent, Wales
Kenneth Scowen

**tintinnid,** any protozoan of the ciliate order Tintinnida, characteristically conical or trumpet-shaped. Although most are marine, some forms are found in fresh and brackish water. The tintinnids secrete loosely fitting gelatinous envelopes (loricas), sometimes containing foreign particles. The structure of the lorica is important in distinguishing individual members of the order. For example, the genus *Tintinnidium* has an elongated, irregularly shaped lorica, and *Tintinnopsis* has a thin-walled, bowl-shaped lorica with a wide opening. The tintinnids have well developed ciliation around the mouth opening; the rest of the cell lacks cilia or is sparsely covered with them.

**Tintoretto,** byname of JACOPO ROBUSTI (b. *c.* 1518, Venice—d. May 31, 1594, Venice), great Mannerist painter of the Venetian school and one of the most important artists of the late Renaissance. Early paintings include "Vulcan Surprising Venus and Mars," the Mannerist "Christ and the Adulteress," and his masterpiece of 1547, "Last Supper" of S. Marcuola. Increasingly concerned with the drama of light and space, he achieved in his mature work (*e.g.*, "The Law and the Golden Calf," *c.* 1562) a luminous, visionary quality.



Tintoretto, self-portrait in oil; in the Louvre, Paris
Giraudon—Art Resource/EB inc.

*Background and early years.* Little is known of Tintoretto's life. In a will of 1539 he called himself an independent professional man—not a surprising description in view of his imposing and forceful personality. No documents have survived regarding Jacopo's artistic education. His biographers, among them Carlo Ridolfi, whose book was published in 1648, speak of an apprenticeship with Titian that was broken off because of the master's resentment of the pupil's proud nature and exceptional accomplishment. On the other hand, a contemporary pointed out that Tintoretto's style was formed by studying formal elements of the Tuscan school, especially those of Michelangelo, and of pictorial elements derived from Titian.

Most probably, Jacopo's precocious talent prompted his father to place him in the workshop of some undistinguished painter, but one with a solid artisan tradition so that his son might learn the foundations of his craft. Traces of an absolute style in his youthful works tend to corroborate this hypothesis. But he soon became aware of the variety of approaches tried by painters working between 1530 and 1540 in Venice and already reacting against the style of Giorgione, who was the first to merge forms and to subordinate local colour to its pervading tone. It was the emigration of Roman artists to Venice in 1527 after the sack of Rome by imperial troops, as well as subsequent contacts with painters from Tuscany and Bologna, that induced the painters of the Venetian school to return to greater plasticism, without altering the fundamental chromatic nature of the Venetian tradition. The influence of Michelangelo, the visit of the art historian Giorgio Vasari to Venice in 1541, and the journeys of Venetian artists to central Italy renewed Venetian painting in depth, giving it means of expression adapted to different types of pictures. In the renewed idiom, form and colour were blended in a synthesis in which light dominated so as to express a richly fantastic and visionary spirit. Thus the early works of Tintoretto were elected by all of these influences. Critics have identified a group of youthful works of Tintoretto, above all *Sacre Conversazioni*, the most important of which is in the Wildenstein Collection, New York City. Painted in 1540, it represents the Virgin with the Child on her knees, facing away from her, and six saints. While the style echoes various elements of the Venetian art of Tintoretto's time, it also shows a definite Michelangelesque influence.

*Career.* A group of 14 octagonal ceiling paintings with mythological themes in Modena, at the Galleria e Museo Estense (originally painted for a Venetian palace), with their singular refinement in perspective and narrative clarity, also belong to Tintoretto's first phase. Among other influences, they recall the fashion of partitioned ceiling paintings imported to Venice by Vasari. This was also the period of Tintoretto's closest collaboration with Andrea Meldolla; together they decorated the Palazzo Zen with frescoes. The fresco technique had an important part in the formation of Tintoretto's idiom, for it suggested to him the quickness of execution that was to become fundamental to his manner of painting. Unfortunately only some 18th-century prints of his frescoes and a few fragments of the numerous frescoed facades that adorned Venice survive.

Tintoretto's drawing exercises were made from nature, from statues, and from small wax models posed in various ways and artificially illuminated, as in tiny stage sets. These methods were suited to the painter's concern with resolving problems of form and light. The indefatigable draftsman acquired a narrative fluency that allowed him to trace with a brisk brushstroke and fanciful inspiration the series of biblical stories, the mythological episodes for the poet Pietro Aretino's house in Venice (1545), and sacred compositions such as "Christ and the Adulteress," in which figures set in vast spaces in fanciful perspectives are illuminated in a distinctly Mannerist style. Tintoretto returned to an earlier form of composition in his masterpiece of 1547, the "Last Supper" of S. Marcuola, in which the choice of rough and popular types succeeds in endorsing the scene with a portrayal of ordinary everyday reality struck with wonder by the revelation of the miracle.

A few months later Tintoretto became the

centre of attention of artists and literary men with his "S. Marco Freeing the Slave." The painting is so rich in structural elements of post-Michelangelesque Roman art that it is reasonable to assume that Tintoretto had visited Rome. He did not, however, interrupt his artistic experiments. Stories from Genesis, painted for the Scuola della Trinità (1550–53), show a new attention to Titian's manner of painting as well as a palpable awareness of nature. The masterpiece of this phase is undoubtedly "Susanna Bathing"; the light creates Susanna's form in crystalline clarity against a background evoked with a fresh poetic sense.

In 1555 Tintoretto, now a famous and sought-after painter, married Faustina Episcopi, who, affectionate and devoted, bore him eight children. At least three of them—Marietta, Domenico, and Marco—learned their father's trade and became his associates. An artist of indefatigable activity, of a veritable fury of creativity, Tintoretto spent most of his life in the bosom of his family and in his workshop. This particular period in Tintoretto's career—marked by greater vivacity of colour, by a predilection for a variegated perspective, and by a highly decorative quality—coincided with his growing admiration for the art of Paolo Veronese, who had been working in the Doges' Palace. The assimilation and transformation of the Veronesian elements in Tintoretto's work are discernible in his beautiful ceiling paintings of Bible stories, now in the Prado, Madrid.

The use of a colour that absorbs light yielded new possibilities for suggesting spaces no longer structured by the pure play of perspective. And in those spaces the painter introduced crowds in harmonized order with the rest of the picture, a feature that had until then been missing in Venetian art. It was at that time that Tintoretto began to participate in the decoration of the church of the Madonna dell'Orto and the private chapel of the Contarini family contained within it, which in 1563 became the final resting place of the great cardinal Gasparo. Tintoretto's works for the Madonna dell'Orto, which occupied him for approximately a decade, also give an idea of the evolution of the idiomatic elements of his art: the "Presentation of the Virgin in the Temple" (1552) was according to Vasari "a highly finished work, and the best executed and most successful painting that there is in the place"; in "St. Peter's Vision of the Cross" and in "The Decapitation of St. Paul" (*c.* 1556), the figures stand out dramatically on a space suffused with a vaporous, unreal light. In the two enormous canvases depicting the Jews worshipping the golden calf while Moses on Mt. Sinai receives the tables of the law and a Last Judgment, Tintoretto painted two works of the highest rank with a great richness of narrative means, with an awareness of the thematic link between the two scenes that attests to a knowledge of scripture and of contemporary spiritual movements. The high figurative quality of the two paintings implies that Tintoretto made a number of experiments in this decade. Tintoretto's spatial conception has a dynamic character. As a modern critic has noted, Tintoretto conveys a feeling of an almost precipitate falling forward or of an equally swift rise. The contrasted movements give the figures a similar instability. To achieve such effects Tintoretto used formulas that were invariably different: in "The Pool of Bethesda" in the church of S. Rocco (1559) the evangelical episode is realized in a compressed space through which the foreshortened ceiling seems to weigh upon the milling crowd; in "St. George and the Dragon" Tintoretto sets the fable in a landscape of considerable depth, intersected by the white walls of the city. A series of canvases that the philosopher and physician Tommaso Rangone, grand guardian of the Scuola di S. Marco, commissioned from Tintoretto in 1562 contains similar elements.

In May 1564 the councillors of the Scuola Grande di S. Rocco decided to have the Sala dell'Albergo decorated with paintings, in place of the movable decorations used during feast days. When Tintoretto presented the Scuola with his oval painting the "Glorification of S. Rocco," the directors decided to entrust him with the decoration of the Sala.

In 1565 his immense "Crucifixion" was displayed there. Around Christ, in the centre, many figures revolve in a livid light that, muting the picture's colours, invests it with dramatic power. The decoration of the chamber was completed in 1567; it included other scenes of Christ's Passion, remarkable for their thematic innovations.

Vasari, who visited Venice in 1566 to bring his *Lives of the Most Eminent Italian Architects, Painters and Sculptors* up to date, had an opportunity to follow Tintoretto's work in progress. Undoubtedly he had the painter's most recent works in mind when he wrote that Tintoretto was "the most extraordinary brain that the art of painting has produced." For all his fundamental reservations about Tintoretto's style, Vasari sensed his greatness.

In 1576, with renewed zeal, Tintoretto resumed the decoration of the Scuola Grande di S. Rocco. He had finished the huge central panel of the upper hall with "The Erection of the Brazen Serpent" in time for the feast of the saint on August 16 and promised to paint a certain number of canvases, "wishing to demonstrate the great love that I bear for the saint and our venerable school, because of my devotion to the glorious Messer San Rocho." In 1581 all the ceiling paintings were completed (10 ovals and 8 rhomboid chiaroscuro panels; the latter restored in the 18th century) and 10 *teleri* on the walls.

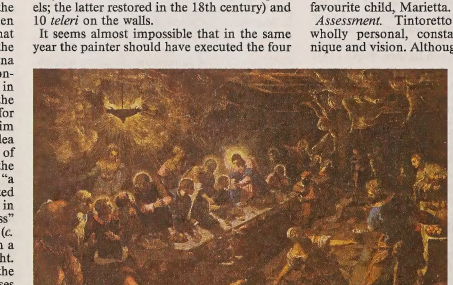
It seems almost impossible that in the same year the painter should have executed the four mythological allegories for the Doges' Palace, of which the most famous is that of "Ariadne, Bacchus, and Venus." All are works of great elegance, with an almost academic finishing touch. But the real Tintoretto is certainly to be found in S. Rocco, where he bears witness to his great faith and, like the medieval mosaicists, offers an illustrated Bible to the crowds of the poor who frequented the beneficent institution. His deep but independent faith in the religious myths, unrestricted by any rules of the Counter-Reformation, is apparent as much in the striking sketch of "The Council of Trent" (Turin, private collection), executed for the Doge Da Ponte, as in the altarpiece of S. Trovaso, executed in 1577 for Milledonne.

By 1577 Marietta and Domenico, already officers of the painters' guild, could help their father, together with other future artists of the close of the 16th and the beginning of the 17th century. Certainly the presence of collaborators is obvious in two cycles: the eight scenes of the "Gonzaga Cycle" (Alte Pinakothek, Munich), with vivid scenes of battles, painted between 1579 and 1580, and the many paintings for the halls of the Scrutinio and of the Maggior Consiglio in the Doges' Palace, which the Republic wanted to adorn with new canvases after the fire of 1577. It was certainly more his wish to finish his immense work in the decoration of S. Rocco than it was his advanced age that induced the painter to leave the canvases of the Doges' Palace largely to his workshop.

In the canvases executed between 1583 and 1587 for the lower hall of the Scuola Grande di S. Rocco, depicting episodes of the life of Mary and Christ, Tintoretto follows a new direction: light in its most lyrical meaning dominates the paintings, dissolving the colour in a flash of diaphanous brushstrokes. Space is multiplied in unlimited successions of perspectives; the scenery at times prevails over the human figure, as in the two great works in the ground floor hall, with the "St. Mary of Egypt" and the "St. Mary Magdalene" immersed in an incandescent hazy atmosphere in which things are animated with a life of their own: an invitation to the contemplative life of the 70-year-old painter, more than ever leaning toward the view of man and his destiny offered by the Christian faith. A marvelous model (in the Louvre) of the "Paradise" for the Doges' Palace and "The Last Supper" of S. Giorgio Maggiore, with the incorporeal apparitions of angelic creatures, finished a few months before his death, are proof of Tintoretto's deep spiritual bent. He died in 1594 and was buried in the church of Madonna dell'Orto next to his favourite child, Marietta.

*Assessment.* Tintoretto was a painter with a wholly personal, constantly evolving technique and vision. Although it is almost certain that his family was originally from Lucca, Tintoretto (a nickname meaning "little dyer," after his father's profession of silk dyer, or *tintore*) is considered a Venetian painter, not only by birth but because he always lived in Venice and because with his innumerable works he contributed to creating the face of that city. He was not only an exponent of the witness to the life of the city, of the sacred and profane complex pictorial developments of Venetian art, but of the myths of a society that formed a part of the dramatic history of 16th-century Italy.

Tintoretto's art was much discussed and highly appreciated in Venice in the years after his death, above all in the acute evaluations of Marco Boschini, the great 17th-century critic of Venetian painting. Roger de Piles, follow-



"The Last Supper," oil painting by Tintoretto, 1592–94; in the chancel of S. Giorgio Maggiore, Venice

SCALA/Art Resource, New York City

ing in the latter's footsteps, exalted Tintoretto's luministic idiom. But to the 18th century, the closer it drew to 19th-century Neoclassical rationality, Tintoretto appears excessive and too remote from its own sensibility. John Ruskin's romantic enthusiasm inaugurated a new attitude toward the art of Tintoretto. And modern art historiography is coming to recognize in him the greatest representative of that wide-ranging European movement that was Mannerism, interpreted in accordance with the great Venetian tradition. (R.Pal./Ed.)

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*Where the same name may denote a person, place, or thing, the articles will be found in that order*

**tintype,** also called FERROTYPE, positive photograph produced by means of a nitrocellulose (collodion) solution applied to a thin enamelled black iron plate immediately prior to exposure. The tintype, introduced in the mid-19th century, was essentially a variation on the ambrotype, an imitation daguerreotype made on glass. Just as the ambrotype was a negative whose silver images appeared grayish-white and whose dark backing made the clear areas of shadows appear dark, so the tintype, actually negative in its chemical formation, was made to appear positive by the black plate.

In posing and lighting, the popular tintype portraits were identical to daguerrotypes; they were of the same standard sizes, and they were enclosed in the same type of case. They did not approach the brilliancy of daguerrotypes, however. By the 1860s the elaborate presentation of tintypes had been abandoned, and the metal sheets were simply inserted in paper envelopes, each with a cutout window the size of the image. Easy to make and inexpensive to purchase, tintypes remained a kind of folk art through the 19th century and were often used by sidewalk portraitists at parks, fairs, and beaches.

**tinware,** utilitarian and decorative objects made of tinplate and, more rarely, of pure tin. Tin was used as an alloy some 30 centuries before the birth of Christ, but the earliest recorded objects of pure tin appear to be a ring and bottle that were found in Egypt and date from the 18th dynasty (1567–1320 BC). The process of plating sheets of iron and steel with tin, though not unknown earlier, was not perfected until the early 18th century. At Pontypool in Wales the Allgood family developed a process of rolling sheets of iron and dipping them into molten tin; the resulting tinplate was then worked into various domestic and decorative items before being japanned, or painted with a heat-resistant varnish (see Pontypool ware). Tinware, often with similar designs, was produced at centres in France, Holland, Germany, and the United States



Punched work, tin coffee pot, from Bucks County, Pa., c. 1840; in the Philadelphia Museum of Art

By courtesy of the Philadelphia Museum of Art, the Titus C. Geesey Collection

throughout the 18th and 19th centuries. *See also* toleware.

**Tíobraid Árann** (Ireland): *see* Tipperary.

**Tioman, Pulau,** island in the South China Sea, about 42 mi (68 km) off Kuala Rompin, Pahang state, West Malaysia (Malaya). It has an area of 53 sq mi (137 sq km) and is 13 mi long and 2 to 8 mi wide, with a self-sufficient population of fishermen. Its main settlements, Kampung Tekek on the west coast and Teluk Juara on the east, are linked by a rough, hilly track. Gunung (Mt.) Kajang (3,406 ft [1,038 m]) is the island's highest point. Tourists visit via Mersing on the mainland to fish, swim, and collect coral. Pop. (latest est.) 1,245.

**Tionontati,** also called TOBACCO NATION, or TOBACCO INDIANS, Iroquoian-speaking Indians formerly living in the mountains south of Nottawasaga Bay, in what are now Grey and Simcoe counties, Ontario. In 1616 they were visited by the French, who called them the Tobacco Nation because of their extensive cultivation of this plant. They also grew maize (corn), beans, squash, and sunflowers; all agricultural work was done by women except for the clearing of the fields for planting. Hunting and fishing were also practiced, although they were of lesser importance. At the time the Jesuits established a mission among them in 1640, the tribe comprised two clans and had nine villages. Civil chiefs and councils of elders guided the civil affairs of the villages; war chiefs were concerned with military matters.

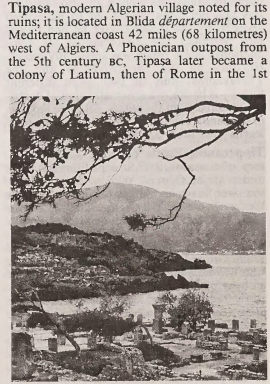
When the Iroquois attacked the Huron (*q.v.*) in 1648–50, many Huron took refuge with the Tionontati; in 1649 the Iroquois attacked one of the principal Tionontati villages, massacred the inhabitants, and destroyed the mission. The Tionontati and the Huron abandoned their country and fled to the region southwest of Lake Superior. The two tribes became amalgamated and were known as the Wyandot (*see* Wendat).

**Tioughnioga Stage,** division of Devonian rocks and time in North America (the Devonian Period began about 395,000,000 years ago and lasted about 50,000,000 years); it precedes the Taghanic Stage and follows the Cazenovian Stage. Rocks of the Tioughnioga Stage in New York compose the upper half of the Hamilton Group and consist of the Kiskatom Redbeds in the eastern part of the state, the Panther Mountain Sandstone in the central part of the state, and various shales to the west, including the Moscow Formation and the underlying Ludlowville Formation. Limestones of the Tioughnioga Stage occur in central and western North America.

**tip-cat,** also called ONE-A-CAT, outdoor game dating back at least to the 17th century and introduced to North America and elsewhere by English colonists. The game was widely popular in 19th-century Great Britain and in early 20th-century North America.

Although there are many varieties of the game, all involve a stick about 3 ft (1 m) long, used as a bat, and a piece of wood (the cat) about 4 in. (10 cm) long, 1 to 2 in. (2.5 to 5 cm) thick, and tapered at the ends. The cat is placed on the ground, struck at one end to propel it upward (tipping the cat), and then slammed with the stick as far as possible. In one version, the batter tries to round the bases, as in rounders, before the fielder retrieves the cat and throws it back to home base. If a batter misses the cat three times or if a fielder catches it on a fly, the batter is out. Earlier versions of the game are based on guessing the distance that the cat is hit, scoring points according to the number that comes up on a four-sided cat, and running from base to base on a large circle while the cat is being retrieved. Some authorities consider tip-cat a forerunner of rounders and cricket.

**Tipasa,** modern Algerian village noted for its ruins; it is located in Blida *département* on the Mediterranean coast 42 miles (68 kilometres) west of Algiers. A Phoenician outpost from the 5th century BC, Tipasa later became a colony of Latium, then of Rome in the 1st



Ruins of Roman occupation, 1st and 2nd centuries AD, at Tipasa, Alg.

© Helen Marcus 1981—Photo Researchers, Inc

and 2nd centuries AD. St. Salsa, according to legend, was martyred there in the 4th century, and, after the rivalries between Catholics and the Donatist heretics over the sanctity of ministers, the town was destroyed at the end of the 5th century. Among its ruins are a Roman forum, a curia, four thermal baths, a theatre, and a large cathedral with nine naves. The modern village, founded in 1857, is in a vine-growing district. Pop. (1987) 8,400.

**tipi** (dwelling): *see* tepee.

**Tipiṭaka** (Pāli: "Triple Basket"), Sanskrit TRIPIṬAKA, the total canon of the southern schools of Buddhism, somewhat pejoratively dubbed Hīnayāna (Lesser Vehicle) by the self-styled Mahāyāna (Greater Vehicle) schools; for the latter, the canon constitutes a preliminary body of teachings, analogous to the Old Testament in Christianity. The books of this southern canon were nearly all written in India within 500 years of the time of the Buddha (between about 500 BC and the beginning of the Christian Era). They appeared in two languages—in Pāli within the Theravāda (Way of the Elders) school, which now predominates in Sri Lanka (Ceylon) and Southeast Asia, and in Sanskrit among the Sarvāstivāda (Doc-

trine That All Is Real), Mahāsaṅghika (Great Community), and other schools that did not survive the demise of Buddhism in India. The Pāli texts constitute the entire surviving body of literature in that language.

Each school had its own canonical collection that differed somewhat from others in the contents of particular texts, which texts it included, and the ordering of texts within the canon. There was more agreement on the first two sections, the *Vinaya Piṭaka* (Sanskrit and Pāli: "Basket of Discipline") and the *Sutta Piṭaka* (Pāli: "Basket of Discourse"; Sanskrit: *Sūtra Piṭaka*) than on the third, the *Abhidhamma Piṭaka* (Pāli: "Basket of Special [or Further] Doctrine"; Sanskrit: *Abhidharma Piṭaka*).

The first of the three, which is also the earliest and smallest, provides for the regulation of monastic life. The second and largest contains the *Hīnayāna-sutta* (Sanskrit: *sūtra*) literature—*i.e.,* sermons and doctrinal and ethical discourses attributed to the Buddha or, in a few cases, to his disciples. (The basic texts produced by Mahāyāna schools are also called *sūtras* and are often considered to have been revealed by the Buddha after he had passed into Nirvāṇa.) The *Abhidhamma* (or *Abhidharma*) *Piṭaka,* which was apparently accepted only by the Sarvāstivādins and the Theravādins—and in two quite different forms—is basically a schematization of doctrinal material from the *suttas.* All three sections of the canon contain, as well, an abundance of legends and other narratives.

**Tippecanoe, Battle of** (Nov. 7, 1811), victory of a seasoned U.S. expeditionary force under Major General William Henry Harrison over Shawnee Indians led by Tecumseh's brother Laulewasikau (Tenskwatawa), known as the Prophet. The battle took place at Prophetstown, the Indian capital on the Tippecanoe River and the site of the present town of Battle Ground, near Lafayette, Ind. Harrison, who was on a mission to destroy the power of an intertribal defensive alliance being promoted by Tecumseh and his brother, repelled the Shawnee attack and burned the village. Discredited, Laulewasikau fled to Canada.

Although the two sides suffered equal losses, the battle was widely regarded as a U.S. victory and helped establish Harrison's reputation. In the presidential election of 1840, he successfully used the slogan, "Tippecanoe and Tyler, too!"

**Tippecanoe River,** river rising in Tippecanoe Lake in Kosciusko county, northern Indiana, U.S. The river flows 166 miles (267 km) generally southwest into the Wabash River north of Lafayette. *Tippecanoe* is probably derived from the Miami Indian name for buffalo fish. Between the towns of Buffalo and Brookston on the river's lower course, Lakes Shafer and Freeman are impounded by power dams. At the junction with the Wabash, Major General William Henry Harrison defeated the Shawnee Indians under the brother of Tecumseh, known as the Prophet (Nov. 7, 1811).

**Tipperary,** Irish TIOBRAID ÁRANN ("House of the Well of Ara"), county in Munster province, Ireland, occupying a broad strip of country between the Rivers Shannon and Suir. It is bounded by Counties Offaly and Laoighis (north), Kilkenny (east), Waterford and Cork (south), and Limerick, Clare, and Galway (west). Physically, the county may be divided into five main areas, each aligned northeast-southwest, as follows:

(1) To the east of Lough (lake) Derg is a lowland, with Nenagh as its main town. An extension of the Irish central lowland, it has many medium-sized farms (50 acres [20 hectares]) that concentrate on raising stock for sale and some farm crops, mainly oats and potatoes. At the lower end of Lough Derg, the Arra Mountains rise to 1,517 feet (462 m).

(2) The second area is a mass of hills extending from the Limerick border and including Keeper Hill (2,277 feet) and Silvermines Mountain (1,607 feet) and running northeastward to the Devilsbit (1,577 feet) and the Roscrea gap; the hill belt is 20 miles (32 km) wide in the south. There are some tiny villages in the farmed valleys, the agriculture of which is similar to that of the surrounding lowlands.

(3) East of these uplands is a corridor 15miles (25 km) wide through which runs the main Dublin-Cork railway. There is a covering of glacial drift, and peat bogs appear between Cashel and Thurles in the Golden Vale and in the upper Suir River valley. The farms average 60 acres (25 hectares), and cattle production for sale predominates. Dairying is prominent near Tipperary town.

(4) The Slieveardagh ridge comprises a number of hills around Fethard and Cashel and extends northward to the Nore Valley. The region, which has some coal seams, is farmed extensively.

(5) The extreme south of the county consists mainly of the middle Suir River lowlands and those of its tributaries, the Tar and the Anner. All this lowland is well farmed, with medium-sized and large farms averaging 90 acres (35 hectares); dairying is the main resource. Around this lowland are four ranges of mountains, the Galtees, the Knockmealdown, the Comeraghs, and Slievenaman.

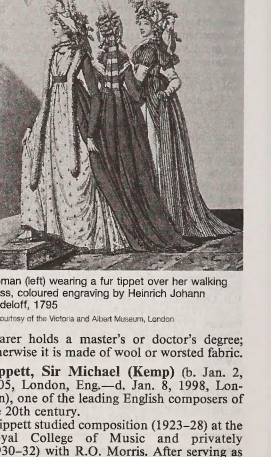
England's Prince John gave land in 1185 in south Tipperary to Philip de Worcester and in north Tipperary to Theobald Walter, who was created chief butler (or botiller) of Ireland; thus were founded the fortunes of the Butler family. In 1328 Edward III made Tipperary a county palatine in favour of the earls of Ormonde, the title of the Butler family, and throughout the late Middle Ages the earls of Ormonde were in the forefront of Irish politics. With the impeachment of the second duke in 1715, the palatine jurisdiction of Tipperary, the last of its kind in Ireland, was abolished.

The present-day county is divided into a North and a South Riding, with county council meetings at Nenagh and Clonmel, respectively; each riding has a county manager. In the north, Nenagh, Templemore, and Thurles are urban districts; in the south, Clonmel is a municipal borough, while Carrick-on-Suir, Cashel, and Tipperary are urban districts. Much of the county's industry is based on the processing of agricultural products. Area 1,643 square miles (4,254 square km). Pop. (1986) 136,619.

**Tipperary,** Irish TIOBRAID ÁRANN ("House of the Well of Ara"), town and urban district, County Tipperary, Ireland. The town grew up around a castle erected by Prince John (later King John) when he was lord of Ireland; the outline of the bailey remains. A chancel arch from a 13th-century Augustinian abbey still stands. In 1339 the town was burned by the O'Briens. New Tipperary was founded in 1890, but it was later abandoned. There is a monument to the Manchester Martyrs—three men executed in Manchester, Eng., in 1867 for killing a police sergeant during an attempted rescue of two Fenian prisoners. Pop. (1986) 5,033.

**tippet,** long, narrow, cloth streamer, usually white, worn around the arm above the elbow, with the long end hanging down to the knee or to the ground. These graceful tippets, worn in the late 14th century by both men and women, developed out of the long flaps created by the narrow 14th-century sleeve.

In the 15th century, the designation tippet came to signify a long streamer (also called liripipe) extending from a hat or hood. Tippet may also refer to an 18th-century capelike or scarflike garment worn around the neck and hanging down in front; this tippet could be made of gauze, crepe, lace, velvet, fur, or feathers. Finally, tippet refers to a long black scarf worn over the robe by Anglican and Episcopal clergymen. It is made of silk if the



Woman (left) wearing a fur tippet over her walking dress, coloured engraving by Heinrich Johann Heideloff, 1795

By courtesy of the Victoria and Albert Museum, London

wearer holds a master's or doctor's degree; otherwise it is made of wool or worsted fabric.

**Tippett, Sir Michael (Kemp)** (b. Jan. 2, 1905, London, Eng.—d. Jan. 8, 1998, London), one of the leading English composers of the 20th century.

Tippett studied composition (1923–28) at the Royal College of Music and privately (1930–32) with R.O. Morris. After serving as music director (1940–51) at Morley College, London, he became a radio and television speaker for the BBC and active as an orchestral conductor. He was knighted in 1966.

Tippett's early music was conservative, but he soon developed a personal, modernistic idiom marked by dissonant counterpoint and rhapsodic lyricism. His works include four symphonies, string quartets, piano sonatas, the oratorio *A Child of Our Time* (1939–41), and the operas *The Midsummer Marriage* (1946–52), *The Knot Garden* (1966–69), and *The Ice Break* (1973–76), for which he wrote his own librettos. Tippett's works were not frequently performed in Great Britain until the 1960s. Similarly, it was not until the following decade that his works were regularly scheduled in the United States.

**Tippu Sultan,** also spelled TIPU SULTAN, also called TIPPU SAHIB, OF FATEH ALI TIPU, byname TIGER OF MYSORE (b. 1749–53?, Devanhalli, India—d. May 4, 1799, Seringapatam), sultan of Mysore, who won fame in the wars of the late 18th century in southern India.

Tippu was instructed in military tactics by French officers in the employ of his father, Hyder Ali, who was the Muslim ruler of Mysore. In 1767 Tippu commanded a corps of cavalry against the Marāṭhās in the Carnatic region of western India, and he fought against the Marāṭhās on several occasions between 1775 and 1779. During the second Mysore War he defeated Colonel John Brathwaite on the banks of the Coleroon River (February 1782). He succeeded his father in December 1782 and in 1784 concluded peace with the British and assumed the title of sultan of Mysore. In 1789, however, he provoked British invasion by attacking their ally, the raja of Travancore. He held the British at bay for more than two years, but by the Treaty of Seringapatam (March 1792) had to cede half his dominions. He remained restless and unwisely allowed his negotiations with Revolutionary France to be-

come known to the British. On this pretext the governor-general, Lord Mornington (later the marquess of Wellesley), launched the fourth Mysore War. Seringapatam, Tippu's capital, was stormed by British-led forces on May 4, 1799, and Tippu died leading his troops in the breach.

Tippu was an able general and administrator, and, though a Muslim, he retained the loyalty of his Hindu subjects. He proved cruel to his enemies and lacked the judgment of his father, however.

*Consult the* INDEX *first*

**Tippu Tib,** also called MUHAMMED BIN HAMID (b. 1837—d. June 14, 1905, Zanzibar [now in Tanzania]), the most famous late 19th-century Arab trader in central and eastern Africa. His ambitious plans for state building inevitably clashed with those of the sultan of Zanzibar and the Belgian king Leopold II. The ivory trade, however, apparently remained his chief interest, with his state-building and political intrigues serving as means to that enterprise.

Tippu Tib's first trading trip to the African interior was in the late 1850s or early 1860s, accompanied by only a few men. By the late 1860s he was leading expeditions of 4,000 men, and shortly thereafter he began to establish a rather loosely organized state in the eastern and central Congo River basin. Ruling over an increasingly large area in the 1870s, he either confirmed local chiefs or replaced them with loyal regents. His main interests, however, were commercial; he established a monopoly on elephant hunting, had roads built, and began to develop plantations around the main Arab settlements, including Kasongo on the upper Congo River, where he himself settled in 1875.

In 1876–77 he accompanied the British explorer Henry M. Stanley partway down the Congo River, and later he sent expeditions as far as the Aruwimi confluence, 110 miles (180 km) downriver of Stanleyville (now Kisangani, Zaire). In the early 1880s he threw in his lot with Sultan Barghash of Zanzibar, who hoped to use him to extend Arab influence in the Congo against the threat of Leopold's International Association of the Congo (the king's private development enterprise). Tippu Tib returned to Stanley Falls in 1883 to try to take over as much of the Congo basin as possible on behalf of Barghash. He remained in the Congo until 1886, when he again went to Zanzibar with more ivory.

By that time Leopold's claim to the Congo basin had been recognized by other European nations, and Tippu Tib had apparently decided that an accommodation with the International Association was inevitable. In February 1887 he signed an agreement making him governor of the district of the Falls in the Congo Free State. It proved to be an impossible position: the Europeans expected him to keep all the Arab traders in the area under control but would not allow him the necessary weapons, and many Arabs resented his alliance with the Europeans against them. In April 1890 he left the Falls for the last time and returned to Zanzibar.

**Tiradentes Conspiracy** (1789), plot organized in the captaincy of Minas Gerais, Brazil, against the Portuguese colonial regime by the Brazilian patriot Joaquim José da Silva Xavier, nicknamed Tiradentes ("Tooth Puller"), because one of his occupations was dentistry. The uprising, which was a precursor of the Brazilian independence movement, was foiled when he was captured the next year; in 1792 he was executed.

**Tirāh,** mountainous tract in west-central North-West Frontier province, Pakistan. It lies on the Afghanistan-Pakistan border between the Khyber Pass and Khanki Valley, northwest of Kohāt town. It is inhabited mainly by Afrīdī and Ōrakzay Pashtun tribes. Tirāh comprises a rugged area of 600–700 square miles (1,550–1,800 square km), watered by the Mastūra (one of the main tributaries of the Bāra River), the Khanki, and the Khurmāna rivers, all of which rise within a few miles of Mount Mitta (12,470 feet [3,801 m]) in the Spin Range. At Mount Mitta the Spin Range splits into several branches between which lie the valleys of Tirāh at elevations of 5,000–7,000 feet (1,500–2,100 m).

Tirāh was the scene of the campaign (1897–98) in which the Afrīdī rose in a jihad (holy war) against the British, captured the Khyber posts, and attacked forts near Peshāwar. In the hardest campaign since the Second Afghan War, 40,000 British and Indian troops were sent to Tirāh. The main body of troops stormed Dargai, overran all of Tirāh, and retook the Khyber posts without opposition.

**Tiranë,** Italian TIRANA, city, capital of Albania. It lies 17 miles (27 km) east of the Adriatic coast and along the Ishm River, at the end of a fertile plain. It was founded in the early 17th century by a Turkish general, Barkinzade Süleyman Paşa, who is said to have built a mosque, a bathhouse, and a bakery in order to attract settlement. The town gradually became a trading centre at a junction of roads and caravan trails. It was chosen to be the capital of Albania in 1920 by a congress at Lushnjë. Under King Zog I (reigned 1928–39), Italian architects were employed to replan the city. The focus is Skanderbeg Square, whose Etehem Bey Mosque (1819) is now flanked by the Soviet-built Palace of Culture. Nearby is the University of Tiranë (1957). The old city stretches to the east and north of the main square and features alehouses and old architecture. Tiranë has museums, a national institute of folklore, a national theatre, and a concert hall. Skanderbeg Square has a large statue of Skanderbeg (Gjergj Kastrioti, the Albanian national hero). The inhabitants of Tiranë are mostly Muslim.



Statue of Skanderbeg (Gjergj Kastrioti) on Skanderbeg Square, Tiranë
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Following the successive Italian and German occupations (1939–44), a communist People's Republic was proclaimed in Tiranë on Jan. 11, 1946. The city subsequently expanded considerably with Soviet and Chinese assistance. Hydroelectric and thermal power plants were completed in 1951, and Tiranë ranks now as the nation's largest city and main industrial centre, with metalworking, tractor repair, food processing, and the manufacture of textiles, pharmaceuticals, cosmetics, dyes, glass, and porcelain. Coal mines operate nearby. There are rail connections to Durrës and Laç, as well as an international airport. Pop. (1999 est.) 279,000.

**Tiraspol,** city, eastern Moldova. It lies along the Dniester River and the Odessa-Chişinău railway. It was founded by Russia in 1795 alongside a fortress built in 1792 to protect the lands Russia had acquired through the Treaty of Jassy (1792). From 1924 to 1940, it was the capital of the then Moldavian Autonomous S.S.R., established by the Soviets on Ukrainian territory east of the Dniester. Occupied by German forces in 1941, Tiraspol was retaken by the Soviets in 1944. The city, with its large Russian population, has been at the centre of a Russian separatist movement east of the Dniester.

Although the centre of an agricultural area, Tiraspol is well-industrialized, producing wines, spirits, foodstuffs, textiles, carpets, glass, furniture, and electrical equipment. The city also has a teacher-training institute. Pop. (1999 est.) 200,700.

**tire,** also spelled TYRE, a continuous band that encircles the rim of a wheel and forms a tread that rolls on either a road, a prepared track, or the ground.

*Types of tires.* There are two main types of tires, those made of metal and those made of rubber. Railroad cars, which run on smooth steel rails, use iron or steel tires for low rolling resistance. The metal tire is basically a flat hoop fitted tightly over the exterior of the wheel. Besides low rolling resistance, its other attributes are strength, durability, and resistance to wear.

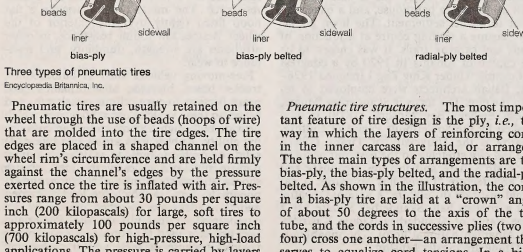
Free-moving vehicles such as automobiles, trucks, buses, bicycles, and airplanes need more friction to turn, climb, accelerate, and brake, so these vehicles use rubber tires, which provide both high friction and some cushioning ability. Rubber tires are of two types: (1) solid, or cushion, tires, in which the rubber portion functions to carry the load, absorb shocks, and resist cutting and abrasion; and (2) pneumatic tires, in which the load is carried and the shocks are absorbed mainly by the compressed air that fills the tire. Pneumatic tires are now used for almost all free-moving vehicles because of their greater cushioning ability and other advantages. Solid rubber tires are now used only on industrial and farm carts and on military vehicles, applications where tires are liable to be cut or pierced.

*Solid tires.* Solid rubber tires were introduced in 1881 on the wheels of hansom cabs in London. They were formerly used for many types of road vehicles, but they have now disappeared from highways owing to legislation that discouraged their use because they were hard on roads. The large sizes were supplanted by large pneumatic tires (truck and bus casings), but small solid tires came to be used extensively on industrial trucks and tractors and on carts. Solid tires are often adhered directly to the wheel or to a metal band applied to the periphery of the wheel.

*Pneumatic tires.* The pneumatic tire is designed to provide a flexible cover with an impermeable lining to contain and restrain the compressed air. This cover is provided with a rubber tread portion that is designed to withstand the cutting and abrasive wear of road contact and to protect the tire against puncture and loss of air. Such a structure has, as distinct from a solid rubber or cushion tire, no capacity in itself either to carry load or absorb shocks. It is entirely dependent on the contained compressed air to enable it to function.

The first patent for a pneumatic tire was issued to Robert William Thomson in England in 1845 for a hollow leather tire filled with air. Although a set of Thomson's "Aerial Wheels" ran for 1,200 miles on an English brougham, the same inventor's solid-rubber tires were more popular; and thus, for almost half a cen-

tury, air-filled tires were forgotten. The growing popularity of the bicycle in the late 19th century revived interest in tire design, and in 1888 John Boyd Dunlop, a veterinary surgeon of Belfast, obtained patents on a pneumatic tire for bicycles. Pneumatic tires were first applied to motor vehicles by the French rubber manufacturer Michelin & Cie. For more than 60 years, pneumatic tires had inner tubes to contain the compressed air and outer casings to protect the inner tubes and provide traction. In the 1950s, however, tubeless tires reinforced by alternating plies, or layers, of cord became standard equipment on new automobiles. In that decade Michelin introduced the radial-ply tire, which is now standard for all automobiles in developed countries.




Three types of pneumatic tires
Encyclopædia Britannica, Inc.

Pneumatic tires are usually retained on the wheel through the use of beads (hoops of wire) that are molded into the tire edges. The tire edges are placed in a shaped channel on the wheel rim's circumference and are held firmly against the channel's edges by the pressure exerted once the tire is inflated with air. Pressures range from about 30 pounds per square inch (200 kilopascals) for large, soft tires to approximately 100 pounds per square inch (700 kilopascals) for high-pressure, high-load applications. The pressure is carried by layers of cords embedded in a rubber cover that in turn serves to contain the air, protect the cords, and give high friction with the ground. This felicious combination is the reason why pneumatic tires are so widely used for transportation. More than 200 million of them are manufactured for motor vehicles alone each year, 90 percent for automobiles and 10 percent for trucks.

*Tire materials.* A pneumatic tire is reinforced by layers of relatively inextensible cords that hold the air pressure and restrict deformation and growth of the tire during use. To this end cord materials must have high stiffness, resistance to repeated flexing, high strength-to-weight ratio, and good adhesion to rubber. Tire cords have been made of cotton, rayon, nylon, polyester, and glass, but steel and polyaramid (an extremely hard and stiff synthetic fibre) are currently the dominant materials in use.

Various rubber compounds are used in different parts of the tire. The liner, which is intended to minimize the loss of air, is usually made of butyl rubber because that material has a low permeability to gas. Sidewalls, on the other hand, must resist scraping, flexing, and attack by ozone in the air. A typical formulation for sidewalls (measured in parts by weight of each ingredient) would be 50 parts natural rubber (for resistance to heat buildup), 50 parts butadiene rubber (for abrasion resistance), and 50 parts carbon black (for reinforcement), along with small amounts of processing oil, antioxidant, and protective wax. A tire's treads must be especially resistant to abrasion. A tread compound might have no natural rubber at all but rather 65 parts styrene-butadiene rubber (for hardness and abrasion resistance), 35 parts butadiene rubber, and as much as 65 parts carbon black.

The addition of carbon black or silica as reinforcing agents in rubber compounds has greatly prolonged tire life. Also contributing to longevity are the abrasion-resistant polymer polybutadiene and improved vulcanization systems. (Vulcanization is the interlinking of rubber molecules in order to create a usable elastic solid. It is conducted by heating the rubber mix along with sulfur and various additives in a tire mold for about 20 minutes at a temperature of approximately 300° F, or 150° C.) These advances, together with the almost universal adoption of radial-ply construction (described below), have extended the life expectancy of some tires to more than 90,000 miles (150,000 km).

*Pneumatic tire structures.* The most important feature of tire design is the ply, *i.e.*, the way in which the layers of reinforcing cords in the inner carcass are laid, or arranged. The three main types of arrangements are the bias-ply, the bias-ply belted, and the radial-ply belted. As shown in the illustration, the cords in a bias-ply tire are laid at a "crown" angle of about 50 degrees to the axis of the tire tube, and the cords in successive plies (two or four) cross one another—an arrangement that serves to equalize cord tensions. In a bias-ply belted tire, another set of cords overlies the bias-laid ones. This extra set of cords, called a belt, is typically made of fibreglass. A radial-ply belted tire also has a belt running around the entire tire, but the cords are typically made of steel wire-mesh, hence the term "steel-belted radial" tire.

Belted bias-ply tires have a longer tread life and provide better gasoline mileage than conventional bias-ply tires. They also have better resistance to blowouts and reduce stopping distance in braking. Belted tires supplanted conventional bias-ply tires in the United States in the 1960s and '70s. Meanwhile, though, radial-ply tires had already become standard equipment in Europe.

In the radial structure, layers of cords are arranged to lie almost perpendicular to the axis of the tire tube. Because the tire is actually a toroid (a circular tube) rather than a straight cylinder, the ply cords actually lie approximately 11 degrees off the perpendicular. This arrangement maximizes the tension across the width of the tire for a given air pressure, and hence gives greater resistance to lateral distortion of the tire on cornering. Radial tires provide better steering characteristics and less rolling resistance than bias-ply tires, tend to run cooler, are safer in bad weather, and are said to give considerably more mileage. They are more expensive than bias-ply tires and have a slightly hard riding quality. Radial tires are now the most widely used type of tire. Bias-ply tires are still widely used in Third World countries, and they are also used for aircraft because they are less susceptible to damage by severe overloads.

*Tire specifications.* Tires made to North American and European standards carry a code that shows their size and expected performance. In the American "P-metric" system, tire size is indicated, for example, by the code P215/70R15, where the letter P denotes a passenger-vehicle tire; 215 denotes the tire width in millimetres; 70 denotes the aspect ratio, *i.e.*, the ratio of the tire's height from rim to tread, relative to its width; R denotes radial construction; and 15 is the wheel rim diameter in inches. In addition to size, a speed rating is given using a letter code: S for a maximum speed of 112 miles per hour (180 km/h); T for 118 mph; H for 130 mph; V for 149 mph; and Z for more than 149 mph. A tread wear rating is given for expected tread life as a percentage of that for a standard tire. For example, a rating of 300 would imply a tread life three times as long as that of the reference tire.

*Snow tires.* Snow tires have an extra-deep tread for better traction on snow and ice. They are reputed to have 50 percent more pulling ability than regular tires on loosely packed snow and nearly 30 percent more on glare ice. In stopping on glare ice, however, snow tires have no advantage over regular tires; tire chains or studded tires are best for ice surfaces. Studded tires usually have about 100 studs tipped with tungsten carbide which contact the road as the tire rotates. Because of the damage they are said to cause road surfaces, they are prohibited in certain localities.

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*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Tiresias,** in Greek mythology, a blind Theban seer. In the *Odyssey* he retained his prophetic gifts even in the underworld, where the hero Odysseus was sent to consult him. At Thebes he played an active part in the tragic events concerning Laius, the king of Thebes, and his son Oedipus (*q.v.*). Later legend told that he lived for seven (or nine) generations, dying after the expedition of the Seven Against Thebes, and that he had once been turned into a woman as the result of killing the female of two coupling snakes; on killing the male he regained his own sex. His blindness was variously explained. One theory was that it was a punishment for revealing the secrets of the gods, which he had learned from his mother, the nymph Chariclo. Another theory was that he enraged Hera, who had contended to her husband, Zeus, that women had less pleasure in love than men, by telling her that love gave women 10 times more pleasure than it gave men. Hera thereupon struck him blind, but Zeus gave him the gift of prophecy. A third explanation was that Tiresias was blinded by Athena because he had watched her undressing to bathe.

The figure of Tiresias recurs in European literature, both as prophet and as man-woman, as in Guillaume Apollinaire's surrealist play *Les Mamelles de Tirésias* (first performed 1917; "The Breasts of Tiresias") and T.S. Eliot's *The Waste Land* (1922).

**Tîrgovişte** (city, Romania): *see* Târgovişte.

**Târgu Jiu** (city, Romania): *see* Târgu Jiu.

**Târgu Mureş** (city, Romania): *see* Târgu Mureş.

**Tirhaka** (Egyptian king): *see* Taharqa.

**Tirich Mir,** highest peak (25,230 ft [7,690 m]) in the Hindu Kush mountain system, lying 155 mi (249 km) north of Peshāwar, Pak., in the North-West Frontier Province near Afghanistan. The Upper Tirich Glacier basin is formed by Tirich Mir East, Tirich Mir (the main summit), peaks to the west, and another group to the north; these peaks form a horseshoe-like semicircle. High precipices rise over the Lower Tirich Glacier and are considered avalanche threats by climbers. The first recorded ascent of Tirich Mir was made by Norwegians in July 1950.

**Tiridates,** Parthian TYRDT, name of Parthian rulers, grouped below chronologically and indicated by the symbol •.

• **Tiridates II** (fl. late 1st century BC), Arsacid prince of the Parthian Empire who revolted against King Phraates IV and drove him into exile (32 BC) among the Scythians. The next year Phraates returned, and Tiridates fled to Syria, taking Phraates' son as hostage. The Roman emperor Augustus returned the son, but not Tiridates, to Phraates. In the spring of 26, Tiridates launched an unsuccessful invasion of Mesopotamia, and he may have returned to Mesopotamia early in 25. Augustus, preoccupied with Spanish affairs, had no more use for Tiridates. By May of 25, Phraates seems to have regained power.

• **Tiridates III** (fl. early 1st century AD), grandson of the Parthian king Phraates IV and an unsuccessful contender for the Parthian throne. He was captured by the Romans, taken to Rome as a hostage, and educated there. In AD 35 the Roman emperor Tiberius sent him and an army under Lucius Vitellius, governor of Syria, against the Parthian ruler Artabanus III, hoping to place Tiridates on the Parthian throne. The Romans entered Seleucia, and Tiridates was crowned king. In 36, however, Artabanus III returned to Mesopotamia, and Tiridates fled to Syria.

**Tirmidhi, at-,** in full ABŪ ʿĪSĀ MUḤAMMAD IBN ʿĪSĀ IBN SAWRAH IBN SHADDĀD AT-TIRMIDHĪ (d. *c.* 892), Arab scholar and author of one of the six canonical collections of spoken traditions (hadith) attributed to the Prophet Muḥammad.

The life of at-Tirmidhī is poorly documented. He journeyed to Khorāsān, to Iraq, and to the Ḥejaz in search of material for his collection and studied with such renowned scholars of Ḥadīth as Aḥmad ibn Ḥanbal, al-Bukhārī, and Abū Dāʿūd as-Sijistānī.

His canonical collection *al-Jāmiʿ as-ṣaḥīḥ* ("The Sound Collections") includes every spoken tradition that had ever been used to support a legal decision, as well as material relating to theological questions, to religious practice, and to popular belief and custom. Of special interest in this work are the author's critical remarks on the links in the chains of transmission (*isnāds*).

In the *Kitāb ash-shamāʾil* ("Book of Good Qualities"), at-Tirmidhī presented those hadiths specifically commenting on the character and life of Muḥammad.

**Tirnovo** (Bulgaria): *see* Veliko Tŭrnovo.

**Tiro, Prosper:** *see* Prosper of Aquitaine, Saint.

**Tirol,** also spelled TYROL, *Bundesland* (federal province), western Austria, consisting of North Tirol (Nordtirol) and East Tirol (Osttirol). It is bounded by Germany on the north, by *Bundesländer* Salzburg and Kärnten (Carinthia) on the east, by Vorarlberg on the west, and by Italy on the south. Tirol (area 4,883 sq mi [12,647 sq km]) is wholly Alpine in character. North Tirol is traversed from southwest to northeast by the Inn River, and East Tirol is drained by the Drava (Drau) River. The Lechtaler Alps lie between the Lech and the Inn rivers in the northwest, while the rugged and barren Karwendel and Kaiser ranges of the Limestone Alps extend across the north and northeast. The Silvretta, Ötztaler, Stubaier, Tuxer, Zillertaler, and Hohe Tauern ranges of the Central Alps extend across the southern part of the state. Although the loftiest peak in the Austrian Tirol, the Wildspitze (12,382 ft [3,774 m]), is in the Ötztaler Alps and its highest parts are covered by glaciers, the Central Alps generally are less rugged than the Limestone Alps, and much of their original wood cover has been cleared for pasture. Their terrain is ideal for skiing. In the eastern part of North Tirol are the slate mountains of the Kitzbüheler Alps, and the Lienz Dolomites rise in East Tirol. The mountain groups are separated by the Inn Valley and by lower stretches and passes, the most important of which are the Arlberg Pass in the west and the Brenner in the south.

Tirol originated as a family name, derived from a castle near Meran (now Merano, Italy). By AD 1150 scions of the family were counts and bailiwicks (land agents) for the bishops of Trent. In 1248 the counts of Tirol acquired extensive lands from the bishop of Brixen (Bressanone, Italy) and by 1271 had practically replaced the ecclesiastical power in the area. In 1342 the Holy Roman emperor Louis IV the Bavarian married Margaret Maultasch (Margaret of Carinthia), heiress to the Tirol, to his son after declaring her marriage to a member of the House of Luxembourg null. In 1363, however, Margaret's death left the Tirol, by previous arrangement, to the Habsburgs, who retained it until 1918. At first the Tirol was held by a junior branch, but it was united with the main Austrian possessions in 1665. Independent-minded Tirolese rose in 1525, when Protestantism was strong there, and again in 1809, when French and Bavarian rule proved irksome. The Counter-Reformation effectively Catholicized the Tirol after the first incident. In 1617 the area's strategic importance in linking Italy and Germany made it a bargaining counter between the Austrian archduke Ferdinand (later Holy Roman emperor as Ferdinand II), who wanted the imperial crown, and his cousin and potential rival Philip III of Spain, who received the Tirol in return for standing down. After World War I, Italy obtained the southern Tirol, with its sizable German-speaking majority, and retained it after World War II, despite objections by Austria.

Population distribution in the Tirol of modern Austria is uneven, with the highest concentrations in the Inn and Drava valleys. The principal towns are Innsbruck (the capital), Kufstein, Lienz, and Solbad Hall (*qq.v.*). The largely rural population is engaged primarily in pasture farming, cattle and livestock raising, dairy farming, and forestry. Wheat and rye are grown in the Inn Valley. There is some mining (salt, copper, magnesite), and most of the industries are small and highly specialized enterprises, some of long tradition, such as the textile mills of Innsbruck. Since World War II, chemical, pharmaceutical, and electrotechnical industries have been developed. Alpine health and winter-sports resorts support a vigorous tourist trade. Most road and rail traffic follows the Inn Valley, the Brenner Pass road, and the Drava Valley. Pop. (1985 est.) 586,663.

**TIROS,** in full TELEVISION AND INFRARED OBSERVATION SATELLITE, any of a series of U.S. meteorological satellites, the first of which was launched on April 1, 1960. The TIROS satellites comprised the first worldwide weather observation system. Equipped with specially designed miniature television cameras, infrared detectors, and videotape recorders, they were able to provide global weather coverage at 24-hour intervals. The cloud-cover pictures transmitted by the TIROS craft enabled meteorologists to track, forecast, and analyze storms. From 1969, a series of advanced weather satellites known as Nimbus largely supplanted TIROS.

**Tirpitz, Alfred von,** original name ALFRED TIRPITZ (b. March 19, 1849, Küstrin, Prussia—d. March 6, 1930, Ebenhausen, near Munich), German admiral, the chief builder of the German Navy in the 17 years preceding World War I and a dominant personality of the emperor William II's reign. He was enno-



Tirpitz, 1915
By courtesy of the Archiv fur Kunst und Geschichte, Berlin

bled in 1900 and attained the rank of admiral in 1903 and that of grand admiral in 1911; he retired in 1916.

*Early career and rise to power.* Tirpitz was the son of a Prussian civil servant. He enlisted in the Prussian Navy as a midshipman in 1865, attended the Kiel Naval School, and was commissioned in 1869. After serving as commander of a torpedo-boat flotilla and as inspector general of the torpedo fleet, he demonstrated his technical ability and devised the tactical principles that were developed systematically when he became chief of staff of the Navy High Command. Promoted to rear admiral in 1895, Tirpitz was sent to command the German cruiser squadron in East Asia from 1896 to 1897 and selected Tsingtao as a future German naval base in China. In June 1897 Tirpitz became secretary of state of the Imperial Navy Department, an appointment that marked the beginning of his two-decade buildup of the German fleet in close collaboration with Emperor William II.

In 1898 Tirpitz introduced the First Fleet Act, for the reorganization of Germany's sea power. This law provided for an active navy consisting of 1 flagship, 16 battleships, 8 armoured coastal ships, and a force of 9 large and 26 small cruisers to be ready by 1904. Such a navy was regarded as strong enough for limited offensives in a war against France and Russia. While the 1898 act was designed to meet the need for a high-seas battle fleet, Tirpitz's Second Fleet Act of 1900 laid down an ambitious program—to build a larger and more modern oceangoing fleet—that the navy was never able to practically fulfill. This law set 1917 as the year of completion for an active navy of 2 flagships, 36 battleships, 11 large cruisers, and 34 small cruisers. Tirpitz knew how to stimulate public interest in a bigger navy, and, as secretary of state from 1897, he displayed great skill as a parliamentarian. Tirpitz was ennobled in 1900 and awarded the Order of the Black Eagle; and in 1911 he rose to the rank of grand admiral.

In the meantime not even the 1900 navy law had evoked any significant political response

in Britain. The reactions were late in coming: not until the British formed their alliances of 1904 (with France) and 1907 (with Russia) and launched the *Dreadnought* (1906) in an effort to score an important technical advantage by constructing oversized capital ships. Their building program turned out to be a miscalculation, however, because not only all the other great powers but even many countries with small navies such as Chile and Turkey immediately followed suit. Nevertheless, because Britain had had a head start since 1905, when it had an edge of seven capital ships over its principal rival, Germany, and because of rapidly increasing British and declining German construction, there were 49 British battleships either in service or being built in 1914, as against 29 German vessels of the same type.

*Critique of Tirpitz's policy.* The decisive question in considering Tirpitz's objectives is whether it was good policy to augment the navy laws to the point that they could not be implemented and must inevitably result in political difficulties. From 1900 onward, when the so-called *Risikoflotte* ("risk fleet"—*i.e.*, a deterrent for potential attackers) was established under the second navy law, it became obvious that the navy was intended not only for actual defense but also as an alliance asset in time of peace. The emperor and Tirpitz hoped to be able, through mounting financial and military pressure, to force Britain to loosen its alliances. But when the British war minister Lord Haldane finally arrived in Berlin in 1912 for talks, political concessions were no longer obtainable from Britain. By that time Germany had discontinued its four-per-year naval vessel production rate and had abandoned the naval armament race with Britain. Thus, Tirpitz's naval policy was no longer an actual threat, but it may have continued to play such a role in the minds of the British public.

However eagerly Tirpitz may have wanted the high-seas fleet to go into action in World War I, he was forced to realize that, given the vastly superior naval strength of the Allies, his policy of naval deterrence had failed and that the conditions for a decision at sea were unfavourable to Germany. Even unlimited submarine warfare, which he favoured but for which the necessary vessels had still to be built, could no longer have had any more than a temporary impact. Faced with mounting opposition, Tirpitz drew the correct conclusion from the failure of his plans when he resigned in March 1916. With anxiety he saw the loss of morale on the home front; he thus became cofounder of the patriotic rallying movement known as the Fatherland Party, which, however, made only a small impact on an increasingly war-weary nation. Once again Tirpitz sat in the Reichstag, from 1924 to 1928 as a deputy of the German National People's Party. But, as circumstances had changed completely, he had lost the power to persuade. He retired to Upper Bavaria, where he died, at Ebenhausen, in 1930.

*Assessment.* Tirpitz was, by the standards of his time, a modern naval officer. He possessed a sound knowledge of the world, a dedicated mind, and an active interest in technology, and he was a brilliant organizer. He was obsessed by his work; he therefore tended to be biased and, once he had enunciated his principles, raised them to the status of a doctrine. The continuous and steady implementation of the naval laws took priority over other technical, tactical, and political considerations. Naval construction and its impact were to determine how the navy was to be used and hence its political value, and not vice versa. With the largest German navy, which under him became the world's second largest, Tirpitz forged an efficient military weapon that did not see the action for which it was intended in the war and finally collapsed from within.

(W.C.H.)

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**Tirso de Molina,** pseudonym of GABRIEL TÉLLEZ (b. March 9?, 1584, Madrid, Spain—d. March 12, 1648, Soria), one of the outstanding dramatists of the Golden Age of Spanish literature.

Tirso studied at the University of Alcalá and in 1601 was professed in the Mercedarian Order. As the order's official historian he wrote *Historia general de la orden de la Merced* in 1637. He was also a theologian of repute. Guided to drama by an inborn sense of the theatrical and inspired by the achievements of Lope de Vega, creator of the Spanish *comedia*, Tirso built on the "free-and-easy" prescriptions that Lope had propounded for dramatic construction. In his plays he sometimes accentuated the religious and philosophical aspects that attracted his theological interest; at other times he drew on his own topographical and historical knowledge, gained while traveling for his order through Spain, Portugal, and the West Indies. Sometimes he borrowed from the vast common stock of Spanish stage material, and at other times he relied on his own powerful imagination.

Three of his dramas appeared in his *Cigarrales de Toledo* (1621; "Weekend Retreats of Toledo"), a set of verses, tales, plays, and critical observations that, arranged after the Italian fashion in a picturesque framework, affect to provide a series of summer recreations for a group of friends. Otherwise his extant output of about 80 dramas—a fragment of the whole—was published chiefly in five *Partes* between 1627 and 1636. The second part presents apparently insoluble problems of authenticity, and the authorship of certain other of his plays outside this part has also been disputed.

The most powerful dramas associated with his name are two tragedies, *El burlador de Sevilla* ("The Seducer of Seville") and *El condenado por desconfiado* (1635; *The Doubted Damned*). The first introduced into literature the hero-villain Don Juan, a libertine whom Tirso derived from popular legends but recreated with originality. The figure of Don Juan subsequently became one of the most famous in all literature through Wolfgang Amadeus Mozart's opera *Don Giovanni* (1787). *El burlador* rises to a majestic climax of nervous tension when Don Juan is confronted with the statue-ghost of the man he has killed, and deliberately chooses to defy this emanation of his diseased conscience. *El condenado por desconfiado* dramatizes a theological paradox: the case of a notorious evildoer who has kept and developed the little faith he had, and who is granted salvation by an act of divine grace, contrasted with the example of a hitherto good-living hermit, eternally damned for allowing his one-time faith to shrivel. Tirso was at his best when portraying the psychological conflicts and contradictions involved in these master characters. At times he reaches Shakespearean standards of insight, tragic sublimity, and irony. The same qualities are found in isolated scenes of his historical dramas, for example in *Antona García* (1635), which is notable for its objective analysis of mob emotion; in *La prudencia en la mujer* (1634; "Prudence in Woman"), with its modern interpretation of ancient regional strife; and in the biblical *La venganza de Tamar* (1634), with its violently realistic scenes.

When inspired, Tirso could dramatize personality and make his best characters memorable as individuals. He is more stark and daring than Lope but less ingenious, more spiritually independent than Pedro Calderón de la Barca but less poetic. His plays of social types and manners, such as *El vergonzoso en palacio* (written 1611, published 1621; "The Bashful Man in the Palace"), are animated, varied in mood, and usually lyrical. At the same time, however, Tirso's style is erratic and sometimes trite. In pure comedy he excels in cloak-and-sword situations; and in, for example, *Don Gil de las calzas verdes* (1635; "Don Gil of the Green Stockings"), he manipulates a complex, rapidly moving plot with exhilarating vitality. His tragedies and comedies are both famous for their clowns, whose wit has a tonic air of spontaneity. Naturalness in diction suited his dramatic purpose better than the ornamental rhetoric then coming into vogue, and generally he avoided affectations, remaining in this respect nearer to Lope than to Calderón. Tirso was not as consistently brilliant as these great contemporaries, but his finest comedies rival theirs, and his best tragedies surpass them.

(LL.McC.)

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**tīrtha,** in Hinduism, a holy river, mountain, or other place made sacred through association with a deity or saint. The word *tīrtha* means literally "river ford," and, by extension, a sacred spot. Honoured as the seven holiest Hindu cities are Kāśī (modern Vārānasi, Uttar Pradesh), the centre of Śiva (Shiva) worship; Ayodhyā (Oudh, in Uttar Pradesh), birthplace of the god Rāma; Mathura (in Uttar Pradesh), scene of Krishna's nativity; Dwārkā (Dvāraka, in Gujarāt state), where the adult Krishna ruled as king; Kānchipuram (Tamil Nadu state), where the temple to the divine mother is built in the shape of a *yantra*, or sacred diagram; Hardwār (in Uttar Pradesh), the spot where the Ganges River is said to have come to Earth; and Ujjain (Madhya Pradesh), site of a famous Śaiva linga (sign of Śiva).

Bathing is said to be particularly cleansing of sin when performed in the confluence of two rivers or at the source or joining of one of the seven sacred rivers—the Ganges, Yamunā, Godāvari, Narmada, Indus, Cauvery, and the no longer visible Saraswati. The four great abodes of the gods, located at the four corners of India—Badrīnātha in the north, Dwārkā in the west, Rāmeswaram in the south, and Puri in the east—attract large numbers of pilgrims yearly. The *pīṭhas*, or spots that mark where pieces of the body of Śiva's wife Satī fell to Earth, are particularly sacred to the devotees of the goddess Śakti. Special occasions, such as an eclipse of the Sun, a Kumbh Mela (*q.v.*; largest of the religious fairs), or the Rathayātrā (car festival) at the Jagannātha (*q.v.*) temple in Puri, draw large gatherings.

The Hindu undertakes his pilgrimage (called the *tīrthayātrā*) as an act of devotion, to carry out a vow, to appease a deity, or to seek prosperity. Upon reaching the *tīrtha* he will usually bathe (*snāna*), circumambulate the temple or holy place (*pradakṣiṇā*), make an offering, carry out a rite such as the *śrāddha* ceremony performed in honour of dead ancestors, have his name recorded by the priests who specially cater to the needs of pilgrims, and listen to the evening expositions of music and religious discourses.

**Tirthankara,** Sanskrit TĪRTHAṄKARA ("Ford-Maker"), also called JINA ("Victor"), in Jainism (a religion of India), a saviour who has succeeded in crossing over life's stream of rebirths and has made a path for others to

follow. Mahāvīra (6th century BC) was the last Tirthankara to appear. His predecessor, Pārśvanātha, lived about 250 years earlier; the other Tirthankaras mentioned in the Jaina scriptures cannot be considered historical figures. According to Jaina belief, each cosmic age produces its own group of 24 Tirthankaras, the first of whom—if it is an age of descending purity—are giants, but they decrease in stature and appear after shorter intervals of time as the age proceeds.



Ṛṣabhanātha and Mahāvīra, the first and last Tirthankaras, stone sculpture from Orissa, India, 11th century; in the British Museum

Reproduced by courtesy of the trustees of the British Museum

In art the Tirthankara is represented either standing stiffly in the pose known as *kāyotsarga* ("dismissing the body") or seated cross-legged on a lion throne in the posture of meditation, *dhyānamudrā*. The images are often carved out of marble or other highly polished stone or are cast in metal, the cold surfaces serving to emphasize the frozen detachment from life. Since the Tirthankara is a perfect being, there is little to distinguish one from another, except for symbolic colours or emblems. The names of the 24 Tirthankaras are attributed to dreams by their mothers before their births or to some other circumstance surrounding their entry into the world.

In order of their appearance, the names, signs, and colours of the Jinas of this age are (1) Ṛṣabhanātha ("Lord Bull"), or Ādinātha ("Lord First"), his emblem the bull, his colour golden; (2) Ajita ("Invincible One"), elephant, golden; (3) Saṃbhava ("Auspicious"), horse, golden; (4) Abhinandana ("Worship"), ape, golden; (5) Sumati ("Wise"), heron, golden; (6) Padmaprabha ("Lotus-Bright"), lotus, red; (7) Supārśva ("Good-Sided"), the swastika symbol, golden; (8) Candraprabha ("Moon-Bright"), moon, white; (9) Suvidhi, or Puṣpadanta ("Religious Duties" or "Blossom-Toothed"), dolphin or *makara* (sea dragon), white; (10) Śītala ("Coolness"), the *śrīvatsa* symbol, golden; (11) Śreyāṃśa ("Good"), rhinoceros, golden; (12) Vāsupūjya ("Worshiped with Offerings of Possessions"), buffalo, red; (13) Vimala ("Clear"), boar, golden; (14) Ananta ("Endless"), hawk (according to the Digambara sect, ram or bear), golden; (15) Dharma ("Duty"), thunderbolt, golden; (16) Śānti ("Peace"), antelope or deer, golden; (17) Kunthu (meaning uncertain), goat, golden; (18) Ara (a division of time), the *nandyāvarta* (an elaborated swastika; according to the Digambara sect, fish), golden; (19) Malli ("Wrestler"), water jug, blue; (20) Suvrata, or Munisuvrata ("Of Good Vows"), tortoise, black; (21) Nami ("Bowing Down"), or Nimin ("Eye-Winking"), blue lotus, golden; (22) Nemi, or Ariṣṭanemi ("The Rim of Whose Wheel is Unhurt"), conch shell, black; (23) Pārśvanātha ("Lord Serpent"), snake, green; (24) Vardhamāna ("Prospering"), later called Mahāvīra ("Great Hero"), lion, golden.

Images of the Tirthankara are not worshiped as personal gods, capable of giving blessings or interfering with human events. Rather, Jain believers pay them homage as representatives of great beings in the hope that they may be filled with a sense of renunciation and the highest virtues and thus encouraged along the path toward their final liberation.

**Tiruchchirāppalli,** also called TRICHINOPOLY, city, central Tamil Nādu state, southeastern India. It is on the main road and rail routes between Madras and Trivandrum and lies at the head of the Kāveri (Cauvery) River delta. It was an important regional capital of the Pallava, Cōḷa, and Vijayanagar dynasties from the 7th to the 17th century. Its rock fortress, dominating the city, was the scene of bitter fighting between Muslim, Marāṭhā, British, and French troops from the 17th to the 19th century. The city is now an industrial centre that has modern heavy electrical, thermal boiler, and locomotive construction workshops, alongside traditional cotton handweaving and cigar-rolling cottage industries. Synthetic diamonds are manufactured as well. The city is also the site of Bharathidasan University (1982). The surrounding Kāveri River valley is the best rice-growing region in the state and also produces sugarcane and betel. Pop. (1991 prelim.) city, 386,628; metropolitan area, 771,120.

**Tirunelveli,** also called TINNEVELLY, city, southern Tamil Nādu state, southeastern India. It lies along the Tāmbraparni River, slightly upstream from the city of Pālayankottai (Pālamcottah). Its name is derived from the Tamil words *tiru* ("holy"), *nel* ("paddy"), and *veli* ("fence"), referring to a legend that the god Śiva (Shiva) protected a devotee's rice crop there. Tirunelveli was a commercial centre during the Pāṇḍya dynasty. With electricity supplied from the Pāpanāśam Dam on the Tāmbraparni River, it has become an industrial city specializing in the manufacture of textiles, cigars, and jewelry, and it has motor workshops. It is the site of Manonmaniam Sundaranar University (1990).

Tirunelveli lies in the fertile alluvial valley of the Tāmbraparni River, which rises in the Western Ghāts mountain range and flows eastward to eventually empty into the Gulf of Mannar. The Tāmbraparni provides irrigation water for crops of rice and cotton. The locality's chief large-scale industry is cotton milling. Pop. (1991 prelim.) city, 135,762; metropolitan area, 365,932.

**Tirupati,** city, southeastern Andhra Pradesh state, southern India. It lies about 67 miles (108 km) northwest of Madras in the Pālkonda Hills. Tirupati is known as the abode of the Hindu god Veṅkaṭeśvara, Lord of Seven Hills. About 6 miles (10 km) northwest of Tirupati, at an elevation of 2,500 feet (750 m), is the sacred hill of Tirumala, which was considered so holy that before 1870 non-Hindus were not permitted to ascend it. At the hill's summit is a temple dedicated to Veṅkaṭeśvara. This temple, nestled among sacred waterfalls and tanks (reservoirs), is a fine example of Dravidian art and is one of the most important pilgrimage centres in India. The temple, which is of great antiquity, is now the centre of Sri Venkateswara University (1954). Pop. (1991 prelim.) 174,393.

**Tiruppūr,** city, western Tamil Nādu state, south-central India, on the Noyil River. It is an active cotton-ginning and distribution centre with rail connections to Coimbatore and Erode. The city became a major centre for the manufacture of cotton-knit textiles late in the 20th century. Tiruppur's name means "holy city," and its Śaiva temple attracts large crowds of pilgrims, especially at the time of the Hindu Rathayātrā (chariot festival) celebrated in May and June. Pop. (1991 prelim.) city, 235,076; metropolitan area, 305,546.

**Tiryns,** prehistoric city in the Argolis, Greece, noted for its architectural remains of the Homeric period. Excavations show the area to have been inhabited from the Neolithic Age. Not later than the beginning of the Early Bronze Age, or Early Helladic Period (*c.* 3000–*c.* 2200 BC), a pre-Greek agricultural people arrived, probably from western Anatolia, as suggested by place-name endings such as *-ssos, -ttos, -inthos, -indos,* and *-enai*. In the Middle Bronze Age, or Middle Helladic Period, people from the north moved in who are believed to have spoken an early variant of the Greek language. In contrast to the violent invasions by these people in other areas, their arrival at Tiryns appeared to have been peaceful. The



Gallery and casements in the east bastion of the palace at Tiryns, 14th century BC

Hirmer Fotoarchiv, München

settlement at Tiryns developed into a centre of the Mycenaean, or Late Helladic, culture, influenced by that of Minoan Crete. Tiryns, situated on a ridge in the plain between Nauplia (modern Návplion) and Mycenae, survived into the classical period but was destroyed by Argos about 468 BC. From the huge stones of the walls of its citadel, supposedly built by the Cyclopes for the legendary king Proteus, the expression Cyclopean masonry is derived.

**Tisa River** (Europe): *see* Tisza River.

**Tischbein, Johann Heinrich Wilhelm** (b. Feb. 15, 1751, Haina, Hesse [Germany]—d. June 26, 1829, Eutin, Oldenburg), German portraitist and friend of the writer J.W. von Goethe.

Tischbein began his career painting portraits at the Prussian court in Berlin. In 1779 he went to Italy and in 1789 was appointed director of the art academy in Naples. Forced to leave in 1799 because of war, the painter retired to northern Germany. Tischbein's most famous painting, "Goethe in the Campagna," was painted in 1787 at the time the two men traveled from Rome to Naples. Though Goethe induced the artist to turn his interest toward the Neoclassical movement, Tischbein

was later influenced by the ideas of German Romanticism.

Tischbein belonged to a family that produced more than 20 artists in three generations. Others of importance include Johann Heinrich Tischbein the Elder (1722–89), who was a court painter in Kassel, in Hesse, and the portraitists Johann Valentin Tischbein (1715–68) and Anton Wilhelm Tischbein (1730–1804).

**Tischendorf, Konstantin von,** in full LOBEGOTT FRIEDRICH KONSTANTIN VON TISCHENDORF (b. Jan. 18, 1815, Lengefeld, Saxony [Germany]—d. Dec. 7, 1874, Leipzig), German biblical critic who made extensive and invaluable contributions to biblical textual criticism, famous for his discovery of the *Codex Sinaiticus,* a celebrated manuscript of the Bible.

While a student at the University of Leipzig, Tischendorf began his work on the recensions of the New Testament text, a task that he was to pursue for the rest of his life. In 1844 he went to the Middle East. While working in the library of the Monastery of St. Catherine in the Sinai Peninsula, he discovered, among some old parchments, leaves of what he was certain were among the oldest biblical manuscripts that he had ever seen. He was permitted to take 43 of these leaves back with him to Leipzig, and in 1846 he published a facsimile edition, taking care to keep secret the place where he had obtained them. In 1853 he made a second journey to Sinai with the hope of recovering the other leaves he had seen on his first trip, but he found no trace of them. He made still a third trip, with the support of the Russian government, in 1859. Just as he was about to give up all hope of finding the manuscripts, the steward of the monastery showed Tischendorf the manuscripts that he was looking for and others besides. After intricate negotiations, and for a sum that has been estimated at about $7,000, Tischendorf procured for the tsar Alexander II what is now known as the *Codex Sinaiticus.* In 1933 the codex was purchased from the Soviet government by the British Museum for £100,000 (about $500,000). These manuscripts date probably from the latter half of the 4th century, were probably written in Egypt, and include most of the Old Testament and the entire New Testament, as well as the *Letter of Barnabas* and part of the *Shepherd of Hermas.*

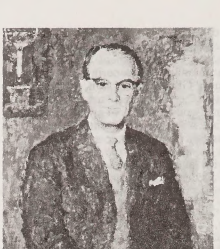
In numerous writings, Tischendorf presented the results of his work. His eighth edition of the Greek New Testament is considered to be of most value to contemporary textual critics.

*Consult the* INDEX *first*

**Tiselius, Arne,** in full ARNE WILHELM KAURIN TISELIUS (b. Aug. 10, 1902, Stockholm, Swed.—d. Oct. 29, 1971, Uppsala), Swedish biochemist who won the Nobel Prize for Chemistry in 1948 for his work on electrophoresis and adsorption analysis.

As an assistant to Theodor Svedberg at the University of Uppsala (1925–32), Tiselius developed the use of electrophoresis for the delicate task of separating proteins in suspension on the basis of their electrical charge. For this work he was awarded his doctorate in 1930.

After lecturing at Uppsala, he conducted research at the Institute for Advanced Study at Princeton (1934–35). Returning to Uppsala (1937), he became a professor of biochemistry and was provided with a newly built institute to house his department. He used electrophoretic methods to separate the chemically similar proteins of blood serum, an achievement that was especially cited in the Nobel award. In 1940 he began research



Tiselius, oil painting by William Fleetwood, 1965; in Gripsholm Castle, Mariefred, Swed.

By courtesy of Svenska Portrattarkivet, Stockholm

into the separation of proteins and other substances by adsorption chromatography. Chairman of the Swedish Natural Science Research Council (1946–50), he became vice president (1947–60) and then president (1960–64) of the Nobel Foundation.

**Tisha be-Av,** English NINTH OF AV, in Judaism, traditional day of mourning for the destruction of the First and Second Temples. According to the Talmud, other disastrous events such as the following occurred on Av 9: the decree that the Jews would wander 40 years in the wilderness; the fall of Bethar in AD 135, ending the second Jewish revolt against Rome; and the establishment in 136 of a pagan temple in Jerusalem, which Jews were no longer permitted to enter. The expulsion of the Jews from Spain in 1492 is also traditionally believed to have occurred on that date. From sunset to sunset, a 24-hour fast is observed, except by Reform Jews. The liturgy of the day, performed by candlelight in a gloomy atmosphere, includes the reading of the Lamentations of Jeremiah and the recital of dirges (*qinot*); certain passages from the Old Testament are also read. Many Jews visit the cemetery on this day. If Tisha be-Av falls on the Sabbath ("Black Sabbath"), the observance is postponed one day. Tisha be-Av marks the end of a period of mourning called the Three Weeks.

**Tiso, Jozef** (b. Oct. 13, 1887, Velká Bytča, Austria-Hungary [now in Slovakia]—d. April 18, 1947, Bratislava, Czech.), Slovak priest and statesman who fought for Slovak autonomy within the Czechoslovak nation during the interwar period and headed the German puppet state of independent Slovakia (1939–45) until he was overthrown by the Red Army and Czechoslovak Partisans at the end of World War II.

Becoming a prominent member of Andrej Hlinka's Slovak People's Party after World War I, Tiso was a member of the Czechoslovak government from 1927 to 1929 and succeeded Hlinka as party leader in 1938. On Oct. 6, 1938, he became premier of autonomous Slovakia in the new federal Czechoslovakia, assuming the presidency after his country, under Adolf Hitler's sponsorship, declared its independence (1939) to forestall annexation by Hungary.

Throughout World War II, though closely supervised by Germany, Tiso's authoritarian government retained a degree of freedom of action, but it collapsed with the arrival of the Red Army in April 1945. He was tried and convicted for treason, suppression of freedom, and crimes against humanity and was executed in 1947.

**Tisquantum** (American Indian): *see* Squanto.

**Tissaphernes,** Old Persian CHITHRAFARNA (d. 395 BC, Colossae, Phrygia [now in Turkey]), Persian satrap (governor) who played a leading part in Persia's struggle to reconquer the Ionian Greek cities of Asia Minor that had been held by Athens since 449.

In 413 Tissaphernes, who was then satrap of Lydia and Caria, formed an alliance with Sparta, and by the next year he had regained most of Ionia. Fearing that a complete victory of Sparta over Athens in the Peloponnesian War would endanger Persian interests, he supplied only limited assistance to his ally. As a result, when the Persian king Darius in 407 decided to support Sparta fully, Tissaphernes was replaced as commander in chief in Asia Minor and as satrap of Lydia by Darius' son, Cyrus the Younger, and his influence was limited to the satrapy of Caria. Cyrus revolted, however, shortly after his brother Artaxerxes took the throne.

Tissaphernes, supporting Artaxerxes, distinguished himself in the Battle of Cunaxa (401), where Cyrus was killed, and afterward treacherously seized the leaders of Cyrus' Greek mercenaries. Reinstated as satrap of Caria and Lydia, he attacked the Ionian cities, control of which had been lost during Cyrus' revolt. This attack led to war with Sparta, and, after Tissaphernes' severe defeat at Sardis in 395, his enemy Parysatis, mother of Cyrus, succeeded in persuading Artaxerxes to have him executed.

**Tisserand, Félix,** in full FRANÇOIS-FÉLIX TISSERAND (b. Jan. 13, 1845, Nuits-St.-Georges, Côte-d'Or, Fr.—d. Oct. 20, 1896, Paris), French astronomer noted for his textbook *Traité de mécanique céleste,* 4 vol. (1889–96; "Treatise on Celestial Mechanics"). This work, an update of Pierre-Simon Laplace's work on the same subject, is still used as a sourcebook by authors writing on celestial mechanics.

Before publishing this work, Tisserand had already established his brilliance in his doctoral dissertation (1868), analyzing Charles-Eugène Delaunay's lunar theory, and in his work as director of the Toulouse Observatory (1873–78). In 1874 he was elected to the Academy of Sciences as a corresponding member and was elevated to full membership in 1878. In 1892 Tisserand was appointed director of the Paris Observatory, and while there he contributed to the production of a still-unfinished international photographic star catalog, the *Catalogue photographique de la carte du ciel* ("Photographic Catalog of the Map of the Sky").

**Tissot, James,** in full JAMES-JOSEPH-JACQUES TISSOT (b. Oct. 15, 1836, Nantes, Fr.—d. Aug. 8, 1902, Buillon Abbey, near Besançon), French painter, engraver, and enameler noted for his portraits of late Victorian society.

After receiving a religious education, Tissot went to Paris at age 19 to study art. In 1859 he exhibited at the Salon (an official exhibition sponsored by the French government). Turning from his rather anguished early works to modern genre paintings and stylish portraits, he quickly became successful in the Paris art world. He fought in the Franco-German War (1870–71), later associating himself with the Paris Commune; in its aftermath he fled to London (May 1871). There he began to rebuild his career, establishing residence in St. John's Wood, London. During that period he made many etchings, dry-points, and mezzotints, as well as paintings. In the late 1870s he also became interested in the craft of cloisonné enameling. Occasionally traveling abroad, he made London his home until November 1882, when his Irish mistress died.

Tissot returned to Paris. He struggled for a time to regain his former popularity but was not entirely successful. In 1885, after a mys-

tical experience, he determined to illustrate a life of Christ. He took a number of trips to the Holy Land and produced some 350 watercolours of New Testament subjects, which were published in two volumes.

**tissue,** in physiology, a level of organization in multicellular organisms; it consists of a group of structurally and functionally similar cells and their intercellular material.

By definition, tissues are absent from unicellular organisms. Even among the simplest multicellular species, such as sponges, tissues are lacking or are poorly differentiated. But multicellular animals and plants that are more advanced have specialized tissues that can organize and regulate an organism's response to its environment.

*Plants.* Bryophytes (liverworts, hornworts, and mosses) are nonvascular plants; *i.e.,* they lack vascular tissues (phloem and xylem) as well as true leaves, stems, and roots. Instead bryophytes absorb water and nutrients directly through leaflike and stemlike structures or through cells comprising the gametophyte body.

In vascular plants, such as angiosperms and gymnosperms, cell division takes place almost exclusively in specific tissues known as meristems. Apical meristems, which are located at the tips of shoots and roots in all vascular plants, give rise to three types of primary meristems, which in turn produce the mature primary tissues of the plant. The three kinds of mature tissues are dermal, vascular, and ground tissues. Primary dermal tissues, called epidermis, make up the outer layer of all plant organs (*e.g.,* stems, roots, leaves, flowers). They help deter excess water loss and invasion by insects and microorganisms. The vascular tissues are of two kinds: water-transporting xylem and food-transporting phloem. Primary xylem and phloem are arranged in vascular bundles that run the length of the plant from roots to leaves. The ground tissues, which comprise the remaining plant matter, include various support, storage, and photosynthetic tissues.

Secondary, or lateral, meristems, which are found in all woody plants and in some herbaceous ones, consist of the vascular cambium and the cork cambium. They produce secondary tissues from a ring of vascular cambium in stems and roots. Secondary phloem forms along the outer edge of the cambium ring, and secondary xylem (*i.e.,* wood) forms along the inner edge of the cambium ring. The cork cambium produces a secondary dermal tissue (periderm) that replaces the epidermis along older stems and roots.

*Animals.* Early in the evolutionary history of animals, tissues became aggregated into organs, which themselves became divided into specialized parts. An early scientific classification of tissues divided them on the basis of the organ system of which they formed a part (*e.g.,* nervous tissues). Embryologists have often classified tissues on the basis of their origin in the developing embryo; *i.e.,* ectodermal, endodermal, and mesodermal tissues. Another method classified tissues into four broad groups according to cell composition: epithelial tissues, composed of cells that make up the body's outer covering and the membranous covering of internal organs, cavities, and canals; endothelial tissues, composed of cells that line the inside of organs; stroma tissues, composed of cells that serve as a matrix in which the other cells are embedded; and connective tissues, a rather amorphous category composed of cells and an extracellular matrix that serve as a connection from one tissue to another.

The most useful of all systems, however, breaks down animal tissues into four classes based on the functions that the tissues perform. The first class includes all those tissues that serve an animal's needs for growth, repair, and energy; *i.e.,* the assimilation, storage, transport, and excretion of nutrients and waste products. In humans, these tissues include the alimentary (or digestive) tract, kidneys, liver, and lungs. The digestive tract leads (in vertebrates) from the mouth through the pharynx, stomach, and intestines to the anus. In vertebrates and some larger invertebrates, oxygen and the nutrients secured by the alimentary tissues or liberated from storage tissues are transported throughout the body by the blood and lymph, which are themselves considered by many to be tissues. Tissues that secure oxygen and excrete carbon dioxide are extremely variable in the animal kingdom. In many invertebrates, gas exchange takes place through the body wall or external gills, but in species adapted to a terrestrial life, an internal sac capable of expansion and contraction served this purpose, and gradually became more complex over evolutionary time as animals' demand for oxygen increased.

The second class of tissues consists of those used in coordination. There are basically two types: physical (nervous and sensory tissues), which operate via electrical impulses along nerve fibres; and the chemical (endocrine tissues), which release hormones into the bloodstream. In invertebrates, both physical and chemical coordination are performed by the same tissues, because the nervous tissues also serve as hormone sources. In vertebrates, most endocrine functions are isolated in specialized glands, several of which are derived from nervous tissue.

The basic unit of all nervous tissue is the neuron, aggregations of which are called ganglia. The bundles of axons along which neurons transmit and receive impulses are called nerves. By comparison, chemical control by hormones is much slower and longer-acting. In many invertebrates, chemical stimulators are secreted by the neurons themselves and then move to their site of action along the axon. In higher vertebrates, the principal endocrine tissues are the thyroid, parathyroid, pituitary, and endocrine constituents of the pancreas and adrenal glands.

The third class of tissues includes those contributing to the body's support and movement. The connective tissues proper surround organs, bones, and muscles, helping to hold them together. Connective tissues proper consist of cells embedded in a matrix composed of an amorphous ground substance and collagen, elastic, and reticular fibres. Tendons and ligaments are examples of extremely strong connective tissues proper. The other major structural tissues are cartilage and bone, which, like connective tissues proper, consist of cells embedded in an intercellular matrix. In cartilage the matrix is firm but rubbery; in bone the matrix is rigid, being impregnated by hard crystals of inorganic salts. Muscle tissue is primarily responsible for movement; it consists of contractile cells. There are two general types of muscle: striated muscle, which moves the skeleton and is under voluntary control; and smooth muscle, which surrounds the walls of many internal organs and cannot normally be controlled voluntarily.

A fourth class of tissues includes reproductive tissues, hemopoietic tissues, and tissue fluids. The most important reproductive tissues are the gonads (ovaries and testes), which produce the gametes (eggs and sperm, respectively). Hemopoietic tissues produce the cellular components of the blood. Among the important tissue fluids are lymph, cerebrospinal fluid, and milk (in mammals).

**tissue culture,** a method of biological research in which fragments of tissue from an animal or plant are transferred to an artificial environment in which they can continue to survive and function. The cultured tissue may consist of a single cell, a population of cells, or a whole or part of an organ. Cells in culture may multiply; change size, form, or function; exhibit specialized activity (muscle cells, for example, may contract); or interact with other cells.

Tissue culture is a relatively recent development. In 1907 the American zoologist Ross G. Harrison successfully demonstrated the growth of frog nerve cell processes in a medium of clotted lymph. Thereafter, a number of experimenters succeeded in cultivating animal cells, using as culture media a variety of biological fluids, such as lymph, blood serum, plasma, and tissue extracts.

Tissue culture permits control of the cellular environment, allowing the behaviour of cells to be both examined and manipulated. Tissue cultures have revealed basic information about cells regarding their composition and form; their biochemical, genetic, and reproductive activity; their nutrition, metabolism, specialized functions, and processes of aging and healing; the effects on cells of physical, chemical, and biological agents (drugs and viruses, for example); and the differences between normal cells and abnormal cells such as cancers. Work with tissue cultures has helped to identify infections, enzyme deficiencies, and chromosomal abnormalities, to classify brain tumours, and to formulate and test drugs and vaccines.

Cells may be grown in a culture medium of biological origin such as blood serum or tissue extract, in a chemically defined synthetic medium, or in a mixture of the two. A medium must contain proper proportions of the necessary nutrients for the cells to be studied and must be appropriately acid or alkaline. Cultures are usually grown either as single layers of cells on a glass or plastic surface or as a suspension in a liquid or semisolid medium. To initiate a culture, a tiny sample of the tissue is dispersed on or in the medium, and the flask, tube, or plate containing the culture is then incubated, usually at a temperature close to that of the tissue's normal environment. Sterile conditions are maintained to prevent contamination with microorganisms.

Live cultured cells may be examined directly with a microscope or observed by means of photographs and motion pictures taken through the microscope. Cells may also be killed, preserved, and stained for further examination or cut into thin sections to disclose additional details under a light or electron microscope.

Cells in tissue culture are subjected to a broad range of experimental treatment. For example, viruses, drugs, hormones, vitamins, disease-causing microorganisms, or suspected cancer-producing chemicals may be added to the culture. Sometimes cultures are grown from single cells, producing uniform biological populations called clones.

Cultures have been used to investigate fundamental processes of growth and development in both normal and abnormal tissues. One finding has been that normal cells undergo an aging process, retaining their ability to multiply readily for only 50 to 100 generations, after which the rate decreases markedly. Many cancer cells, on the other hand, apparently can be perpetuated forever.

Since the discovery that certain viruses will grow in tissue cultures, the technique has been used to produce vaccines against poliomyelitis, influenza, measles, mumps, and other infectious diseases. Cell cultures have also produced viral inhibitors, including interferon. Hormones are now being produced from cultures of cells or organs. The cultured white blood cells from two individuals can be used to determine compatibility between potential donors and recipients of tissue transplants. By removing and culturing cells from a pregnant woman, it is possible to tell whether her fetus

has the chromosome defect associated with Down syndrome (mongolism).

The identification and diagnosis of chromosome abnormalities and inherited disorders has been greatly enhanced by the development of somatic cell genetics. Tissue culture techniques have been used to culture many kinds of hybrid cells that contain chromosomes from different species in the same cell, allowing the functions of individual chromosomes to be separately defined. Tissue-culture studies have clarified the genetic causes of certain hereditary diseases, and methods have been developed for detecting environmental substances that may cause gene damage. The nature of certain cancers has been elucidated by the discovery of specific genes and chromosomal aberrations that are associated with the disease. Studies of cell cultures have revealed the existence of a so-called cytoskeleton in mammalian cells, which gives the cell its shape and regulates a variety of biochemical activities.

**Tista River,** a tributary of the Brahmaputra River, flowing through Sikkim (India) and Bangladesh. It rises in the Himalayas near Chunthang, Sikkim, flows south cutting through the Outer Himalayas east of Darjeeling (Dārjiling), and turns southeast to run through Sivok Gota Pass onto the plains of West Bengal. It then crosses the Rangpur region of Bangladesh to join the Brahmaputra River near Chilmāri after a total course of 250 miles (400 km). The Tista River drains one of the wettest parts of the Himalayas and flows through tropical rain forest in its upper reaches. Its flow is greatest during the summer (June to September), when the monsoon rains are heaviest and glaciers supply abundant meltwater. Its lower reaches are marked by flooding and frequent, violent course changes; navigation is impaired by shoals and quicksand near the junction with the Brahmaputra. The Tista Barrage Project is part of a program of river projects in the Barind region to provide irrigation for the plains between the Ganges River and the Brahmaputra.

**Tisza, István, Gróf** (Count) (b. April 22, 1861, Budapest, Hung., Austrian Empire—d. Oct. 31, 1918, Budapest), Hungarian statesman who became prime minister of Hungary as well as one of the most prominent defenders of the Austro-Hungarian dualist system of government. He was an opponent of voting franchise reform in Hungary, and he was a loyal supporter of the monarchy's alliance with Germany throughout World War I.

Entering the Hungarian Parliament in 1886, Tisza became a leader of the Liberal Party (led by his father, Kálmán Tisza) and a defender of the dual monarchy and of Hungary's large landed interests. He became prime minister in 1903 but was heavily defeated at the polls in 1905. He served as president of the lower



István, Count Tisza, portrait by Gyula Benczúr; in the Hungarian National Museum, Budapest

Interfoto MTI, Hungary

house from 1912 and was again prime minister from June 1913. In July 1914 Tisza initially resisted the view that Austria-Hungary should declare war on Serbia; he agreed to support the war only if Austria-Hungary would not annex further Slav territory (he regarded an increase in Slav subjects as a danger to the dualist system). Tisza resigned in protest over the decree of the new emperor Charles I (Hungarian king Charles IV) for suffrage reform in Hungary (June 15, 1917). Held responsible for provoking the war and for his country's suffering during World War I, Tisza was assassinated shortly before the end of the war.

**Tisza, Kálmán** (b. Dec. 16, 1830, Geszt, Hung., Austrian Empire—d. March 23, 1902, Budapest), Hungarian statesman and longtime premier who led the coalition that ruled Hungary for the last 30 years of his life. He made his country a strong, unified, and economically viable state within the Austro-Hungarian system of dual government.

A member of an old Calvinist landowning family, Tisza participated in the first Hungarian parliamentary government during the Revolution of 1848–49. Exiled after the restoration of Austrian rule, he returned to Hungary and took a major part in the struggle for Hungarian national autonomy within the Austro-Hungarian system of dual government. At a time of economic crisis and internal debate over Hungary's continued acceptance of the Austro-Hungarian Ausgleich (German: "Compromise") of 1867, Tisza changed sides in 1875 and undertook to maintain the Ausgleich. Toward this end he succeeded in fusing the often contradictory interests of the nobility, business, and the small landowners into the new Liberal Party, which supported the Ausgleich and through which he served as prime minister of Hungary during much of 1875–90. As prime minister Tisza instituted social, political, economic, and legal reforms that became the basis for Hungary's development as a modern nation. Tisza resigned in 1890, protesting at alleged interference from the Austrian emperor, but to his death he retained political preeminence in his party.

**Tisza River,** Romanian, Russian, and Serbo-Croatian TISA, a major tributary of the middle Danube River, rising in the Bukovina segment of the Carpathian Mountains. Its two headstreams, the Black and White Tisza, unite east of Sighet on the Ukraine-Romania border. From Sighet, Rom., the Tisza flows northwest through a small portion of Ukraine and then into Hungary. It then flows in a great northward loop to where the Slovak, Ukrainian, and Hungarian frontiers converge near Chop, Ukraine. The Tisza continues southwest through Hungary to Szolnok; then it cuts southward across the Great Alfold, paralleling the Danube, which it joins 28 miles (45 km) north of Belgrade, Serbia and Montenegro, after a meandering course (largely canalized) of 619 miles (996 km). Its drainage area is 60,690 square miles (157,186 square km).

The Tisza in its mountain course is a clear, rapid stream; the lack of an extensive lake system in the Carpathians to steady the seasonal runoff explains the spectacular contrast between its maximum and minimum levels and results in three annual floods—in early spring, early summer, and fall. When high water in the Tisza meets similar conditions in the Danube, the Tisza flows back into its own course, causing severe flooding. Such a coincidence destroyed Szeged, Hung., in the spring of 1879; dikes now protect the city. Regulation of the river was begun in the second half of the 19th century, and there are 2,400 miles (3,860 km) of flood-control levees along its course. The main east-bank tributaries are the Szamos, Körös, and Maros (Romanian Someş, Criş, Mureş); on the west bank are the Bodrog and the Sajó. The Tiszalök Dam (1954) on the upper river forms the largest reservoir in Hungary, provides hydroelectric power, and, with the Eastern Main Canal linking the Tisza and the Berettyó to the Körös, helps to irrigate the Hajdúság and Hortobágy plains. Szolnok, Csongrád, and Szeged rank as river ports. A canal in Serbia and Montenegro links the Tisza with the Danube before their natural confluence.

**tit,** also called TITMOUSE, plural TITMICE, any of a number of small active birds of the songbird family Paridae (order Passeriformes). The name tit is used primarily in the Old World; in the New World a parid is called titmouse or chickadee. The term tit is also used in combinations for birds of other families that resemble parids in behaviour and appearance—*e.g.,* tit-babbler, tit-tyrant, wrentit.

Parid tits are woodland and garden birds. Perhaps the best-known species is the great tit (*Parus major*), found in Europe, northwestern



(Top) Tufted titmouse (*Parus bicolor*), (bottom) blue tit (*Parus caeruleus*)

(Top) Dan Sudia—The National Audubon Society Collection, (bottom) Brian Bevan—Ardea Photographics

Africa, and Asia nearly to Java. It is 14 cm (5.5 inches) long, and it has a white-faced black head and a black centre line on its underparts, which are yellow in Western races and whitish or buffy in the Orient.

In North America "titmouse" applies only to four species that are crested. The best known of these is the tufted titmouse (*P. bicolor*), a 17-centimetre bluish gray bird with pinkish brown flanks. Another familiar North American parid is the black-capped chickadee (*P. atricapillus; see* chickadee).

**Titāgarh,** also spelled TITTĀGARH, city, southeastern West Bengal state, northeastern India. It lies just east of the Hooghly (Hugli) River and is part of the Calcutta urban agglomeration. Titāgarh was constituted a municipality in 1895, when it was separated from Barrackpore municipality. Connected by road and rail with Calcutta, it has jute and paper milling, manufactures glass and textile machinery, and processes tea. Pop. (2001 prelim.) 124,198.

**Titan,** in Greek mythology, any of the children of Uranus (Heaven) and Gaea (Earth) and their descendants. According to Hesiod's *Theogony,* there were 12 original Titans: the brothers Oceanus, Coeus, Crius, Hyperion, Iapetus, and Cronus and the sisters Thea, Rhea, Themis, Mnemosyne, Phoebe, and Tethys. At the instigation of Gaea the Titans rebelled against their father, who had shut them up in the underworld (Tartarus). Under the leadership of Cronus they deposed Uranus and set

up Cronus as their ruler. But one of Cronus' sons, Zeus, rebelled against his father, and a struggle then ensued between them in which most of the Titans sided with Cronus. Zeus and his brothers and sisters finally defeated the Titans after 10 years of fierce battles (the Titanomachia). The Titans were then hurled down by Zeus and imprisoned in a cavity beneath Tartarus.

**Titan,** largest moon of Saturn and the only satellite in the solar system known to have clouds and a dense atmosphere. It was discovered in 1655 by Christiaan Huygens. Titan orbits Saturn in an elliptical orbit of eccentricity 0.029 and with a semimajor axis of 1,221,860 km (759,264 miles), taking 15.945 Earth days for one revolution. The satellite is believed to make one rotation for each revolution, so that it always keeps the same hemisphere toward Saturn. The diameter of Titan is 5,150 km (3,200 miles), making it the second largest moon (after Ganymede) in the solar system. Its mass is $1.3457 \times 10^{25}$ g; the resulting bulk density of 1.881 g per cubic cm implies that Titan's interior is a mixture of rocky and icy materials, the latter probably including solid ammonia and methane as well as solid water.

Titan's surface temperature and atmospheric pressure, first determined by the Voyager 1 spacecraft in 1981, are $94 \pm 2$ K ($-179 \pm 2°$ C) and approximately 1.6 bars (1.6 times the atmospheric pressure at the surface of the Earth), respectively. Its atmosphere is composed primarily of nitrogen, as is the Earth's, with several percent methane. In addition to hydrogen, carbon monoxide, and carbon dioxide, minor constituents (all between 20 and 0.01 parts per 1,000,000) include the organic gases ethane, propane, acetylene, ethylene, hydrogen cyanide, diacetylene, methylacetylene, cyanoacetylene, and cyanogen. Titan is enveloped in a layer of deep-reddish haze, probably composed of an aerosol of still more complex organic solids that slowly settle through the atmosphere and accumulate on the surface. The amount produced—predominantly by solar ultraviolet light falling on the nitrogen/methane atmosphere—throughout the history of Titan is the equivalent of a continuous layer of organic solids covering the entire surface to a depth of at least hundreds of metres. Above the surface and beneath most of the opaque organic haze lies a thick cloud of condensed methane. Some evidence suggests that an extensive ocean of liquid methane and ethane covers much of the surface. As a deep-frozen repository of the types of organic molecules that led to the origin of life on Earth 4 billion years ago, and as the most probable locale in the solar system for a liquid hydrocarbon ocean, Titan represents an extraordinary objective for future spacecraft exploration.

**Titan rocket,** any of a series of U.S. rockets that were originally developed as intercontinental ballistic missiles (ICBMs) but were also used as space launch vehicles.

The Titan I, the first in the series, was built by the Martin Company (now the Lockheed Martin Corporation) for the U.S. Air Force in the late 1950s. A two-staged ICBM fueled by kerosene and liquid oxygen, it was designed to deliver a four-megaton nuclear warhead more than 5,000 miles (8,000 km) to targets in the Soviet Union.

By 1965 the Titan I had been replaced by the Titan II, a much larger ICBM (approximately 100 feet [30 m] long) that was fueled by internally stored hypergolic fuels (self-igniting liquids such as hydrazine and nitrogen tetroxide). Tipped with a warhead of nine megatons' force, Titan II, stationed at bases in the central and western United States, was the principal weapon in the land-based U.S. nuclear arsenal until it was replaced by more accurate solid-fueled ICBMs such as the Minuteman. The last Titan IIs were deactivated between 1982 and 1987. The Titan II was also used by the National Aeronautics and Space Administration (NASA) as the launcher for the Gemini manned spacecraft during the 1960s.



Titan II launching from its silo
U.S. Air Force; photograph provided by Donald Boelling

The Titan III was a series of space launchers based on the Titan II. In order to acquire greater thrust, most of the rockets employed two "strap-on" boosters burning solid propellants. A variety of upper stages, such as Agena or Centaur, were mounted atop the second stage in cases when further maneuverability or escape from Earth orbit were required. The most successful vehicles in the series were the 160-foot Titan III-E/Centaur combination, which launched the Viking, Voyager, and Helios space probes during the 1970s.

The Titan IV, developed from the Titan III in the late 1980s, was built with larger and more powerful engines in order to lift heavy payloads such as those carried by the Space Shuttle. Boosted by two solid-propellant strapons and often combined with an upper stage such as Centaur, it became the largest expendable launch vehicle (approaching 200 feet) employed in the United States. The Titan IV series lifted a number of civilian and military satellites into space.

**Titania,** major satellite of Uranus, first detected in 1787 by the English astronomer William Herschel, who had discovered the planet itself six years earlier. Titania orbits at a distance of 435,840 km (270,818 miles) from the centre of Uranus; its orbital period is 8.706 days. Titania is the second largest of the five major Uranian satellites. Its estimated diameter is 1,600 km (990 miles), and its mass about $6.8 \times 10^{-5}$ that of Uranus. Titania appears to be made up chiefly of water ice; a small amount of methane frost and rock is probably present as well. Its surface has many bright craters, along with trenches and a deep fault line extending roughly 1,600 km (1,000 miles). These and other related subsidence features strongly suggest the occurrence of tectonic processes.

**Titanic,** British luxury passenger liner that sank on April 14–15, 1912, en route to New York City from Southampton, Eng., during its maiden voyage. The vessel sank with a loss of about 1,500 lives at a point about 400 miles (640 km) south of Newfoundland.

The great ship, at that time the largest and most luxurious afloat, had a double-bottomed hull that was divided into 16 watertight compartments. Because four of these could be flooded without endangering the liner's buoyancy, it was considered unsinkable. Shortly before midnight on April 14, the ship collided with an iceberg; five of its watertight compartments were ruptured, causing the ship to sink at 2:20 AM April 15. Inquiries held in the United States and Great Britain alleged that the Leyland liner *Californian,* which was less than 20 miles (32 km) away all night, could have aided the stricken vessel had its radio operator been on duty and thereby received the *Titanic*'s distress signals. Only the arrival of the Cunard liner *Carpathia* 1 hour and 20 minutes after the *Titanic* went down prevented further loss of life in the icy waters.

As a result of the disaster, the first International Convention for Safety of Life at Sea was called in London in 1913. The convention drew up rules requiring that every ship have lifeboat space for each person embarked (the *Titanic* had only 1,178 boat spaces for the 2,224 persons aboard); that lifeboat drills be held during each voyage; and, because the *Californian* had not heard the distress signals of the *Titanic,* that ships maintain a 24-hour radio watch. The International Ice Patrol also was established to warn ships of icebergs in the North Atlantic shipping lanes.

On Sept. 1, 1985, the wreck of the *Titanic* was found lying upright in two pieces on the ocean floor at a depth of about 4,000 m (13,100 feet). The ship was located at about 41°46′ N 50°14′ W and was explored by an unmanned submersible under the direction of American and French scientists. The expedition found no sign of the long gash previously



The *Titanic*
The Bettmann Archive

thought to have been ripped in the ship's hull by the iceberg. The scientists posited instead that the collision's impact had buckled or loosened seams in the adjacent hull plates, causing them to separate and thus allowing water to flood in and sink the ship.

**titanite** (mineral): *see* sphene.

**titanium** (Ti), chemical element, silvery-gray metal of Group IVb of the periodic table. Titanium is a lightweight, high-strength, low-corrosion structural metal and is used in alloy form for parts in high-speed aircraft. A compound of titanium and oxygen was discovered (1791) by the English chemist and mineralogist William Gregor and independently rediscovered (1795) and named by the German chemist Martin Heinrich Klaproth.

*Occurrence, properties, and uses.* Titanium is widely distributed and constitutes 0.44 percent of the Earth's crust. The metal is found combined in practically all rocks, sand, clay, and other soils. It is also present in plants and animals, natural waters and deep-sea dredgings, and meteorites and stars. The two prime commercial minerals are ilmenite and rutile. The metal was isolated in pure form (1910) by the metallurgist Matthew A. Hunter by reducing titanium tetrachloride ($TiCl_4$) with sodium in an airtight steel cylinder. After 1950 titanium changed from a laboratory curiosity to an important structural metal commercially produced by the Kroll process (magnesium reduction of the tetrachloride).

For treatment of the mining, recovery, and refining of titanium, *see* MACROPAEDIA: Industries, Extraction and Processing. For comparative statistical data on titanium production, *see* MICROPAEDIA: mining (table).

Pure titanium is ductile, about half as dense as iron and less than twice as dense as aluminum; it can be polished to a high lustre. The metal has a very low electrical and thermal conductivity and is paramagnetic (weakly attracted to a magnet). Two crystal structures

exist: below 883° C (1,621° F), hexagonal-close-packed (alpha); above 883° C, body-centred-cubic (beta). Natural titanium consists of five stable isotopes: titanium-46 (8.0 per cent), titanium-47 (7.3 percent), titanium-48 (73.8 percent), titanium-49 (5.5 percent), and titanium-50 (5.4 percent).

Titanium is important as an alloying agent with most metals and some nonmetals. Some of these alloys have much higher tensile strengths than does titanium itself. Titanium has excellent corrosion-resistance in many environments because of the formation of a passive oxide surface film. No noticeable corrosion of the metal occurs despite exposure to seawater for more than three years. Its combination of high strength, low density, and excellent corrosion-resistance make it useful for many parts of aircraft, spacecraft, missiles, and ships. It also is used in prosthetic devices, because it does not react with fleshy tissue and bone. Titanium has also been utilized as a deoxidizer in steel and as an alloying addition in many steels to reduce grain size, in stainless steel to reduce carbon content, in aluminum to refine grain size, and in copper to produce hardening.

Although at room temperatures titanium is resistant to tarnishing, at elevated temperatures it reacts with oxygen in the air. This is no detriment to the properties of titanium during forging or fabrication of its alloys; the oxide scale is removed after fabrication. In the liquid state, however, titanium is very reactive and reduces all known refractories.

*Compounds.* Titanium has three valences, as in the oxygen compounds titanium(II) oxide, titanium monoxide, or TiO; titanium(III) oxide, or dititanium trioxide, $Ti_2O_3$; and titanium(IV) oxide, or titanium dioxide, $TiO_2$. The +4 oxidation state is the most stable.

The chemistry of divalent titanium is rather restricted. By contrast, many compounds are formed by trivalent titanium. One of the more important varieties is the trichloride $TiCl_3$, a crystalline form of which is particularly useful as a catalyst in the stereospecific polymerization of propylene to make the commercially valuable polymer polypropylene.

Of the compounds formed by tetravalent titanium, the dioxide is the most important. This nontoxic, pure white powder is used extensively as a pigment in paints, enamels, and lacquers. It occurs in nature as the minerals brookite, octahedrite, anatase, and rutile.

Another compound of commercial significance is titanium tetrachloride, a colourless liquid used to obtain titanium metal. It is also utilized for skywriting and producing smoke screens and as a catalyst in many organic reactions.

| | |
|---|---|
| atomic number | 22 |
| atomic weight | 47.88 |
| melting point | 1,660° C (3,020° F) |
| boiling point | 3,287° C (5,949° F) |
| density | 4.5 (20° C) |
| valence | 2, 3, 4 |
| electronic config. | 2-8-10-2 or $(Ar)3d^24s^2$ |

**titanothere,** any member of an extinct group of large-hoofed mammals that originated in North America during the Early Eocene Epoch (from 57.8 to 52 million years ago) and were present in North America and Asia during the Oligocene Epoch (which occurred from 36.6 to 23.7 million years ago). They became extinct during the middle Oligocene. Most were large forms that fed mainly on soft vegetation. The skulls were massive and frequently adorned with large horns that were probably effective battering rams in combat with other titanotheres, perhaps between males for territorial dominance, or as defensive weapons against predators. The bodies were bulky, the limbs pillarlike and strong, and the brain very small and primitive. The remains of titanotheres are abundant in the geologic record, and the different forms must have been locally numerous; it is possible that the titanotheres moved about in herds. They probably became extinct because their relatively simple dentition could not effectively cope with the high silica content of the grasses that were spreading during the Oligocene Epoch.

**Titchener, Edward Bradford** (b. June 11, 1867, Chichester, Sussex, Eng.—d. Aug. 3, 1927, Ithaca, N.Y., U.S.), English-born psychologist and a major figure in the establishment of experimental psychology in the United States. A disciple of the German psychologist Wilhelm Wundt, the founder of experimental psychology, Titchener gave Wundt's theory on the scope and method of psychology a precise, systematic expression.

In 1890 Titchener entered Wundt's laboratory at the University of Leipzig, and he received his Ph.D. in 1892. Though he had little personal contact with Wundt, he thoroughly assimilated and espoused the view that the concern of psychology is the systematic, experimental study of the normal, adult mind and that its proper, not to say exclusive, method is introspection, or the precise examination and description of conscious experience. He continued to expound Wundt's views after his arrival at Cornell University, Ithaca, N.Y. (1892), where he became professor of psychology (1895–1927).

From 1898 Titchener was the foremost exponent of structural psychology, which concerns itself with the components and arrangement of mental states and processes. In his ambition to transplant the psychology established by Wundt and nurtured in Germany, he translated 11 German works, including titles by Wundt and Oswald Külpe. He himself wrote eight works, many of which went through several revised editions and were translated into a number of languages. By far the most important was *Experimental Psychology,* 4 vol. (1901–05), consisting of two student manuals and two teachers' manuals. Designed to drill students in laboratory method, the manuals were patterned on those used in qualitative and quantitative experiments in chemistry.

Among Titchener's other works was *A Textbook of Psychology* (1910), a comprehensive, yet concise, exposition of his psychology. Though a charter member of the American Psychological Association in 1892, he did not remain with it for long. In 1904 he founded the Society of Experimental Psychologists.

**Titchfield, William Henry Cavendish Bentinck, Marquess of:** *see* Portland, William Henry Cavendish Bentinck, 3rd Duke of.

**Titchmarsh, Edward Charles** (b. June 1, 1899, Newbury, Berkshire, Eng.—d. Jan. 18, 1963, Oxford, Oxfordshire), English mathematician whose contributions to analysis placed him in the forefront of his profession.

A lecturer at University College, London, from 1923, Titchmarsh was appointed professor of pure mathematics at the University of Liverpool in 1929 and two years later became Savilian professor of geometry at the University of Oxford. He devoted his early research to the theory of Fourier integrals and series and added new findings to the study of Fourier transforms. He further contributed to the theory of conjugate functions and general integral transforms and thus formed a major part of his *Introduction to the Theory of Fourier Integrals* (1937). He next turned his attention to the study of the theory of integral functions, especially the Riemann zeta-function (a complex-number function), and published his results in *The Zeta-Function of Riemann* (1930) and more fully elaborated this work in *The Theory of the Riemann Zeta-Function* (1951). From his studies of complex-variable theory he wrote *The Theory of Functions* (1932), which became a leading textbook on real and complex function theory and was translated into numerous languages.

After 1939 Titchmarsh concentrated his research on the theory of function expansion in eigenfunctions of differential equations, an area of vital importance to quantum theory, and published many of his results in *Eigenfunction Expansions Associated with Second-Order Differential Equations* (Part 1, 1946; Part 2, 1958). His contributions helped resolve the differences between the general theory of quantum mechanics and the methods used to solve particular problems in quantum theory.

**Titelouze, Jean** (b. 1563, Saint-Omer, Fr.—d. Oct. 25, 1633, Rouen), French organist and composer whose improvisatory skills and virtuoso technique made him much sought after as a performer. His compositions rank him among the finest French Baroque church composers.

Titelouze's family had been active musically in Saint-Omer since the early 16th century. In 1585 he was appointed organist at the Church of Saint-Jean in Rouen; in 1588 he rose to the post of Rouen cathedral organist, and by 1610 he had become a canon at the cathedral, where he remained until his death, although he left the city to give organ recitals all over France.

His most important publication, *Hymnes de l'église pour toucher sur l'orgue . . .* (1623; "Church Hymns for the Organ"), was followed in 1626 by publication of organ versets (interludes) built on the chant of the Magnificat (the "Song of Mary"). He also wrote several masses for choir. Titelouze's music is strictly contrapuntal and modal but rhythmically free; it is not flashy but rather reflective and mystical, as befits liturgical music. His reputation remains high, although his music is not easily available in modern editions.

**tithe** (from Old English *teogothian,* "tenth"), a custom dating back to Old Testament times and adopted by the Christian church whereby lay people contributed a 10th of their income for religious purposes, often under ecclesiastical or legal obligation. The money (or its equivalent in crops, farm stock, etc.) was used to support the clergy, maintain churches, and assist the poor. Tithing was also a prime source of subsidy for the construction of many magnificent cathedrals in Europe.

Despite serious resistance, tithing became obligatory as Christianity spread across Europe. It was enjoined by ecclesiastical law from the 6th century and enforced in Europe by civil law from the 8th century. In England in the 10th century, payment was made obligatory under ecclesiastical penalties by Edmund I and under temporal penalties by Edgar. In the 14th century Pope Gregory VII, in an effort to control abuses, outlawed lay ownership of tithes.

During the 16th-century Protestant Reformation, Martin Luther approved in general of paying tithes to the temporal sovereign, and the imposition of tithes continued for the benefit of Protestant as well as Roman Catholic churches. Gradually, however, opposition grew. Tithes were repealed in France during the Revolution (1789), without compensation to tithe holders. Other countries abolished certain kinds of tithes and indemnified the holders. By 1887 the tithe had been brought to an end in Italy. It was abolished in Ireland at the disestablishment of the Anglican church in 1871, and it gradually died out in the Church of Scotland. In England in 1836, the tithe was commuted for a rent charge depending on the price of grain, and in 1936 the tithe rent charges were abolished. New methods of taxation were developed in those countries that provided financial support of the church out of government funds. Remnants of the tithing system do exist, how-

ever, in certain Protestant European countries. In Germany, for example, citizens must pay a church tax unless they formally renounce membership in a church.

Tithe was never a legal requirement in the United States. Members of certain churches, however, including the Latter-day Saints and Seventh-day Adventists, are required to tithe, and some Christians in other churches do so voluntarily.

The Eastern Orthodox churches never accepted the idea of tithes, and Orthodox church members have never paid them.

**Tithonian Stage,** all those rocks deposited worldwide during the Tithonian Age (152 to 144 million years ago). The Tithonian is the uppermost of 11 stages making up the Jurassic System. The Tithonian's name is derived not from a geographic source but rather from the Greek mythological figure Tithonus, who was the consort of Eos (Aurora), the goddess of the dawn.

Numerous ammonite biozones (shorter spans of time characterized by fossil mollusks) are recognized in the Tithonian. The ammonite biozones of *Glochiceras lithographicum* (which occurs low in the succession) and *Pseudovigatites scruposus* (occurring high in the succession) are used to correlate the Tithonian with more endemic forms in western Russia (where it is locally named the Volgian Stage) and in England (locally named the Purbeckian Stage). The Tithonian overlies the Kimmeridgian Stage and is itself overlain by the Berriasian Stage of the Cretaceous System.

**Tithonus,** in Greek legend, son of Laomedon, king of Troy, and of Strymo, daughter of the river Scamander. Eos (Aurora) fell in love with Tithonus and took him to Ethiopia where she bore Emathion and Memnon (*q.v.*). When Eos requested Zeus to grant him eternal life the god consented, but Eos forgot to ask also for eternal youth, so her husband grew old and was transformed into a cicada.

**titi,** also spelled TEETEE, any of three species of arboreal monkeys making up the genus *Callicebus* (family Cebidae). They are found in South American rain forests, especially along the Amazon and other rivers. Titis have long, soft, glossy fur and rather flat, high faces set in small, round heads. They are about 25–60 cm (10–24 inches) long, excluding the furry tail that measures 25–55 cm. Titis may be dark brown, gray, reddish, or blackish, depending on the species, and have patterned or differently coloured underparts, face, limbs, and tail. They live in small territorial groups and are active during the day. They use their tails for balance while moving about and intertwine their tails while resting together in trees. Titis eat fruit, bird eggs, insects, and small birds. Breeding is not seasonal. The single offspring clings to the male except when being fed.

**titi** (shrub): *see* buckwheat tree.

**Titian,** Italian in full TIZIANO VECELLIO, or VECELLI (b. 1488/90, Pieve di Cadore, republic of Venice [Italy]—d. Aug. 27, 1576, Venice), the greatest Italian Renaissance painter of the Venetian school. The range of his accomplishments—his observant portraits ("Philip II," 1550–51), poignant religious compositions ("Christ Crowned with Thorns," 1546–50), and joyous treatments of mythological subjects ("Venus and Adonis," 1553–54)—has made him one of the giants of Western art.

A brief treatment of Titian follows. For full treatment, *see* MACROPAEDIA: Titian.

At nine years of age Titian was apprenticed to a mosaicist in Venice. He then worked under the Venetian painter Giovanni Bellini and collaborated with Giorgione, whose influence shows particularly in Titian's early works. The exceptional quality of his mature works led to an international reputation and patronage by Italian nobles, the Venetian Republic, the Habsburgs (by whom he was knighted), and Pope Paul III. He traveled to Ferrara, Bologna, Rome, Milan, and outside Italy to Augsburg. From 1551, however, he remained in Venice until his death. Titian's prominence during his lifetime was acknowledged by the government of his city, by the neighbouring courts of Ferrara, Mantua, and Urbino, by the pope, and by Emperor Charles V and his son Philip, king of Spain.

Titian's life was exceptionally long and creative. As a result, the evolution of Italian art through the larger part of a century is reflected in his oeuvre. His career may be divided into five phases: First, there were the years of apprenticeship in which he absorbed the achievements of the past. Second, with a bound, he left all of his contemporaries behind and in a miraculous outburst of inventive power directed every branch of painting into new channels, demanding greater material size for greater spiritual expression. Third, there followed a calming-down period when the artist had reached his 40s and his interest turned to refinement and detail. Fourth, he returned to the youthful conceptions of his heroic era, but with new interpretations. Fifth and last, in the isolation and loneliness of age, he rejected all compromise with the demands of his period; this art of Titian's old age, which disregarded his patrons' tastes, became the pure expression of the master's intentions and his fulfillment.

**Titicaca, Lake,** Spanish LAGO TITICACA, the world's highest lake navigable to large vessels, lying at 12,500 feet (3,810 m) above sea level in the Andes Mountains of South America, astride the border between Peru to the west and Bolivia to the east. Titicaca is the second largest lake of South America (after Maracaibo). It covers some 3,200 square miles (8,300 square km) and extends in a northwest-to-southeast direction for a distance of 120 miles (190 km). It is 50 miles (80 km) across at its widest point. A narrow strait, Tiquina, separates the lake into two bodies of water. The smaller, in the southeast, is called Lake Huiñaymarca in Bolivia and Lake Pequeño in Peru; the larger, in the northwest, is called Lake Chucuito in Bolivia and Lake Grande in Peru.

The meaning of the name Titicaca is uncertain, but it has been variously translated as Rock of the Puma or Crag of Lead. Titicaca lies between Andean ranges in a vast basin (about 22,400 square miles [58,000 square km] in area) that comprises most of the Altiplano (High Plateau) of the northern Andes. In the snow-covered Cordillera Real on the northeastern (Bolivian) shore of the lake, some of the highest peaks in the Andes rise to heights of more than 21,000 feet (6,400 m).

The lake averages between 460 and 600 feet (140 and 180 m) in depth, but the bottom tilts sharply toward the Bolivian shore, reaching its greatest recorded depth of 920 feet (280 m) off Isla Soto in the lake's northeast corner.

More than 25 rivers empty their waters into Titicaca; the largest, the Ramis, draining about two-fifths of the entire Titicaca Basin, enters the northwestern corner of the lake. One small river, the Desaguadero, drains the lake at its southern end. This single outlet empties only 5 percent of the lake's excess water; the rest is lost by evaporation under the fierce sun and strong winds of the dry Altiplano.

Titicaca's level fluctuates seasonally and over a cycle of years. During the rainy season (summer, from December to March) the level of the lake rises, normally to recede during the dry winter months. It was formerly believed that Titicaca was slowly drying up, but modern studies have seemed to refute this, indicating a more or less regular cycle of rise and fall.

Titicaca's waters are limpid and only slightly brackish, with salinity ranging from 5.2 to 5.5 parts per 1,000. Surface temperatures average 56° F (14° C); from a thermocline at 66 feet (20 m) temperatures drop to 52° F (11° C) at the bottom. Analyses show measurable quantities of sodium chloride, sodium sulfate, calcium sulfate, and magnesium sulfate in the water.

Lake Titicaca's fish life consists principally of two species of killifish (*Orestias*)—a small fish, usually striped or barred with black—and a catfish (*Trichomycterus*). In 1939, and subsequently, trout were introduced into Titicaca. A large frog (*Telmatobius*), which may reach a length of nearly a foot, inhabits the shallower regions of the lake.

Forty-one islands, some of them densely populated, rise from Titicaca's waters. The largest, Titicaca Island (Spanish: Isla de Titicaca, also called Isla del Sol), lies just off the tip of the Copacabana Peninsula in Bolivia.

Ruins on the shore and on the islands attest to the previous existence of one of the oldest civilizations known in the Americas, antedating the Christian era. The chief site is at Tiahuanaco, Bolivia, at the southern end of the lake. On Titicaca Island ruins of a temple mark the spot where, according to the tradition of the Incas (a Quechuan people of Peru who established an empire about 1100), the legendary founders of the Inca dynasty, Manco Capac and Mama Ocllo, were sent down to Earth by the Sun.

The Aymara people living in the Titicaca Basin still practice their ancient methods of agriculture on stepped terraces that predate Inca times. They grow barley, quinoa (a type of pigweed that produces a small grain), and the potato, which originated on the Altiplano. The highest cultivated plot in the world was found near Titicaca—a field of barley growing at a height of 15,420 feet (4,700 m) above sea level. At this height the grain never ripens, but the stalks furnish forage for llamas and alpacas, the American relatives of the camel that serve the Indians as beasts of burden and as a source of meat.

The remnants of an ancient people, the Uru, still live on floating mats of dried totora (a reedlike papyrus that grows in dense brakes in the marshy shallows). From the totora, the Uru and other lake dwellers make their famed balsas—boats fashioned of bundles of dried reeds lashed together that resemble the crescent-shaped papyrus craft pictured on ancient Egyptian monuments.

In 1862 the first steamer to ply the lake was prefabricated in England and carried in pieces on muleback up to the lake. Today vessels make regular crossings from Puno, on the Peruvian shore, to the small Bolivian port of Guaqui. A narrow-gauge railway connects Guaqui with La Paz, capital of Bolivia. The world's second-highest railway runs from Puno down to Arequipa and the Pacific, completing land-bound Bolivia's principal link with the sea.

**Titius, Johann Daniel,** Titius also spelled TIETZ (b. Jan. 2, 1729, Konitz, Prussia [now Chojnice, Poland]—d. Dec. 11, 1796, Wittenberg, Saxony [now in Germany]), Prussian astronomer, physicist, and biologist whose law (1766) expressing the distances between the planets and the Sun was confirmed by J.E. Bode in 1772.

Having received a degree from the University of Leipzig (1752), Titius joined the faculty of the University of Wittenberg in 1756. The Titius-Bode law (also called Bode's law) proved to be accurate in accounting for the average distance between planetoids and the Sun and also for the distance between Uranus (discovered in 1781) and the Sun. It did not, however, accurately predict the distances of Neptune and Pluto. Although best known for his law, Titius was also active in physics, con-

centrating on thermometry, and in biology, classifying plants, animals, and minerals.

**Titius-Bode law** (astronomy): *see* Bode's law.

**titlark** (bird): *see* pipit.

**titmouse** (bird): *see* tit.

**Tito, Josip Broz,** original name JOSIP BROZ (b. May 7, 1892, Kumrovec, near Zagreb, Croatia, Austria-Hungary [now in Croatia]—d. May 4, 1980, Ljubljana, Yugos. [now in Slovenia]), Yugoslav revolutionary and statesman. He was secretary-general (later president) of the Communist Party (League of Communists) of Yugoslavia (1939–80), supreme commander of the Yugoslav Partisans (1941–45) and the Yugoslav People's Army (1945–80), and marshal (1943–80), premier (1945–53), and president (1953–80) of Yugoslavia. Tito was the chief architect of the "second Yugoslavia," a socialist federation that lasted from World War II until 1991. He was the first Communist leader in power to defy Soviet hegemony, a backer of independent roads to socialism (sometimes referred to as "national communism"), and a promoter of the policy of nonalignment between the two hostile blocs in the Cold War.

*Early life.* Josip Broz was born to a large peasant family in Kumrovec, northwest of Zagreb, the capital of Croatia, of a Croat father and a Slovene mother. He was apprenticed to a locksmith in 1907 and completed his training in 1910, when he joined the Social Democratic Party of Croatia-Slavonia at Zagreb. After working as an itinerant metalworker in various Austro-Hungarian and German centres, he was drafted into the Austro-Hungarian army in 1913, completed noncommissioned-officer training, and was sent as a sergeant in the war against Serbia in 1914. Transferred to the Russian front in early 1915, he was seriously wounded and captured by the Russians in April 1915. After a long hospitalization he was sent to prisoner-of-war camps, where he became acquainted with Bolshevik propaganda. In 1917 he participated in the July Days demonstrations in Petrograd (St. Petersburg) and, after the October Revolution, joined a Red Guard unit in Omsk, Siberia. Following a White counteroffensive, he fled to Kirgiziya (now Kyrgyzstan) and subsequently returned to Omsk, where he married a Russian woman and joined the South Slav section of the Bolshevik party. In October 1920 he returned to his native Croatia (then part of the newly established Kingdom of the Serbs, Croats, and Slovenes) and soon joined the Communist Party of Yugoslavia (CPY).

*Communist organizer.* Broz's career as a communist militant was cut short in December 1920 by a state ban against communist activities. He lost his job in a Zagreb locksmith shop and moved to a nearby village, where he worked as a mill mechanic until 1923. Having revived his links with the underground CPY, he served as a local and regional party functionary and trade union organizer in Croatia and Serbia until 1927, when he joined the CPY committee for Zagreb, eventually becoming its political secretary. His success at reviving the CPY's vitality was cut short by arrest in August 1928. The police discovered bombs in Broz's apartment—a testimony to his adherence to the new insurrectionary line of the Comintern, the Soviet-sponsored organization of international communism. During his trial, which ended with sentencing to a five-year term, Broz defended himself with exceptional courage and gained further credit with the party authorities.

Broz's prison term coincided with the establishment of the royal Yugoslav dictatorship, which was promulgated by King Alexander I in order to stem the nationalistic movements of disaffected non-Serbs. In an attempt to break the modest influence of the CPY, the government arrested most of the party cadre, sentencing many of its members to terms far harsher than Broz's. Despite these blows, at the time of Broz's release in March 1934, the CPY was slowly recuperating under the agile leadership in exile of Milan Gorkić. Gorkić summoned Broz to the CPY's Vienna headquarters, where he attempted to secure his cooperation by bringing him into the CPY Politburo. It was at this time that Broz assumed the pseudonym Tito, one of many that he used in underground party work. From February 1935 to October 1936, Tito was in the Soviet Union, where he worked in the Comintern apparatus.



Tito, 1972
Sygma

By 1937 Tito was increasingly involved in the CPY's underground work in Yugoslavia, where he established ties with a new generation of militants. In 1937–38, Joseph Stalin's purges devastated the CPY leadership, claiming the lives of Gorkić and most of the other topmost veterans. Tito profited from (and probably was an accomplice in) the repression, gaining the Comintern's mandate to replenish the CPY's leadership councils with his hand-picked lieutenants—Edvard Kardelj, Alexander Ranković, Milovan Djilas, and Ivo Lola Ribar. He was the Comintern's choice for the CPY's new secretary-general, a position he formally assumed in 1939. At the Fifth Land Conference of the CPY, an underground minicongress held in Zagreb in October 1940, Tito sketched the CPY's leftist strategy, which focused the party on armed insurrection and on a Soviet-style federalist solution to Yugoslavia's nationality conflict. At that time the CPY had some 7,000 members, not counting the additional 17,200 members of the Young Communist League.

*Partisan leader.* An opportunity for armed insurgency presented itself after the Axis powers, led by Germany and Italy, occupied and partitioned Yugoslavia in April 1941. The CPY remained the only organized political group ready and capable of contending with the occupiers and their collaborators throughout the territory of the defunct Yugoslav state. This meant that the communist-dominated Partisan units were not simply auxiliaries of the Allied war effort but an offensive force in their own right. As a result, Tito's Partisans became a threat not only to the occupiers and collaborators but also to the royal government-in-exile and its domestic exponents, the Serbian Chetniks of Dragoljub Mihailović. In time, Communist pressure drove the Chetniks into tactical alliances with the Axis, thereby precipitating their isolation and defeat.

In 1943, after Tito's headquarters survived bruising Axis operations from January to June (particularly in the battles of Neretva and Sutjeska), the Western Allies recognized him as the leader of the Yugoslav resistance and obliged the London government-in-exile to come to terms with him. The Soviet army, aided by Tito's Partisans, liberated Serbia in October 1944, thereby sealing the fate of the Yugoslav dynasty, which had the strongest following in this largest of the Yugoslav lands. There ensued a series of mop-up operations that strengthened Communist control of the whole of Yugoslavia by May 1945.

*The conflict with Stalin.* Tito consolidated his power in the summer and fall of 1945 by purging his government of noncommunists and by holding fraudulent elections that legitimated the jettisoning of the monarchy. The Federal People's Republic of Yugoslavia was proclaimed under a new constitution in November 1945. Trials of captured collaborationists, Catholic prelates, opposition figures, and even distrusted communists were conducted in order to fashion Yugoslavia in the Soviet mold. Tito's excesses in imitation eventually became as irritating to Moscow as did his independent manner—especially in foreign policy, where Tito pursued risky aims in Albania and Greece at a time when Stalin advised caution. In the spring of 1948, Stalin initiated a series of moves to purge the Yugoslav leadership. This effort was unsuccessful, as Tito maintained his control over the CPY, the Yugoslav army, and the secret police. Stalin then opted for a public condemnation of Tito and for the expulsion of the CPY from the Cominform, the European organization of mainly ruling communist parties. In the ensuing war of words, economic boycotts, and occasional armed provocations (during which Stalin briefly considered military intervention), Yugoslavia was cut off from the Soviet Union and its eastern European satellites and steadily drew closer to the West.

*The policy of nonalignment.* The West smoothed Yugoslavia's course by offering aid and military assistance. By 1953 military aid had evolved into an informal association with NATO via a tripartite pact with Greece and Turkey that included a provision for mutual defense. After the changes in the Soviet Union following Stalin's death in 1953, Tito was faced with a choice: either continue the Westward course and give up one-party dictatorship (an idea promoted by Milovan Djilas but rejected by Tito in January 1954) or seek reconciliation with a somewhat reformed new Soviet leadership. The latter course became increasingly possible after a conciliatory state visit by Nikita Khrushchev to Belgrade in May 1955. However, the limits of reconciliation became obvious after the Soviet intervention in Hungary in 1956; this was followed by a new Soviet campaign against Tito, aimed at blaming the Yugoslavs for inspiring the Hungarian insurgents.

Nevertheless, Stalin's departure lessened the pressures for greater integration with the West, and Tito came to conceive of his internal and foreign policy as being equidistant from both blocs. Seeking like-minded statesmen elsewhere, he found them in the leaders of the developing countries. Negotiations with Gamal Abdel Nasser of Egypt and Jawaharlal Nehru of India in June 1956 led to a closer cooperation among states that were "nonengaged" in the East-West confrontation. From nonengagement evolved the concept of "active nonalignment"—that is, the promotion of alternatives to bloc politics, as opposed to mere neutrality. The first meeting of nonaligned states took place in Belgrade under Tito's sponsorship in 1961. The movement continued thereafter, but by the end of his life Tito had been eclipsed by new member states, such as Cuba, that conceived of nonalignment as anti-Westernism.

*Self-management and decentralization.* The break with the Soviet Union also inspired a search for a new model of socialism in

Yugoslavia. In this area Tito, never a theoretician, depended on the ideological formulations of his lieutenants, notably Edvard Kardelj. But he supported the notion of workers' management of production, embodied in the formation of the first workers' councils in 1950. In the process, Soviet-style central planning was abandoned and central agencies were trimmed.

Workers' self-management had important consequences for internal relations in multinational Yugoslavia. As power steadily shifted from the federation to the republics, conservative centralist forces fought back, opening cleavages within the communist elite between 1963 and 1972. During this period Tito purged first the Serbian centralists (notably, Alexander Ranković in 1966) and then the leaders of the decentralizing and liberal forces in Croatia (1971) and Serbia (1972). The Croatian purge had a further effect of destabilizing Tito's rule in Yugoslavia's most industrially advanced republic.

*Retrenchment of the 1970s.* Tito's response to the crises of the 1960s and early '70s was to fashion a system of "symmetrical federalism," in which various internal rules and rituals (including a rotating presidency to lead Yugoslavia after Tito's death) were supposed to formalize equality among the six republics and Serbia's two autonomous provinces (Kosovo and the Vojvodina). This system, enshrined in the constitution of 1974, promoted the weaker and smaller federal units at the expense of the big two—Serbia and Croatia. Serbia's displeasure at the independent role assigned to its autonomous provinces and the promotion of minority identity (especially that of the Albanians in Kosovo) was felt already in Tito's last years, but it became radicalized after his death in 1980. Serb resentment provided the opening for Slobodan Milošević and other promoters of recentralization, who contributed greatly to the undoing of Tito's federal system during the following decade.

*Assessment.* The irony of Tito's remarkable life is that he created the conditions for the eventual destruction of his lifelong effort. He created a federal state, yet he constantly fretted over the pitfalls of decentralization. He knew that the Serbs, Croats, Slovenes, and others could not be integrated within some new supranation, nor would they willingly accept the hegemony of any of their number; yet his supranational Yugoslavism frequently smacked of unitarism. He promoted self-management but never gave up on the party's monopoly of power. He preached peaceful coexistence but built an army that, in 1991, delivered the coup de grâce to the dying Yugoslav state. At his death, the state treasury was empty and political opportunists unchecked. He died too late for constructive change, too early to prevent chaos. (I.B.)

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**Titograd** (Yugoslavia): *see* Podgorica.

**Titov, Gherman Stepanovich** (b. Sept. 11, 1935, near Barnaul, Russia, U.S.S.R.—d. Sept. 20, 2000, Moscow, Russia), Soviet cosmonaut who piloted the Vostok 2 spacecraft, launched Aug. 6, 1961, on the first manned spaceflight of more than a single orbit.

Titov was accepted in 1953 for aviation cadet training, graduating in 1957 as a jet fighter pilot from the Stalingrad Flying Academy. In 1960 he entered cosmonaut training, during the course of which he received the Order of Lenin for an engineering proposal.

During the Vostok 2 flight of 25 hours 18 minutes, Titov was assigned the communications code name Eagle. His radio identification, "I am Eaglel," was spoken with intense excitement and made an impression on listeners around the world. Following his flight Titov was named a Hero of the Soviet Union and received another Order of Lenin. In 1962 he became a deputy of the Supreme Soviet, a position that he held until 1970, and in 1968 he graduated from the Zhukovsky Air Force Engineering Academy. Titov became a major general in 1975. In subsequent years he worked as an assistant to the chief editor of the *Journal of Aviation and Cosmonautics*. Titov's writings in English translation include *I Am Eagle* (1962) and *Seven Cosmic Dawns* (1963).

**Titovo Užice** (town, Yugoslavia): *see* Užice.

**titration,** process of chemical analysis in which the quantity of some constituent of a sample is determined by adding to the measured sample an exactly known quantity of another substance with which the desired constituent reacts in a definite, known proportion. The process is usually carried out by gradually adding a standard solution (*i.e.,* a solution of known concentration) of titrating reagent, or titrant, from a burette, essentially a long, graduated measuring tube with a stopcock and a delivery tube at its lower end. The addition is stopped when the equivalence point is reached.

At the equivalence point of a titration, an exactly equivalent amount of titrant has been added to the sample. The experimental point at which the completion of the reaction is marked by some signal is called the end point. This signal can be the colour change of an indicator or a change in some electrical property that is measured during the titration. The difference between the end point and the equivalence point is the titration error, which is kept as small as possible by the proper choice of an end-point signal and a method for detecting it.

For many titration reactions it is possible to find a suitable visual colour indicator that will signal the end point at, or very close to, the equivalence point. Such titrations, classified according to the nature of the chemical reaction occurring between the sample and titrant, include: acid-base titrations, precipitation titrations, complex-formation titrations, and oxidation-reduction (redox) titrations. In acid-base titration (*i.e.,* the titration of an acid with a base, or vice versa), the indicator is a substance that can exist in two forms, an acid form and a basic form, which differ in colour. For example, litmus is blue in alkaline solution and red in acid solution. Phenolphthalein is colourless in acid solution and red in alkaline solution. A wide choice of acid-base indicators is available, varying not only in the colours of the two forms but also in their sensitivity toward acid or base.

Precipitation titrations may be illustrated by the example of the determination of chloride content of a sample by titration with silver nitrate, which precipitates the chloride in the form of silver chloride. The presence of the first slight excess of silver ion (*i.e.,* the end point) can be marked by the appearance of a coloured precipitate. One way in which this can be done is by employing potassium chromate as indicator. Potassium chromate reacts with the first slight excess silver ion to form a red precipitate of silver chromate. Another method involves the use of an adsorption indicator, the indicator action being based on the formation on the surface of the precipitate of an adsorbed layer of silver indicator salt, which forms only when an excess of silver ion is present.

The most important titrations based upon complex-formation reactions are those involving the titration of metal ions with the reagent disodium ethylenediaminetetraacetate (a salt of edetic acid, or EDTA). The indicators are dyes that have the property of forming a coloured complex with the metal ion. As the titration proceeds, the reagent reacts first with uncomplexed metal ions, and, finally, at the end point it reacts with the metal-indicator complex. The colour change corresponds to the conversion of the metal-dye complex into the free dye.

In oxidation-reduction (redox) titrations the indicator action is analogous to the other types of visual colour titrations. In the immediate vicinity of the end point, the indicator undergoes oxidation or reduction, depending upon whether the titrant is an oxidizing agent or a reducing agent. The oxidized and reduced forms of the indicator have distinctly different colours.

Alternatively, for many titrations the end point can be detected by electrical measurements. These titrations may be classified according to the electrical quantity that is measured. Potentiometric titrations involve the measurement of the potential difference between two electrodes of a cell; conductometric titrations, the electrical conductance or resistance; amperometric titrations, the electric current passing during the course of the titration; and coulometric titrations, the total quantity of electricity passed during the titration. In the four titrations just mentioned, except coulometric titrations, the end point is indicated by a marked change in the electrical quantity that is being measured. In coulometric titrations, the quantity of electricity required to carry out a known reaction is measured, and from Faraday's law the quantity of material present is calculated.

**Tittāgarh** (India): *see* Titāgarh.

**Tittle, Y.A.,** byname of YELBERTON ABRAHAM TITTLE, JR. (b. Oct. 24, 1926, Marshall, Texas, U.S.), American professional-football quarterback.

Tittle started playing football at an early age and was all-state halfback at Marshall (Texas) High School. He became a quarterback at Louisiana State University (Baton Rouge; 1944–47), and teams that he led won 23 games, lost 11, and tied 2; his yardage for completed passes was 2,576.

Tittle became a professional with the Baltimore Colts in 1948 (of the National Football League [NFL] from 1950), and when the Colts disbanded he went with the NFL San Francisco 49ers in 1951. He was traded to the NFL New York Giants in 1961 and became their first-string quarterback, leading them to three divisional championships (1961–63). In a 1962 game against the Washington Redskins, he threw a record-tying seven touchdown passes, and he led the league in touchdown passes (1955, 1962–63), the 36 thrown in the last year tying him for an all-time record that persisted into the 1980s. After retirement in 1964, he became an insurance broker in Palo Alto, Calif. He was elected to the football Hall of Fame in 1971.

**Titus** (ancient Roman personal name, or praenomen): *see under* gens or family name or honorific (*e.g.,* under Atticus for Titus Pomponius Atticus), except as below.

**Titus,** in full TITUS VESPASIANUS AUGUSTUS, original name TITUS FLAVIUS VESPASIANUS (b. Dec. 30, AD 39—d. Sept. 13, AD 81), Ro-

man emperor (79–81), and the conqueror of Jerusalem in 70.

After service in Britain and Germany, Titus commanded a legion under his father, Vespasian, in Judaea (67). Following the emperor Nero's death in June 68, Titus was energetic in promoting his father's candidacy for the imperial crown. Licinius Mucianus, legate of Syria, whom he reconciled with Vespasian, considered that one of Vespasian's greatest assets was to have so promising a son and heir. Immediately on being proclaimed emperor in 69, Vespasian gave Titus charge of the Jewish war, and a large-scale campaign in 70 culminated in the capture and destruction of Jerusalem in September. (The Arch of Titus [81], still standing at the entrance to the Roman Forum, commemorated his victory.)

The victorious troops in Palestine urged Titus to take them with him to Italy; it was suspected that they acted on his prompting and that he was considering some sort of challenge to his father. But eventually he returned alone in summer 71, triumphed jointly with Vespasian, and was made commander of the Praetorian Guard. He also received tribunician power and was his father's colleague in the censorship of 73 and in several consulships. Although Vespasian had in various ways avoided making Titus his own equal, the son became the military arm of the new principate and is described by Suetonius as *particeps atque etiam tutor imperii* ("sharer and even protector of the empire"). As such he incurred unpopularity, worsened by his relations with Berenice (sister of the Syrian Herod Agrippa II), who lived with him for a time in the palace and hoped to become his wife. But the Romans had memories of Cleopatra, and marriage to an Eastern queen was repugnant to public opinion. Twice he reluctantly had to dismiss her, the second time just after Vespasian's death.

In 79 Titus suppressed a conspiracy, doubtless concerned with the succession, but, when Vespasian died on June 23, he succeeded promptly and peacefully. His relations with his brother Domitian were bad, but in other ways his short rule was unexpectedly popular in Rome. He was outstandingly good-looking, cultivated, and affable; Suetonius called him "the darling of the human race." His success was won largely by lavish expenditure, some of it purely personal largesse but some public bounty, like the assistance to Campania after Vesuvius erupted in 79 and the rebuilding of Rome after the fire in 80. He completed construction of the Flavian Amphitheatre, better known as the Colosseum, and opened it with ceremonies lasting more than 100 days. His sudden death at age 41 was supposedly hastened by Domitian, who became his successor as emperor.

Titus married twice, but his first wife died, and he divorced the second soon after the birth (*c.* 65) of his only child, a daughter, Flavia Julia, to whom he accorded the title Augusta. She married her cousin Flavius Sabinus, but after his death in 84 she lived openly as mistress of her uncle Domitian.

**Titus,** SAINT (fl. 1st century AD—d. traditionally Crete; Western feast day January 26 [with Timothy], Eastern feast day August 25), a disciple of St. Paul the Apostle, for whom he was secretary. According to tradition he was the first bishop of Crete.

Known from New Testament allusions in Acts of the Apostles and the Pauline Letters, Titus was a Gentile convert whom Paul, in contrast to his expediency in Timothy's case, refused to allow to be circumcised (Galatians 2) at Jerusalem when the Jewish-Christian party demanded this concession to religious tradition. He also appears in connection with the Corinthian church, where he was lauded by Paul.

Titus was specially entrusted with organizing the alms collection for poor Christians of Judaea and evidently acted as a commissioner of Paul at Corinth, where he replaced Timothy. According to 2 Timothy 4:10, he made a subsequent mission to Dalmatia, but The Letter of Paul to Titus, which contains the rule of episcopal life, implies that he superintended a zealous apostolate in Crete as Paul's delegate. Later tradition made him bishop of Crete. In 1966 his head was returned from Venice, where it had been venerated at St. Mark's since the 9th century, to the Church of St. Titus in Iráklion (Herakleion) in Crete.

**Titus, The Letter of Paul to,** also called THE EPISTLE OF ST. PAUL THE APOSTLE TO TITUS, a New Testament writing addressed to one of Paul's close companions, Titus, who was the organizer of the churches in Crete. It, and the two letters of Paul to Timothy, have been called Pastoral Letters because they deal principally with heresies and church discipline. The letter urges Titus to appoint worthy elders to positions of responsibility, to preach sound doctrine, and to exemplify in his own life the virtues that are expected of all Christians. It warns against the disruptive influence of "Jewish myths," especially those put forward by the "circumcision party." That Paul actually wrote the letter to Titus is much disputed, the answer depending on arguments that extend also to the two letters of Paul to Timothy.

**Titus Tatius,** traditionally the Sabine king who ruled with Romulus, the founder of Rome. It is unlikely that either Titus Tatius or Romulus was a historical personage. According to the legend, the conflict between the Romans and the Sabines began when Romulus invited the Sabines to a festival and abducted their women. Titus Tatius then seized Rome's Capitoline Hill by bribing Tarpeia, daughter of the commander of the Roman guard. In the ensuing battle, fought in the valley between the Capitoline and Palatine hills, the Sabine women rushed into the fray and stopped the fighting. A formal treaty was drawn up uniting the Romans and Sabines under a dual kingship of Titus Tatius and Romulus. The community continued to be called Rome, but, as a concession to the Sabines, its citizens were known as Quirites (from Cures, the principal town of the Sabines). The dual kingship survived for only a few years before Titus Tatius was killed by a mob.

The Romans read much back into the legend of Titus Tatius. In addition to viewing the reign of Titus Tatius and Romulus as the prototype of their own dual magistracies, they found in Titus the eponym of both the Titienses (one of the three original Roman tribes) and the religious brotherhood known as the *sodales Titii.*

Titus Tatius is credited by tradition with establishing altars to many deities (probably Sabine) at Rome, among them Ops, Flora, Veiovis, Saturn, Sol, Luna, Vulcan, Summanus, Larunda, Terminus, Quirinus, Vertumnus, the Lares, Lucina, and Diana.

**Titusville,** city, seat (1879) of Brevard county, east-central Florida, U.S. The city is linked to the John F. Kennedy Space Center on northern Merritt Island via a causeway across the Indian River (lagoon). It was originally founded (1867) as Sand Point by Colonel Henry T. Titus, for whom it was renamed in 1874. When incorporated as a town in 1886, it was a port served by a mule-drawn railway that carried freight as far as Sanford, 35 miles (56 km) inland. In 1887 the Jacksonville, Tampa, and Key West Railroad was extended to Titusville, which developed as a citrus-shipping point and commercial-fishing port. It attained city status in 1946 and consolidated with Indian River City and Whispering Hills Golf Estate in 1963. Its economy has become increasingly dominated by tourism and the nearby aerospace research and industrial complex. Pop. (1992 est.) city, 40,922; (1990) Melbourne–Titusville–Palm Bay MSA, 398,-978.

**Titusville,** city, Crawford county, northwestern Pennsylvania, U.S. It lies along Oil Creek, 40 miles (64 km) southeast of Erie. Founded in 1796 by Jonathan Titus, a surveyor, it developed as a lumbering and agricultural centre. On Aug. 27, 1859, the world's first successful oil well was drilled just outside the city limits



Replica of the original Drake oil well, Titusville, Pa.
Milt and Joan Mann from CameraMann

by Edwin L. Drake, marking the beginning of the state's oil boom. The nation's first oil refinery was installed there, and the first extensive natural-gas industry was developed in the area about 1872. On June 5, 1892, Oil Creek flooded, wrecking many oil tanks and causing extensive damage.

Titusville's last refinery closed in 1950; alloy steel forgings, plastic and petroleum products, textiles, and electronic components are now the city's major products. A regional campus of the University of Pittsburgh is in Titusville. A replica of the original well house and derrick and a museum are in the Drake Well Memorial Park. Inc. borough, 1847; city, 1866. Pop. (1992 est.) 6,352.

**tityra** (genus *Tityra*), any of three species of tropical American birds of the cotinga



Masked tityra (*Tityra semifasciata*)
Drawing by Murrell Butler

family (Cotingidae, order Passeriformes). The masked tityra (*Tityra semifasciata*) is common in woods and open country from Mexico to Bolivia and Brazil, the black-tailed tityra (*T. cayana*) occurs throughout tropical South America, and the black-crowned tityra (*T. inquisitor*) ranges from Mexico to Argentina. The males of all three species are about 20 cm (8 inches) long and are pale gray with black on the head, wings, and tail; the females are similar but browner in hue. The bill is stout and slightly hooked. Tityras utter froglike sounds and nest in tree holes, which, in the case of the masked tityra, may be usurped from a toucan or woodpecker by stuffing leaves into the hole until it is abandoned by the owner.

**Tiumen** (Russia): *see* Tyumen.

**Tiutchev, Fyodor Ivanovich:** *see* Tyutchev, Fyodor Ivanovich.

**Tiv,** people living on both sides of the Benue River in Nigeria; they speak a language of the Benue-Congo branch of the Niger-Congo family. The Tiv language was reduced to writing by missionaries in about 1920, and this system is taught to Tiv pupils who attend primary school.

The Tiv are subsistence farmers whose main crops are yams, millet, and sorghum, all of which are eaten as porridge or are made more palatable by their combination in sauces and stews. Although goats and chickens are plentiful, few cattle are kept because of the tsetse fly. The polygynous Tiv family occupies a cluster of round huts surrounding a reception hut; brothers usually live next to one another.

Tiv social organization is based on patrilineages. Genealogies go back many generations to a single ancestor; the descendants (through the male line) of each person in the genealogy form a territorial kinship group. The force of patrilineal descent, while dominant in Tiv institutions, is balanced by other organizations, such as age grades (groups of men of about the same age who provide mutual assistance and allies against lineage pressure), cooperative groups, and institutionalized friendships. Although traditionally the Tiv had no chiefs (political decisions were made by lineage elders), the British administration established a paramount chief in 1948. The Tiv's complex system of exchange marriage was outlawed in 1927 and was replaced by marriage with bridewealth.

Some Tiv have converted to Christianity, and a lesser number have adopted Islām; but the tribal religion, based on the manipulation of forces (*akombo*) entrusted to man by a creator god, remains strong. The *akombo* are manifested in certain symbols or emblems and in diseases that they create. An organization of elders who have the ability to manipulate these forces meets at night to repair those manifestations of *akombo* (*e.g.*, epidemics) that affect the group; these phenomena require human sacrifice or its metaphorical equivalent. The Tiv numbered about 2,500,000 in the late 20th century.

**Tivaouane,** town, northwestern Senegal. It is located about 50 miles (80 km) northeast of Dakar, the national capital. Senegal's principal mineral exports (aluminum and especially calcium phosphates) are quarried near Tivaouane. The town is linked by road and rail with the ports of Dakar and Saint-Louis and serves as the country's main centre for the Sūfi-Muslim Tijāniyah sect. The Wolof people constitute the town's main inhabitants. Pop. (1997 est.) 32,100.

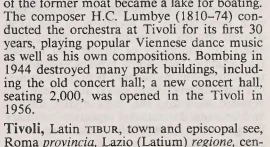
**Tiverton** (England): *see* Mid Devon.

**Tiverton,** town ("township"), Newport county, Rhode Island, U.S. It lies along the Sakonnet River and Mount Hope Bay, opposite Portsmouth and Bristol. Originally a part of Massachusetts Bay Colony and named for Tiverton, Devon, Eng., it was annexed to Rhode Island in 1746 and was incorporated in 1747. Southwest of Tiverton Four Corners, the Battle of Almy's Pea Field was fought during King Philip's (Indian) War on July 8, 1675. During the American Revolution, Fort Barton, on Tiverton Heights, was a mustering point for Colonial forces prior to the Battle of Rhode Island (1778). Farming, fishing, and boatbuilding were early activities, and textile mills were established in 1827. Agriculture and tourism are now the economic mainstays. Pop. (1990) 14,312.

**Tivoli,** pleasure garden in Copenhagen. Cafés, restaurants, pavilions, open-air theatres, and an amusement park are scattered among Tivoli's extensive flower gardens. Fireworks, coloured floodlights, and illuminated fountains brighten the park at night; and symphony concerts, pantomimes, and ballets are performed throughout the summer.

The park was opened in 1843 by the writer-architect Georg Carstensen (1812–59) on the southern ramparts of the old city. A remnant of the former moat became a lake for boating. The composer H.C. Lumbye (1810–74) conducted the orchestra at Tivoli for its first 30 years, playing popular Viennese dance music as well as his own compositions. Bombing in 1944 destroyed many park buildings, including the old concert hall; a new concert hall, seating 2,000, was opened in the Tivoli in 1956.

**Tivoli,** Latin TIBUR, town and episcopal see, Roma *provincia,* Lazio (Latium) *regione,* central Italy. It is picturesquely situated on the western slopes of the Sabine Hills, along the Aniene River where it enters the Campagna di Roma, just east of Rome. The site commanded the principal natural route eastward from Rome along the Via Tiburtina Valeria and has been continuously occupied since prehistoric times.



Hadrian's villa, Tivoli, Italy
SCALA—Art Resource

Tivoli was originally an independent member of the Latin League (communities that cooperated in political and social matters) and a rival of Rome, but it passed within the Roman orbit in the 4th century BC. The town received Roman citizenship in 90 BC and attained prosperity as a summer resort under the late republic and early empire. The Roman emperor Augustus and the poets Horace, Catullus, and Sextus Propertius were among its sojourners. Many wealthy Romans built villas and erected small temples in the vicinity of Tivoli. After suffering during the barbarian invasions, the town recovered by the 10th century, became an imperial free city, and maintained its autonomy to some degree until 1816.

Tivoli is an important landmark in the history of architecture, and its monuments are among the most impressive to survive from antiquity; their excavation since the 16th century played a considerable part in shaping successive generations of classicizing taste. Among the remains of wealthy Roman residences in the immediate neighbourhood, the most important are those of the one that was subsequently acquired by the emperor Hadrian in the 1st century to become the nucleus of his famous villa. Hadrian's villa was the largest and most sumptuous imperial villa in the Roman Empire. It was begun about AD 118 and took about 10 years to build. It lies in a plain below the hill town of Tivoli. The villa contained palaces, libraries, guest quarters, public baths, and two theatres. The remnants of many great brick and concrete structures remain.

Among other surviving Roman monuments are two small temples and the great temple of Hercules Victor (Ercole Vincitore) within the town, as well as remains of aqueducts and of the poet Horace's Sabine farm nearby. There are also notable medieval landmarks, including the castle (now a prison) built in 1458–64 by Pope Pius II, and the Villa d'Este, begun in 1550 by Pirro Ligorio for Cardinal Ippolito d'Este. The gardens of the Villa d'Este are a magnificent example of Renaissance landscape architecture and are unrivaled in the wealth and fantasy of their fountains. Tivoli's famous waterfalls of the Aniene, 354 feet (108 m) high, have been diminished in volume by hydroelectric projects and other diversions, and indiscriminate building has robbed the old town of much of the charm that made it a favourite resort of artists and travelers during the 18th and 19th centuries.

Tourism along with papermaking and light industry are the chief economic occupations of modern-day Tivoli. Pop. (2000 est.) mun., 52,809.

**Tiw** (Germanic god): *see* Tyr.

**Tiwanacu,** also spelled TIWANAKU (Bolivia): *see* Tiahuanacu.

**Tiwi,** resort town, southeastern Luzon, Philippines. It is situated along Lagonoy Gulf of the Philippine Sea. The town lies in a bed of volcanic vents over an active geothermal area; through the vents, sulfurous live steam pours continuously. Tiwi Hot Springs National Park is nearby; there tourists can boil food in the steaming water. There are local handicraft industries utilizing abaca and clay. Pop. (1990) 34,658.

**Tiy,** also spelled TIYE (b. *c.* 1400 BC, Ipu, Egypt—d. *c.* 1340), one of the most illustrious queens of Egypt.

She was the daughter of Yuya, the commander of the Egyptian chariotry and overseer of the cattle of the local god Min; her mother, Thuya, was also an Egyptian. Although she was not of royal blood, Tiy became the favoured wife of Amenhotep III (reigned 1390–53 BC), a powerful king of the 18th dynasty, who gave her considerable prominence in state affairs and in public ceremonies; her name appeared with the king's on official documents. She was the mother of Amenhotep IV, or Akhenaton, and was one of his circle of advisers after his accession. Her mummy, which is kept in the Egyptian Museum at Cairo, was identified in 1976.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Tizi Ouzou,** town, north-central Algeria, in the Grande Kabylie. It lies in a narrow valley of the Wadi Tizi Ouzou, separated from the Wadi Sébaou Valley by Mount Beloua. Named for the flowering broom (*ouzou*) that grows in the pass (*tizi*) connecting the two valleys, Tizi Ouzou was built by the Turks and enlarged by the French. The town is a regional trade centre noted for basketry; it is the site of the Algerian Institute of Hotel and Tourist Technology. Olives, figs,

and grapes are processed there. Pop. (1998 est.) mun., 77,475.

**Tiznit,** town, provincial capital, and province, Sud region, Morocco. The town lies near the Atlantic coast and the Tachilla and Ouarzemimene mountains of the Anti-Atlas range. It was founded in 1882 during the reign of Mauläy Hasan as a military base from which he launched expeditions to subdue the peoples of the Oued (river) Sous region and the neighbouring mountainous areas. Tiznit was eventually occupied by French troops (1917–56). Enclosed by 4 mi (6 km) of walls, it is now a market centre where irrigated orchards, dates, vegetables, and barley are cultivated. Artisan industries include jewelry, engraved silver, and inlaid weapons. The town is connected by road with Agadir.

Tiznit province has an area of 2,687 sq mi (6,960 sq km). It is bounded by the provinces of Agadir to the north, Tata to the east, Guelmim to the south, and the Atlantic Ocean to the west. Cereals, sheep, goats, and cattle are raised. There are iron deposits in the mountains. Pop. (1971) town, 11,391; (1981 est.) province, 353,000.

**Tjilatjap** (Indonesia): *see* Cilacap.

**Tjirebon** (Indonesia): *see* Cirebon.

**Tjokroaminoto, Omar Said** (b. Aug. 16, 1882, Desa Bakur, Madiun, Java—d. Dec. 17, 1935, Jogjakarta), highly influential Indonesian leader of the early Indonesian nationalist movement, closely linked with the Sarekat Islām (*q.v.*; Islāmic Association), which he shaped as a political force.

The Sarekat Dagang Islām (Association of Islāmic Traders), established in 1911 to promote the interests of Indonesian traders faced with growing Chinese competition, was reorganized as Sarekat Islām the following year by Tjokroaminoto. He broadened the focus of the group, greatly expanding its appeal, and organized it along Western lines. There were, however, substantial non-Western elements.

Tjokroaminoto, who had a powerful personality, became widely popular among Javanese peasants. By 1914 he had become the central figure of a messianic movement, and the Sarekat Islām had taken on strong mystical overtones. He was not a strong leader, however, and he failed to reinforce his popular appeal with a clear, consistent policy. His concern for the need for unity against Dutch rule led him to make compromises, while other groups with more coherent programs were politically more effective. In 1918 he became a member of the Volksraad.

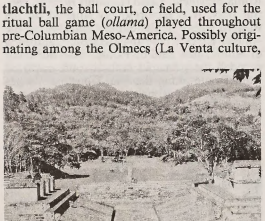
In the early years of Sarekat Islām, Tjokroaminoto came into contact with a number of young nationalists, among whom was Sukarno, who became the first president of Indonesia. Tjokroaminoto tutored Sukarno, who also married his daughter. After 1920 Tjokroaminoto's fortunes declined. He was jailed by the Dutch in 1921 on a charge of perjury but was released in 1922. By 1923 Sukarno, who had ended his marriage, had broken politically with Tjokroaminoto and adopted a more radical position. They were later reconciled, and in 1926 Sukarno wrote for *Bandéra Islām* ("Flag of Islām"), a journal edited by Tjokroaminoto after his release from prison. But his passive and conciliatory positions prevented Tjokroaminoto from ever regaining the power and influence he had held in the early days of Sarekat Islām.

**tjurunga,** also spelled CHURINGA, in Australian Aboriginal religion, a mythical being and a ritual object, usually made of wood or stone, that is a representation or manifestation of such a being. An Aranda word, *tjurunga* traditionally referred to sacred or secret–sacred things set apart, or taboo; for example, certain rites, stone, and wooden slab objects, bull-roarers, ground paintings and earth mounds, ritual poles and emblems, headgear, and sacred songs. More popularly, the term is applied to flat, oval, worked stones, normally incised with sacred designs, and to wooden boards ranging in length from about 2 inches (5 centimetres) to 10 feet (3 metres) or so and bearing intricate patterns of mythological significance. Most *tjurunga* were used in men's secret–sacred rituals; some small objects figured in women's rituals and still smaller objects in men's love magic.

Each person has a personal bond with a *tjurunga*. At initiation, a youth (not a girl) is introduced to the rituals and *tjurunga* of his local descent group and to those of others. Later he receives his own *tjurunga* object and the knowledge that goes with it (or them). At death, the *tjurunga* might be buried with the corpse, or the dead person's spirit might seek the place where its *tjurunga* "body" (that is, the mythic being itself) rested.

*Tjurunga* represent in essence the indestructible personalities of members of the local descent groups connected with them; they assert the continuity of all life and human immortality. They are a symbol and an expression of communication between man and the mythological time called the Dreaming, between man and the great mythic beings, and between the material aspects of ordinary living and the spiritual heritage of man.

**tlachtli,** the ball court, or field, used for the ritual ball game (*ollama*) played throughout pre-Columbian Meso-America. Possibly originating among the Olmecs (La Venta culture, *c.* 800–*c.* 400 BC) or even earlier, the game spread to subsequent cultures, among them those of Monte Albán and El Tajín; the Maya (as *pok-ta-pok*); and the Toltec, Mixtec, and Aztec. In Aztec times, *ollama* was a nobles' game and was often accompanied by heavy betting. Various myths mention the ball game, sometimes as a contest between day and night deities. It is still played in isolated regions. "*Tlachtli*" and "*ollama*" are Nahuatl words.



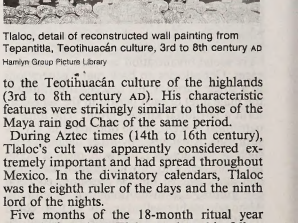
Maya *pok-ta-pok* ball court, at Copán, Honduras, *c.* AD 775
Irmgard Groth

The ball court, shaped like a capital I with serifs and oriented north–south or east–west, represented the heavens. Players, wearing heavy padding, used elbows, knees, and hips to knock a solid rubber ball into the opponent's end of the court; in post-Classic times (after *c.* AD 900), the object was to hit the ball through one of two vertical stone rings (placed on each side of the court). The ball represented the sun (or moon or stars), and the rings represented the sunrise and sunset or the equinoxes. Extremely violent, the game often caused serious injury and, occasionally, death.

**Tlaelquani** (Aztec goddess): *see* Tlazoltéotl.

**Tlalnepantla,** in full TLALNEPANTLA DE COMONFORT, city, northeastern México state, central Mexico. At an altitude of 7,474 ft (2,278 m) above sea level on the Río Tlalnepantla, it was founded by the Otomi Indians and conquered by the Aztecs; archaeological remains have been found on the site, and two Aztec pyramids are nearby. The city's church was begun in 1583. Originally an agricultural and livestock-raising centre, Tlalnepantla has become virtually a northwestern industrial suburb of Mexico City. It is an important transportation hub, receiving and servicing the railroad lines running to Nuevo Laredo, Guadalajara, Pachuca, and Veracruz. Among the city's varied industries are iron and bronze foundries, basic chemical plants, and factories manufacturing mosaics, instruments, machinery, and electrical equipment. Pop. (1995) 708,013.

**Tlaloc** (Nahuatl: He Who Makes Things Sprout), the Aztec rain god. Representations of a rain god wearing a peculiar mask, with large round eyes and long fangs, date at least



Tlaloc, detail of reconstructed wall painting from Tepantitla, Teotihuacán culture, 3rd to 8th century AD
Hamlyn Group Picture Library

to the Teotihuacán culture of the highlands (3rd to 8th century AD). His characteristic features were strikingly similar to those of the Maya rain god Chac of the same period.

During Aztec times (14th to 16th century), Tlaloc's cult was apparently considered extremely important and had spread throughout Mexico. In the divinatory calendars, Tlaloc was the eighth ruler of the days and the ninth lord of the nights.

Five months of the 18-month ritual year were dedicated to Tlaloc and to his fellow deities, the Tlaloque, who were believed to dwell on the mountaintops. Children were sacrificed to Tlaloc on the first month, Atlcaualo, and on the third, Tozoztontli. During the sixth month, Etzalqualiztli, the rain priests ceremonially bathed in the lake; they imitated the cries of waterfowls and used magic "fog rattles" (*ayauhchicauaztli*) in order to obtain rain. The 13th month, Tepeilhuitl, was dedicated to the mountain Tlaloque; small idols made of amaranth paste were ritually killed and eaten. A similar rite was held on the 16th month, Atemoztli.

Tlaloc had been one of the main deities of the agricultural tribes of central Mexico for many centuries, until the warlike northern tribes invaded that part of the country, bringing with them the astral cults of the sun (Huitzilopochtli) and the starry night sky (Tezcatlipoca). Aztec syncretism placed both Huitzilipochtli and Tlaloc at the head of the pantheon. The Teocalli (Great Temple) at Tenochtitlán, the Aztec capital, supported on its lofty pyramid two sanctuaries of equal size: one, dedicated to Huitzilopochtli, was painted in white and red, and the other, dedicated to Tlaloc, was painted in white and blue. The rain god's high priest, the Quetzalcóatl Tlaloc Tlamacazqui (Feathered Serpent, Priest of Tlaloc) ruled with a title and rank equal to that of the sun god's high priest.

Tlaloc was not only highly revered, but he was also greatly feared. He could send out the rain or provoke drought and hunger. He hurled the lightning upon the earth and unleashed the devastating hurricanes. The Tlaloque, it was believed, could send down to the earth different kinds of rain, beneficent

or crop-destroying. Certain illnesses, such as dropsy, leprosy, and rheumatism, were said to be caused by Tlaloc and his fellow deities. Although the dead were generally cremated, those who had died from one of the special illnesses or who had drowned or who had been struck by lightning were buried. Tlaloc bestowed on them an eternal and blissful life in his paradise, Tlalocan.

Associated with Tlaloc was his companion Chalchiuhtlicue ("She Who Wears a Jade Skirt"), also called Matlalcueye ("She Who Wears a Green Skirt"), the goddess of freshwater lakes and streams.

**Tlalpan,** *delegación,* central *distrito federal* ("federal district"), central Mexico. At 1,425 feet (2,294 m) above sea level in the Valley of Mexico, it is on the northeastern slopes of the extinct Cerro Ajusco volcano. In the district are remains of a pre-Columbian town, and 1.5 miles (2.5 km) west of Tlalpan is the Cuicuilco Pyramid, considered to be the oldest man-made structure on the North American continent (dating from 8000 to 7000 BC). During the colonial era the settlement was called San Agustín de las Cuevas, after the church of the same name (1532). Given city status in 1827, Tlalpan served as capital of México state from 1827 to 1830. It retains a traditional and tranquil atmosphere, with large residences, health-care institutions, and rehabilitation centres. Because of its proximity to central Mexico City, which lies approximately 12.5 miles (20 km) to the north-northeast, Tlalpan is easily accessible by highway, railroad, and air. Pop. (1990) 485,043.

**Tlaquepaque,** city, north-central Jalisco *estado* ("state"), west-central Mexico. Formerly known as San Pedro Tlaquepaque, the city lies in the temperate Guadalajara valley, approximately 5,400 feet (1,650 m) above sea level. A suburb of Guadalajara, the state capital, 7 miles (11 km) southeast, Tlaquepaque is primarily a handicrafts centre, known especially for its pottery, textiles, and hand-blown glass. The city is also the commercial and manufacturing centre for the surrounding agricultural region, which yields wheat, corn (maize), peanuts (groundnuts), sugarcane, tobacco, and various fruits and vegetables. Because of its proximity to Guadalajara, the city is easily accessible by highway, railroad, and air. Pop. (1995) 434,710.

**Tlaxcala,** inland plateau *estado* ("state"), central Mexico, bordered by the states of Puebla on the northeast, east, and south; by México on the west; and by Hidalgo on the northwest. The smallest Mexican state, its 1,551-square-mile (4,016-square-kilometre) territory has a mean elevation of 7,000 feet (2,100 m) and a cool, healthful climate, but frequent winter frosts are injurious to local agriculture. The state occupies roughly the same area as the Indian principality of Tlaxcala, which refused to surrender to the Aztec confederation and joined Hernán Cortés as his principal Indian ally in the conquest of Mexico (1519–21). Continued loyalty to Spain brought the Tlaxcalans many privileges. The martial traditions of the Indian population were reasserted during the War of Independence in 1810, and again in 1847, against United States forces.

Almost exclusively agricultural, the state produces cereals (corn [maize] and barley), raises both dairy cows and fighting bulls, and has numerous handicrafts, notably the weaving of serapes and woolen cloth. Industry is predominantly textile-based, with woolens of special quality. Railways and highways traverse the state, linking Tlaxcala, the state capital, to Mexico City to the west and to Puebla to the south. Pop. (1990) 771,700.

**Tlaxcala,** in full TLAXCALA DE XICOHTÉNCATL, town, capital of Tlaxcala *estado* ("state"), east-central Mexico. It lies along the Zahuapan River at the northwest foot of La



San Francisco Church in Tlaxcala city, Mex.
A. Harlap—Black Star/EB Inc.

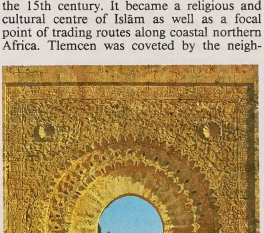
Malinche volcano, 7,388 feet (2,252 m) above sea level. The city lies in the region inhabited by the Tlaxcalan Indians, and the designation "de Xicohténcatl" commemorates a Tlaxcalan chieftain who vigorously opposed his people's aid to the Spanish conquistador Hernán Cortés. In 1519 Cortés conquered the city, where two years later he established the first Christian church (San Francisco) in the Americas. It was near Tlaxcala that Hernán Cortés built the brigantines which he transported to the Lake of Mexico for his final onslaught on the Aztec capital of Tenochtitlán (now Mexico City). The Sanctuary of Ocotlán and archaeological ruins are nearby. The surrounding area produces corn (maize), beans, lima beans, and livestock. The textile industry is well developed in the city, producing cotton, wool, and synthetic fibres. Tlaxcala can be reached by highway from Puebla to the south and from Mexico City to the west. Pop. (1990) 50,500.

**Tlazoltéotl** (Nahuatl: "Filth Deity"), also called IXCUINA, or TLAELQUANI, Aztec goddess who represented sexual impurity and sinful behaviour; she was probably introduced to the Aztecs from the gulf lowlands of Huaxteca. Tlazoltéotl was an important and complex earth-mother goddess. She was known in four guises, associated with different stages of life. As a young woman, she was a carefree temptress. In her second form she was the destructive goddess of gambling and uncertainty. In her middle age she was the great goddess able to absorb human sin, and, in her final manifestation, she was a destructive and terrifying hag preying upon youths. Tlazoltéotl was thought to provoke both carnal lust and illicit sexual activity, but she could also grant absolution to those who had so sinned. She became best known for her capacity to cleanse such sins during confessionals conducted by her priests. Thus, although she could, in one form, inspire debauched behaviour, she could also forgive sinners and remove corruption from the world. She was portrayed in an elaborate headdress of raw cotton and in some representations wearing the skin of a sacrificial victim, or in a costume that featured symbols of the moon.

*Articles are alphabetized word by word, not letter by letter*

**Tlemcen,** also spelled (after 1981) TILIMSEN, town, northwestern Algeria. It lies near the Moroccan border. Tlemcen is backed by the cliffs of the well-watered Tlemcen Mountains and overlooks the fertile Hennaya and Maghnia plains. Lying at an elevation of 2,648 feet (807 m), Tlemcen is located sufficiently inland to avoid the humidity of the Mediterranean coast but is near enough to receive cooling sea breezes in summer. The resulting temperate climate favoured Tlemcen's development and explains its historical importance.

The earliest settlement on the site was called Pomaria ("Orchards") by the Romans in the 4th century because of the local profusion of orchards and gardens. The town was later renamed Agadir ("Escarpment") by the Berbers. This eventually merged with the neighbouring Almoravid military settlement of Tagrart, which was founded in the 11th century. The union evolved in the 13th century as the town of Tlemcen (from the Berber *tilmisane,* "springs," for the local perennial springs). Tlemcen was the capital of the 'Abd al-Wādid kingdom of Tilimsan from the 13th to the 15th century. It became a religious and cultural centre of Islām as well as a focal point of trading routes along coastal northern Africa. Tlemcen was coveted by the neighbouring Marīnid kingdom of Fès (Fez) to the west, however, and the Marīnids established the fortified camp of Mansoura 1.5 miles (2.4 km) west of Tlemcen as a base from which to besiege the town. Tlemcen was periodically besieged by the Marīnids throughout the 14th century, but during times of truce the rulers of the town worked on its architectural adornment and developed its religious and educational institutions and its commerce and industry. The city declined at the end of the 14th century, and it fell to the Algerian Turks in 1559. In 1842 it was secured by the French, who surrounded it with ramparts. Tlemcen served as a headquarters for the Algerian nationalist leader Ahmed Ben Bella in 1962.



The monumental door of the ruined minaret of the mosque of Mansoura in the ancient Marīnid occupation camp west of Tlemcen, Alg.
John Elk III—Bruce Coleman Inc.

Tlemcen has more buildings dating from the 12th to the 15th century than any other town in Algeria. With the exception of the Great Mosque built by the Almoravids in the 12th century, most of the city's medieval buildings strongly reflect the influence of Moorish Spain. The Mosque of Sidi bel Ḥassan (1296, now a museum), the Méchouar, or citadel (1145, now a military hospital and barracks), the Sahrij, or Great Basin (a 14th-century reservoir, now dry), and the Grotto of Rabbi Ephraim ben Israel Ankawa (15th century) are notable landmarks. Tlemcen's winding, narrow, arched streets are crowded with shops, cafés, and mosques. The ruins of the Marīnid city of Mansoura to the west has notable examples of Hispano-Moorish art.

Tlemcen supports a bustling trade in agri-

cultural products and textile (including silk), leather, and metal handicrafts and has some light industrial development. The population is sharply divided between the Hadars (the middle class, descended from the Moors) and the Koulouglis (descendants of Turks and Arab women), each living within its own sector. Pop. (1987 prelim.) 107,632.

**Tlingit,** northernmost Indians of the North Pacific Coast of North America, inhabiting the islands and coastal lands of southern Alaska from Yakutat Bay to Cape Fox. They were speakers of the Tlingit language, which is believed to be related to Athabascan. They were divided into 14 territorial groups, or tribes. According to tradition, some of their ancestors came from the south; others migrated from the interior.

Tlingit groups were organized into twofold divisions, or moieties, each individual being assigned at birth according to his mother's affiliation. Moieties were subdivided into clans, groups whose members traced their relationship to a legendary common ancestor. The basic social unit, however, was the lineage of people related through maternal descent. The lineage was usually politically independent, each lineage having its own chief, with no overall tribal authority. Lineages might cooperate, as in war, but there was no compulsion to do so. During the historic period there was a tendency for tribes consisting of one or more lineages to consolidate into unified villages, but formerly each lineage probably had its own village. Each lineage owned and exploited lands of economic importance and functioned as the basic ceremonial unit.

Tlingit economy was based on fishing, with salmon caught by harpoons, nets, and traps the main source of food. The Tlingit also hunted sea, and sometimes land, mammals. Wood was the primary material for manufacture and was used for houses, canoes, dishes, utensils, and other objects. Large permanent houses were built near good fishing grounds and safe landing places for canoes, often along the beaches of a bay sheltered from the tides. The houses were occupied only in winter; during the summer, inhabitants scattered for fishing and hunting. Tlingit potlatches (*q.v.*), the ceremonial distributions of gifts, marked a cycle of rituals mourning the death of a chief. *See also* Haida; Tsimshian.

**TM:** *see* Transcendental Meditation.

**TNT** (explosive): *see* trinitrotoluene.

**To' Janggut,** original name MUHAMMAD HASAN BIN MUNAS (b. 1853, Jeram, Kelantan, Federation of Malaya and Singapore [now in Malaysia]—d. May 24, 1915, Pasir Puteh, Kelantan, Straits Settlements), Malay leader of a peasant rebellion in Malaya in 1915, directed against British colonial rule.

Muhammad Hasan, known as To' Janggut because of his long white beard, was a peasant farmer and an itinerant rice trader in the southernmost district of Kelantan, a state that came under British control in 1909. Among the effects of colonial rule were displacement of the independent powers of district territorial chiefs and the introduction of new and unwelcome forms of land taxation.

As a former and loyal follower of the Pasir Puteh chief, To' Janggut was affected by both measures. In April 1915 he organized first a tax boycott and then an armed rising of almost 2,000 farmers, designed to expel the British. Troops had to be brought in from Singapore to quell the rising, which lasted for a month. Though there was no great loss of life, To' Janggut died in the final attack on his stronghold, and his name continues to live as that of an early hero in the anticolonialist struggle.

**To' Kenali,** original name MUHAMMAD YUSOF BIN AHMAD (b. 1868, Kampung Kenali, Kelantan, Straits Settlements [now in Malaysia]—d. Nov. 19, 1933, Kampong Kota Baharu, Straits Settlements), Malay theologian and teacher who became the archetype of the rural Malay religious teacher (*'alim*), with a reputation that spread far beyond his native Kelantan to Sumatra, Java, and Cambodia.

Muhammad Yusof, born into a poor, peasant family, was taught the fundamentals of the Islāmic religion at home, in his village, and in the nearby capital, Kota Baharu. He went to Mecca at the age of 18 and studied there for 22 years. He returned to Kelantan in 1908 and began to teach from his house, attracting students who set up their own small huts (*pondok*) in the traditional manner, which allowed them to live nearby while studying with him. Though he was invited by the sultan to teach in the state mosque in Kota Baharu, and did so from 1915 to 1920, it was at the Pondok To' Kenali that his influence was chiefly felt; it became one of the largest schools in the state, with more than 300 students by the mid-1920s. To' Kenali played a considerable role in developing Arabic-language instruction as well as religious teaching in Malaysia, and many of his students came to occupy important positions in Islāmic affairs in the country. In addition, he played an important part in shaping the state Majlis Agama Islām ("Islāmic Religious Council"), set up in 1915 to oversee all aspects of Islām in Kelantan. It later became the model for similar councils in the remaining Malay states.

**To-lun,** Mongolian DOLON NOR, or DOLOON NUUR, Pinyin DUOLUN, or DOLONNUR, town in the Inner Mongolian autonomous *ch'ü* (region), China. Until 1952 the town was in the former Chahar province.

Historically important as the site of Shangtu (the Xanadu of Samuel Coleridge's poem "Kubla Khan"), it was founded by Kublai Khan in 1256 and became the summer capital of the Mongol emperors of China, known as the "city of 108 temples." Excavations have revealed that the site comprised a walled inner city containing official buildings, surrounded by an outer wall, while on the west and north a third wall enclosed a large park. The city was sacked and burned in the Red Turban Muslim Rebellion in 1358 and again in 1363. In 1369 the Chinese Ming armies took the area. To-lun, however, remained an important symbolic site for the Mongols, and the Chinese Manchu emperors encouraged its development as a religious centre. Under the Manchus an enormous lamasery was founded there in 1694, which at one time housed more than 3,000 monks. The Mongols flocked to the temples, many Chinese merchants arrived in the locality to trade with them, and To-lun became one of the major collecting points along the Inner Mongolian border.

After 1949 a highway was constructed linking the city with Kalgan (Chang-chia-k'ou) in Hopeh province to the southwest and Ch'ihfeng in Inner Mongolia to the east. The highway stimulated development, and many Chinese farmers settled in the vicinity, pressing the pastoral Mongols (who now constitute a minority in the region) further north. To-lun remains an important collecting centre for pastoral products. Pop. (mid-1980s est.) 10,000–50,000.

**To Nhu** (pseudonym): *see* Nguyen Du.

**T'o-pa** DYNASTY: *see* Wei dynasty.

**T'o-pa Hung** (Chinese emperor): *see* Hsiao-wen Ti.

**toad,** any squat, rough-skinned, tailless amphibian of the order Anura, and especially a member of the family Bufonidae. The true toads (*Bufo*), with more than 300 species, are found worldwide except in Australasia, Madagascar, polar regions, and Polynesia, though *Bufo marinus* has been introduced into Australia and some South Pacific islands. Besides *Bufo,* the family includes 25 genera, one of which (*Nectophrynoides*) contains the only anurans that bear live young.



(Top) American toad (*Bufo americanus*); (bottom) variegated toad (*Atelopus zeteki*) from Panama

(Top) George Porter—The National Audubon Society Collection/Photo Researchers, (bottom) E.S. Ross

A brief treatment of toads follows. For full treatment, *see* MACROPAEDIA: Amphibians.

Variegated toads (*Atelopus*) are found in South and Central America. They are commonly square-headed and have enlarged hind feet. Some are brightly coloured in black with yellow, red, or green. When molested, the small, poisonous *Melanophryniscus stelzneri* of Uruguay bends its head and limbs over its body to display its bright-orange hands and feet. This position may be a method of warning the intruder of the toxicity of the toad.

True toads, of which the American toad (*Bufo americanus*) and the European toad (*B. bufo*) are representative, are stout-bodied with short legs that limit them to the characteristic walking or hopping gait. Their size ranges from about 2 to 25 cm (1 to 10 inches). The thick, dry, often warty skin on the back is generally mottled brown. Poison-secreting glands are located on the back and in the warts but are most concentrated in two prominent raised areas behind the eyes, the parotid glands.

The poison, which is secreted or ejected when the toad is molested, irritates the eyes and mucous membranes of many, though not all, predators. The poisons of the Colorado River toad (*B. alvarius*) and the giant toad (*B. marinus*) affect animals as large as dogs, in some instances causing temporary paralysis or even death. The Chinese have long used dried toad poison to treat various ailments. Contrary to popular belief, toads do not cause warts.

True toads are mainly terrestrial and nocturnal. They frequently remain in fairly small areas, feeding on whatever insects or small animals they can catch. Most remain in their burrows in winter and during drought. They breed in water and may migrate 1.5 km (1 mile) or more to a suitable breeding pond. The eggs (600 to over 30,000, depending on

species) are laid in two long jelly tubes. The tadpoles hatch in a few days and transform into adults in one to three months.

**toad bug,** any insect of the family Gelastocoridae (order Heteroptera), which numbers about 100 species. These insects, which resemble tiny frogs, have short, broad bodies and protruding eyes; they catch their prey by leaping upon it.

Toad bugs are found in all zoogeographic regions living along the muddy edges of streams and ponds. Some species spend part of their



Toad bug (*Gelastocoris oculatus*)
Richard Parker

lives in underground holes that they make. Their eggs have been found buried in sand. The colour of toad bugs varies, depending on the environment in which they live.

**toadfish,** any of about 45 species of bottom-living fishes constituting the family Batrachoididae and the order Batrachoidiformes. They are found chiefly in the New World and mostly in warm seas—occasionally in freshwater. Toadfishes are heavy-bodied fishes with broad, flattened heads and large mouths equipped with strong teeth. They grow to a maximum of about 40 cm (16 inches) and either are scaleless or have small scales. Most can produce audible grunting or croaking



Oyster toadfish (*Opsanus tau*)
Roman Vishniac

sounds. Toadfishes are carnivorous and sometimes bite when touched.

They are divided into three groups: true toadfishes, such as the oyster toadfish (*Opsanus tau*), a common resident of shallow coastal waters along eastern North America; venomous toadfishes (*Thalassophryne* and *Daector*), found in Central and South America and notable for inflicting painful wounds with the hollow, venom-injecting spines on their dorsal fins and gill covers; and midshipmen (*Porichthys*), shallow-water American fishes named for numerous (600–840) small, buttonlike light organs arranged in rows along the body.

**toadflax,** also called SPURRED SNAPDRAGON, any member of a genus (*Linaria*) of nearly 100 herbaceous plants native to the North Temperate Zone, particularly the Mediterranean region. The common name refers to their flaxlike leaves; the flowers are two-lipped and spurred like snapdragons. Among the prominent members are common toadflax, or butter-and-eggs (*L. vulgaris*), with yellow and or-



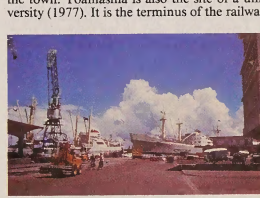
Common toadflax (*Linaria vulgaris*)
Joan E. Rahn

ange flower parts. Native to Eurasia, it is now widely naturalized in North America. Blue, or old-field, toadflax (*L. canadensis*) is a delicate light-blue flowering plant found throughout North America. From North Africa come the cloven-lip toadflax (*L. bipartita*) and purple-net toadflax (*L. reticulata*), both of which have purple and orange bicoloured flowers.

**toadstool,** any of various inedible or poisonous species of mushrooms (division Mycota). *See* mushroom.

**toadstool poisoning:** *see* mushroom poisoning.

**Toamasina,** formerly TAMATAVE, town, eastern Madagascar. The town lies along the Indian Ocean. It was rebuilt after destruction by hurricane in 1927, with the modern sector centring on the tree-lined avenue Poincaré. Toamasina is Madagascar's commercial hub and foremost port, handling much of the island's foreign trade. It exports coffee, vanilla, pepper, cloves, and graphite and imports machinery, textiles, and foodstuffs. There are food-processing, metal-working, and other plants in the town. Toamasina is also the site of a university (1977). It is the terminus of the railway



Dockside scene at Toamasina, Madagascar
J. Cannon—Ostman Agency

from Antananarivo, the national capital, 135 miles (217 km) southwest, and also has an airfield. Pop. (1990 est.) 145,431.

**Toarcian Stage,** division representing all rocks deposited worldwide during the Toarcian Age (193–187 million years ago). The Toarcian is the fourth of 11 divisions (in ascending order) that make up the Jurassic System and is the uppermost stage of the Early Jurassic. No global stratotype section and point (GSSP) for the base of the stage has been approved by the International Commission on Stratigraphy. Many different and conflicting stage names have been proposed for the Jurassic System, but the present scheme conforms closely to the order imposed by the French geologist Alcide d'Orbigny in the mid-19th century.

The stage's name is derived from the village of Thouars (Latin: Toarcium), which lies 75 km (45 miles) north of Niort in the Deux-Sèvres region of western France. The standard succession is better known from the Lorraine region of northeastern France, where about 100 m (330 feet) of marls and shales with nodular limestones are represented. Four ammonite cephalopod biozones (shorter spans of time characterized by a type of fossil mollusk), beginning with *Dactylioceras tenuicostatum* and ending with *Lytoceras jurense,* are recognized in Toarcian strata in Europe. Some species of *Dactylioceras* have a worldwide distribution and are known from the circum-Pacific belt. Rocks of the Toarcian Stage overlie those of the Pliensbachian Stage and underlie rocks of the Aalenian Stage.

**toastmaster's glass,** English glass about the size of an ordinary drinking glass but with only about one-quarter of its capacity; the



Toastmaster's glass, English, *c.* 1730; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London; photograph, A.C. Cooper Ltd.

glass creates the illusion of being full by means of a depression in its bowl, which in fact is almost solid. It owed its origin to the clubs of 18th-century England, where the toastmaster had to remain sober enough to carry out his office.

**Toba** DYNASTY: *see* Wei dynasty.

**Toba, Go-,** in full GO-TOBA TENNŌ, personal name TAKAHIRA (b. Aug. 6, 1180, Kyōto, Japan—d. March 28, 1239, Oki province, Japan), 82nd emperor of Japan, whose attempt to restore power to the imperial house resulted in total subjugation of the Japanese court.

He was placed on the throne in 1183, taking the reign name Go-Toba ("Later Toba"), by the Minamoto clan after it had established military hegemony over most of Japan.

After reigning for 15 years, Go-Toba in 1198 abdicated in favour of his son in order to form a cloister government (*insei*) through which he dominated the imperial court. The following year Minamoto Yoritomo, head of the Minamoto clan, whom the emperor had appointed to the office of shogun (military dictator), died, and in the next few years members of the Hōjō family established themselves as the hereditary shogunal regents, thus effectively usurping the power of the shogun.

Go-Toba took advantage of the ensuing friction to develop his own power structure, including a sizable army. In 1219 the last of the Minamoto line died, and Hōjō Yoshitoki (1163–1224) became firmly established as regent. Go-Toba believed there was enough discontent with Hōjō rule to warrant a confrontation. After accusing Yoshitoki of being a rebel in 1221, he issued a call to warrior families throughout the country to join his forces. The Hōjō, however, reacted swiftly, and less than a month later the uprising was

over. Go-Toba and his two sons were exiled, and the Hōjō family solidified their military and economic hold on the court. The incident is known as the Jōkyū Disturbance (Jōkyū no ran), from the name of the period between 1219 and 1221 in which the incident occurred.

**Toba, Lake,** Indonesian DANAU TOBA, lake in the Barisan Mountains, north-central Sumatra, Indonesia. It covers an area of about 440 square miles (1,140 square km), excluding Samosir Island, which occupies a large part of the lake's centre and which is about 30 miles (50 km) long and 10 miles (15 km) wide. The lake drains east through the Asahan River into the Strait of Malacca; along the Asahan River several major hydroelectric projects were completed in the 1980s to supply power for industrialization of the lesser-developed areas of northern Sumatra. A high-quality aluminum-processing and smelting centre was also completed in 1984 at the mouth of the Asahan on the coast.

**Toba Sōjō,** byname ABBOT OF TOBA, also called KAKUYŪ (b. 1053, Japan—d. 1140, Japan), 47th head priest of the Enryaku-ji,



"Scrolls of Frolicking Animals," detail of hand scroll attributed to Toba Sōjō, mid-12th century; in the Kōzan-ji, Kyōto

By courtesy of the Kozan-ji Temple, Kyoto; photograph, Umegabata Ukyoku

which is headquarters of the Tendai sect of Buddhism, near Kyōto in modern Shiga Prefecture.

Toba is traditionally regarded as the artist of a series of important narrative scrolls featuring humorous secular subjects: "History of Mount Shigi" and "Scrolls of Frolicking Animals." The "History of Mount Shigi" consists of illustrations of miracles and is notable for its lifelike crowds of people in action. In the "Scrolls of Frolicking Animals" the artist used a new technique of free-line ink drawing against a white background to depict the frolicking animals, which, some say, were caricatures of contemporary Buddhist priests. Because the four "Scrolls of Frolicking Animals" differ greatly in quality, it is now believed they were painted by Toba Sōjō and another, later artist. Despite doubts concerning their authorship, the caricature drawings are so closely associated with the Abbot that the appellation *Toba-e* ("Toba paintings") is given to similar, although cruder, cartoon drawings popular during the Tokugawa period (1603–1867).

**tobacco,** any of numerous species of *Nicotiana* or the cured leaves of several of the species that are used after processing in various ways for smoking, snuffing, chewing, and extracting of nicotine. Common tobacco is *Nicotiana tabacum,* native to South America, Mexico, and the West Indies. Wild tobacco is *Nicotiana rustica,* the species cultivated by the Indians of eastern North America and presently cultivated in Turkey, India, and several European countries. These two species were described by Carolus Linnaeus in 1753. Other species, such as *N. attenuata, N. trigonophylla,* and *N. quadrivalvis,* have been used



(Left) Wild tobacco (*Nicotiana rustica*), about 3 feet high, and (right) cultivated tobacco (*N. tabacum*), about 4½ feet

By courtesy of (left) the U.S. Department of Agriculture; (right) photograph, J. Horace McFarland Company

for smoking by the Indians of western North America. Ornamental, flowering tobaccos are *N. sylvestris* and *N. alata grandiflora.* All species of *Nicotiana* are probably native to the Western Hemisphere except several species native to Australia.

A brief treatment of tobacco follows. For full treatment, *see* MACROPAEDIA: Farming and Agricultural Technology.

When Christopher Columbus discovered the Americas, he found the natives using tobacco in much the same manner as it is used today. The American Indians believed it to possess medicinal properties, which was the main reason for its introduction into Europe. Tobacco was important in Indian ceremonies, such as the smoking of the pipe of peace. Evidently the natives of North and South America had developed crude methods of tobacco culture. Tobacco-growing's extension to practically all parts of the world began with its introduction into Europe: France, 1556; Portugal, 1558; Spain, 1559; and England, 1565. Jean Nicot, the French ambassador to Lisbon in whose honour the genus *Nicotiana* was named, is said to have sent the seed of *N. tabacum* to Catherine de Médicis, the queen consort and regent of France. Portuguese and Spanish sailors took tobacco from Europe to all parts of the world.

There are no available records as to early tobacco culture outside Europe, but the beginnings of tobacco culture by European settlers in America took place in the following areas on the dates indicated: Santo Domingo, 1531; Cuba, 1580; Brazil, 1600; Jamestown, Virginia, 1612; Maryland, 1631. Tobacco soon became the chief commodity exchanged by the colonists for European manufactured articles.

Overproduction was an economic problem from the beginning. After the American Revolution tobacco culture expanded from the colonial areas in Virginia and Maryland into Kentucky, Tennessee, North Carolina, Ohio, and Missouri. Tobacco leaves were originally air-cured—left to dry in a barn or shed for several weeks. Later, smoke from a wood fire was used (fire curing), thereby enabling the leaf to withstand long ocean voyages by sailing ship. About 1825 the fire-curing method was modified in parts of Virginia and North Carolina by the use of charcoal, which eliminated the effect of smoke on the taste and aroma of the leaf. The method was further modified after the American Civil War by the introduction of a furnace with metal flues.

A light, air-cured leaf known as White Burley appeared about 1864, after a farmer in Brown County, Ohio, found individual tobacco plants that were deficient in green colouring. These plants, when cured, manifested a light yellowish-red colour, and the cured leaf was porous, extremely absorptive, and highly suitable for use in manufacturing mixtures for chewing and smoking. It has also been suitable for use in manufacturing the popular American blended cigarette.

Common tobacco may grow to a height of 4 to 6 feet (1 to 2 m) when not topped. The flowers, which are borne in a panicle and are normally self-fertilizing, are usually pink but may be carmine or white. The leaves of some of the large varieties may reach a length of 2 to 3 feet, with a width of about half the length; but some of the Turkish, or Oriental, kinds, as grown commercially, may be less than 3 inches (7.6 cm) long.

*N. rustica* varies from 2 to 4 feet in height and usually develops suckers, or axillary shoots. The leaves are thick and broadly oval; the flowers are pale yellow to greenish. Both common tobacco and *N. rustica* have an epidermal covering of hairs, some of which are glandular and secrete a viscid liquid. Both species may have a high alkaloid content; that of *N. rustica* tends to be higher.

Nicotine (*q.v.*) occurs in tobacco along with related alkaloids and organic acids such as malic and citric. Nicotine content is determined by the species, variety, and strain of tobacco; the growing conditions, particularly soil and climate; the methods of culture and cure; and the position on the plant from which the leaves are taken (lower leaves usually have less nicotine). There is considerable variation in commercial tobacco, but on average the dark, air-cured and fire-cured types contain 4 to 4.5 percent nicotine; cigar filler and Burley contain 3.5 to 4 percent; flue-cured, 2.5 to 3 percent; Maryland, 2 percent; and Turkish, less than 2 percent. *N. rustica* has been grown with up to 10 percent nicotine in the leaf. During the fermentation or aging process, there is a loss in nicotine. In cigar tobaccos, which are subjected to a heavy fermentation, one-half or more of the nicotine may disappear.

Tobacco is high in ash content, which ranges from 15 to 25 percent of the leaf on a water-free basis. Flue-cured tobacco is rich in sugar, the cigarette grades having 15 to 20 percent or more. Cigar tobaccos are high in nitrogenous compounds but are almost free of starch and sugars.

If leaf tobacco is not bought in ready-stemmed form, the first step in turning it into a product that the consumer can smoke, chew, or take as snuff is to remove midribs (central veins). For most products, manufacturers blend leaf of various types, origins, grades, and crop years to obtain the qualities that they require and to assure uniformity over the years. Cigarette manufacturers usually add sweetening preparations and flavourings and process the tobacco in a variety of secret ways before it is fed, as finely shredded rag, into the cigarette-making machines. Preparation of tobaccos for pipe smoking and chewing is as varied as the assortment of these products. Their manufacture may involve the incorporation of additives and the application of pressure and heat. Snuff is usually made by fermenting fire-cured leaf and stem, and grinding it; salts and flavourings may be added. Cigars are made by wrapping a binder leaf around a bunch of cut filler leaf and overwrapping with a fine wrapper leaf; on all but the finest cigars the work is largely mechanized.

In the United States and increasingly elsewhere, stems and scrap are used for nicotine extractions or are ground down and made into reconstituted sheet in a process akin to papermaking. The sheet may be used as a substitute cigar binder or, more rarely, as wrapper, or it may be finely cut and used to supplement natural tobacco in cigarettes. *See also* chewing tobacco; cigar; cigarette; smoking; snuff.

**Tobacco Nation,** also called TOBACCO INDIANS: *see* Tionontati.

**Tobey, Mark** (b. Dec. 11, 1890, Centerville, Wis., U.S.—d. April 24, 1976, Basel, Switz.), American painter whose work is characterized by a rhythmical, abstract calligraphy, usually white on a dark ground.

Tobey studied at the School of the Art In-

stitute of Chicago and worked for a time as a fashion illustrator and portraitist in New York City. His conversion to the Bahāʾī faith in 1918 marked the beginning of a lifelong interest in non-Western spirituality.

Tobey's mature painting style evolved after a visit to East Asia in 1934, during which time he spent one month in a Zen monastery in Kyōto and studied Chinese calligraphy in Shanghai. The calligraphic influence first manifested itself in the tangled brushwork of his cityscapes of the 1930s (*e.g.*, "Broadway," 1936), and Tobey went on to develop a unique style consisting of a web or network of calligraphic marks painted in white against a gray or coloured ground. This "white writing" soon displaced all realistic representation in his work. Tobey's works are small in size by modern American standards, and the cool refinement of their primarily watercolour, tempera, or pastel surfaces further distinguishes them from those of his contemporaries.

**Tobin, James** (b. March 5, 1918, Champaign, Ill., U.S.—d. March 11, 2002, New Haven, Conn.), American economist whose contributions to the theoretical formulation of investment behaviour offered valuable insights into financial markets. His work earned him the Nobel Prize for Economics in 1981.

After taking degrees from Harvard University (B.A., 1939; Ph.D., 1947), Tobin spent 1941–42 as an economist with the Office of Price Administration in Washington, D.C. During World War II he served in the Naval Reserve, rising to second in command of the destroyer USS *Kearney*. In 1950 he joined the faculty of Yale University, where in 1957 he became the Sterling Professor of Economics. In addition to teaching, he served as director of the Cowles Foundation for Research in Economics (1955–61 and 1964–65).

Tobin, regarded by many as the most distinguished American Keynesian economist, argued that monetary policy is effective in only one area—capital investment—and that interest rates are an important factor in capital investment but not the only one. He introduced "Tobin's *q*," the ratio of the market value of an asset to its replacement cost. If an asset's *q* is greater than one, then new investment in similar assets will be profitable.

Tobin served as an adviser to Democratic presidential candidate George McGovern in 1972. Like many economists across the political spectrum, he pointed out the harmful consequences of government policies, such as the effect of a high minimum wage on the job prospects for inner-city youths. Among his publications are *The American Business Creed* (with others, 1961), *National Economic Policy* (1966), *Essays in Economics*, 3 vol. (1971–82), and *The New Economics One Decade Older* (1974).

**Tobit,** also called THE BOOK OF TOBIAS, apocryphal work (noncanonical for Jews and Protestants) that found its way into the Roman Catholic canon via the Septuagint. A religious folktale and a Judaicized version of the story of the grateful dead, it relates how Tobit, a pious Jew exiled to Nineveh in Assyria, observed the precepts of Hebrew Law by giving alms and by burying the dead. In spite of his good works, Tobit was struck blind.

Concurrent with Tobit's story is that of Sarah, daughter of Tobit's closest relative, whose seven successive husbands were each killed by a demon on their wedding night. When Tobit and Sarah pray to God for deliverance, God sends the angel Raphael to act as intercessor. Tobit regains his sight, and Sarah marries Tobit's son Tobias. The story closes with Tobit's song of thanksgiving and an account of his death.

The book is mainly concerned with the problem of reconciling evil in the world with divine justice. Tobit and Sarah are pious Jews unaccountably afflicted by malevolent forces, but their faith is rewarded, and God is vindicated as both just and omnipotent. Other themes are the need for Jews living outside Palestine to observe religious law strictly and the promise of the restoration of Israel as a nation.

Historical inaccuracies, archaisms, and confused geographic references indicate that the book was not actually written at Nineveh in the early 7th century BC. Rather, its emphasis on the burial of the dead suggests it was written, possibly at Antioch, during the reign (175–164 BC) of Antiochus IV Epiphanes of Syria, when Jews faithful to their religion were forbidden to bury their dead.

**tobogganing,** the sport of sliding down snow-covered slopes and artificial-ice-covered chutes on a runnerless sled called a toboggan. In Europe, small sleds with runners are also called toboggans (*see* lugeing; skeleton sledding).



Tobogganing
Authenticated News International

The runnerless toboggan was originally an American Indian sled made of poles tied together with thongs. The modern version is usually built of thin, straight-grained boards of hickory, birch, or oak fastened together by light crosspieces. Some are made of metal or laminated wood. The front end is bent up and back to form the hood and is braced by rope or leather thongs. The flat sliding surface is generally about 18 inches (45 cm) wide and from 4 to 9 feet (1.2 to 2.7 m) long. The toboggan is light in weight and will support a heavy load on soft snow. It is well adapted to sliding down open slopes, where its large surface rides easily on loose, fluffy snow. Several persons can ride at one time, either lying prone or in a sitting position. The toboggan can be steered by lifting and twisting the front or by dragging a foot in the snow. It is also useful for hauling loads over wilderness trails or cross-country as well as for sport.

Tobogganing as a sport probably originated on the slopes of Mount Royal in Montreal. During the late 1880s it spread to the United States, where it had considerable popularity until the early 1930s, when widespread enthusiasm for skiing brought about its popular decline. During the heyday of tobogganing, many artificial chutes were constructed. They were about 3 feet (about 1 m) wide with sides of ice or wood and frequently were built with several parallel tracks to accommodate more than one toboggan at a time. The chutes were quite steep at the top in order to accelerate the toboggan quickly. Speeds up to 60 miles (96.6 km) per hour were attained.

World competition sledding is frequently described as tobogganing, but it actually involves bobsledding (*q.v.*), lugeing, and skeleton (Cresta) sledding as well.

**Tobol River,** river, left-bank tributary of the Irtysh River, flowing through northern Kazakhstan into southern Russia. After rising in the low mountains of the Turgay Plateau, it flows northeast across the West Siberian Plain past the cities of Kustanay (Kazakhstan) and Kurgan (Russia) before entering the Irtysh River at Tobolsk after a course of 989 miles (1,591 km). Its main tributaries are the Ubagan River in the upper reaches and the Iset, Tura, and Tavda rivers in the lower reaches. It has a drainage basin of 164,500 square miles (426,000 square km). The Tobol is frozen from November to April, and high water occurs in spring. Its Karatamar Reservoir supplies water to the iron-ore industry of Rudny in Kazakhstan.

**Tobolsk,** city, Tyumen *oblast* (province), northwestern Russia. It lies at the confluence of the Irtysh and Tobol rivers. Founded in 1587, it was one of the chief centres of early Russian colonization in Siberia because it lay along an important river route to the east, but it declined when bypassed by the Trans-Siberian Railroad in the 1890s. Today it is a river port and station on the Tyumen-Surgut railway. One of Russia's largest petrochemical complexes, using natural-gas liquids from the West Siberian oil fields, is located there. Pop. (2000 est.) 97,100.

**Tobruk,** also spelled TUBRUQ, port, northeastern Libya. It was the site of Antipyrgos, an ancient Greek agricultural colony, and thereafter of a Roman fortress guarding the Cyrenaican frontier. The town later became a way station on the coastal caravan route. Because it is Libya's only natural harbour, Tobruk was occupied by the Italians as early as 1911 and was subsequently used as a naval and air base for their military operations to the south.

During World War II Tobruk changed hands several times and was the focus of some of the most prolonged fighting in the North African theatre of operations. The British captured the port from the Italians in January 1941, taking 25,000 prisoners in the process. The British were then forced by the Germans to withdraw to the east, leaving Tobruk an isolated British garrison that was periodically besieged by the Germans from March 1941 to June 1942, when the Germans captured the city, taking about 35,000 Allied troops prisoner and capturing immense quantities of matériel. The British finally recaptured Tobruk on Nov. 13, 1942, after their el-Alamein offensive.

Tobruk was subsequently rebuilt and became the residence of Libya's king, Idris, until his overthrow in 1969. It was expanded in the 1960s by the building of Marsā al-Ḥarīqah (Marsa el-Hariga), a port terminal linked by pipeline to the Sarir oil field, 320 miles (515 km) south. The British base at al-ʿAdam to the south was evacuated in 1970. British, French, and German war cemeteries are nearby. Tobruk lies on a coastal highway that connects Tripoli with Banghāzī and Cairo. Pop. (1990 est.) 92,000.

**Tocantins,** inland *estado* ("state") of north-central Brazil. A part of the sparsely settled Central-West region, Tocantins is bounded by the states of Maranhão and Piauí to the northeast, Bahia to the east, Goiás to the south, Mato Grosso to the west, and Pará to the northwest. Tocantins was created from the northern half of Goiás (*q.v.*) state in 1989. Its area is 107,075 square miles (277,322 square km). The capital is Palmas.

The state lies in the Brazilian Highlands at elevations between 330 and 1,300 feet (100 and 400 m) above sea level. It is drained northward by the Araguaia and Tocantins rivers, which have cut deep valleys. The highlands of the state are covered with woodland savanna, and the river valleys support dense semideciduous forest. The northern tip of Tocantins is covered with tropical rain forest.

The climate is generally subtropical. There is only a small variation in average monthly temperature, and the average annual temperature is 75° F (24° C). The average annual rainfall is about 59 inches (1,500 mm), and precipitation falls mostly between October and March.

Tocantins is a developing frontier area, and its inhabitants historically have been mostly of Indian and mixed European-Indian ancestry. The growing of rice, corn (maize), and soybeans and the raising of cattle are the main economic activities. The state's mineral resources include bauxite, limestone, tin, gypsum, and gold. The major towns are Araguaína, Gurupi, Pôrto Nacional, and Palmas. Araguaína and Gurupi are connected by paved roads north to Belém and south to Brasília. Pop. (1995 est.) 1,007,000.

**Tocantins River,** Portuguese RIO TOCANTINS, river that rises in several headstreams, including the Paranã and Maranhão rivers, on the central plateau in Goiás state, Brazil. It flows northward through Goiás and then Tocantins states until it receives the Manuel Alves Grande River. Looping westward, it marks the boundary of Tocantins and Maranhão states as far as its junction with the Araguaia River. The Tocantins again turns northward and flows into the Pará River, a navigable arm of the Amazon River delta, which empties into the Atlantic Ocean. The Tocantins is of little use for navigation, for its 1,677-mile (2,699-kilometre) course is frequently interrupted by rapids and waterfalls.

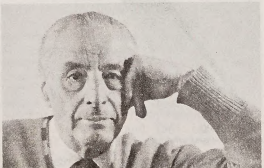
**toccata,** musical form for keyboard instruments, written in a free style that is characterized by full chords, rapid runs, high harmonies, and other virtuoso elements designed to show off the performer's "touch."

In the late 16th century in Venice such composers as Giovanni Gabrieli and Claudio Merulo wrote organ toccatas (many with such titles as *Fantasia* and *Intonazione*), often achieving a majestic virtuosity by means of florid scale passages, embellishments, unsteady rhythms and harmonies, changes of mood, and freedom of tempo. Merulo initiated the later common practice of alternating fugal sections (using melodic imitation) with rapid toccata passages. In Rome, Girolamo Frescobaldi (d. 1643) composed toccatas that consisted of highly improvisatory sections loosely strung together, marked by sudden changes in harmonies and figuration. They were intended to be played with a free tempo and could be performed in their entirety or in one or more sections. Frescobaldi's German pupil Johann Jakob Froberger was an important transmitter of the style to Germany. Like his teacher, Froberger delighted in the use of chromatic harmonies (using notes foreign to the mode of the piece); and, like Merulo, he characteristically placed a contrasting fugal section between introductory and closing passages in toccata style.

The juxtaposition of improvisatory and fugal passages—which appealed to the Baroque fascination with the union of opposites—became a prominent feature of the toccatas of the organist-composers of north Germany, culminating in the works of Dietrich Buxtehude and, later, J.S. Bach. Buxtehude's toccatas, in contrast to, for example, those of Frescobaldi, are shaped by an underlying formal structure. Two, even three, fugal sections often alternate with toccata passages, and the fugue subjects are frequently variations of a basic motif. In the late Baroque era, as in a number of works of J.S. Bach, the association of the two opposite styles often took the form of an improvisatory first movement (termed prelude, toccata, fantasia, etc.) followed by a fugue, as in Bach's *Toccata and Fugue in D Minor,* BWV 565, for organ. Toccatas were occasionally composed after the Baroque era ended, a notable example being the third section of Claude Debussy's suite *Pour le piano* (composed 1896–1901).

**Toccoa,** city, seat (1905) of Stephens county, northeastern Georgia, U.S. It lies on the Dahlonega Plateau, northwest of Hartwell Dam and Lake near the South Carolina boundary. Laid out in 1873, it lies at the edge of Chattahoochee National Forest in a prosperous agricultural area. The city has some industry, including the manufacture of textiles, heavy machinery, furniture, and caskets. Toccoa Falls College (formerly Institute) was established in 1907 as an independent Christian school. Toccoa (from Cherokee *toccoa,* "beautiful") Falls, a cascade 186 feet (57 m) high on Toccoa Creek, is on the campus. In November 1977 the Kelley Barnes earthen dam on the creek burst after torrential rains and flooded the campus, killing 39 persons. Inc. 1875. Pop. (1994 est.) 8,813.

**Toch, Ernst** (b. Dec. 7, 1887, Vienna, Austria—d. Oct. 1, 1964, Los Angeles, Calif., U.S.), composer whose works, noted for their perfection of form, fused elements from the classical tradition with modern musical ideas. Although he rarely carried innovation to great lengths, he was considered a leader of the avant-garde composers in pre-Nazi Germany



Toch
By courtesy of Archiv B. Schott's Söhne, Mainz, Ger.

and, like many of them, went into exile when Adolf Hitler came to power. A pianist of concert stature, Toch wrote for that instrument sonatas, études, and a concerto (1926)—a considerable part of his creative output.

In 1909 Toch won the Mozart Prize, which enabled him to study piano at Frankfurt am Main. As a composer he was self-taught. From 1929 to 1933 he taught piano and composition in Berlin. He went on a concert tour of the United States in 1932 and taught composition at the New School for Social Research in New York from 1934 to 1936 and at the University of Southern California in Los Angeles from 1937 to 1948. After that he taught privately and made several European concert tours. He lived in Switzerland from 1950 to 1958, then spent the remainder of his life in Los Angeles. Toch was a teacher of considerable influence; a number of his students, including André Previn, became eminent composers.

His orchestral works are often of a humorous character, notably the *Bunte Suite* (1929). In spite of the largely traditional nature of his style, he experimented at times with new devices, as in his *Gesprochene Musik* (*Spoken Music*) for spoken voices (1930). He wrote chamber music, several chamber operas, and music for films. Of his five symphonies, the *Third* (1956) won a Pulitzer Prize. He published two theoretical works, *Melodielehre* (1923; "Melodic Theory") and *The Shaping Forces in Music* (1948).

**Tocharian languages,** Tocharian also spelled TOKHARIAN, a small group of extinct Indo-European languages that were spoken in the Tarim River Basin (in the centre of the modern Uighur Autonomous Region of Sinkiang, China) during the latter half of the 1st millennium AD.

A brief treatment of the Tocharian language follows. For full treatment, *see* MACROPAEDIA: Languages of the World: *Tocharian languages*.

Documents dating to AD 500–700 attest to two languages: Tocharian A, from the area of Turfan in the east, and Tocharian B, chiefly from the region of Kucha in the west but also from the Turfan area. The Tocharian languages are written in a northern Indian syllabary (a set of characters representing syllables) known as Brāhmī, which was also used in writing Sanskrit manuscripts from the same area. The first successful attempt at grammatical analysis and translation was made by the German scholars Emil Sieg and Wilhelm Siegling in 1908. The German name Tocharisch was proposed, and the language was shown to be Indo-European.

Tocharian forms a branch of the Indo-European language family not closely related to Indo-Aryan or Iranian but showing an affinity with such languages as Latin and the Germanic languages. Tocharian differs greatly from almost all other Indo-European languages in that, in the former, all the Indo-European stops of each series fall together in a system of three (voiceless) stops, *p, t,* and *k* (the same merger is found, independently, in some Anatolian languages). The Tocharian verb reflects the Indo-European verbal system both in stem formations and in personal endings. The noun shows somewhat less of its Indo-European origins. Most of the attested cases are built up by the addition of postpositions to the accusative form. The vocabulary shows the influence of Iranian and Sanskrit (the latter language particularly has been the source of Buddhist terminology). Tocharian literature is Buddhistic in content, with a large portion of philosophical, didactic, and canonical works. In Tocharian B there are also commercial documents, such as monastery records, caravan passes, medical and magical texts, and the like. These are important source materials for the social, economic, and political life of Central Asia.

Despite its historical position on the eastern frontier of the Indo-European world and the obvious lexical influence of Indo-Aryan and Iranian, Tocharian seems more closely allied linguistically with languages of the Indo-European northwest, particularly Italic and Germanic, in the matter of common vocabulary and certain verbal categories. To a lesser extent Tocharian would appear to share certain features with Balto-Slavic and Greek. With regard to the two Tocharian languages themselves, it is possible that Tocharian A was, at the time of documentation, a dead liturgical language preserved in the Buddhist monasteries in the east, whereas Tocharian B was a living language in the west (note that commercial or at least nonliturgical documents are found in that language). The presence of manuscripts in B mixed with those in A in the monasteries of the east can be accounted for by ascribing the B manuscripts to a new missionary initiative by Buddhist monks from the west.

*Consult the* INDEX *first*

**Tochigi,** *ken* (prefecture), Honshu, Japan, in the northern Kantō *chihō* (region). It occupies an area of 2,476 square miles (6,414 square km). The eastern border with Ibaraki prefecture is formed by Mount Yamizo and associated mountains. Western Tochigi prefecture is occupied by the Ashio Highlands and



Winding road on the Iroha Slope near Nikkō, Tochigi prefecture, Japan
Tsuneo Iwata—Bon

bordered by the mountains associated with Mounts Taishaku and Shirane. The Ashio Highlands are the site of the resorts of Nikkō, Shiobara, and Kawaji. Nikkō National Park in Tochigi contains Lake Chūzenji. The main river in the prefecture, the Kinu River, runs longitudinally between the eastern and western mountain groups.

Major agricultural products of the prefecture are rice, vegetables, tobacco, hemp, and wax gourds. Cattle are also raised. There is some mining in the Ashio Highlands, yielding copper and manganese. Traditional industries include the manufacture of ceramics, while modern industry produces automobiles, processed foods, and electric appliances. Major cities include Utsunomiya, the prefectural capital, and the commercial and industrial centre of Tochigi prefecture. The Keihin Industrial Zone spread to prefectures in the northern Kantō region, including Tochigi, during the 1960s. Pop. (1987 est.) 1,892,000.

**Tocopilla,** capital of Tocopilla *provincia,* Antofagasta *región,* northern Chile, situated on the Pacific coast. Founded in about 1850, it developed as a shipping point for copper mined inland. Now it is a major port and rail terminus for the nitrate and iodine mined at nearby María Elena and Pedro de Valdivia and for the copper mined at Chuquicamata, 93 miles (150 km) east. Hydroelectric power for Chuquicamata is generated in Tocopilla, where there is a copper-concentrate plant. Tocopilla is also known for its deep-sea fishing. It possesses an airport and is linked by road to the Pan-American Highway and the main north–south railroad. Pop. (1987 est.) 22,109.

**Tocqueville, Alexis (Charles-Henri-Maurice Clérel) de** (b. July 29, 1805, Paris—d. April 16, 1859, Cannes, Fr.), political scientist, historian, and politician, best-known for *Democracy in America,* 4 vol. (1835–40), a perceptive analysis of the political and social system of the United States in the early 19th century.

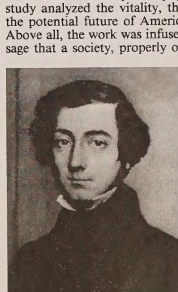
*Early life.* Tocqueville was a great-grandson of the statesman Chrétien de Malesherbes, a liberal aristocratic victim of the French Revolution and a political model for the young Tocqueville. Almost diminutive in stature, acutely sensitive, and plagued by severe bouts of anxiety since childhood, he remained close to his parents throughout his life.

Given the choice of a variety of careers, Tocqueville chose the one most congenial to him: that of politician. Despite a frail voice in a fragile body, distaste for the daily demands of parliamentary existence, and long periods of illness and nervous exhaustion, he adhered to his original choice until he was driven from office. His decision in favour of a public career was made with some assurance of success. His father was a loyal royalist prefect and in 1827 was made a peer of France by Charles X. At that time, young Tocqueville moved easily into government service as an apprentice magistrate. There he prepared himself for political life while observing the impending constitutional confrontation between the Conservatives and the Liberals with growing sympathy for the latter. He was strongly influenced by the lectures of the historian and statesman François Guizot, who asserted that the decline of aristocratic privilege was historically inevitable. And finally, after the manner of Liberals under the autocratic regime of the restored Bourbon kings, Tocqueville began to study English history as a model of political development.

He entered public life in the company of a close friend who was to become his alter ego—Gustave de Beaumont. Their life histories are virtual mirror images. Of similar backgrounds and positions, they were companions in their travels in America, England, and Algeria, coordinated their writings, and ultimately entered the legislature together.

The July Revolution of 1830 that put the "citizen king" Louis-Philippe of Orléans on the throne was a turning point for Tocqueville. It deepened his conviction that France was moving rapidly toward complete social equality. Breaking with the older liberal generation, he no longer compared France with the English constitutional monarchy but with democratic America. Of more personal concern, despite his oath of loyalty to the new monarch, his position had become precarious because of his family ties with the ousted Bourbon king. He and Beaumont, seeking to escape from their uncomfortable political situation, asked for and received official permission to study the uncontroversial problem of prison reforms in America. They also hoped to return with knowledge of a society that would mark them as especially fit to help mold France's political future.

*Visit to the United States.* The two men spent nine months in the United States during 1831 and 1832, out of which came first their joint book, *Du système pénitentiaire aux États-Unis et de son application en France* (1833; *On the Penitentiary System in the United States and Its Application in France*); Beaumont's *Marie, ou l'esclavage aux États-Unis* (1835; *Marie, or Slavery in the United States*), on America's race problems; and the first part of Tocqueville's *De la démocratie* (1835–40; *Democracy in America*). On the basis of observations, readings, and discussions with a host of eminent Americans, Tocqueville attempted to penetrate directly to the essentials of American society and to highlight that aspect—equality of conditions—that was most relevant to his own philosophy. Tocqueville's study analyzed the vitality, the excesses, and the potential future of American democracy. Above all, the work was infused with his message that a society, properly organized, could hope to retain liberty in a democratic social order.



Tocqueville, detail of an oil painting by T. Chassériau; in the Musée de Versailles
H. Roger-Viollet

The first part of *De la démocratie* won an immediate reputation for its author as a political scientist. This period quite probably was the happiest and most optimistic of his life. Tocqueville was named to the Legion of Honour, the Academy of Moral and Political Sciences (1838), and the French Academy (1841). With the prizes and royalties from the book, he even found himself able to rebuild his ancestral chateau in Normandy. Within a few years his book had been published in England, Belgium, Germany, Spain, Hungary, Denmark, and Sweden. In the United States, while it was sometimes viewed as having been derived from politically biased sources, it was soon accorded the status of a classic. In 1836 Tocqueville married Mary Mottely, an Englishwoman.

Tocqueville spent four more years working on the final portion of *De la démocratie,* which was published in 1840. Its composition took far longer, moved farther afield, and ended far more soberly than Tocqueville had originally intended. American society slid into the background, while Tocqueville now attempted to complete a picture of the influence of equality itself on all aspects of modern society. France increasingly became his principal example, and what he saw there altered the tone of his work. He observed the curtailment of liberties by the Liberals, who had come to power in 1830, as well as the growth of state intervention in economic development. Most depressing to him was the increased political apathy and acquiescence of his fellow citizens in this rising paternalism. His chapters on democratic individualism and centralization in *De la démocratie* contained a new warning based on these observations. A mild, stagnant despotism now seemed to him democracy's greatest danger.

*First political career.* This was also the period in which Tocqueville fulfilled his lifelong ambition to enter politics. He lost his first bid for the Chamber of Deputies in 1837, but he won the following election in 1839. Eventually, Tocqueville built up an enormous personal influence in his constituency. He won every election after the first by more than 70 percent of the vote and became president of his departmental council (a local representative body). At the level of local politics his quest for preeminence was completely fulfilled, but his need for uncompromised dignity and independence deprived him of influence in the Chamber of Deputies for a much longer time. He was not able to follow the leadership of others, nor did his oratorical style win him quick recognition as a leader himself. As a result, he had no major legislative accomplishment to his credit during the reign of Louis-Philippe. His speech prophesying revolution only a few weeks before it took place in February 1848 fell on deaf ears. The biting sketches of friend, foe, and even himself in his *Souvenirs* (1893; "Recollections") reflect his feeling of the general mediocrity of political leadership before and after 1848.

*Revolution of 1848.* The February Revolution brought about a new political situation for France and for Tocqueville. Having for years decried apathy as the chief danger for France, Tocqueville recognized even before the revolution that France was faced with a politically awakened working class that might well propel French politics into socialist and revolutionary channels. Tocqueville considered economic independence as necessary to the preservation of his own intellectual independence. He thus viewed pressures of the dependent poor for state welfare, and of the unemployed for state employment, as the initial steps to a universal and degrading dependence on the state by all

social classes. Unsympathetic to revolutionaries and contemptuous of socialists before the revolution, Tocqueville opposed the demands of the Parisian workers during the June days of 1848, when their uprising was bloodily suppressed by the military dictator Gen. Louis Cavaignac, as well as in the debates over the constitution of 1848. The only intellectual change produced in Tocqueville by the events of 1848 was a recognition of the strength of socialist ideas and of the problematic nature of the proprietary society. But while he had sought to reconcile the aristocracy to liberal democracy in *De la démocratie,* he rejected social democracy as it emerged in 1848 as incompatible with liberal democracy.

Politically, Tocqueville's own position was dramatically improved by the February Revolution. His electorate expanded from 700 to 160,000 under universal manhood suffrage. He was elected as a conservative Republican to the Constituent Assembly by 79 percent of the voters and again in 1849 by more than 87 percent. Along with Beaumont, he was nominated to the committee that wrote the constitution of the Second Republic, and the following year he became vice president of the Assembly. He served as minister of foreign affairs between June and October of 1849. During his short tenure he worked cautiously to preserve the balance of power in Europe and to prevent France from extending its foreign involvements. His speeches were more successful and his self-confidence soared, but the results gave him little more durable satisfaction than those he had attained during the July monarchy under Louis-Philippe.

In June 1849 a government crisis produced by French armed intervention to restore papal authority in Rome was the occasion for Tocqueville's brief appointment to the Ministry of Foreign Affairs. Shortly after his dismissal from the ministry by Pres. Louis-Napoléon Bonaparte in October 1849 he suffered a physical collapse. After a slow recovery he performed a final service for the Second French Republic. As reporter for the constitutional revision committee he attempted to avert the final confrontation between the President and the legislature, which ended with an executive seizure of dictatorial power. Briefly imprisoned for opposing Louis-Napoléon's coup d'état on Dec. 2, 1851, Tocqueville was deprived of all political offices for refusing his oath to the new regime. He was thrown back on a small circle of political allies and friends and felt a deeper sense of isolation and political pessimism than ever before.

*Return to politics.* Seeking to reenter politics, he reverted to the strategy of his youthful success—the publication of a book on the fundamental themes of liberty and equality. This time he chose as his subject the French Revolution. *L'Ancien Régime et la Révolution* (*The Old Regime and the Revolution*) appeared in 1856, after years of research and intermittent illness, as the first part of his projected study. In this work, Tocqueville sought to demonstrate the continuity of political behaviour and attitudes that made postrevolutionary French society as prepared to accept despotism as that of the old regime. In this final study the traumatic events of the years 1848–51 were clearly the source of his emphasis on the durability of centralization and class hostility in French history. France seemed less the democratic society of the future he had glimpsed in America than the prisoner of its own past. Against the pessimism of his analysis of French political tendencies, *L'Ancien Régime* reaffirmed the libertarian example of the Anglo-American world. The acclaim that greeted this study briefly dispelled the gloom of his last years. Once again his book made him a public figure. His visit to England in 1857, culminating in an audience with the Prince Consort, was the last public triumph of his life. He returned to his work; but before he could finish his study of the Revolution, he collapsed and died.

*Reputation.* Tocqueville's reputation in the 19th century reached its high point during the decade following his death, as the great European powers accommodated themselves to universal suffrage. He died just at the onset of a revival of liberalism in France. The nine-volume publication of his works, edited by Beaumont (1860–66), was received as the legacy of a martyr of liberty. In England his name was invoked during the franchise reform debates of the 1860s, and in Germany it was linked to controversies over liberalization and federalization in the years preceding the empire devised by Bismarck. After 1870 his influence began to decline, a process not substantially reversed either by the posthumous publication of his *Souvenirs* in 1893 or that of his correspondence with his friend, the diplomatist and philosopher Arthur de Gobineau. By the turn of the century he was almost forgotten, and his works were generally regarded as outdated classics. They seemed too abstract and speculative for a generation that believed only in ascertained knowledge. Moreover, Tocqueville's prediction of democracy as a vast and uniformly levelling power seemed to have miscarried by not foreseeing both the extent of the new inequalities and conflicts produced by industrialization and those produced by European nationalisms and imperialism. The classless society had failed to appear in Europe; and America seemed to have become European by becoming nationalist and imperialist rather than vice versa. In France, Tocqueville's name was too closely identified with a narrowly defined Liberal tradition, which rapidly lost influence during the Third Republic. While his work as an innovative historian was acknowledged, it is significant that the revival of his ideas and reputation as a political sociologist owes so much to American, English, and German scholarship.

The 20th-century totalitarian challenge to the survival of liberal institutions produced by two world wars and by the Great Depression of the 1930s fostered a "Tocqueville renaissance." The outdated facts of his books seemed less significant than the political philosophy implicit in his search to preserve liberty in public life and his strategies for analyzing latent social tendencies. His work was found to display a wealth of fruitful philosophical and sociological hypotheses. At a popular level, the renewed upsurge of social democracy of Europe after 1945 combined with the polarization of the Cold War to produce a view of Tocqueville in the West as an alternative to Marx as a prophet of social change. Again, as in the late 1840s and 1860s, Tocqueville rose to heights of popularity. Whether changes in social and intellectual climate will cause another levelling off only time will tell. It seems certain, however, that henceforth Tocqueville will continue to be invoked as an authority and inspiration by those sharing his contempt of static authoritarian societies as well as his belief in the final disappearance of class divisions and in liberty as the ultimate political value. (S.Dr.)

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**Toda,** also called TODAGA (Saharan people): *see* Teda.

**Toda,** pastoral tribe of the Nīlgiri Hills of southern India. Numbering only about 800 in the early 1960s, they were rapidly increasing in population because of improved health facilities. The Toda language is Dravidian but is the most aberrant of that linguistic stock.

The Toda live in settlements of from three to seven small thatched houses scattered over the pasture slopes; built on a wooden framework, the typical house has an arched roof in the shape of a half barrel. The Toda traditionally trade dairy products, as well as cane and bamboo articles, with the other Nīlgiri peoples, receiving Baḍaga grain and cloth and Kota tools and pottery in exchange. Kurumba jungle people play music for Toda funerals and supply various forest products.

Toda religion centres on the all-important buffalo. Ritual must be performed for almost every dairy activity, from milking and giving the herds salt to churning butter and shifting pastures seasonally. There are ceremonies for the ordination of dairymen-priests, for rebuilding dairies, and for rethatching funerary temples. These rites and the complex funeral rituals are the major occasions of social intercourse, when intricate poetic songs alluding to the buffalo cult are composed and chanted.

Polyandry is fairly common; several men, usually brothers, may share one wife. When a Toda woman becomes pregnant one of her husbands ceremonially presents her with a toy bow and arrow, thus proclaiming himself the social father of her children.

Some Toda pasture land has come under recent cultivation by other peoples and much of it has been reforested. This threatens to undermine Toda culture by greatly diminishing

the buffalo herds. A separate community of Toda (numbering 187 in 1960) converted to Christianity during the 20th century.

**Toda,** city, Saitama *ken* (prefecture), Honshu, Japan, on the alluvial plain of the Ara River. During the Tokugawa era (1603–1867) it was a post town and ferry station. The city is now linked to Tokyo city by bridge and has developed into an industrial suburb of the Tokyo-Yokohama metropolitan area. Pop. (1990) 87,600.

**Tōdai Temple,** Japanese TŌDAI-JI ("Great Eastern Temple"), monumental Japanese temple and centre of the Kegon sect of Japanese Buddhism, located in Nara. The main buildings were constructed between AD 745 and 752 under the emperor Shōmu and marked the adoption of Buddhism as a state religion. The temple was the largest and most powerful monastery in Japan during the Nara period (710–784). The Daibutsu (Great Buddha) Hall was built in the centre of a vast enclosure of some 2 square miles (5 square km) with gates, pagodas, subsidiary buildings, and colonnades. It was an enormous wooden building measuring some 288 by 169 feet (88 by 52 m) in ground plan. It housed a colossal seated bronze statue, the Daibutsu (Great Buddha), of Birushana Butsu (Vairocana), originally some 53 feet (16 m) high. The original building was destroyed in 1180, and the present Daibutsu Hall dates from the early 18th century. The building was renovated between 1974 and 1980; with a length of 187 feet (57 m), a width of 165 feet (50 m), and a height of 155 feet (47 m), it is still the largest wooden building in the world. The bronze statue has also undergone extensive restorations, the last of which was completed in 1692.

Among the three surviving structures of the Tōdai Temple is the Shōsō House, the main repository for the temple's most precious objects. The largest of the temple's repositories—and the sole extant example—it is a huge structure built on 40 pillars that are 8 feet (2.4 m) high. The main structure supported by them, 107 by 30 feet (33 by 9 m), is 46 feet (14 m) high and is covered with a hipped ridge roof of tiles; the front and two sides consist of timbers, triangular in cross section, laid horizontally one over another, giving a corrugated appearance. The Shōsō House treasure—the nucleus of which is a collection of more than 600 personal objects belonging to the emperor Shōmu—consists of about 9,020 works of fine and decorative art, which provide an eloquent picture of court life of the Nara period. The Shōsō House is not open to the public, but each autumn a selection of its treasures (all of which are now stored in fireproof concrete repositories) is put on display.

**Todd (of Trumpington), Alexander Robertus Todd, Baron** (b. Oct. 2, 1907, Glasgow, Scot.—d. Jan. 10, 1997, Cambridge, Eng.), British biochemist whose research on the structure and synthesis of nucleotides, nucleosides, and nucleotide coenzymes gained him the 1957 Nobel Prize for Chemistry.

After receiving doctorates from the universities of Frankfurt am Main (1931) and Oxford (1933), Todd held posts with the Lister Institute of Preventive Medicine, London, and the University of London before becoming professor of organic chemistry at the University of Manchester (1938–44) and then at Cambridge (1944–71), where he was also master of Christ's College (1963–78). He was named chancellor of the University of Strathclyde in 1975 and was visiting professor at Hatfield Polytechnic (1978–86).

While at Manchester he began work on nucleosides, compounds that form the structural units of nucleic acids (DNA and RNA). In 1949 he synthesized a related substance, adenosine triphosphate (ATP), which is vital to energy utilization in living organisms. He synthesized two other important compounds, flavin adenine dinucleotide (FAD) in 1949 and uridine triphosphate in 1954. In 1955 he elucidated the structure of vitamin $B_{12}$.

Todd also worked on the structure and synthesis of vitamin $B_1$, vitamin E, and alkaloid substances found in marijuana and hashish. He studied other alkaloids as well, plant and insect pigments, and mold products, including penicillin. He served as chairman (1952–64) of the British government's advisory committee on scientific policy, and in 1975 he was elected president of the Royal Society. Knighted in 1954, he was created a life peer in 1962 and made a member of the Royal Order of Merit in 1977.

**Todd, Michael,** byname MIKE TODD, original name AVROM HIRSCH GOLDBOGEN (b. June 22, 1909, Minneapolis, Minn., U.S.—d. March 22, 1958, near Grants, N.M.), American showman with a flair for the flamboyant who is remembered as a film producer for *Around the World in Eighty Days* (1956).

Todd made his first mark as a showman with a dancing revue at the Century of Progress exhibition in Chicago in 1933. He later wrote for the slapstick comedy team of Olsen and Johnson. Todd produced and cowrote many Broadway revues, beginning with *Call Me Ziggy* (1936). His later productions included *Hot Mikado* (1939), Gilbert and Sullivan set to jazz, productions for the 1939 World's Fair in New York City, *Something for the Boys* (1943), Cole Porter's *Mexican Hayride* (1944), and *Up in Central Park* (1945).

Todd promoted the development of the wide-screen film technique called Todd-AO, first used in the film version of *Oklahoma!* (1955). In October 1956 *Around the World in Eighty Days* in Todd-AO opened with a barrage of publicity generated by Todd. It won the Academy Award as best picture of the year.

Todd, who married his third wife, Elizabeth Taylor, in 1957, was killed in an airplane crash in 1958.

**Todd, Thomas** (b. Jan. 23, 1765, King and Queen county, Va. [U.S.]—d. Feb. 7, 1826, Frankfort, Ky.), associate justice of the United States Supreme Court (1807–26).

Todd was admitted to the bar in 1786 and gained his first legal and political experience as a clerk for several citizens' conventions called by the movement to separate Kentucky from its parent state, Virginia. After Kentucky achieved statehood, Todd served as the clerk of the state Court of Appeals until being named justice of the court in 1801. In 1806 he became chief justice. Much of the caseload before the Kentucky courts concerned land titles, and Todd's decisions served as the basis of the state's subsequent land policies.

In 1807 President Thomas Jefferson appointed Todd to the U.S. Supreme Court, where he became a follower of Chief Justice John Marshall in constitutional construction, although he was politically a supporter of Jefferson. He rendered few opinions on the court but was an invaluable resource to it on the land laws, a major national issue during his tenure on the bench.

**Todd River,** intermittent river in south-central Northern Territory, Australia. It rises in the MacDonnell Ranges and flows southeast for 200 miles (320 km), passing through Heavitree Gap and the town of Alice Springs and across sandhill country, eventually disappearing in the Simpson Desert. Its principal tributaries are the Trafina and Giles creeks. Surveyors for the Overland Telegraph Line named it in 1870 for Sir Charles Heavitree Todd, then postmaster general.

**toddy cat,** any of several arboreal palm civets. *See* civet.

**Todga** (people): *see* Teda.

**Todi,** ancient (Latin) TUDER, town and episcopal see, Perugia *provincia,* Umbria *regione,* central Italy, south of Perugia. The town, on a hill overlooking the Tiber River, is of ancient Umbrian origin and served as an Etruscan fortress before becoming the Roman Tuder. Its



Annunziata Cathedral, Todi, Italy
SCALA—Art Resource

extensive remains include an Etruscan necropolis, a Roman amphitheatre, theatre, and forum, and ancient and medieval town walls. The Palazzo del Popolo (1213–33) dates from Todi's period as an independent commune, as do the late 13th-century Palazzo del Capitano and the Palazzo dei Priori. The Romanesque and Gothic cathedral and the churches of San Fortunato (1292; 15th-century facade) and Santa Maria della Consolazione (1508–24) are also notable. Todi's manufactures include television sets and wrought-iron articles. Pop. (1993 est.) mun., 16,736.

**Todmorden,** town ("parish"), Calderdale district, metropolitan area of West Yorkshire, England, on the River Calder and the Rochdale Canal. Surrounded by high moorland, it is a junction for east-west rail routes across the Pennines. Industries formerly included cotton spinning (related to the cotton industry of neighbouring Lancashire); light engineering later was developed. Pop. (1991) 11,969.

**Todos os Santos Bay,** also called ALL SAINTS BAY, Portuguese BAÍA DE TODOS OS SANTOS, sheltered bay of the Atlantic Ocean, eastern coast of Brazil. A natural harbour, it is 25 miles (40 km) long and 20 miles (32 km) wide. Salvador, the principal seaport and capital of Bahia state, is on the peninsula that separates the bay from the Atlantic. Todos os Santos Bay receives the Paraguaçu River and is surrounded by the Recôncavo, a fertile coastal lowland. Its main channel is dredged from the Atlantic entrance to the port of São Francisco do Conde, an outlet for the petroleum refinery at Mataripe. Brazil's first producing oil field is on the bay's northeast shore between Candeias and Lobato.

Early in the 18th century, many African slaves were shipped to the bay region to work sugar plantations. The bay was named by its discoverer Amerigo Vespucci, the Italian navigator, who is said to have entered it on All Saints' Day, Nov. 1, 1501.

**tody,** any of five species of small, brilliantly coloured forest birds constituting the genus *Todus* of the order Coraciiformes. They occur in the West Indies. Four distinct but closely related broad-billed todies may be found on the islands of Cuba, Puerto Rico, Jamaica, and Hispaniola (some systems of classification group them in a single species, *Todus subulatus*). The fifth, the narrow-billed tody (*T. angustirostris*), is found only on His-

paniola. About 9 to 12 cm (3.5 to 5 inches) long, all have grass-green backs and bright red



Jamaican tody (*Todus todus*)
J.A.L. Cooke—Photo Researchers/EB Inc.

bibs. They dig tiny nest burrows in sandbanks and feed on insects, caught on the wing.

**Toeban** (Indonesia): *see* Tuban.

**Tōei Company, Ltd.,** leading Japanese motion-picture studio, the films of which are usually dramas and thrillers for children and rural audiences. Tōei was formed in 1951 from the Tōyoko and Ōizumi Studios and the Tokyo Motion Picture Distribution Company. By 1954 it was producing two full-length features a week by eliminating set changes and concentrating on action pictures.

Tōei was the first to set up a definite program for making wide-screen films and lent exhibitors the money to convert to wide-screen facilities. In the 1950s Tōei entered television broadcasting.

**Tofalar,** also called KARAGAS, KARAGA, or TUBALAR, Turkic-speaking people of southern Siberia who numbered about 800 in the mid-1980s. Their traditional habitat was the northern slopes of the Eastern Sayan Mountains, where they lived by nomadic hunting and reindeer breeding. Of all the peoples of Siberia, only the Tofalar failed to develop the technology of automatic traps, relying instead on pitfalls for the larger hooved animals. Since the mid-17th century they have been under powerful Russian cultural influence.

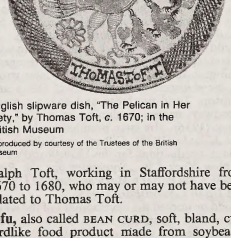
The Tofalar are of mixed origin; they are close to the Tuvinian in language, culture, and history. The languages of both peoples were originally Uralic, but in the last several centuries they have given way to Turkic languages and Russian. Little is known of Tofalar history before Russian contact.

Their traditional social organization was based on patrilineal clans. Members of the same clan did not marry one another. Both in social organization and in their shamanistic religion they were typical of indigenous Siberian peoples. The Soviet authorities collectivized them and settled them in permanent villages, and their economy is now based on cooperative fur farming. Their traditional tents (in winter of hide and in summer of birch bark) were replaced by wooden houses of Russian type. *See also* Tuvinian.

**Toft, Thomas** (fl. 1660–80), one of the most prominent of the English potters working in Staffordshire during the 17th century. The Staffordshire potters were known for the excellence of their slipware, a kind of coarse earthenware decorated with a coloured clay and water mixture of creamlike consistency called slip.

Toft was the first to add aluminous shale, or fireclay, a clay that can withstand high temperatures, to the paste for his earthenware. His work is characterized by restrained use of colour and unsophisticated, frequently amusing decoration. Toft ware bears designs in shades of red and brown, with small white dots adding liveliness. His themes include portraits of royalty, coats of arms, and emblems. His signature often appears on the wares. Toft's large plates and oven dishes are considered outstanding works of art. He also produced porringers, bowls, jars, cups, and candlesticks.

Several other Staffordshire potters working during the same period produced works showing the influence of Toft. This group includes




English slipware dish, "The Pelican in Her Piety," by Thomas Toft, *c.* 1670; in the British Museum
Reproduced by courtesy of the Trustees of the British Museum

Ralph Toft, working in Staffordshire from 1670 to 1680, who may or may not have been related to Thomas Toft.

**tofu,** also called BEAN CURD, soft, bland, custardlike food product made from soybeans. It is an important source of protein in the cuisines of China, Japan, Korea, and Southeast Asia. Tofu is believed to date from the Han Dynasty (206 BC–AD 220).

Tofu is made from dried soybeans that are soaked in water, crushed, and boiled. The mixture is separated into solid pulp (*okara*) and soy "milk." Coagulants such as calcium and magnesium chlorides and sulfates are added to the soy milk to separate the curds from the whey. The soy milk is poured into molds to allow the carbohydrate-laden whey to drain off. The resultant soft cakes are cut into squares and stored under water until sold, in bulk or in individual water-filled tubs.

Tofu is 6–8 percent protein and high in calcium, potassium, and iron. *Okara* and soy whey, the by-products of tofu manufacture, are also eaten. The skin that forms on top of the soy milk as it stands is removed and dried in sheets for use in vegetarian dishes. Tofu may be grilled, deep-fried, simmered, stir-fried, steamed, or eaten fresh. In China fermented bean curd is popular. Chinese tofu has a somewhat firmer texture and more pronounced taste than that favoured in Japan.

**toga,** characteristic loose, draped outer garment of Roman citizens. Adopted by the Romans from the Etruscans, it was originally worn by both sexes of all classes but was gradually abandoned by women, then by labouring people, and finally by the patricians themselves. Throughout the history of the empire, however, it remained the state dress, the garment of the emperor and high officials. Made from an oval-shaped piece of material, the toga had voluminous folds, requiring such skill to drape that often a special slave was retained for this operation. Because the mass of folds prevented active pursuits, the toga became the distinctive garment of the upper classes.

Colour and pattern were rigidly prescribed for most wearers. For example, senators and candidates wore white togas (*toga candida*); freeborn boys, until puberty, wore a purple-bordered toga (*toga praetexta*); after reaching puberty, adolescents began to wear the plain



Imperial Roman toga on Tiberius (reigned AD 14–37); in the Louvre, Paris
Giraudon—Art Resource/EB Inc.

man's toga (*toga pura,* or *toga virilis*); people in mourning wore dark colours (*toga pulla*); and for triumphs and, in the later period, for consuls, the toga was richly embroidered and patterned (*toga picta*). After about AD 100, the toga began to diminish in size.

**togavirus,** any of three genera of arthropod-borne viruses (arboviruses) of the family Togaviridae. Flaviviruses, once considered to be of the Togaviridae, are now designated as members of a separate family, Flaviviridae.

The togavirus genera are *Alphavirus,* which is carried by mosquitoes; *Rubivirus,* also called rubella, or German measles, virus; and *Pestivirus,* which infects only animals (hog cholera virus and bovine diarrhea virus). Some *Alphavirus* species produce severe encephalitis in humans. Horses also may be severely or fatally infected by equine encephalitis. *Rubivirus* is immunologically distinct from the other togaviruses (*see* rubella).

**Togbo** (people): *see* Banda.

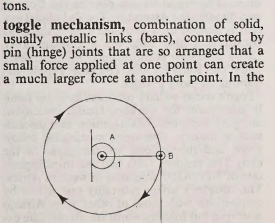
**Toggenburg,** breed of dairy goat originating in the Toggenburg valley of Switzerland. The oldest breed of dairy goat in the United States, the Toggenburg has proved widely adaptable. It is characterized by a comparatively small, solid-coloured body of any shade of brown, white ears with a dark central spot, two white stripes down the face, and predominantly white legs. As is that of other goats, milk of the Toggenburg is whiter and more easily digestible than cow's milk.

**Toggenburg Succession,** in Swiss history, a long territorial dispute that gave rise to the Old Zürich War (1436–50) and the Second Villmergen War (1712). In the Middle Ages the counts of Toggenburg, as vassals of the German kings or Holy Roman emperors, held extensive possessions in what is now northeastern Switzerland. When the male line of the dynasty died out in 1436, it left undecided the question of who would rule a large territory that was bounded to the west and to the southwest by Zürich, by Schwyz, and by Glarus—all three of which were members of the Swiss Confederation—and to the southeast by lands held by two of the three leagues later known collectively as the Grisons. While the southeasternmost part of the territory was taken over by the newly formed Zehngerichtenbund (League of Ten Jurisdictions), the rest of the inheritance was open to dispute: most

of the countship was assigned to the lords of Raron (in distant Valais); but the dependencies nearest to Lake Zürich and a tract to the east of them were promptly invaded by the men of Schwyz—to the fierce resentment of Zürich, which wanted at least to control the shore of the lake. A meeting of the Swiss confederates in 1437 authorized Schwyz and Glarus to retain nearly all the occupied zone; Zürich's rejection of this settlement led to the Old Zürich War, in which Schwyz, and later other members of the confederation, successfully opposed Zürich.

The main countship of Toggenburg, having been sold by the Raron to the prince-abbot of Sankt Gallen in 1468, was twice again a ground for discord: during the Swiss Reformation a period of anti-Catholic rule in the 1520s was followed, in 1531, by a restoration of the abbot's regime, subject to the toleration of Protestant observances in Toggenburg; and in 1712 the abbot Leodegar Bürgisser's efforts to reassert his feudal rights over Toggenburg in order to strengthen Swiss Catholicism provoked the leading Protestant confederates, Zürich and Bern, to undertake the Toggenburg (or Second Villmergen) War, in which they quickly defeated the Abbot's five Catholic supporters, Luzern, Uri, Schwyz, Unterwalden, and Zug. The final settlement, under which the ancient Toggenburg inheritance was divided between the secularized canton of Sankt Gallen and Graubünden (the Grisons areas), came in 1802–03, with Napoleon I's Act of Mediation for a new Switzerland of 19 cantons.

**toggle mechanism,** combination of solid, usually metallic links (bars), connected by pin (hinge) joints that are so arranged that a small force applied at one point can create a much larger force at another point. In the




Toggle mechanism

Figure, showing a toggle mechanism at work in a rock-crushing machine, the numbered links are pin-connected at A, B, C, D, and E. Rotation of link 1 about the fixed pivot A causes the block to slide back and forth. The relation between the force in link 2 acting at C and the force $W$ exerted on the block at D, and thus on the rock, depends on the angle symbolized by the Greek letter theta, $\theta$; the smaller the angle, the greater is $W$ in terms of $F$. For $\theta$ equal to one degree, $W$ is nearly 29 times $F$. Toggle mechanisms are used to obtain large force amplification in such applications as sheet metal punching and forming machines. *See also* linkage.

**Toghril Beg,** Toghrīl also spelled TUGHRIL (b. *c.* 990—d. Sept. 4, 1063, Rayy, Iran), founder of the Seljuq dynasty, which ruled in Iran, Iraq, Syria, and Anatolia during the 11th–14th centuries. Under his rule the Seljuqs assumed the leadership of the Islāmic world by establishing political mastery over the ʿAbbāsid caliphate in Baghdad.

The grandson of Seljuq, chief of the Oğuz tribes in the Jand region, Toghrīl, with his brother Chaghrī, entered Muslim Transoxania shortly before 1016, and in 1025 they and their uncle Arslan entered the service of the Turkish Qarakhanid prince of Bukhara. Defeated by Maḥmūd of Ghazna in the same year, Toghrīl and Chaghrī took refuge in Khwārezm (around the estuary of the Amu Darya [river], southeast of the Aral Sea), while Arslan settled in Khorāsān. Later, however, after their kinsmen in Khorāsān had been driven by Maḥmūd to western Iran, the two brothers themselves entered Khorāsān, where, having established close ties with the orthodox Muslim groups in the large towns, they subdued Merv and Nishāpūr (1028–29). Finally, in 1040 at Dandānqān, the Seljuqs inflicted a decisive defeat on Maḥmūd's son Mas'ūd. Khorāsān was then formed into a principality for Chaghrī, while Toghrīl was left free to conquer the Iranian plateau.

A methodical ruler, Toghrīl succeeded in building an empire by careful planning. The first conquests were generally made by the Turkmen raiders led by his foster brother Ibrāhīm Ināl. He himself then followed to administer the conquered territories. In this way, between 1040 and 1044, he occupied the Caspian areas of Khorāsān, Rayy, and Hamadan and established his suzerainty over Isfahan. In 1049 and 1054 he sent expeditions of Turkmens into the Byzantine lands of Anatolia, attempting to prevent Turkmen raids into the surrounding Muslim territories while at the same time increasing Seljuq power against the Byzantine Empire.

In 1055 Toghrīl, after conquering the principalities to the east and north of Iraq, entered Baghdad, where he was commissioned to overthrow the Shīʿī Fāṭimid caliphs of Cairo in Egypt and to restore, under the ʿAbbāsid caliph, the religious and political unity of the Islāmic world. A mounting threat from the Shīʿī and discontent among his supporters over administration and reward for services, however, resulted in a general uprising against Toghrīl. Prince Ināl with his Turkmens revolted in Mesopotamia and Iran, while a coalition of Arab and Shīʿī Būyid forces, financed and controlled by the Fāṭimids of Cairo and led by Basāsīrī, entered Baghdad (1058). The ʿAbbāsid caliph was imprisoned, and prayers were recited in the name of the Fāṭimid caliph of Cairo. Toghrīl then crushed the rebellion (1060), regained Baghdad, and pacified the Arabs of Mesopotamia. During his last years he fought the petty princes in northwest Iran and forced the Caliph to give him a daughter in marriage.

**togidashi maki-e,** in Japanese lacquerwork, kind of *maki-e* (*q.v.*). In this technique, the design is painted in lacquer, and gold or silver powder is sprinkled over it; when the lacquer is dry, another coat is applied to the design to fix the powder. *Rō-iro-urushi* (black lacquer without oil) is then applied over the entire surface, and, after it has dried, it is burnished briefly with charcoal, applying a little water until the gold powder is faintly revealed. Following this process (called *aratogi*) comes the *suri-urushi* process, in which raw lacquer is applied with cotton and wiped with crumpled rice paper; a finishing burnish (*shiage togi*) is then done with charcoal. Next, granular charcoal is applied with water, using a soft cloth, and gently polished. Finally, *suri-urushi* and polishing is repeated three times.

The earliest extant example of *togidashi maki-e* is found on the scabbard of a Chinese T'ang-style sword of the Nara period (645–794), owned by the Shōsō-in in Nara. In the Heian period (794–1185), *togidashi maki-e* lacquer ware flourished. From the Muromachi



Four-case *inrō* with pheasant design executed in red, orange, and yellow *togidashi*, the rocks, tree, and stream in silver and gold *togidashi*, highlighted with tiny pieces of *aogai*, signed Kajikawa Bunryusai, 19th century

From Melvin and Betty Jansa, *Inro and Other Miniature Forms of Japanese Lacquer Art*; Charles E. Tuttle, Inc.

period (1338–1573), the technique was combined with high relief (*takamaki-e*), and the ware was called *shishiai togidashi maki-e*.

**Togliatti, Palmiro** (b. March 26, 1893, Genoa—d. Aug. 21, 1964, Yalta, Ukrainian S.S.R.), politician who led the Italian Communist Party for nearly 40 years and made it the largest in western Europe.



Togliatti

By courtesy of Camera dei Deputati, Rome

Born into a middle-class family, Togliatti received an education in law at Turin University, served as an officer and was wounded in World War I, and became a tutor at Turin. In 1919 he helped launch a left-wing weekly, *L'Ordine nuovo* ("New Order"), which became a rallying point for the Communist wing that broke away from the Socialist Party in 1921. Beginning in 1922 Togliatti edited *Il Comunista* and in April 1924 became a member of the Central Committee of the Communist Party. While he was attending a meeting of the Communist International (Comintern) in Moscow in 1926, the party was banned by Mussolini, and nearly all its leaders except Togliatti were arrested. He remained in exile, organizing clandestine meetings of the Italian Communist Party at Lyon in 1926 and at Cologne in 1931. In 1935, under the name of Ercoli, he became a member of the secretariat of the Comintern. During World War II he broadcast resistance messages to Italy, appealing to Fascist rank and file to join forces with liberal and left elements. He followed the same path on his return to Italy, entering the government of Marshal Badoglio in April 1944 as minister without portfolio and serv-

ing as vice premier under Alcide De Gasperi in 1945. In the 1948 elections his coalition tactic paid dividends with the return of 135 communist deputies.

On July 14, 1948, Togliatti was seriously wounded by a young fascist, and workers rose on strike throughout Italy in protest. Yet Togliatti stuck to his "Italian road to socialism" in preference to violent revolution, rejecting the Stalinist concept of an internationally directed movement in favour of a democratically oriented and national one. Atheistic propaganda he also repudiated as of no value to the Italian Communist Party, which had "stretched out its hand" to the Roman Catholics.

A memorandum outlining his political doctrine, published after his death, strengthened the trend toward liberalization in communist countries, including the Soviet Union, which in 1964 renamed Stavropol for him (as Tolyatti).

*To make the best use of the Britannica, consult the* INDEX *first*

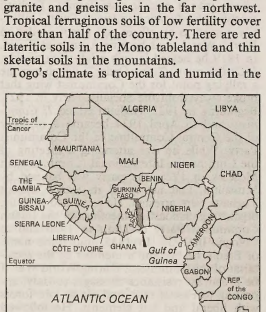
**Togo,** officially REPUBLIC OF TOGO, French TOGO, or RÉPUBLIQUE TOGOLAISE, republic of western Africa. Occupying a narrow strip of land stretching about 320 miles (about 500 km) northward from a coastline of about 32 miles (51 km) on the Gulf of Guinea of the Atlantic Ocean, Togo is bordered by Benin on the east, Burkina Faso (formerly Upper Volta) on the north, and Ghana on the west. The capital is Lomé. Area 21,925 square miles (56,785 square km). Pop. (2003 est.) 5,429,000.

A brief treatment of Togo follows. For full treatment, *see* MACROPAEDIA: Western Africa.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*The land.* Togo consists of six geographic regions. The coastal region is narrow, low-lying, sandy beach backed by tidal flats and shallow lagoons. The Ouatchi Plateau extends about 20 miles (32 km) inland at an elevation of about 200 to 300 feet (60 to 90 m). To the northeast, a higher tableland is drained by the Mono River and its tributaries and is underlain by Precambrian gneiss. From there the land rises toward the Togo Mountains, which extend across the country from southwest to northeast. Mount Baumann, rising to about 3,235 feet (986 m), is the highest point in Togo. To the north is the Oti River sandstone plateau. A higher region mainly composed of granite and gneiss lies in the far northwest. Tropical ferruginous soils of low fertility cover more than half of the country. There are red lateritic soils in the Mono tableland and thin skeletal soils in the mountains.

Togo's climate is tropical and humid in the south, with mean monthly temperatures ranging between 77° and 82° F (25° and 28° C). In the north, monthly temperature variations are greater—from 81° to 90° F (27° to 32° C). The rainy seasons occur from mid-April through June and from mid-September through October in the south and from June through September in the north. The region of Kpalimé, located about 65 miles (105 km) north of the Gulf of Guinea, receives the greatest amount of rainfall (about 70 inches [1,800 mm] annually). The drier coastal zone receives only about 24 to 36 inches (610 to 914 mm) of rain annually. The southwestern highland regions are covered with dense tropical forests. Elsewhere the natural vegetation is chiefly of the savanna type. A dense belt of reeds is found along the coastal lagoons. The fauna is varied and includes elephants, lions, various monkeys, hippopotamuses, crocodiles, snakes, and many species of birds.




Togo

Apart from mineral deposits, which constitute about one-fifth of the country's total exports. Phosphate is extracted by the government's Togolese Office of Phosphates, and its production fluctuates with the demand of the world market. Other important industries include a major cement plant and a petroleum refinery.

Industry in Togo is dominated by mining and quarrying. Togo is one of the world's leading producers of phosphates, which constitute

Apart from mining, industry is largely small-scale, with manufacturing centring on the processing of agricultural commodities and the production of substitutes for imported consumer goods. The country's electricity is generated largely from thermal sources and from the joint Togo-Benin hydroelectric project at Nangbeto. This is occasionally supplemented by imports from Ghana's huge Akosombo hydroelectric facility.

Communications throughout Togo are complicated by the country's long, narrow shape, but the road system is being improved. There are two international airports. Tourism was once a growing source of foreign exchange, but the political crises of the 1990s and other factors led to its general decline.

Fiscal austerity and increases in taxation have been employed to maintain a balanced budget in Togo, and foreign funds are often needed to offset a chronic deficit on the balance of payments. Borrowing for ambitious development plans, once a common practice, has been greatly curtailed. Total imports (composed of machinery and transport equipment, foodstuffs, consumer goods, iron and steel, and fuels) by far exceed the value of total exports. Ghana and France are Togo's principal trading partners; others include Benin, Burkina Faso, Canada, the Philippines, and Italy.

*Government and social conditions.* Under the constitution approved in 1992, legislative authority rests in an 81-member National Assembly, the members of which are chosen in multiparty elections for five-year terms. A popularly elected president, who is head of state, appoints a prime minister, who is head of government, and the Council of Ministers (cabinet) and other members of the government. The president can dismiss the Council and dissolve the Assembly. Togo's judicial system is headed by a Supreme Court; the 1992 constitution also calls for a Constitutional Court to review constitutional matters. Since 1969 the party of the Togolese People has dominated party politics.

Togo's social-welfare program includes family allowances for workers. Health conditions are generally poor. Malnutrition and diseases such as malaria, dysentery, meningitis, yellow fever, and tuberculosis are common. In the early 21st century Togo had the third highest rate of HIV/AIDS infection in western Africa. The country's infant mortality rate is low by comparison with those of other West African countries but high by world standards. Life expectancy is about 52 years for men and 55 years for women.

Public education offers six years of free primary schooling (officially compulsory) and up to seven years of secondary education. Nearly three-fourths of children aged 6 to 11 years attend primary school, but considerably fewer advance to secondary school. The major institution of higher education is the University of Lomé (established as the University of Benin).

*Cultural life.* Like other African peoples, the Togolese have a strong oral tradition. Before independence, there were a few Togolese writers using French. After independence, regional literature emerged with the works of several novelists and playwrights. Founded in 1967, the African Ballet of Togo aims at popularizing the traditional dances of the various ethnic groups.

*History.* The Gur-speaking Voltaic peoples in the north and the Kwa peoples in the southwest were the region's earliest-known inhabitants. The Ewe (divided into about 120 clans and subclans) emigrated from Nigeria between the 14th and 16th centuries, and the Ane (or Mina) emigrated from present-day Ghana and Côte d'Ivoire (Ivory Coast) after the 17th century.

During the 18th century the Togo part of the Slave Coast was held by the Danes. Until 1884 what is now Togo was an intermediate zone between the black African military states of Ashanti and Dahomey, and its various ethnic groups lived in general isolation from each other. German missionaries arrived in 1847, and in 1884 many coastal chiefs accepted

German protection. The German protectorate extended its boundaries in 1897 and 1899. German administration was efficient but oppressive in its use of forced labour. In 1914, at the beginning of World War I, British and French forces occupied Togo. In 1922 the League of Nations issued mandates to Britain and France. The western portion of Togo, administered by Britain, had economic relations with the Gold Coast. The eastern portion was administered by France and had economic connections with Dahomey (now Benin) and French West Africa, particularly during the 1930s. In 1946 the British and French governments placed their Togoland territories under UN trusteeship. In 1956 the British trust territory was incorporated into the Gold Coast. French Togoland became an autonomous republic within the French Union in 1956. After the country gained independence in 1960, it maintained economic relations with France. Togo joined the Organization of African Unity in 1963 and subscribed to the Joint African and Malagasy Organization in 1965.

Relations between Togo and Ghana were strained when Kwame Nkrumah was president of Ghana but improved after Nkrumah's fall. Assassination and coups in the 1960s brought General Gnassingbé Eyadéma to power in 1967. Two new constitutions in 1979 and 1992 ushered in the Third and Fourth Republics, respectively, and in 1993, amid allegations of electoral fraud and intimidation, Eyadéma was returned to office in what were presumably Togo's first free elections. Despite accusations of corruption and widespread civil rights abuses, Eyadéma was reelected in 1998.

**Tōgō Heihachirō**, KŌSHAKU (Marquess) (b. Jan. 27, 1848, Kagoshima, Satsuma province, Japan—d. May 30, 1934, Tokyo), admiral who led the Japanese fleet to victory in the Russo-Japanese War. In the process he developed new tactics for closing with an advancing enemy fleet.

Tōgō studied naval science in England from 1871 to 1878. Upon his return he was appointed a lieutenant first class. After serving in a number of naval posts, he was appointed commander in chief of the combined fleet (December 1903) and was made an admiral in 1904. As commander in chief of the Japanese navy at the outbreak of the war, he directed the 10-month naval blockade of the great Russian military base at Port Arthur (now Lüshun, on the Yellow Sea), helping to bring about its surrender on Jan. 2, 1905. In desperation the Russians dispatched their Baltic fleet to Japan, confronting Admiral Tōgō's forces on May 27 in the Tsushima Strait, which connects the Sea of Japan (East Sea) with the East China Sea. Tōgō "crossed the enemy's T"—*i.e.*, he turned his column across the Russian line of advance—and destroyed 33 out of the 35 Russian ships, ending the war. This spectacular maneuver was later used by the British and French navies. The victory—the first occasion in the modern era in which an Asian power had defeated a European nation—forced the Western countries to begin to look upon Japan as an equal.

He became chief of the Naval General Staff and war councillor to the emperor after the war. In 1913 he was promoted to fleet admiral. From 1914 to 1924 he was in charge of the education of future emperor Hirohito.

**Togo Mountains** (Africa): *see* Akwapim-Togo Ranges.

**Togoland,** former German protectorate, western Africa, now divided between the Republics of Togo and Ghana.

Togoland covered 34,934 square miles (90,479 square km) between the British Gold Coast Colony to the west and French Dahomey to the east. Inhabited by a mixture of Ewe and other peoples, it became a political unit in 1884 when, in the European scramble for overseas territories, German chancellor Otto von Bismarck claimed it for Germany, and other European powers formally recognized the claim. The Germans intended to make Togoland a model colony. Because the region lacked mineral resources (its phosphate reserves were not then known), Germany concentrated on agricultural development. Valuable oil palms grew naturally near the coast. The Germans introduced additional export crops, especially cacao and cotton, to be grown on plantations worked by African labour. Lomé, on the Gulf of Guinea, was developed as the principal town and port, and roads and railways were constructed to link the port to parts of the interior. The Germans also established a judicial and administrative system. The infrastructure, designed to serve German needs, brought some unity to the protectorate.

During World War I France and Britain occupied the protectorate, and in 1922 it was formally divided between them under a League of Nations mandate. Two-thirds of the land and people, including Lomé, became French Togoland, bordering Dahomey. The remainder in the west, bordering the Gold Coast, became British Togoland. In 1946 the two Togolands became United Nations trust territories. The British part was administered with the Gold Coast and became part of independent Ghana in 1957, but French Togoland remained administratively distinct from Dahomey (now Benin) and became independent as the Republic of Togo in 1960. Lingering sentiment for the reunification of Togoland, especially among Ewe people in Ghana, has occasionally strained relations between Togo and Ghana since independence.

**Togon-temür,** posthumous name SHUN-TI (b. 1320, China—d. 1370, China), last emperor (reigned 1333–68) of the Yüan (Mongol) dynasty in China, under whom the population was provoked into rebellion.

Togon-temür became emperor at the age of 13 but proved to be a weak ruler who preferred to spend his time exploring the religious cult of Lamaism and dallying with his harem rather than governing the country. In the early years of his reign, power was held by the anti-Chinese minister Bayan, who suspended the civil-service examinations, prohibited Chinese from wearing certain colours or using certain ideographs, and even proposed mass execution of Chinese on the basis of their names. Bayan's discriminatory policies, together with the deteriorating economic situation of the country, caused widespread rebellion. In 1339 the minister was banished and many of his policies reversed.

But the emperor still showed little interest in governing, and the situation continued to deteriorate. Togon-temür's son, the heir apparent, became alarmed at the increasing power his father was putting into the hands of Buddhist priests and eunuchs and plotted unsuccessfully to depose him. In 1368, when the foremost rebel leader, Chu Yüan-chang (1328–98), advanced on the capital at Peking, Togon-temür disregarded appeals urging him to stay and defend his inheritance. Instead he fled into the steppes of Inner Asia, ending the dynasty. He was given the posthumous name of Hui tsung ("Gracious Ancestor") by the Mongols but is usually known as Shun-ti ("Favourable Emperor"), a title given him by the Ming dynasty (1368–1644).

**Tōhō Motion Picture Company,** leading Japanese motion-picture studio.

The company was founded in 1936 by Kobayashi Ichizō, a former businessman who was the creator of an all-girl "opera troupe." In 1932 he had organized the Tokyo Takarazuka Theatre Corporation, subsequently acquiring several established theatres and building new and larger ones. His structures housed three or more separate theatres, a model that is still followed in Japan. In 1935 he had gained control of two small companies, the PCL, a studio that had first used modern production methods, and the JO, a company that produced advertising films. The next year the Tōhō Motion Picture Distribution Corporation was formed to distribute films produced by these two studios. Famed director Kurosawa Akira (*q.v.*) was one of the company's earliest employees.

Tōhō was the foremost Japanese filmmaker during World War II. After the war, however, it experienced severe labour difficulties over unionization. By 1948 Tōhō had ended production and was acting as a distributor for the films of the Shintōhō Motion Picture Company (*q.v.*), which had been financed by Tōhō in 1947. The studio reopened and in the 1950s introduced the first successful Japanese-developed wide-screen process, Tohoscope, similar to the American CinemaScope technique.

**Tohoku,** *chihō* (region), located on northern Honshu, Japan, and including the *ken* (prefectures) of Aomori, Akita, Iwate, Yamagata, Miyagi, and Fukushima. Its name is derived from the Japanese terms *tō* ("east") and *hoku* ("north"). The region is also known as Ōu, in reference to its main mountain range. Tohoku *chihō* occupies nearly one-fifth of Japan's total area but contains less than one-tenth of the country's total population; it constitutes Japan's least-developed region, after Hokkaido.

Three mountain ranges run roughly parallel across Tohoku from north to south, separated by rows of lowlands. The ranges and lowlands are, from east to west, the Kitakami Range and Abukuma Range, the Kitakami River and Abukuma River lowlands; the Ōu Range; a row of basins constituting the Median Groove; and the Dewa Mountains and the mountains associated with Mount Asahi and Mount Iide. Maritime lowlands occur along the Sea of Japan coast.

The backbone range of the Ōu Mountains forms the major climatic boundary of the region. It separates the western area of warmer summers and snowy winters from the eastern area of cooler summers and drier winters. The northeastern coastal belt is frequented by sea fog and cool easterly winds during the growing season. The highly indented coast of the Kitakami Range is subject to destructive tsunamis (ocean waves caused by earthquakes).

Tohoku depends chiefly on agriculture and is often referred to as the rice granary of Japan. Fruit is also grown, and cattle are raised. During the 1950s dams were constructed in the mountains of Tohoku to form a power-generation area. Primary industries include forestry, mining, and fishing. The region is known for such traditional manufactures as lacquerware, iron and copper utensils, toys, and textiles. During the late 1970s industrial agglomerations began forming in cities such as Hachinohe, Akita, Sendai, and Jōban-Kōriyama. Communications were improved by the completion of the Seikan Tunnel (a submarine tunnel between Aomori and Hokkaido), which was completed in 1988. Tourism has grown rapidly, based on three national parks and numerous hot springs. Urban growth has been comparatively slow, however. Area 25,858 square miles (66,971 square km). Pop. (1999 est.) 9,831,484.

**Ṭohorot** (Hebrew: "Purifications"), the last of the six major divisions, or orders (*sedarim*), of the Mishna (codification of Jewish oral laws), which was given its final form early in the 3rd century AD by Judah ha-Nasi. *Ṭohorot* consists of 12 tractates (treatises) that deal with ritual impurity and rites of purification. Their names are: *Kelim* ("Vessels"), *Oholot* ("Tents"), *Nega'im* ("Plagues"), *Para* ("Cow"),

*Tohorot* ("Purifications"), *Miqwa'ot* ("Ritual Baths"), *Nidda* ("A Menstruous Woman"), *Makhshirin* ("Predisposers"), *Zavim* ("Those with Unclean Discharges"), *Tevul yom* ("Daytime Bathers"), *Yadayim* ("Hands"), and *'Uqtzin* ("Stalks"). The Palestinian and Babylonian Talmuds both have Gemara (scholarly commentaries) on *Nidda* but on none of the other tractates.

**toile de Jouy** (French: "fabric of Jouy"), also called JOUY PRINT, cotton or linen printed with designs of landscapes and figures for which the 18th-century factory of Jouy-en-Josas, near Versailles, Fr., was famous. The Jouy factory was started in 1760 by a Franco-German, Christophe-Philippe Oberkampf. His designs were printed originally from woodblocks alone but from 1770 from copperplates as well, this innovation having been anticipated in England in 1757. English printed cottons of similar subjects (such as those of Old Ford, *c.* 1760–80) had a parallel development and achieved standards as high as Jouy; the term toile de Jouy has come to be used loosely for the Jouy type of printed cottons produced in England and at other French factories. A



Detail of "Les Travaux de la Manufacture," copperplate-printed cotton by Jean-Baptiste Huet, one of Oberkampf's chief designers at the Jouy factory, Jouy-en-Josas, Fr., 1783; in the Art Institute of Chicago

By courtesy of the Art Institute of Chicago, gift of Mrs. Potter Palmer II

strong, if limited, vogue for them in upholstery and wallpaper continued.

**toile peinte** (French: "painted linen"), plural TOILES PEINTES, large sheet of heavy, flexible fabric on which a tapestry cartoon (a full-sized preliminary study from which the finished tapestry is made) has been painted. Unlike cartoons drawn on paper, *toiles peintes* were intended to be hung as though they were finished tapestries. Most *toiles peintes* date from the 16th century in France. The finest collection of old *toiles peintes* belongs to the Cathedral of Reims.

**toilet table** (furniture): *see* dressing table.

**Toison d'Or, l'Ordre de la** (French), Spanish TOISÓN DE ORO, LA ORDEN DEL: *see* Golden Fleece, The Order of the.

**Toit, Stephanus Jacobus Du:** *see* Du Toit, Stephanus Jacobus.

**Tōjō Hideki** (b. Dec. 30, 1884, Tokyo, Japan—d. Dec. 23, 1948, Tokyo), soldier and statesman who was prime minister of Japan during most of World War II (1941–44) and who was subsequently tried and executed as a war criminal.

A graduate of the Imperial Military Academy and the Military Staff College, Tōjō served



Tōjō Hideki

By courtesy of the International Society for Educational Information, Tokyo

briefly as military attaché in Japan's embassy in Berlin after World War I. He earned esteem as an administrator and skillful field commander and became noted as a stern disciplinarian. In 1928 he was made commander of the 1st Infantry Regiment, which in 1936 participated in the mutiny of the Tokyo garrison. In 1937 he was named chief of staff of the Kwantung Army in Manchuria. He returned to Tokyo in 1938 as vice-minister of war and was one of the leading advocates of Japan's Tripartite Pact with Germany and Italy (1940). In July 1940 he was appointed minister of war in the Cabinet of Premier Prince Konoe Fumimaro. Tōjō succeeded Konoe as prime minister on Oct. 16, 1941, and pledged his government to a Greater East Asia program, a "New Order in Asia." He retained control of the ministry of war and was also minister of commerce and industry from 1943.

A hardworking and efficient bureaucrat, Tōjō was also one of the most aggressive militarists in the Japanese leadership. He led his country's war efforts after the attack on the U.S. base at Pearl Harbor, Dec. 7, 1941, and under his direction smashing victories were initially scored throughout Southeast Asia and the Pacific. After prolonged Japanese military reverses in the Pacific, Tōjō assumed virtual dictatorial powers, taking over the post of the chief of the General Staff. But the successful U.S. invasion of the Marianas so weakened his government that he was removed as chief of staff on July 16, 1944, and on July 18 his entire Cabinet resigned.

On Sept. 11, 1945, after Japan's formal surrender, Tōjō shot himself in a suicide attempt, but he was nursed back to health and on April 29, 1946, with other Japanese wartime leaders, was indicted and tried as a war criminal before the International Military Tribunal for the Far East. He was found guilty and hanged.

**Tojolabal,** Mayan Indians of Chiapas in southeastern Mexico, near the Guatemalan border. The Tojolabal language is closely related to that of the Tzotzil and Tzeltal, their neighbours to the northwest, and to that of the Chuj, to the southeast in Guatemala; and there are many cultural similarities between the groups. The territory inhabited by the Tojolabal is one of large highland plains separated by low hills.

The people are agriculturists, raising the Middle American staples—corn (maize), beans, and squash—in family plots. Coffee and sugarcane are grown as cash crops in some areas. Settlements consist of farm households dispersed around central villages; most permanent inhabitants of such villages are Europeanized or modernized Indians or persons of mixed ancestry.

Tojolabal houses are characteristically of wattle-and-daub construction, with thatched roofs. Crafts that are still seen are the weaving of woolen blankets and some pottery making. The Tojolabal are Roman Catholic, with an orientation toward the veneration of saints. Caves, springs, and hills are also worshiped, however, and crop-fertility rituals are performed. The institution of ritual kinship (*compadrazgo*) is complex and of great importance; godparents are selected at several important points in a child's life.

**Toka Gorge,** Norwegian TOKAGJELET, gorge, Hordaland *fylke* (county), western Norway, near the village of Norheimsund about 25 miles (40 km) east of Bergen. A waterfall flowing into the gorge makes the area a popular tourist spot. Access is via a road from Bergen that has steep grades and many hairpin turns and penetrates Toka Gorge through tunnels and along ledges cut into the walls of the gorge. The drive through Toka Gorge provides spectacular views of the falls and the surrounding mountains.

**Tōkai Bank Ltd.,** Japanese TŌKAI GINKŌ, former commercial bank in Nagoya, Japan, that merged with Sanwa Bank in 2002 to create UFJ Bank, a subsidiary of UFJ Holdings, Inc. It is based in Ōsaka.

The bank was established in 1941 through the merger of Itō Bank (established 1881), Nagoya Bank (1882), and Aichi Bank (1896). In addition to offering a full range of commercial banking services, Tōkai participated actively in the foreign exchange markets. The merger with Sanwa occurred at a time when three other top Japanese banks were merging to form Mizuho Holdings, Inc., then the world's largest bank holding company.

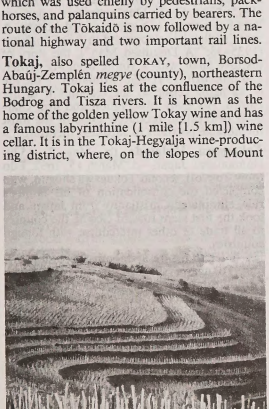
**Tōkai region,** Japanese TŌKAI-CHIHŌ, industrial region, central Japan, extending along the Tōkaidō Line (railway) between Tokyo and Nagoya, and occupying areas of Shizuoka *ken* (prefecture). Tōkai is neither an administrative nor a political entity. It has close economic ties with the Chūkyō Industrial Zone. The region is characterized by both coastal lowlands and the inland peaks. Traditional manufactures included cotton textiles, wood products, and rice paper, which were supplemented during the Meiji period (1868–1912) by cotton spinning and Western-style papermanufacturing techniques imported from Europe and the United States. Tōkai became Japan's major paper producer during World War I. World War II increased the need for heavy industries. After the war, the region's industries were converted to produce electrical appliances and transport equipment, and the Korean War (1950–53) revived the local textile, paper, and wood industries. Tagonoura port was built near Mount Fuji during the 1950s as the area's industrial production increased. (Shizuoka had previously been the region's only port.) Meanwhile, factories in Tōkai city, outside Nagoya, were built along the Tōkaidō Line to provide iron and steel for the motor-vehicle industry in Toyota city. Tōkai's most extensive development occurred during the 1950s and '60s. Major industrial subdivisions of Tōkai are the Eastern Suruga Bay district, the Shizuoka and Shimizu district, and the Hamamatsu district. Industries in the Eastern Suruga Bay district produce paper, textiles, and photographic film. Lumber products (resins, furniture, lacquer ware) are manufactured and tea is processed in Shizuoka. Aluminum, canning (oranges and tuna), and chemical factories operate in Shimizu. Hamamatsu is Japan's leader in the production of pianos and motorcycles. Land subsidence and river-pollution problems have caused industries to create public industrial water supplies and drainage systems.

**Tōkaidō** (Japanese: "Eastern Sea Road"), historic road that connected Osaka and Kyoto with Tokyo (formerly Edo) in Japan. The

Tōkaidō was 303 miles (488 km) long and ran mostly along the Pacific (*i.e.*, southern) coast of Honshu. From ancient times the road was the chief route from the capital city of Kyoto eastward to central Honshu. The Tōkaidō became even more important during the Tokugawa period (1603–1867), since it connnected the new capital city of Tokyo with western Honshu.

Along the Tōkaidō were 53 post-station towns whose inns and vendors provided lodging, refreshment, and gifts for the road's travelers. The road was well known for its picturesque views, which were recorded by the artist Hiroshige in a series of woodblock prints entitled "Fifty-three Stages on the Tōkaidō" (1832). During the Tokugawa period, the Tōkaidō is recorded as having a smooth, well-kept roadbed that averaged 18 feet (5.5 m) in width. This roadbed consisted of a deep layer of crushed gravel overlaid with sand and was paved with stone on mountainous slopes. Wheeled vehicles were rare on the Tōkaidō, which was used chiefly by pedestrians, packhorses, and palanquins carried by bearers. The route of the Tōkaidō is now followed by a national highway and two important rail lines.

**Tokaj,** also spelled TOKAY, town, Borsod-Abaúj-Zemplén *megye* (county), northeastern Hungary. Tokaj lies at the confluence of the Bodrog and Tisza rivers. It is known as the home of the golden yellow Tokay wine and has a famous labyrinthine (1 mile [1.5 km]) wine cellar. It is in the Tokaj-Hegyalja wine-producing district, where, on the slopes of Mount



Vineyards near Tokaj, Hung., on the slopes of the Hegyalja region
Interphoto—FPG

Tokaj and the Hegyalja region to the north and west, the conditions for viticulture are excellent. Production there dates from the 12th century, when immigrant Italian and Walloon farmers introduced viticulture and left a legacy of architectural diversity in the town's residences. Tokaj has a small artists' colony. The town's industries include chemicals, timber processing, and brandy distilling. Secondary rail and road links cross the Tisza at Tokaj. Pop. (1990 prelim.) 5,371.

**Tokat,** city, north-central Turkey. It lies along a tributary of the Yeşil River. Surrounded by orchards and gardens, Tokat lies in a plain beneath steep hills that are crowned by a ruined citadel, often identified as the ancient fortress Dazimon. Tokat stands near the site of ancient Comana of Pontus, one of the most important cities of the Pontus district during the Roman period; Tokat rose to prominence after Comana's decline in Byzantine times. During the 11th–13th century it was an important city of a Turkmen principality and later of the Seljuq Turks; it was incorporated into the Ottoman Empire about 1392. Noteworthy among its landmarks, mostly dating from the Seljuq period, are the blue-tiled Gök (Blue) Medrese, a 13th-century Islāmic religious school that houses the local museum, and the Halef Gazi Tekkesi monastery, dating from about 1290. Local industries include manufacture of copper utensils (a local specialty), tanning, and calico printing.

The area in which Tokat is situated is an important fruit-growing region. Tobacco, cereals, and sugar beets are also cultivated in its sheltered basins, which are well watered by the Yeşil River and its tributaries, the Kelkit and Çekerek. Sugar beets are sent to the sugar refinery at Turhal, west of Tokat city. Mineral resources include lignite, antimony, and marble. Pop. (1990) city, 83,058.

**Tokay,** also spelled TOKAJI, famous, usually sweet white wine of Hungary, made from the Hungarian Furmint grape. The wine derives its name from the Tokaj district of northeastern Hungary. Though some Tokay is dry, the finest version, Tokaji Aszu, is made from late-ripened grapes affected by *Botrytis cinerea,* a mold that concentrates grape sugars and flavours into honeylike sweetness.

The sweetness of Tokay is traditionally measured by the number of *puttonyos,* or baskets, of sweet grapes used. A three *puttonyos* wine is lightly sweet; five *puttonyos* denotes the highest degree of sweetness. The legendary Tokay *Eszencia,* a concentrated sweet essence of low alcohol famed for its miraculous restorative properties, is virtually unobtainable today.

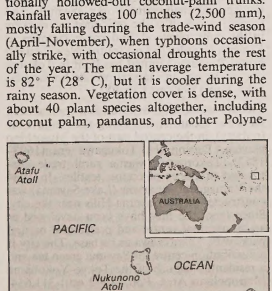
The name tokay is also applied generically to certain sweet wines of indifferent quality that bear no resemblance to Hungarian Tokay.

**Tokelau,** also called (1916–46) UNION GROUP, or (1946–76) TOKELAU ISLANDS, island territory of New Zealand, consisting of three atolls in the South Pacific Ocean. Tokelau lies 300 miles (480 km) north of Western Samoa and 2,400 miles (3,900 km) southwest of Hawaii. Area 3.9 square miles (10.1 square km). Pop. (1992 est.) 1,700.

For information about regional aspects of Tokelau, *see* MACROPAEDIA: Pacific Islands.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*The land.* The Tokelau group consists of three coral atolls, Fakaofu (1 square mile), Nukunono (2.1 square miles), and Atafu (0.8 square mile), arranged in a southeast-to-northwest line. Each atoll consists of numerous islets, located on its reef, which falls off sharply a short distance from shore. The lagoons are shallow and dotted with coral outcrops and thus are unnavigable. The islands are low-lying and range from 8 to 15 feet (2.4 to 4.5 m) above sea level. Their coral-sand soil is highly porous, necessitating rain catchments, traditionally hollowed-out coconut-palm trunks. Rainfall averages 100 inches (2,500 mm), mostly falling during the trade-wind season (April–November), when typhoons occasionally strike, with occasional droughts the rest of the year. The mean average temperature is 82° F (28° C), but it is cooler during the rainy season. Vegetation cover is dense, with about 40 plant species altogether, including coconut palm, pandanus, and other Polynesian trees and shrubs. Wildlife includes rats, lizards, seabirds, and a few migratory birds.




Tokelau

*The people.* The people are overwhelmingly Polynesian and are culturally and linguistically linked to those of Samoa. Tokelauan is the official language, but English is widely used. Almost all of the people are Christian (about 70 percent Congregational and 30 percent Roman Catholic). Population density is greatest on Atafu. The size of the population has been relatively steady because of emigration to New Zealand and Samoa.

*The economy.* Tokelau's economy consists largely of subsistence agriculture (including fishing). Land tenure is based upon kinship lines and land reserved for communal use. Coconuts, grown for copra, are the only cash crop. Taro, grown in special excavated gardens fertilized with leaf compost, and breadfruit, pawpaw, and bananas are subsistence crops. Pigs and chickens are the main livestock raised for subsistence. Lagoon and ocean fish and shellfish are caught for local consumption, but in the 1980s New Zealand established a 200-mile exclusive economic zone, and a fisheries training program was started by the South Pacific Commission. Tauanave trees are specially grown on selected islets for canoes, houses, and other domestic needs.

Manufacturing is restricted to copra production, tuna processing, canoe building and woodwork, and traditional woven hats, mats, and bags. In the early 1980s electrical generators were installed, and electricity was made available to each atoll. Philatelic stamp and coin sales raise additional revenue, but Tokelau's budgetary expenses regularly exceed revenue, requiring aid from New Zealand. The large expatriate community is an important source of revenue through remittances.

The islands have neither roads nor motor vehicles. There are no navigable passages into the lagoons and hence no good ports. Ships must anchor off the reef and use lighters to take on or put off passengers and goods.

Tokelau's external trade is mainly with New Zealand; copra is exported, and food, building materials, and fuels are the main imports.

*Government and social conditions.* Tokelau is administered as part of New Zealand under the Tokelau Islands Act of 1948, as amended. An administrator is appointed to a three-year term by New Zealand's minister of foreign affairs, but most authority is delegated to the official secretary of Tokelau affairs, based at Apia, Western Samoa. Local self-government is embodied in village administrators and the Tokelau general *fono* (assembly), which handles budgets and makes recommendations to the New Zealand Parliament.

Each atoll has its own hospital, with a resident doctor. Perennial shortages of fresh water have been partly alleviated by installing water storage and catchment tanks.

Education is free for children aged 5 to 15, and attendance is near 100 percent. Each atoll has a primary school. Secondary education is available in Western Samoa and Niue, higher education in New Zealand and Fiji.

*History.* As indicated by linguistic affinity, Tokelau was probably settled from Samoa by drift voyages, and the small atolls rapidly became densely settled with nucleated villages. The first European visitor was the British commodore John Byron, who gave Atafu the name Duke of York Island. Nukunono was sighted and named Duke of Clarence Island by Captain Edwards of HMS *Pandora* in 1791, while he was searching for HMS *Bounty* mutineers. Whalers began visiting the group in the 1820s, and a thorough survey was made by the United States Exploring Expedition in 1841; its ethnologist, Horatio Hale, gave a detailed report on local customs and language, and the expedition gave Fakaofu the name Bowditch

Island. French-sponsored Samoan missionaries converted Nukunono's people to Roman Catholicism from the mid-1840s, and London Missionary Society-sponsored Samoans reached Atafu in 1858; both groups later Christianized Fakaofu. In 1863 Peruvian slave raiders abducted many islanders, and roughly contemporary outbreaks of disease reduced the population to about 200. Beachcombers of diverse nationalities subsequently settled and intermarried with Tokelauans. British interest began in 1877, when the high commissioner in Fiji received jurisdiction over British nationals in Tokelau, and in 1889 a protectorate was established. In 1916, under the name Union Group, Tokelau became part of the Gilbert and Ellice Islands Colony, and many Tokelauans emigrated to work on Banaba (Ocean) Island. New Zealand was granted jurisdiction over Tokelau in 1925, administering the group from Western Samoa. In 1948 the Tokelau Islands Act made the group part of New Zealand, and until 1962 cultural and language ties to Samoans led some Tokelauans to migrate to Western Samoa. From 1962 migration shifted to New Zealand, which appoints the islands' administrator. In 1976 the group was officially named Tokelau.

**Tokharian language:** *see* Tocharian language.

**Toki,** city, Gifu *ken* (prefecture), Honshu, Japan. It lies along the Toki River. During the civil wars of the Momoyama period (1568–1614), refugees (including potters) fleeing from Seto city settled in Toki and Mino cities under the protection of the lords of Toki. Kilns were established there for the production of Oribe ware for use in the tea ceremony. The city is still noted for its production of pottery. Pop. (1990) 64,946.

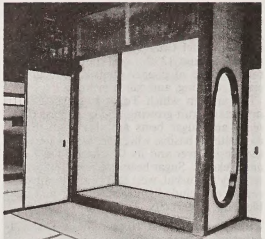
**Tokiwa Mitsunaga** (*c.* last half of the 12th century, Kyōto, Japan), leading Japanese painter of the 12th century.

Mitsunaga was famous for his detailed scroll paintings of groups of courtiers. His major achievement, 60 horizontal hand scrolls, "Annual Rites and Ceremonies" (1173), shows courtiers engaged in various ceremonies and festivities against the background of different sections of the palace compound. Although the originals were destroyed by fire in 1626, copies of 20 of the scrolls, made in 1626 by the court painter Jōkei, still remain.

In 1173 Mitsunaga cooperated with the other major artist of the century, Fujiwara Takanobu, to paint the "Imperial Procession" on the shoji (sliding paper doors) of a palace building that was subsequently destroyed by fire. Mitsunaga is also believed by many to have painted the "Narrative Scroll of Ban Dainagon," extant today, illustrating the story of the downfall of Tomo Yoshio (Ban Dainagon), the chief councillor of state who lived in the first half of the 9th century. Executed on three scrolls with precise line drawing and brilliant colours, it features large groups of figures and is filled with a sense of dramatic action.

**Tokmak,** formerly (until 1963) BOLSHOY TOKMAK, city, northern Kyrgyzstan, on the Chu River. Originally an early 19th-century fort, it became a district town after capture by the Russians in 1867, a status it lost to Pishpek (now Bishkek) in 1878. It was made a town again in 1927, and industrial development followed the construction of the railway in 1938. Pop. (1991 est.) 71,200.

**toko-no-ma,** alcove in a Japanese room, used for the display of paintings, pottery, flower arrangements, and other forms of art. Household accessories are removed when not in use so that the *toko-no-ma,* found in almost every



*Toko-no-ma* in one of the formal reception rooms of the Katsura Imperial Villa, Kyōto
Tatsuzo Sato, Kyoto; photograph, the Museum of Modern Art, New York City

Japanese house, is the focal point of the interior.

A feature of the *shoin* architectural style, which originated in the Kamakura period (1192–1333), the *toko-no-ma* developed from the private altar in Zen Buddhist priests' homes, which consisted of an alcove containing a narrow wooden table with an incense burner, votive candles, and flower vessels placed before a Buddhist scroll hung on the wall. In its adaptation to the Japanese house, it was used exclusively for the display of art objects.

**Tokoname,** city, Aichi *ken* (prefecture), Honshu, Japan. It lies on the west coast of the Chita Peninsula, facing Ise Bay. Pottery manufacture was probably introduced to the city in the 8th century. Tokoname has since been renowned for its ceramic pipes, teapots, and tea utensils, which are produced in numerous kilns and small factories. The former town of Ōno (now part of Tokoname) was an important commercial port for shipment to Ōsaka and Edo (now Tōkyo) during the Tokugawa era (1603–1867). Pop. (1990) 51,784.

**Tokoroa,** town, Waikato local government region, north-central North Island, New Zealand. It lies in the upper Waikato River basin of the Volcanic Plateau. It was constituted a county town in 1953. Tokoroa is a market and service centre that has grown rapidly since the late 1940s. Lying along the Taupo-Putaruru Highway and a rail line to Auckland (140 miles [225 km] northwest), Tokoroa is situated in a region of sheep and dairy farming and large tree plantations. In addition to its own cheese-making works, joinery, general engineering works, sawmills, and stone quarries, it is the residence for workers in the pulp, plywood, and paper factories at Kinleith (4 miles [6 km] south). New Zealand Forest Products Limited has built in Tokoroa one of the nation's largest private housing estates. Pop. (1992 est.) 16,400.

**Tokorozawa,** city, Saitama *ken* (prefecture), Honshu, Japan. It lies along the Seibu Line (railway), in the central part of the Musashino plateau. During the Tokugawa era (1603–1867), Tokorozawa was a rural trade centre and producer of cotton textiles. In 1934 the Yamaguchi Reservoir (Lake Sayama) was constructed in the Sayama Hills near the city. Since then, the hills have been developed as an amusement centre and prefectural natural park, with Tokorozawa as its base. The city is a distribution centre for Sayama green tea and a residential suburb of the Tokyo-Yokohama Metropolitan Area. Pop. (1992 est.) 311,654.

**Tokuda Shūsei,** pseudonym of TOKUDA SUEO (b. Dec. 23, 1871, Kanazawa, Japan—d. Nov. 18, 1943, Tokyo), novelist who, with Masamune Hakuchō, Tayama Katai, and Shimazaki Tōson, was one of the "four pillars" of naturalism.

Shūsei left Kanazawa in 1894 to become a disciple of Ozaki Kōyō, then the leader of the literary world. Shūsei's talents were not suited to Kōyō's lush romantic style, and he was slow to gain recognition. But when, after the Russo-Japanese War (1904–05), the tide of literary taste began to turn toward realistic, objective description, Shūsei came into his own. His direct, terse style, seemingly drab by earlier standards, was the perfect vehicle for his sharp, unsentimental portrayal of people living economically and emotionally depressed lives. *Arajotai* (1907; "The New Household"), recounting the life of the wife of a small businessman, brought him his first public recognition. *Ashiato* (1910; "Footprints"), about the passivity of his own wife's early life, and *Kabi* (1911; "Mold"), describing the circumstances of their marriage, continue the theme of inertia and general hopelessness, as does *Tadare* (1914; "Festering"). *Arakure* (1915; "The Tough One") presents a particularly fine portrait of a strong-willed woman. A more mellow tone appeared in *Kasō jimbutsu* (1935–38; "A Disguised Man"), the story of his love affair with a young would-be writer, and *Shukuzu* (1941–46; "Miniature"), the life of an aging geisha as she recounts it to her patron. His sharp observation and firm character delineation produced some of the most memorable portraits in Japanese literature.

**Tokugawa Hidetada** (b. May 2, 1579, Hamamatsu, Japan—d. March 15, 1632, Edo [now Tokyo]), second Tokugawa shogun, who completed the consolidation of his family's rule, eliminated Christianity from Japan, and took the first steps toward closing the country to all trade or other intercourse with foreign countries.

In order to assure a smooth succession, the first Tokugawa shogun, Ieyasu, named his third and most even-tempered son, Hidetada, to the shogunate in 1605, two years after the establishment of the Tokugawa regime. Hidetada ruled in name only, however, for Ieyasu continued to control the actual workings of the government until his death in 1616, after which Hidetada finished the restructuring of the central government administration.

Apparently fearful of rebellion by Japanese Christians (Kirishitan), who were aided by Spain, Hidetada immediately repeated his father's ban on Christianity. When his edict was ignored, he had four missionaries executed (1617), the first Christians to be martyred in Japan. In 1622 he ordered the execution of 120 missionaries and Japanese converts. Moreover, he banned all Christian literature and forced his vassals, several of whom were pursuing pro-Christian policies, to institute similar persecutions in their own realms.

In order to regulate outside influence and prevent the further spread of Christianity, Hidetada decreed that foreign vessels, except those from China, enter Japan only through the ports of Nagasaki and Hirado. He severed relations with the Spanish; the English had already closed their unprofitable trading base in Japan. Hidetada's efforts to isolate Japan were successfully completed by his son and successor, Tokugawa Iemitsu.

*Articles are alphabetized word by word, not letter by letter*

**Tokugawa Iemitsu** (b. Aug. 12, 1604, Edo [now Tokyo], Japan—d. June 8, 1651, Edo), third Tokugawa shogun in Japan, the one under whom the Tokugawa regime assumed many of the characteristics that marked it for the next two and a half centuries.

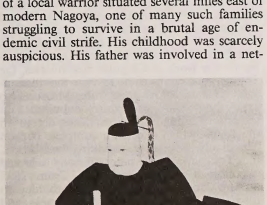
Iemitsu became shogun in 1623, when his father, Hidetada, retired in his favour, though

Hidetada retained authority until his death in 1632. At the time of Iemitsu's accession, the daimyos, or great feudal lords, no longer threatened Tokugawa power as they had at the beginning of his grandfather's reign. Iemitsu was the first shogun to treat them with disdain. He further strengthened the shogunate by eliminating the few remaining prerogatives of the emperor, whose role was merely symbolic. Finally, Iemitsu established strict administrative criteria by which the government was to be run and promulgated rules for the education and behaviour of the hereditary warriors attached to the Tokugawa house. He even stripped his own brother of his fief and forced him to commit suicide for inappropriate treatment of his vassals.

Iemitsu also carried to completion the anti-Christian policies of his father; he expelled or executed the remaining Christian missionaries in Japan and forced the entire population to register as parishioners of Buddhist temples. In 1638 the rebellion staged by inhabitants of the Shimabara Peninsula was ruthlessly suppressed when he found strong Christian adherents among them. The following year he expelled the Portuguese to prevent the spread of seditious ideas, thus closing his country to all commerce with the outside world except for a limited, strictly regulated trade with Korea and with Dutch and Chinese merchants at the port of Nagasaki—a policy of seclusion that remained unaltered for more than 200 years.

**Tokugawa Ieyasu,** original name TOKUGAWA TAKECHIYO (b. Jan. 31, 1543, Okazaki, Japan—d. June 1, 1616, Sumpu), the founder of the last shogunate in Japan, the Tokugawa, or Edo, shogunate (1603–1867).

*Early life.* Ieyasu was born into the family of a local warrior situated several miles east of modern Nagoya, one of many such families struggling to survive in a brutal age of endemic civil strife. His childhood was scarcely auspicious. His father was involved in a net-



Tokugawa Ieyasu, detail, colour on paper; in the collection of the Daiyo-ji (Daiyo Temple), Tokyo

By courtesy of the International Society for Educational Information, Tokyo, Inc.

work of shifting alliances that repeatedly drew him into battle. When Ieyasu was two, his mother was permanently separated from his father's family because of one such change in alliances, and when he was seven, military adversity compelled his father to send him away as hostage to the Imagawa family, powerful neighbours headquartered at Sumpu (modern Shizuoka) to the east.

Conditions at Sumpu were more settled, and Ieyasu was trained in the military and governmental arts and developed a great love for falconry. In the late 1550s he took a wife, fathered the first of several sons, and began to acquire military experience by leading forces on behalf of Imagawa. Despite his personal comfort, however, Ieyasu's years at Sumpu had been worrisome ones. He had learned that his father had been murdered by a close vassal in 1549 and had observed helplessly from afar the subsequent disintegration of his family fortunes.

*Leadership of the Tokugawa.* In 1560 Imagawa was slain during a battle with Oda Nobunaga, a powerful neighbour to the west, and young Ieyasu seized the opportunity to return to his family's small castle and assume control of his surviving relatives and vassals. Within months he took steps to ally himself with Nobunaga, at the same time pacifying the new and inept leader of the Imagawa house long enough to recall his wife and son from Sumpu. Freed for a few years from warring with neighbours, he directed his military efforts to crushing rebellious Buddhist sectarian groups within the Tokugawa domain. Concurrently, he devoted much energy to improving his small army's command structure, appointing civil administrators, and formulating and enforcing procedures of taxation, law enforcement, and litigation.

During the later 1560s the Imagawa domain disintegrated, and Ieyasu expanded to the east as opportunity permitted. In 1570 this expansion led him to move his headquarters eastward to Hamamatsu, a small coastal town that he developed into the commercial and strategic centre of a thriving domain. Relying heavily on his alliance with the mighty Nobunaga, Ieyasu survived the vicissitudes of endemic war and slowly extended his territory until, by the early 1580s, he had become an important daimyo (feudal baron), in control of the fertile and populous area stretching from Okazaki eastward to the mountain barrier at Hakone.

In 1582 Nobunaga was wounded by a rebellious subordinate and committed suicide; Toyotomi Hideyoshi, his most brilliant general, quickly avenged the death and moved to assume Nobunaga's preeminent political position. Ieyasu, then in the prime of life, emerged as his principal rival. After a few bloody but indecisive skirmishes, however, the cautious Ieyasu offered a vow of fealty, and Hideyoshi was content to leave Ieyasu's domain intact. During the rest of the 1580s, while Hideyoshi busily extended his control over the daimyo of southwestern Japan, Ieyasu strengthened himself as best he could. He continued to enlarge his vassal force, increase his domain's productivity, and improve the reliability of his administration. And in 1586, for greater security, he moved his headquarters even farther to the east, away from Hideyoshi, to Sumpu, the town he had known years before as a hostage.

*Conquest of the Hōjō.* In 1589 Hideyoshi determined to obtain vows of subordination from the Hōjō daimyo, who held a large district east of the Hakone mountain barrier. When Hōjō refused to submit, Hideyoshi and Ieyasu mobilized a great army and navy that blockaded the Hōjō forces in their seaside castle at Odawara. After a long and patient siege the Hōjō were starved into capitulation. At Hideyoshi's suggestion Ieyasu then surrendered his coastal provinces west of Hakone in return for the Hōjō domain to the east. As rapidly as possible he moved thousands of vassals, their military equipment, and their households to the little fort and farmlands near the fishing village of Edo (modern Tokyo), nearly a month's march from Hideyoshi's headquarters near Kyōto.

During the 1590s Ieyasu, unlike several great daimyos from western Japan, avoided involvement in Hideyoshi's two disastrous military expeditions to Korea. Instead he grasped the opportunity afforded by his transfer to his new lands to deploy his forces rationally and to make his domain as secure as possible. He stationed his most powerful vassals on the perimeter of his territory and along main access routes, keeping the least powerful—and least dangerous to himself—nearer Edo.

He then placed large tracts of land close by the town under direct administration by appointed officials, thereby assuring his castle inhabitants easy access to the largest possible supply of foodstuffs, and made detailed land and property surveys in order to regularize taxation. He also confiscated the weapons of all villagers, thereby reducing the likelihood of peasant rebellion, and moved vigorously to attract skilled artisans and businessmen to his new castle town. He undertook engineering projects to enlarge his castle, facilitate urban growth, and assure a water supply for the town populace. When Hideyoshi died in 1598, Ieyasu had the largest, most reliable army and the most productive and best organized domain in all Japan.

Hideyoshi's death precipitated another daimyo power struggle, and Ieyasu, as the most powerful and most respected of Hideyoshi's former vassal advisers, became the head of one faction in that struggle. The armies assembled in the autumn of 1600 at Sekigahara, some 50 miles (80 kilometres) northeast of Kyōto, and in the ensuing battle Ieyasu's eastern army triumphed.

*Mastery of Japan.* This triumph left Ieyasu the undisputed master of Japan, and he moved swiftly to make his mastery permanent. Just as, in earlier years, he had consistently secured every military gain by adjusting administrative arrangements to fit his new needs, so, after the Battle of Sekigahara, he initiated an extensive project of shifting daimyos about. In the process he stripped many erstwhile enemies of their lands, placed a number of his allies in strategic locations near surviving enemies, and secured for himself and his most faithful vassals direct control of much of central Japan. Then, having secured the strategic heartland, he proceeded over the next several years to make his control more sure by issuing regulations and establishing supervisory organs to constrain daimyos, Imperial court nobles, and clerics, as well as his own vassals.

In 1603 the powerless but prestigious Imperial court, which over the years had dutifully assigned Ieyasu titles that reflected his growing power, appointed him shogun (generalissimo), thereby acknowledging that this most powerful daimyo in Japan was the man officially authorized to keep the peace in the emperor's name. Two years later Ieyasu formally retired, left Edo for the more pleasant surroundings of his old home at Sumpu, and had the shogunal title assigned to his son Hidetada, intending thereby to assure that the title was recognized as a hereditary Tokugawa prerogative.

As shogun, and then as retired shogun, Ieyasu assumed responsibility for foreign affairs, a responsibility he seems to have welcomed. Because the Ming dynasty in China was faltering and was without much influence abroad, the conduct of Japanese foreign affairs, which would normally have been mainly with China, involved responding to Portuguese, Dutch, and English requests for trade and to Portuguese and Spanish requests for the right to proselytize in Japan. Ieyasu welcomed the trade, seeing in it a means of acquiring firearms, commercial profits, and general information.

By 1612, however, certain diplomatic incidents had convinced the old soldier that the missionaries were, potentially at least, part of a secular threat to the political order that he had so laboriously constructed, and in the next two years he took steps to stop missionary activity and discourage the practice of their religion. Ieyasu started a trend that his successors were to pursue for three decades, until Christianity was nearly eradicated in Japan and only a token foreign trade survived at Nagasaki.

Ieyasu's daimyo transfers and political reforms of the years after the battle at Seki-

gahara had greatly strengthened his position, but he remained wary of the daimyos, and from 1604 until 1614 he had his son Hidetada keep them at work building and enlarging the castle at Edo. Thousands of ships and tens of thousands of men were employed for years on end hauling huge stones and great logs from distant points to Edo.

By the time of his death Ieyasu had built the largest castle in the world, a sprawling network of broad moats, towering stone walls, long wooden parapets, huge gatehouses, and great fireproof warehouses full of rice and coin. Around it lay mansions in which the daimyos lived as hostages. Edo became a bustling town and port, full of artisans, traders, clerks, and labourers.

*Elimination of remaining rivals.* This great construction effort left Ieyasu stronger, and the cost involved left the daimyos much poorer. Yet Ieyasu still did not feel that his family fortunes were secure, for he knew full well that the undoubted military might of the Tokugawa family must evolve into undoubted political right. Although Hidetada was shogun, that did not necessarily settle the question of rightful authority, because Hideyoshi had been survived by a son, Hideyori; and, even as he was growing up in his great castle at Ōsaka, the boy gradually acquired more warrior followers and began to appear as a real threat to Tokugawa legitimacy.

By 1614, however, many of the powerful former followers of Hideyoshi had died, and Ieyasu apparently felt that he could safely undertake to destroy this last potential rival. After sufficient tension had developed, he mobilized his armies, and in two desultory and unimpressive campaigns, the old warrior finally reduced the great castle and destroyed its inmates. He then made more territorial adjustments favourable to the Tokugawa forces and returned again to his home at Sumpu. A year later, in 1616, he sickened and died, having accomplished what a century of warriors had attempted and failed: he brought enduring preeminence to his own family and a lasting peace to Japan. (C.D.T.)

BIBLIOGRAPHY. A.L. Sadler, *The Maker of Modern Japan: The Life of Tokugawa Ieyasu* (1937, reprinted 1977), is the principal work in English, containing mostly battle stories and anecdotes. C.D. Totman, *Politics in the Tokugawa Bakufu, 1600–1843*, ch. 1 (1967), summarizes the administrative aspects of Ieyasu's rise to power. Koya Nakamura, *Ieyasu den* (1965), is a sympathetic scholarly biography by the preeminent scholar of Ieyasu (in Japanese).

**Tokugawa Keiki:** *see* Tokugawa Yoshinobu.

**Tokugawa Mitsukuni** (b. July 11, 1628, Mito, Hitachi Province, Japan—d. Jan. 14, 1701, Nishiyama, Hitachi Province), Japanese feudal lord who began the compilation of the *Dai Nihon shi* ("History of Great Japan"), a comprehensive rewriting of Japanese history modelled after the great Chinese dynastic histories. Mitsukuni's project, which was not finally completed until 1906 (although most of the work was done during his lifetime), helped establish Confucian philosophy in Japan and also served to reawaken Japanese nationalistic feelings and loyalty to the throne.

Scion of the ruling Tokugawa family and grandson of the first Tokugawa shogun, Tokugawa Ieyasu, Mitsukuni was an influential member of the Tokugawa government as well as the lord of Mito, one of the most important independent fiefs in the country.

After leading a dissolute life as a youth, Mitsukuni became interested in classical studies, feeling that all earlier works dealing with Japanese history were mere calendars of events. He was 30 years old when he began the compilation of his history.

The structure of the *Dai Nihon shi* is similar to that of the historical studies done by the 12th-century Chinese Neo-Confucian thinker Chu Hsi; Mitsukuni, like Chu Hsi, intended his study to be morally instructive, evaluating men of the past and thus teaching the men of the present about the nature of virtue. Mitsukuni was fortunate to gain the aid of many eminent scholars, especially that of the Chinese Ming dynasty loyalist Chu Shun-shui (*q.v.*).

In tracing the history of the Japanese Imperial family and the steps by which the power of the throne had been usurped by the shoguns, Mitsukuni revived loyalty to the emperor. As a result, the Mito fief became one of the leading centres of the movement that resulted in the Meiji Restoration (1868), which overthrew the shogunate and restored power to the Imperial house.

*Where the same name may denote a person, place, or thing, the articles will be found in that order*

**Tokugawa Nariaki** (b. April 4, 1800, Edo, Japan—d. Sept. 29, 1860, Mito, Hitachi Province), Japanese advocate of reform measures designed to place more power in the hands of the emperor and the great lords and to keep foreigners out of Japan. He played a prominent role in the Meiji Restoration (1868), which overthrew the Tokugawa family, whose members for more than 250 years had ruled Japan through the office of shogun.

A member of the Tokugawa family himself, Nariaki in 1829 succeeded his brother as head of Mito *han* (fief), one of the most powerful of the many feudal fiefs into which Japan was then divided. Although controlled by the Tokugawa house, Mito had become the centre of a movement claiming that the true Japanese way was the way of the emperor, whose power the shogun had usurped. An articulate adherent of the movement, Nariaki urged the central government to grant more power to the feudal lords, to encourage national consolidation, and to adopt Western military and industrial techniques to strengthen national defenses. Western techniques, however, were to be applied without allowing Westerners to enter the country, for Nariaki believed that increased trade and contact with the West violated sacred Japanese tradition.

Because of Nariaki's prestige, the reform program he instituted in his own domain became a model for the rest of the country. He reorganized the fief's finances and administration, carried out extensive public works, began an iron and shipbuilding industry, and introduced Western military techniques. When he began to cast his own cannon in direct violation of the Shogun's internal security provisions, however, he was forced to abdicate as head of Mito *han* in favour of his son Keiki. He continued to exercise influence in Mito, however, and in 1848 he was allowed to resume his post.

Five years later Commodore Matthew C. Perry of the U.S. Navy was sent to Japan in command of a fleet of gunships to force the country to end its two centuries of isolation. In an attempt to consolidate national opinion, the government called on Nariaki for advice; he demanded that no concessions be made. When a treaty was signed with Perry the following year, Nariaki became the head of an influential group demanding reform of the shogunate.

Although Nariaki's son Keiki was considered the most eligible candidate to succeed the Shogun (Tokugawa Iesada) when he died in 1858, another contender was chosen, and the government then concluded the treaty that established trade between the United States and Japan. Nariaki attacked this treaty, concluded without the Emperor's consent, as a betrayal of Japanese tradition. This attack was viewed as insubordination by the Shogun, and Nariaki and his party were ordered into retirement. The disintegration of Tokugawa power after Nariaki's death eventually brought a more reform-minded group to power within the shogunate. Keiki, named shogun in 1866 as Tokugawa Yoshinobu, presided over the subsequent demise of the shogunate.

**Tokugawa period,** also called EDO PERIOD (1603–1867), the final period of traditional Japan, a time of internal peace, political stability, and economic growth under the shogunate (military dictatorship) founded by Tokugawa Ieyasu. As shogun, Ieyasu achieved hegemony over the entire country by balancing the power of potentially hostile domains (*tozama*) with strategically placed allies (*fudai*) and collateral houses (*shimpan*). As a further strategy of control, beginning in 1635, Ieyasu's successor required the domainal lords, or daimyo, to maintain households in the Tokugawa administrative capital of Edo (modern Tokyo) and reside there for several months every other year. The resulting system of semi-autonomous domains directed by the central authority of the Tokugawa shogunate lasted for more than 250 years.

As part of the systematic plan to maintain stability, the social order was officially frozen, and mobility between the four classes (*i.e.*, warriors, farmers, artisans, and merchants) was prohibited. Numerous members of the warrior class, or samurai (*q.v.*), took up residence in the capital and other castle towns where many of them became bureaucrats. Peasants, who made up 80 percent of the population, were forbidden to engage in non-agricultural activities so as to insure a stable and continuing source of income for those in positions of authority. Another aspect of the Tokugawa concern with political stability was fear of foreign ideas and military intervention. Cognizant that the colonial expansion of Spain and Portugal in Asia had been made possible by the work of Catholic missionaries, the Tokugawa shoguns came to view the missionaries as a threat to their rule. Measures to expel them from the country culminated in the promulgation of three exclusion decrees in the 1630s, which effected a complete ban on Christianity. Moreover, in issuing these orders, the Tokugawa shogunate officially adopted a policy of national seclusion. From 1633 onward Japanese subjects were forbidden to travel abroad or to return from overseas, and foreign contact was limited to a few Chinese and Dutch merchants still allowed to trade through the southern port of Nagasaki.

The national economy expanded rapidly from the 1680s to the early 1700s. The emphasis placed on agricultural production by the Tokugawa shogunate encouraged considerable growth in that economic sector. Expansion of commerce and the manufacturing industry was even greater, stimulated by the development of large urban centres, most notably Edo, Ōsaka, and Kyōto, in the wake of the government's efforts at centralization and its success in maintaining peace. The production of fine silk and cotton fabrics, manufacture of paper and porcelain, and sake brewing flourished in the cities and towns, as did trading in these commodities. This increase in mercantile activity gave rise to wholesalers and exchange brokers, and the ever-widening use of currency and credit produced powerful financiers. The emergence of this well-to-do merchant class brought with it a dynamic urban culture that found expression in new literary and art forms (*see* Genroku period).

While merchants and to a lesser extent tradesmen continued to prosper well into the 18th century, the daimyo and samurai began to experience financial difficulties. Their primary source of income was a fixed stipend tied to agricultural production, which had not kept



"Boats Returning to Yabase," *nishiki-e* print from the series "Eight Views of Lake Biwa" by the Ukiyo-e artist Hiroshige, Tokugawa period, 1835
By courtesy of the Art Institute of Chicago. Clarence Buckingham Collection

pace with other sectors of the national economy. Several attempts at fiscal reform were made by the government during the late 18th and 19th centuries, but the financial strain on the warrior class increased as the period progressed. During its final 30 years in power the Tokugawa shogunate had to contend with peasant uprisings and samurai unrest as well as with financial problems. These factors, combined with the growing threat of Western encroachment, brought into serious question the continued existence of the regime, and by the 1860s many demanded the restoration of direct Imperial rule as a means of unifying the country and solving the prevailing problems. The powerful southwestern *tozama* domains of Chōshū and Satsuma exerted the greatest pressure on the Tokugawa government and brought about the overthrow of the last shogun, Hitotsubashi Keiki (or Yoshinobu), in 1867. Less than a year later the Meiji emperor was restored to supreme power (*see* Meiji Restoration).

**Tokugawa Tsunayoshi** (b. Feb. 23, 1646, Edo, Japan—d. Feb. 19, 1709, Edo), fifth Tokugawa shogun of Japan, known as the "Dog Shogun" because of his obsession with dogs.

Proclaimed shogun in 1680, Tsunayoshi presided over one of the most prosperous and peaceful periods in Japanese history. His major accomplishments were in cultural affairs, in which he worked to promote the Neo-Confucianism of the 12th-century Chinese scholar Chu Hsi, whose philosophy emphasized loyalty to the government as man's first duty. Toward the end of his career, however, Tsunayoshi tended to ignore the duties of government for the pleasures of his palace, and the government became somewhat lax and at times eccentric, as evident in his notorious decrees relating to the welfare of dogs.

Born in the Year of the Dog, Tsunayoshi was influenced by a Buddhist monk who told him he had been a dog in his previous existence. As a result, Tsunayoshi decreed the death penalty for anyone who harmed a dog, insisted that dogs be addressed only in honorific terms, and kept an estimated 50,000 of them at government expense, feeding them on a choice diet of rice and dried fish.

**Tokugawa Yoshimune** (b. Nov. 27, 1684, Kii Province, Japan—d. July 12, 1751, Edo), eighth Tokugawa shogun, who is considered one of Japan's greatest rulers. His far-reaching reforms totally reshaped the central administrative structure and temporarily halted the decline of the shogunate.

Yoshimune was originally the head of Kii, one of the three hereditary Japanese feudal fiefs ruled by descendants of the original Tokugawa ruler not in the main line of succession to the shogunate. A lack of sons in the main branch of the family, however, resulted in Yoshimune's succession to the position of shogun in 1716. Upon assuming his new office, he tried to institute the program he had used successfully in Kii to alleviate that fief's monetary problems. He began by reducing the number of hereditary governmental retainers, who were paid fixed governmental stipends. To slow the increase in their numbers, he refused to allow most inheritances past the first generation. He also attempted to set a good example by eliminating court luxuries and returning to the simple and austere life of the Tokugawa founder. At the same time, he tried to improve the quality of the administration and to raise national morale by instituting a vigorous program of education for all his subordinates, designed to improve their literary skill and to imbue them with the old warrior values of discipline and leadership. Finally, he adopted methods designed to combat corruption.

Since the chief source of revenue was the tax on agricultural produce, Yoshimune attempted to increase crop yields by developing new land and popularizing new crops, such as sweet potatoes and sugarcane, that could be grown in soil not used for rice cultivation. In an effort to find other sources of income, he licensed commercial monopolies and attempted to regulate rice prices. But his limitation on trade merely had a depressing effect on the economy. While his reforms did revitalize the government, his reputation as one of the greatest of Japanese reformers has been questioned because his efforts resulted in little more than a temporary respite; following his reign, corruption and inefficiency again became rampant.

There can be no doubt, however, that Yoshimune's inquiring spirit led to the growth of interest in Western science; he himself had a large globe made, and he also imported a telescope from the Netherlands. He helped develop the first law code of the Tokugawa era (1603–1867). The resulting Kansei Code, not completed until after Yoshimune's death, laid the basis for a more humane law than had previously been in existence. He retired in 1745 in favour of his son, although he acted as a guardian of shogunal power until his death.

**Tokugawa Yoshinobu,** original name TOKUGAWA KEIKI (b. Oct. 28, 1837, Edo, Japan—d. Jan. 22, 1913, Tokyo), the last Tokugawa shogun of Japan, who helped make the Meiji Restoration (1868)—the overthrow of the shogunate and restoration of power to the emperor—a relatively peaceful transition.

Born into the ruling Tokugawa family, Keiki was the son of Tokugawa Nariaki, who was the head of the feudal fief of Mito. The Hitotsubashi family, a Tokugawa branch that, like the Mito extension, was eligible to succeed to the shogunate, had no male heirs during this period. Thus, when Keiki, seventh son of Nariaki, was adopted into the Hitotsubashi family, he greatly increased his chance to succeed to the shogunate. When the shogun Tokugawa Iesada died without heir in 1858, Nariaki attempted to push his son's candidacy as a way of implementing his own reformist policies. A more moderate group prevailed, however, and an infant boy (Tokugawa Iemochi) was chosen as the new shogun. Keiki and his father, along with other radicals, were forced into domiciliary confinement.

The government's policy of granting trading concessions to the West, however, soon aroused strong opposition and brought about renewed demands that the shogun yield some of his power to the emperor. In 1862 the government was finally forced to accept a compromise in which Keiki was appointed guardian to the new shogun.

Keiki immediately moved to introduce reforms to bring the Imperial court and the shogun into closer harmony and allow the great lords to have some voice in the decision-making processes. Under pressure he agreed to expel all foreigners from the country on June 25, 1863. When that day passed with no action, however, criticism of the shogunate again increased.

In 1864 the radical rulers of the fief of Chōshū openly defied the central government, and Keiki successfully mounted a punitive expedition. After the forces of the shogunate withdrew, however, in 1865, the radicals again assumed power in Chōshū. A second expedition against the fief the following year was defeated, because many of the great lords, alienated by Keiki's attempts to reassert his authority at their expense, refused to come to his aid. Although the sudden death of the shogun, Iemochi, allowed Keiki to withdraw his troops and save face, the weakness of the shogunal forces was obvious.

Elevated to shogun in 1866, as Tokugawa Yoshinobu, he made a desperate effort to obtain French aid. As pressure increased he agreed to surrender his powers in 1867, expecting to be the first among equals in any new power structure that emerged. Satsuma and Chōshū leaders, however, decided to move first; on Jan. 3, 1868, a group of radical samurai seized the palace in Kyōto and declared an Imperial restoration. Although Yoshinobu agreed to accept the results of the coup, his advisers refused, and a short civil war ensued. When the Imperial forces marched on the shogunal capital at Edo (now Tokyo), Yoshinobu finally forced his troops to surrender. Yoshinobu himself was allowed to retire to Mito. Later pardoned, he was granted the rank of prince in 1902.

**Tokusa Burakumin** (Japanese minority): *see* Burakumin.

**Tokushima,** prefecture (*ken*) and city, Shikoku, Japan, facing the Pacific Ocean. The prefecture's 1,600 sq mi (4,145 sq km) are drained by the Yoshino-gawa (Yoshino River), whose valley is followed by a major railway. Since the Tokugawa era (1603–1867) salt making and the cultivation and processing of indigo and tobacco have been special activities. Other agricultural products include rice, vegetables, and flowers for the Ōsaka–Kōbe area.

Because of available land and abundant water resources, the chemical industry was established in the 1960s in the prefectural capital, Tokushima, on the lower course of the Yoshino-gawa. Traditional industries produce cotton textiles, processed foods, and wood articles. Important cities are Tokushima, famous for the annual Japanese festival with the folk dance of *awa odori* and puppet shows; Naruto;

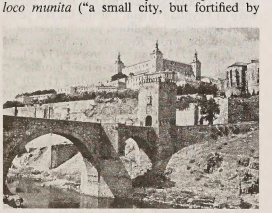
largest copper mine; the ore is extracted by strip or open-cut mining, concentrated, and trucked to the port of Sangi. There also is a major coalfield nearby. Local agriculture (corn [maize], coconuts) adds to the city's economy. Toledo has a commercial airport and ferry service across Tañon Strait to San Carlos on the island of Negros. Inc. city, 1960. Pop. (1990 est.) 117,245.

**Toledo,** *provincia,* in the *comunidad autónoma* ("autonomous community") of Castile-La Mancha, south-central Spain. It is bordered north by the provinces of Ávila and Madrid, east by Cuenca, south by Ciudad Real, and west by Cáceres and Badajoz. It has an area of 5,934 square miles (15,368 square km). Most of the province is crossed by the Tagus River and its numerous tributaries. In the northwest there is a mountainous area that joins the Sierra de Gredos; in the south there are the steep mountains of Toledo that separate the basin of the Tagus from that of the Guadiana; in the east lies a portion of the plateau of La Mancha, which extends farther south; and in the centre are wide plains, well-watered by the Tagus.

Products of Toledo province include minerals (iron, lead, silver, mercury, copper, kaolin, phosphates, and graphite), wheat, oats, vegetable oils, wine, fruit, vegetables, and timber; sheep, pigs, and horses are also raised. Industry is concentrated in the provincial capital, Toledo (*q.v.*). Pop. (1988 est.) 490,938.

**Toledo,** ancient (Latin) TOLETUM, or (Arabic) TULAYTULAH, city, capital of Toledo *provincia,* which is situated in the *comunidad autónoma* ("autonomous community") of Castile-La Mancha, south-central Spain, on a rugged promontory washed on three sides by the Tagus River. It lies 42 miles (67 km) south-southwest of Madrid.

Of ancient origin, Toledo is mentioned by the Roman historian Livy as *urbs parva. sed loco munita* ("a small city, but fortified by



The Alcántara Bridge across the Tagus River in Toledo, Spain, overlooked by the Alcázar (fortress)
Edith Henriksson—Ostman Agency

location"). Conquered by the Roman general Marcus Fulvius Nobilior in 193 BC, it became an important Roman colony and the capital of Carpentia. The city was the residence of the Visigothic court in the 6th century and site of the famous councils, the third of which (589) was particularly important because of King Recared's conversion to Christianity. During the Moorish period (712–1085), it was the home of an important Mozarab community (Arabic-speaking Christians). Taken by King Alfonso VI in 1085, it became the most important political and social centre of Castile. It was the scene of a fusion of Christian, Arab, and Jewish culture, an example of which was the School of Translators (Escuela de Traductores) established by Alfonso X the Wise in the 13th century. The city's importance declined after Philip II made Madrid his capital (1560).

Toledo is considered most representative of Spanish culture, and the whole urban area has been declared a national monument. Its rocky site has resulted in narrow, winding streets, with steep gradients and rough surfaces, centring on the Plaza del Zocodover. Two bridges cross the Tagus: in the northeast is the bridge of Alcántara, at the foot of the medieval castle of San Servando, parts of which date from Roman and Moorish times; in the northwest is the bridge of San Martín, dating from the late 13th century. Parts of the walls of Toledo are of Visigothic origin, although most are Moorish or Christian. There are well-preserved gateways from various periods, including the Puerta Vieja de Bisagra (10th century), traditionally used by Alfonso VI in 1085.

Important buildings showing Islāmic influence include the former mosques of Bib-al-Mardom (Cristo de la Luz; 10th century), with interesting cross vaulting, and of Las Tornerías; the Mudéjar synagogues of Santa María la Blanca (12th century) and El Tránsito (14th century; housing the Sephardi museum); and the Mudéjar churches of San Román, of Cristo de la Vega, of Santiago del Arrabal, and of Santo Tomé. The last has a fine tower and a chapel containing the painting "Burial of the Conde de Orgaz" by El Greco.

The cathedral, generally considered the most Hispanic of Spanish Gothic cathedrals, was begun by King Ferdinand III and Archbishop Rodrigo Jimenez de Rada in 1226. Outstanding among innumerable works of art are the choir stalls, the large *retablo mayor* ("raised altarpiece"), the ornate chapel of Don Alvaro de Luna, the Mozarab Chapel, and the Chapter House. There is also a rich museum that has a processional custodia (for carrying the monstrance and Host) by Enrique de Arfe (1524) and a series of paintings by El Greco, Francisco de Goya, Sir Anthony Van Dyck, Luis de Morales, and others.

The elaborate Church of San Juan de los Reyes, constructed by Juan Guas, is in Isabelline style. Of the same period is the Casa de la Santa Hermandad, now partly a museum. Dating from the early 16th century is the Hospital de Santa Cruz, designed by Enrique de Egas, restored and now used for the Provincial Museum of Archaeology and Fine Arts. Construction of the Alcázar (fortress), which dominates the city, began about 1531 to a design by Alonso de Covarrubias and with a fine patio by Francisco Villalpando; it houses the Army Museum. Its defense by the Nationalists in 1936 was one of the most heroic episodes of the Spanish Civil War. Other buildings such as the Ayuntamiento (early 18th century), the numerous Baroque churches, the Neoclassical Hospital del Nuncio and the Institute of Secondary Education, the museums of El Greco's house and of the Taller del Moro, and the modern Military Academy of Infantry, parks, and promenades justify the city's prestige and fame.

Toledan steel and particularly swords have long been famous, being mentioned as early as the 1st century BC in the *Cynegetica* of Grattius "Faliscus." There is an important National Factory of Arms and workshops for damask and engraving, which produce metalwork decorated in the Mudéjar tradition. A characteristic product is marzipan, a Christmas sweet made from almonds and sugar. Pop. (1982 est.) 61,813.

**Toledo,** city, seat (1835) of Lucas county, northwestern Ohio, U.S., at the mouth of the Maumee River (bridged). It lies along Maumee Bay (southwestern tip of Lake Erie), 55 miles (89 km) southwest of Detroit and is a principal Great Lakes port, being the hub of a metropolitan complex that includes Ottawa Hills, Maumee, Oregon, Sylvania, Perrysburg, and Rossford. The area was opened to white settlement after the Battle of Fallen Timbers, a conflict fought nearby in 1794 and resolved in a series of Indian treaties negotiated between 1795 and 1817. Fort Industry (1803–05) was located at the mouth of Swan Creek (now downtown Toledo), where permanent settlement was made after the War of 1812. Two villages, Port Lawrence (1817) and Vistula (1832), were consolidated in 1833 and named for Toledo, Spain. The united community was incorporated as a city in 1837.

Ohio's decision to include the Toledo area (then part of the Michigan Territory) in the state's canal system led to a boundary dispute (the so-called Toledo War of 1835). Residents of the city organized to transfer the political jurisdiction of the lower Maumee from the Michigan Territory to Ohio. Michigan, led by Governor Stevens T. Mason, opposed this and sent troops. Ohio Governor Robert Lucas called out the militia, and the state legislature organized most of the disputed area into Lucas County, with the present Ohio line as the northern boundary. The dispute was settled by President Andrew Jackson in favour of Ohio. In 1836 the U.S. Congress compensated Michigan for the loss by awarding it the Upper Peninsula and admission to statehood.

Industrial development was spurred in the 1830s and '40s by the arrival of the railroads, the construction of the Wabash and Erie and Miami and Erie canals, and by the discovery of local deposits of gas and oil in 1844. Glassmaking (now a major industry) was introduced in the late 1880s by Edward Libbey and Michael Owens. Toledo is now a major commercial, industrial, and transportation centre. Its port, connected with the St. Lawrence Seaway, is one of the world's largest for bituminous coal shipping. Foreign commerce receipts are mostly for grain, wood pulp, paper, pig iron, iron ore, stone, sand and gravel, aluminum ingots, and structural steel. Highly diversified manufactures include glass, automobiles (including the celebrated Jeep), auto parts, plastics, petroleum, weighing machines, furnaces, machinery, and tools.

The University of Toledo was established in 1872, Davis Junior College of Business in 1869, the Medical College of Ohio at Toledo in 1964, and Michael J. Owens Technical College in 1967. The Toledo Museum of Art has a notable glass collection. The city has a Roman Catholic cathedral (Our Lady Queen of the Holy Rosary), an orchestra, and zoological gardens with an open-air amphitheatre. Nearby are the Crane Creek State Park and the Toledo Raceway Park for horse racing. Pop. (1990) city, 332,943; MSA, 614,128.

**Tolentino de Almeida, Nicolau** (b. Sept. 10, 1740, Lisbon, Port.—d. June 23, 1811), Portugal's leading satirical poet of the 18th century.

At age 20 Tolentino entered the University of Coimbra to study law; he interrupted his studies three years later to become a teacher of rhetoric. In 1776 he was appointed to a post in Lisbon and the following year was named professor of rhetoric. About 1777, Tolentino grew tired of his teaching and aspired to public office. He dedicated numerous verses to members of the new political generation and, like other poets of the period, drew satirical sketches of the former minister, the Marquês de Pombal (*A Quixotada*). He eventually was made an officer in the royal administration. In 1790 he was made a knight of the royal family, and in 1801 his works were published by the state.

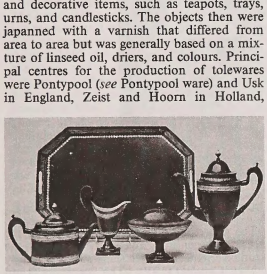
Tolentino's literary importance is based on the wide range of social types depicted in his poetic vignettes and on the light he sheds on the writer's position in Portuguese society from Pombal's reign to the end of the century.

**Toleration, Edict of,** German TOLERANZ-PATENT (Oct. 19, 1781), law promulgated by the Holy Roman emperor Joseph II granting limited freedom of worship to non-Roman Catholic Christians and removing civil disabilities to which they had been previously subject

in the Austrian domains, while maintaining a privileged position for the Catholic Church. In an edict of Jan. 2, 1782, sometimes also called the Toleranzpatent, Joseph regulated the status of Jews in the Habsburg territories, freeing them from many discriminatory restrictions.

**Toleration Act** (May 24, 1689), act of Parliament granting freedom of worship to Nonconformists (*i.e.*, dissenting Protestants such as Baptists, Congregationalists, and Methodists). It was one of a series of measures that firmly established the Revolution of 1688 in England. It allowed Nonconformists their own places of worship and their own teachers and preachers, subject to acceptance of certain oaths of allegiance. It did not apply to Catholics and Unitarians and maintained the existing social and political disabilities (including exclusion from political office) for dissenters.

**toleware,** any object of japanned (varnished) tinplate and pewter. The term is derived from the French name for such objects, *tôle peinte.* The tinplate sheets of iron or steel dipped in molten tin or pewter (an alloy of tin and copper) were worked into a variety of domestic and decorative items, such as teapots, trays, urns, and candlesticks. The objects then were japanned with a varnish that differed from area to area but was generally based on a mixture of linseed oil, driers, and colours. Principal centres for the production of tolewares were Pontypool (*see* Pontypool ware) and Usk in England, Zeist and Hoorn in Holland,



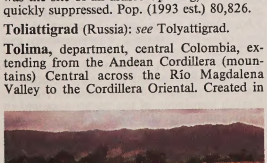
English toleware tea set, *c.* 1800
Helga Studio photo for Richard B. Faber, Boston

Paris, and, in the United States, Pennsylvania. The trade began in Europe in the first half of the 18th century, a little later in the United States, and had all but ceased by the end of the 19th century.

**Toliara,** also spelled TOLIARY, formerly TULÉAR, town, southwestern Madagascar. The town is a port on Saint-Augustin Bay of the Mozambique Channel and serves as the outlet for the agricultural products of the hinterland. It also ships marine products, processes sisal, produces soap and food products, and has a livestock-breeding station and an experimental agriculture station. In April 1971 Toliara was the site of an armed uprising, which was quickly suppressed. Pop. (1993 est.) 80,826.

**Toliattigrad** (Russia): *see* Tolyattigrad.

**Tolima,** department, central Colombia, extending from the Andean Cordillera (mountains) Central across the Río Magdalena Valley to the Cordillera Oriental. Created in



Cattle herd in Tolima department, Colombia
Carl Frank

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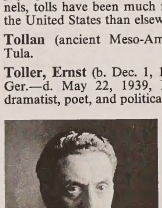
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**Toller, Ernst** (b. Dec. 1, 1893, Samotschin, Ger.—d. May 22, 1939, New York City), dramatist, poet, and political activist, who was



Toller
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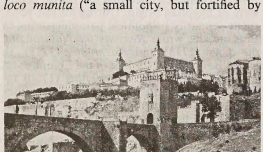
largest copper mine; the ore is extracted by strip or open-cut mining, concentrated, and trucked to the port of Sangi. There also is a major coalfield nearby. Local agriculture (corn [maize], coconuts) adds to the city's economy. Toledo has a commercial airport and ferry service across Tañon Strait to San Carlos on the island of Negros. Inc. city, 1960. Pop. (1990 est.) 117,245.

**Toledo,** *provincia,* in the *comunidad autónoma* ("autonomous community") of Castile-La Mancha, south-central Spain. It is bordered north by the provinces of Avila and Madrid, east by Cuenca, south by Ciudad Real, and west by Cáceres and Badajoz. It has an area of 5,934 square miles (15,368 square km). Most of the province is crossed by the Tagus River and its numerous tributaries. In the northwest there is a mountainous area that joins the Sierra de Gredos; in the south there are the steep mountains of Toledo that separate the basin of the Tagus from that of the Guadiana; in the east lies a portion of the plateau of La Mancha, which extends farther south; and in the centre are wide plains, well-watered by the Tagus.

Products of Toledo province include minerals (iron, lead, silver, mercury, copper, kaolin, phosphates, and graphite), wheat, oats, vegetable oils, wine, fruit, vegetables, and timber; sheep, pigs, and horses are also raised. Industry is concentrated in the provincial capital, Toledo (*q.v.*). Pop. (1988 est.) 490,938.

**Toledo,** ancient (Latin) TOLETUM, or (Arabic) TULAYTULAH, city, capital of Toledo *provincia,* which is situated in the *comunidad autónoma* ("autonomous community") of Castile-La Mancha, south-central Spain, on a rugged promontory washed on three sides by the Tagus River. It lies 42 miles (67 km) south-southwest of Madrid.

Of ancient origin, Toledo is mentioned by the Roman historian Livy as *urbs parva, sed loco munita* ("a small city, but fortified by



The Alcántara Bridge across the Tagus River in Toledo, Spain, overlooked by the Alcázar (fortress)
Edith Henriksson—Ostman Agency

location"). Conquered by the Roman general Marcus Fulvius Nobilior in 193 BC, it became an important Roman colony and the capital of Carpentia. The city was the residence of the Visigothic court in the 6th century and site of the famous councils, the third of which (589) was particularly important because of King Recared's conversion to Christianity. During the Moorish period (712–1085), it was the home of an important Mozarab community (Arabic-speaking Christians). Taken by King Alfonso VI in 1085, it became the most important political and social centre of Castile. It was the scene of a fusion of Christian, Arab, and Jewish culture, an example of which was the School of Translators (Escuela de Traductores) established by Alfonso X the Wise in the 13th century. The city's importance declined after Philip II made Madrid his capital (1560).

Toledo is considered most representative of Spanish culture, and the whole urban area has been declared a national monument. Its rocky site has resulted in narrow, winding streets, with steep gradients and rough surfaces, centring on the Plaza del Zocodover. Two bridges cross the Tagus: in the northeast is the bridge of Alcántara, at the foot of the medieval castle of San Servando, parts of which date from Roman and Moorish times; in the northwest is the bridge of San Martín, dating from the late 13th century. Parts of the walls of Toledo are of Visigothic origin, although most are Moorish or Christian. There are well-preserved gateways from various periods, including the Puerta Vieja de Bisagra (10th century), traditionally used by Alfonso VI in 1085.

Important buildings showing Islāmic influence include the former mosques of Bib-al-Mardom (Cristo de la Luz; 10th century), with interesting cross vaulting, and of Las Tornerías; the Mudéjar synagogues of Santa María la Blanca (12th century) and El Tránsito (14th century; housing the Sephardi museum); and the Mudéjar churches of San Román, of Cristo de la Vega, of Santiago del Arrabal, and of Santo Tomé. The last has a fine tower and a chapel containing the painting "Burial of the Conde de Orgaz" by El Greco.

The cathedral, generally considered the most Hispanic of Spanish Gothic cathedrals, was begun by King Ferdinand III and Archbishop Rodrigo Jimenez de Rada in 1226. Outstanding among innumerable works of art are the choir stalls, the large *retablo mayor* ("raised altarpiece"), the ornate chapel of Don Alvaro de Luna, the Mozarab Chapel, and the Chapter House. There is also a rich museum that has a processional custodia (for carrying the monstrance and Host) by Enrique de Arfe (1524) and a series of paintings by El Greco, Francisco de Goya, Sir Anthony Van Dyck, Luis de Morales, and others.

The elaborate Church of San Juan de los Reyes, constructed by Juan Guas, is in Isabelline style. Of the same period is the Casa de la Santa Hermandad, now partly a museum. Dating from the early 16th century is the Hospital de Santa Cruz, designed by Enrique de Egas, restored and now used for the Provincial Museum of Archaeology and Fine Arts. Construction of the Alcázar (fortress), which dominates the city, began about 1531 to a design by Alonso de Covarrubias and with a fine patio by Francisco Villalpando; it houses the Army Museum. Its defense by the Nationalists in 1936 was one of the most heroic episodes of the Spanish Civil War. Other buildings such as the Ayuntamiento (early 18th century), the numerous Baroque churches, the Neoclassical Hospital del Nuncio and the Institute of Secondary Education, the museums of El Greco's house and of the Taller del Moro, and the modern Military Academy of Infantry, parks, and promenades justify the city's prestige and fame.

Toledan steel and particularly swords have long been famous, being mentioned as early as the 1st century BC in the *Cynegetica* of Grattius "Faliscus." There is an important National Factory of Arms and workshops for damask and engraving, which produce metalwork decorated in the Mudéjar tradition. A characteristic product is marzipan, a Christmas sweet made from almonds and sugar. Pop. (1982 est.) 61,813.

**Toledo,** city, seat (1835) of Lucas county, northwestern Ohio, U.S., at the mouth of the Maumee River (bridged). It lies along Maumee Bay (southwestern tip of Lake Erie), 55 miles (89 km) southwest of Detroit and is a principal Great Lakes port, being the hub of a metropolitan complex that includes Ottawa Hills, Maumee, Oregon, Sylvania, Perrysburg, and Rossford. The area was opened to white settlement after the Battle of Fallen Timbers, a conflict fought nearby in 1794 and resolved in a series of Indian treaties negotiated between 1795 and 1817. Fort Industry (1803–05) was located at the mouth of Swan Creek (now downtown Toledo), where permanent settlement was made after the War of 1812. Two villages, Port Lawrence (1817) and Vistula (1832), were consolidated in 1833 and named for Toledo, Spain. The united community was incorporated as a city in 1837.

Ohio's decision to include the Toledo area (then part of the Michigan Territory) in the state's canal system led to a boundary dispute (the so-called Toledo War of 1835). Residents of the city organized to transfer the political jurisdiction of the lower Maumee from the Michigan Territory to Ohio. Michigan, led by Governor Stevens T. Mason, opposed this and sent troops. Ohio Governor Robert Lucas called out the militia, and the state legislature organized most of the disputed area into Lucas County, with the present Ohio line as the northern boundary. The dispute was settled by President Andrew Jackson in favour of Ohio. In 1836 the U.S. Congress compensated Michigan for the loss by awarding it the Upper Peninsula and admission to statehood.

Industrial development was spurred in the 1830s and '40s by the arrival of the railroads, the construction of the Wabash and Erie and Miami and Erie canals, and by the discovery of local deposits of gas and oil in 1844. Glassmaking (now a major industry) was introduced in the late 1880s by Edward Libbey and Michael Owens. Toledo is now a major commercial, industrial, and transportation centre. Its port, connected with the St. Lawrence Seaway, is one of the world's largest for bituminous coal shipping. Foreign commerce receipts are mostly for grain, wood pulp, paper, pig iron, iron ore, stone, sand and gravel, aluminum ingots, and structural steel. Highly diversified manufactures include glass, automobiles (including the celebrated Jeep), auto parts, plastics, petroleum, weighing machines, furnaces, machinery, and tools.

The University of Toledo was established in 1872, Davis Junior College of Business in 1869, the Medical College of Ohio at Toledo in 1964, and Michael J. Owens Technical College in 1967. The Toledo Museum of Art has a notable glass collection. The city has a Roman Catholic cathedral (Our Lady Queen of the Holy Rosary), an orchestra, and zoological gardens with an open-air amphitheatre. Nearby are the Crane Creek State Park and the Toledo Raceway Park for horse racing. Pop. (1990) city, 332,943; MSA, 614,128.

**Tolentino de Almeida, Nicolau** (b. Sept. 10, 1740, Lisbon, Port.—d. June 23, 1811), Portugal's leading satirical poet of the 18th century.

At age 20 Tolentino entered the University of Coimbra to study law; he interrupted his studies three years later to become a teacher of rhetoric. In 1776 he was appointed to a post in Lisbon and the following year was named professor of rhetoric. About 1777, Tolentino grew tired of his teaching and aspired to public office. He dedicated numerous verses to members of the new political generation and, like other poets of the period, drew satirical sketches of the former minister, the Marquês de Pombal (*A Quixotada*). He eventually was made an officer in the royal administration. In 1790 he was made a knight of the royal family, and in 1801 his works were published by the state.

Tolentino's literary importance is based on the wide range of social types depicted in his poetic vignettes and on the light he sheds on the writer's position in Portuguese society from Pombal's reign to the end of the century.

**Toleration, Edict of,** German TOLERANZPATENT (Oct. 19, 1781), law promulgated by the Holy Roman emperor Joseph II granting limited freedom of worship to non-Roman Catholic Christians and removing civil disabilities to which they had been previously subject

in the Austrian domains, while maintaining a privileged position for the Catholic Church. In an edict of Jan. 2, 1782, sometimes also called the Toleranzpatent, Joseph regulated the status of Jews in the Habsburg territories, freeing them from many discriminatory restrictions.

**Toleration Act** (May 24, 1689), act of Parliament granting freedom of worship to Nonconformists (*i.e.,* dissenting Protestants such as Baptists, Congregationalists, and Methodists). It was one of a series of measures that firmly established the Revolution of 1688 in England. It allowed Nonconformists their own places of worship and their own teachers and preachers, subject to acceptance of certain oaths of allegiance. It did not apply to Catholics and Unitarians and maintained the existing social and political disabilities (including exclusion from political office) for dissenters.

**toleware,** any object of japanned (varnished) tinplate and pewter. The term is derived from the French name for such objects, *tôle peinte.* The tinplate sheets of iron or steel dipped in molten tin or pewter (an alloy of tin and copper) were worked into a variety of domestic and decorative items, such as teapots, trays, urns, and candlesticks. The objects then were japanned with a varnish that differed from area to area but was generally based on a mixture of linseed oil, driers, and colours. Principal centres for the production of tolewares were Pontypool (*see* Pontypool ware) and Usk in England, Zeist and Hoorn in Holland,



English toleware tea set, *c.* 1800
Helga Studio photo for Richard B. Faber, Boston

Paris, and, in the United States, Pennsylvania. The trade began in Europe in the first half of the 18th century, a little later in the United States, and had all but ceased by the end of the 19th century.

**Toliara,** also spelled TOLIARY, formerly TULÉAR, town, southwestern Madagascar. The town is a port on Saint-Augustin Bay of the Mozambique Channel and serves as the outlet for the agricultural products of the hinterland. It also ships marine products, processes sisal, produces soap and food products, and has a livestock-breeding station and an experimental agriculture station. In April 1971 Toliara was the site of an armed uprising, which was quickly suppressed. Pop. (1993 est.) 80,826.

**Toliattigrad** (Russia): *see* Tolyattigrad.

**Tolima,** department, central Colombia, extending from the Andean Cordillera (mountains) Central across the Río Magdalena Valley to the Cordillera Oriental. Created in



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1861, it occupies an area of 9,097 square miles (23,562 square km). The department ranks first in Colombia in the production of rice and sesame; other crops grown in Tolima include cotton, coffee, corn (maize), bananas, sugarcane, and beans. Livestock, particularly cattle and pigs, are numerous. There is some light industry. Tolima is traversed by highways and railroads, which link Ibagué (*q.v.*), the departmental capital, with Bogotá, Armenia, and Neiva. Pop. (1997 est.) 1,310,963.

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sentenced to imprisonment for five years. A scheme to get him shot in the prison yard was frustrated by a kindly old guard, who routed him away from the gunmen.

In confinement Toller wrote *Masse-Mensch* (1920; *Man and the Masses*, 1923), a play that brought him widespread fame. Books of lyrics added to his reputation. In 1933, immediately before the accession of Hitler, he emigrated to the United States. Also in that year he brought out his vivid autobiography, *Eine Jugend in Deutschland* (*I Was a German,* 1934).

In Hollywood Toller had a brief, unhappy stint as a scriptwriter. Impoverished, convinced that his plays were passé, and separated from his young wife, he hanged himself in his Manhattan hotel.

**Tolman, Edward C(hace)** (b. April 14, 1886, West Newton, Mass., U.S.—d. Nov. 19, 1959, Berkeley, Calif.), U.S. psychologist who developed a system of psychology known as purposive, or molar, behaviourism, which attempts to explore the entire action of the total organism.

Brother of the chemist and physicist Richard C. Tolman, Edward Tolman taught psychology at the University of California, Berkeley (1918–54). Though influenced by a number of other psychologists, including E.B. Holt, his system perhaps owes one of its most obvious debts to Gestalt psychology, which strives to understand the components of mental life as structured wholes. About 1922 he began to assert that the stimulus-response behaviourism of John B. Watson was too limited because it selected the conditioned reflex as the unit of habit. Tolman advanced his system in his major work, *Purposive Behavior in Animals and Men* (1932). He suggested that the unit of behaviour is the total, goal-directed act, using varied muscular movements that are organized about the purposes served, and guided by cognitive processes. His system remained behaviourist by its adherence to objective observation.

**Tolman, Richard C(hace)** (b. March 4, 1881, West Newton, Mass., U.S.—d. Sept. 5, 1948, Pasadena, Calif.), U.S. physical chemist and physicist who demonstrated the electron to be the charge-carrying particle in the flow of electricity in metals and determined its mass.

Tolman became professor and dean of graduate studies at the California Institute of Technology (1922–48), Pasadena. He published treatises on statistical mechanics (1927, 1938) and relativity theory (1927, 1934). During World War II he was vice chairman of the National Defense Research Committeè and chief science adviser to Brig. Gen. Leslie R. Groves, head of military affairs concerning the development of the atomic bomb. After the war he was adviser to Bernard M. Baruch, then U.S. representative to the United Nations Atomic Energy Commission.

**Tolmeita** (Libya): *see* Ptolemais.

**Tolna,** *megye* (county), south central Hungary, extending westward from the Danube and with an area of 1,429 sq mi (3,702 sq km). Near the Danube the landscape is flat, rising gently west to the Hegyhát ("Ridge of Hills") and the northeastern outliers of the Mecsek Mountains. In the Sárköz riverine lowland the Gemenc Forest is a wildlife sanctuary. Corn (maize), wheat, tobacco, and tomatoes are important crops; there is some canning of fruit, vegetables, and meat. Pigs, sheep, and cattle are raised, and leather is produced. In the Sárköz area the peasant costumes are known for the quality of their embroidery and weaving.

Principal towns are Szekszárd (*q.v.*), the *megye* seat, Paks, where Hungary's first atomic power plant was constructed, and Dunaföldvár, where road and rail cross the Danube. Near Szekszárd is the Plant Research Institute, which concentrates on improving strains of hops, soybeans, and sunflowers. Pop. (1990 prelim.) 253,681.

**Tolpuddle Martyrs,** six English farm labourers who were sentenced (March 1834) to seven years' transportation to a penal colony in Australia for organizing trade-union activities in the Dorsetshire village of Tolpuddle. Their leaders, George and James Loveless (or Lovelace), had established a lodge of the Friendly Society of Agricultural Labourers during the great national wave of trade-union activity in 1833–34.

The Whig government, alarmed at the dimensions of working-class discontent, arrested six Tolpuddle labourers—the Loveless brothers, James Brine, Thomas Stanfield and his son John, and James Hammett—ostensibly for administering unlawful oaths but actually for combining to protect their already meagre wages. Convicted and sentenced by a hostile judge and jury, the six men became popular heroes.

There was an immediate public reaction in all parts of the country, particularly in London, where there were large-scale demonstrations in which many future Chartist leaders took part. The government largely ignored popular sentiment, and it was not until March 1836 that the sentences were remitted.

**Tolstoy, Aleksey Konstantinovich, Graf** (Count) (b. Sept. 5 [Aug. 24, old style], 1817, St. Petersburg—d. Oct. 10 [Sept. 28, O.S.], 1875, Krasny Rog, Russia), Russian poet, novelist, and dramatist, an outstanding writer of humorous and satirical verse, serious poetry, and novels and dramas on historical themes.

A distant relative of Leo Tolstoy, Aleksey Konstantinovich held various honorary posts at court and spent much time in western Europe. In the 1850s, in collaboration with two cousins, Tolstoy began to publish comic verse under the joint pseudonym "Kozma Prutkov," who is portrayed as a clerk in the Ministry of Finance. Other satirical verses were written under Tolstoy's own name. *Son statskogo sovetnika Popova* (1878; "The Dream of Councillor Popov") makes fun of Russian bureaucracy and political careerism.

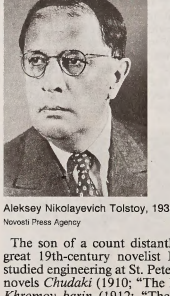
Tolstoy had, together with his gift for humour, a deep interest in Russia's past, which he tended to contrast with the unsatisfactory and absurd present. Among his most popular historical works is *Knyaz Serebryany* (1862; *Prince Serebrenni,* 1874), a novel about 16th-century Russia inspired by the works of Sir Walter Scott and the German Romantics. Tolstoy's dramatic trilogy about the late 16th and early 17th centuries belongs to Russia's best historical dramatic writing. The three plays—*Smert Ioanna Groznogo* (1866; *The Death of Ivan the Terrible,* 1869); *Tsar Fyodor Ioannovich* (1868; *Czar Feodor Ioannovitch,* 1924); and *Tsar Boris* (1870)—are written in blank verse and inspired to some extent by Shakespeare. *Tsar Fyodor,* the character study of a good man but a weak ruler, is probably his masterpiece. In the same historical vein he also wrote ballads, using the subject matter of Russian folk songs or idealized historical figures.



Aleksey Konstantinovich Tolstoy, portrait after an oil painting by I.E. Repin, 1879
By courtesy of the State Literature Museum, Moscow

As a lyrical poet Tolstoy had a considerable range of style and feeling. In addition to many love and nature poems, he wrote a very effective paraphrase of St. John Damascene's prayer for the dead in *Ioann Damaskin* (1859; Eng. trans. in *The Oxford Book of Russian Verse,* 1925). Much of his poetry has been set to music by Tchaikovsky, Mussorgsky, Rimsky-Korsakov, and others.

**Tolstoy, Aleksey Nikolayevich, Graf** (Count) (b. Jan. 10 [Dec. 29, 1882, old style], 1883, Nikolayevsk, Russia—d. Feb. 23, 1945, Moscow), novelist and short-story writer, a former nobleman and "White" Russian émigré who became a supporter of the Soviet regime and an honoured artist of the Soviet Union.



Aleksey Nikolayevich Tolstoy, 1935
Novosti Press Agency

The son of a count distantly related to the great 19th-century novelist Leo Tolstoy, he studied engineering at St. Petersburg. His early novels *Chudaki* (1910; "The Eccentrics") and *Khromoy barin* (1912; "The Lame Squire") deal with gentry families in a spirit of comic realism reminiscent of Gogol. After the Bolshevik Revolution he supported the Whites in the Russian Civil War and emigrated to western Europe, where he lived from 1919 to 1923. During this time he wrote one of his finest works, *Detstvo Nikity* (1921; *Nikita's Childhood,* 1945), a nostalgic, partly autobiographical study of a small boy's life.

In 1923, prompted by homesickness, Tolstoy asked to return to Russia, where he enjoyed a productive and prosperous career for the rest of his life. He was a natural storyteller and many of his works are purely entertaining. He wrote science fiction (*Aelita,* 1922), children's stories, thrillers, stories of international intrigue, and more than 20 plays. His most extensive serious work is his trilogy of novels *Khozhdeniye po mukam.* Consisting of *Sestry* (1920–21; "Sisters"), *Vosemnadtsaty god* (1927–28; "The Year 1918"), and *Khmuroe utro* (1940–41; "A Gloomy Morning"), it is a study of Russian intellectuals converted to the Bolshevik cause during the Civil War. An English translation of the trilogy appeared in 1946 under the title *The Road to Calvary* (1946). For the trilogy and for his long unfinished historical novel *Pyotr I* (1929–45; *Peter the First,* 1956), he received Stalin prizes. During World War II he was a prolific author of patriotic articles and also composed his two-part play *Ivan the Terrible* (1943), a dramatic apologia for the pathologically cruel tsar. The play earned Tolstoy his third Stalin Prize.

**Tolstoy, Dmitry Andreyevich, Graf** (Count) (b. March 13 [March 1, old style], 1823, Moscow—d. May 7 [April 25, O.S.],

1889, St. Petersburg, Russian Empire), tsarist Russian government official known for his reactionary policies.

Tolstoy was appointed to the education ministry in 1866, charged with imposing strict discipline on both the students and teachers and keeping them from exposure to revolutionary doctrines that were thought to have become dangerously widespread in the Russian Empire. He also proceeded to undo many of the previous educational reforms. Greek and Latin classical studies were introduced into the curriculum to discipline the students. Entry into the universities became more difficult because only the affluent could afford the preparatory schools teaching the classics. An inspectorate of public schools was founded in 1869 on the initiative of Tolstoy to maintain surveillance and supervision over the morals of the students and teachers and to combat "politically and morally criminal propaganda." Textbooks and lectures were censored, and teachers were dismissed without a hearing. As president of the Imperial Academy of Sciences, Tolstoy sought to limit the teaching of science. In 1880 he left the Ministry of Education.

Tolstoy became minister of the interior in 1882 and followed a policy of uncompromising reaction and counterreform aimed at revision of the liberal legislation of the 1860s. In August 1882 strict censorship was placed on the press, and some newspapers and periodicals had to submit all copy to official censors before publication. In July 1889 the peasant townships were placed under land captains chosen by the minister of the interior. Land captains had to be members of the landowning nobility, and they appointed the town elders who had the power to fine and arrest the peasants without trial. Tolstoy's ministry ended when he died in 1889.

**Tolstoy, Leo,** Tolstoy also spelled TOLSTOI, Russian in full LEV NIKOLAYEVICH, COUNT (Graf) TOLSTOY (b. Aug. 28 [Sept. 9, New Style], 1828, Yasnaya Polyana, Tula province, Russian Empire—d. Nov. 7 [Nov. 20], 1910, Astapovo, Ryazan province), Russian author, one of the world's greatest novelists.

A brief treatment of Leo Tolstoy follows. For full treatment, *see* MACROPAEDIA: Tolstoy.

The son of a landed noble family, Tolstoy was educated at Kazan University but, dissatisfied with the teaching, returned in 1847 to his estate at Yasnaya Polyana. Joining his brother Nikolay in the Caucasus in 1851, he entered the army a year later. He saw action in local engagements against hill tribesmen and at the siege of Sevastopol during the Crimean War. He visited France, Switzerland, and Germany in 1857 and on returning started a school for peasant children at Yasnaya Polyana. In 1862 he married Sonya (Sofya) Andreyevna Bers, the daughter of a prominent Moscow physician.

Tolstoy had already acquired a reputation as a brilliant short-story writer with his *Sevastopolskiye rasskazy* (1855–56; *Sevastopol Sketches*) and as a novelist with *Kazaki* (1863; *The Cossacks*). The publication of *Voyna i mir* (1865–69; *War and Peace*), however, established him as the preeminent Russian novelist. The book is set in Russia during the Napoleonic Wars and examines the lives and experiences of a large cast of characters, each of whom is differently affected by the French invasion of their country in 1812. Subtle psychological analysis and detailed social observations are handled by the author with the utmost objectivity in this monumental narrative. The structure of *War and Peace,* with its flawless placement of complex characters in a turbulent historical setting, is regarded as one of the great artistic achievements in the history of the Western novel.

Tolstoy's second major novel, *Anna Karenina* (1875–77), centres on a married woman whose life ends in tragedy and early death after she deserts her husband out of misguided love for a younger man. The novel is similar to *War and Peace* in its use of parallel sets of characters whose circumstances resemble one another but whose personalities and outlooks on life differ. *Anna Karenina* shows Tolstoy's increasing emphasis on moral conflict in his fiction and dwells on a theme first broached in *War and Peace,* that of the ultimate meaning and purpose of human existence.

In *Ispoved* (1878–79, published 1884; *My Confession*) Tolstoy gave an account of the spiritual crisis he endured in his search for an answer to the meaning of life. He eventually turned to a form of Christian anarchism and devoted himself to social reform. In *Chto takoye iskusstvo?* (1898; *What Is Art?*) Tolstoy developed an aesthetic system that gave art a religious and moral function. He wrote one more full-length novel, *Voskreseniye* (1899; *Resurrection*), and plays dealing with social problems, including *Vlas tmy* (performed 1888; *The Power of Darkness*). Torn between his urge to live as a wandering ascetic and his responsibilities as a landed proprietor and successful artist, Tolstoy left home one night and died a few days later at a remote railway junction.

**Tolstoy, Pyotr Andreyevich, Count** (Graf) (b. 1645, Russia—d. 1729, Solovetsky Monastery, Solovetsky Island, in the White Sea, Russian Empire), diplomat and statesman who was a close collaborator and influential adviser of Peter I the Great of Russia (reigned 1682–1725).



Pyotr Andreyevich Tolstoy, engraving by A. Grachov, after a portrait by Y. Argunos
Novosti Press Agency

The son of Andrey Vasilyevich Tolstoy, a court official, Pyotr Tolstoy became a *stolnik,* or steward, for Tsar Alexis. In May 1682 he helped make Sophia Alekseyevna the regent for her brothers, Alexis' two sons, Ivan V and Peter I (reigned jointly 1682–96). Although Tolstoy subsequently withdrew his support from Sophia when Peter seized power from her in 1689, he was banished from Moscow until 1697, when, in order to gain Peter's favour, he volunteered to go to Italy to learn seamanship.

After studying there for two years, Tolstoy gained Peter's confidence and in 1702 was sent as Russia's first permanent envoy to Turkey. For the next eight years, while Russia was engaged in the Great Northern War against Sweden, he performed the difficult task of easing Russo-Turkish tension—which was aggravated by Peter's construction of a naval fleet on the Black Sea—and maintained peace on Russia's southern borders. In November 1710, however, after Charles XII of Sweden had taken refuge in Turkish territory (following his defeat at the Battle of Poltava in June 1709), the Turks reversed their policy, imprisoned Tolstoy, and entered a war with Russia. He was released in April 1712, after a truce had been concluded. He later attended the negotiating sessions that resulted in the Peace of Adrianople (June 1713).

Returning to Russia, Tolstoy was appointed senator, president of the Board of Trade, and member of the Commission for Foreign Affairs. In 1717 he went, as Peter's special envoy, to Vienna and Naples and convinced the tsarevich Alexis, who had fled from his father, to return to Russia. As a reward for successfully accomplishing this mission—which ultimately resulted in Alexis' death—Tolstoy was appointed head of the secret chancellery (*i.e.,* the political police; 1718).

On the occasion of the coronation of Peter's second wife, Catherine, as empress-consort (May 1724), Tolstoy was honoured with the title of count. Following Peter's death (in early 1725), he supported Catherine's candidacy for the throne, and after her accession he became a member of the Supreme Privy Council (created February 1726), which assumed the real tasks of government during Catherine's reign (1725–27). But when Tolstoy, because of his previous involvement in the disgrace and demise of Alexis, objected to Catherine's naming Alexis' son (the future Peter II) as her heir, he fell into disfavour and was banished to Solovetsky Monastery (May 1727).

**Toltec,** Nahuatl-speaking people who held sway over what is now central Mexico from the 10th to the 12th century AD. Their name has many meanings: an "urbanite," a "cultured" person, and, literally, the "reed people," derived from their urban centre, Tollan ("Place of the Reeds"), near the modern town of Tula, about 50 miles (80 km) north of Mexico City. About AD 900 they sacked and burned the great city of Teotihuacán under the leadership, according to tradition, of Mixcóatl ("Cloud Serpent"). Under his son, Ce Acatl Topiltzin Quetzalcóatl, they formed a number of small states of various ethnic origins into an empire later in the 10th century. The ruler Topiltzin introduced the cult of Quetzalcóatl ("Feathered Serpent"), which name he adopted. This cult and others, as well as the Toltec military orders of the Coyote, the Jaguar, and the Eagle, were introduced into important Mayan cities to the south in Yucatán, such as Chichén Itzá and Mayapán, indicating the broad influence of the Toltec. The advent of the Toltec also marked the rise of militarism in Mesoamerica. They also were noted as builders and craftsmen and have been credited with the creation of fine metalwork, monumental porticoes, serpent columns, gigantic statues, carved human and animal standard-bearers, and peculiar reclining Chac-Mool figures. Beginning in the 12th century the invasion of the nomadic Chichimec destroyed the Toltec hegemony in central Mexico. Among the invaders were the Aztec, or Mexica, who destroyed Tollan about the mid-12th century. *See also* Mesoamerican civilization.

**Toluca,** in full TOLUCA DE LERDO, city, capital of México *estado* ("state"), central Mexico. It lies in the valley of the same name at an elevation of 8,793 feet (2,680 m) and is one of the highest cities in North America. It was founded in 1530 and attained city status in 1533. The designation "de Lerdo" was adopted in 1861 in honour of the Mexican president Sebastián Lerdo de Tejada. It is a commercial and communications centre, but agriculture and livestock raising in the vicinity also are of major significance. Toluca's industries include textile manufacturing, brewing and distilling, and food processing. Its oldest church was founded soon after the Spanish conquest and rebuilt in 1585. The Autonomous University of the State of México was established in the city in 1956. Toluca is joined by railway, highway, and air routes to Mexico City to the

east-northeast and to other plateau cities. Pop. (1990) 487,630.

**toluene,** aromatic hydrocarbon used extensively as starting material for the manufacture of industrial chemicals. It comprises 15–20 percent of coal-tar light oil and is a minor constituent of petroleum. Both sources provide toluene for commercial use, but larger amounts are made by catalytic reforming of petroleum naphtha. The compound is used in the synthesis of trinitrotoluene (TNT), benzoic acid, saccharin, dyes, photographic chemicals, and pharmaceuticals. It is also used as a solvent and antiknock additive for aviation gasoline. Pure toluene (melting point, −95° C [−139° F]; boiling point, 110.6° C [231.1° F]) is a colourless, flammable, toxic liquid, insoluble in water but soluble in all common organic solvents. Its chemical formula is that of methylbenzene, $C_6H_5CH_3$.

**Tolyattigrad,** also spelled TOLIATTIGRAD, formerly (1964–91) TOLYATTI, or (until 1964) STAVROPOL, city, Samara *oblast* (province), western Russia, on the Volga River. Founded as a fortress in 1738 and known as Stavropol, it was given city status in 1780 and again in 1946. Overshadowed by Samara, it remained unimportant until the beginning in 1950 of the huge V.I. Lenin barrage (dam) and hydroelectric station, immediately below Stavropol at Zhigulyovsk. On completion in 1957, the dam's reservoir, covering over 2,000 square miles (5,200 square km) and extending some 370 miles (600 km) upstream, flooded the site of Stavropol, which was moved to a higher location as Novy (New) Stavropol. In 1964 Stavropol was renamed for the Italian Communist Party leader Palmiro Togliatti. Tolyattigrad is a chemical centre producing synthetic rubber, fertilizers, and chemical fibres. The city also manufactures machinery.

In 1970 the largest automobile works in Russia began production in the city. As a result, the city grew with exceptional speed from only 72,000 inhabitants in 1959. It has several research institutes and a polytechnic institute. Pop. (1997 est.) 712,000.

**Tom Price,** mining town, northwestern Western Australia, in the Hamersley Range area near Mount Tom Price, the site of major high-grade deposits of hematite. The town was constructed during 1965–66 by Hamersley Iron Proprietary Ltd. as the residential and service centre for workers at the huge open-cut iron-ore mine at Mount Tom Price. The town and the mountain are named after Thomas Moore Price, a vice president of Kaiser Steel Ltd., who encouraged mining development in the Hamersley Range. In the late 20th century millions of tons of iron ore were sent by rail annually 180 miles (290 km) to the deep-sea port of Dampier for shipment, mainly to Japan and the United States. Pop. (1986) 3,435.

**Tom Thumb, General:** *see* Stratton, Charles.

**Tomacelli, Pietro** (pope): *see* Boniface IX.

**tomahawk** (from Algonkian *otomahuk:* "to knock down"), the war hatchet of the North American Indians. Early versions were made by tying a stone head to a handle with animal sinew or by passing a double-pointed chipped stone through a hole bored in a handle. After the arrival of Europeans, tomahawk heads often were made of iron obtained in trade. Globe-headed clubs, often ornately incised and decorated with feathers, and used for ceremonies as well as war, have also been called tomahawks.

**Tomakomai,** city, southern Hokkaido, Japan, facing the Pacific Ocean. The city was a regional transport and commerce centre in the early 19th century. A pulp and paper industry has operated there since 1910, and chemicals are also produced. Commercial and industrial ports were completed in 1963, to serve as the basis for heavier industrialization; another port was completed in 1976. Pop. (2001 est.) 171,300.

**Tomar,** city and *concelho* (municipality), Santarém district, central Portugal, on the Nabão River, a tributary of the Zêzere, northeast of Lisbon. The city contains notable examples of architecture, including the ruined castle of the Knights Templar; the 12th-century church and castle of the Order of Christ (Ordem de Cristo; founded 1314), which played an important part in the voyages of discovery; a 16th-century church built in the Manueline style (a mixture of Moorish and florid Gothic) by João de Castilho; and the Renaissance church of Our Lady of the Immaculate Conception (Nossa Senhora da Conceição; 1579). The ruined palace of Henry the Navigator was restored in the 16th century. Tomar is an agricultural trade centre (olive oil, wine, fruits, vegetables), and some timbering is carried on nearby. Pop. (2001 est.) city, 17,900; (1987 est.) *concelho,* 46,300.

**Tomara** DYNASTY, one of the minor early medieval ruling houses of northern India. The family is known from scattered sources, and it is impossible to reconstruct its history in any detail. Purāṇic evidence gives the early location in the Himalayan region. According to bardic tradition, the dynasty was one of the 36 Rājput tribes. The history of the family spans the period between the reign of Anaṅgapāla, who founded the city of Delhi in the 11th century AD, and the incorporation of Delhi within the Cāhamāna kingdom in 1164. Although Delhi subsequently became decisively a part of the Cāhamāna kingdom, numismatic and comparatively late literary evidence indicates that such Tomara kings as Anaṅgapāla and Madanapāla continued to rule as feudatories, presumably until the final conquest of Delhi by the Muslims in 1192–93.

**Tómas Gudmundsson** (Icelandic poet): *see* Gudmundsson, Tómas.

**Tomasi di Lampedusa, Giuseppe** (b. Dec. 23, 1896, Palermo, Sicily, Italy—d. July 23, 1957, Rome, Italy), Italian author, Duke of Palma, and Prince of Lampedusa, internationally renowned for his only novel, *Il gattopardo* (1958; *The Leopard*).

Born into the Sicilian aristocracy, Lampedusa served as an artillery officer during World War I. After his capture and imprisonment in Hungary, he escaped and returned to Italy on foot. After a nervous breakdown precluded the diplomatic career to which he had aspired, he devoted himself to an intensely private life of intellectual activity, reading in several languages, discussing literature with a small group of friends, and writing for his own enjoyment.

In 1955 Lampedusa began writing the novel that, although rejected by publishers during his lifetime, brought him world acclaim with its posthumous publication. The novel is a psychological study of Don Fabrizio, prince of Salina (called the Leopard, after his family crest), who witnesses with detachment the transfer of power in Sicily from the old Bourbon aristocracy to the new Kingdom of Italy and the grasping, unscrupulous liberal bourgeoisie during the 1860s. Don Fabrizio's nephew, by contrast, participates opportunistically in the revolution and marries into the new class.

While adhering to the Don's conservative viewpoint, the novel unfolds in a series of compelling dramatic scenes, matched by richness of literary style. The character of Don Fabrizio is one of the most striking in modern Italian literature, and the book, despite the ideological controveries it stimulated, is widely recognized as a masterpiece.

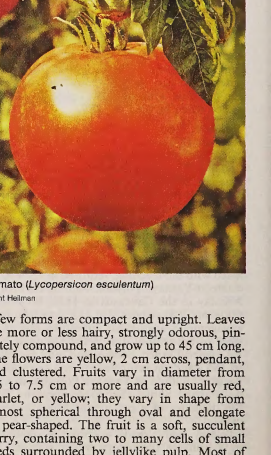
The author's only other book, also published posthumously, was *Racconti* (1961; *Two Stories and a Memory*).

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**Tomaszów Mazowiecki,** town, Piotrków *województwo* (province), central Poland, on the Pilica River. A major textile centre, the town contains Poland's largest synthetic-silk factories as well as carpet factories and leatherworks. A national bison preserve is located in nearby Spalska forest. The town has good road and rail connections to Warsaw and Łódź.

Founded in the late 18th century, the town received municipal rights in 1830. The weaving industry was the primary economic staple after the early 1800s, with textile plants appearing as synthetic processes were developed. Pop. (1991 est.) 69,900.

**tomato,** any fruit of the numerous cultivated varieties of *Lycopersicon esculentum,* a plant of the nightshade family (Solanaceae); also, the fruit of *L. pimpinelli folium,* the tiny currant tomato. Tomato plants are generally much branched, spreading 60–180 cm (24–72 inches) and recumbent when fruiting, but



Tomato (*Lycopersicon esculentum*)
Grant Heilman

a few forms are compact and upright. Leaves are more or less hairy, strongly odorous, pinnately compound, and grow up to 45 cm long. The flowers are yellow, 2 cm across, pendant, and clustered. Fruits vary in diameter from 1.5 to 7.5 cm or more and are usually red, scarlet, or yellow; they vary in shape from almost spherical through oval and elongate to pear-shaped. The fruit is a soft, succulent berry, containing two to many cells of small seeds surrounded by jellylike pulp. Most of the tomato's vitamin C is found in this pulp. The tomato is used raw in salads, served as a cooked vegetable, used as an ingredient of various prepared dishes, and pickled.

The wild species originated in the Andean area of South America, probably mainly in Peru and Ecuador, and is thought to have been domesticated in Mexico long before the arrival of Europeans; its name is derived from the Náhuatl (Aztec) word *tomatl.* The tomato was introduced to Europe by the Spanish in the early 16th century. The Spanish and Italians seem to have been the first peoples to adopt it as a food; it has remained a staple of Italian cuisine.

The Italians called the tomato *pomodoro* ("golden apple"), which has given rise to speculation that the first tomatoes known to Europeans were yellow; similarly, it has been suggested that the French called it *pomme d'amour* ("love apple") because it was thought

to have aphrodisiacal properties. Some scholars assert, however, that the tomato was at first taken to be a kind of eggplant, of which it is a close relative. The eggplant was called *pomme des Mours* ("apple of the Moors") because it was a favourite vegetable of the Arabs; *pomodoro* and *pomme d'amour* may be corruptions of this name.

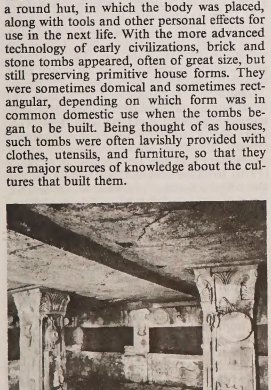
In France and northern Europe the tomato was at first grown as an ornamental plant. Since botanists recognized it as a relative of the poisons belladonna and deadly nightshade, it was regarded with suspicion as a food. (The roots and leaves of the tomato plant are in fact poisonous; they contain the neurotoxin solanine.)

Tomatoes were introduced to North America from Europe; Thomas Jefferson is known to have raised them at Monticello in 1781. The tomato was used for food in Louisiana as early as 1812, but not in the northeastern states until about 1835, and it did not attain widespread popularity in the United States until the early 20th century.

By the late 20th century the United States was the world's leading producer of tomatoes. Southern European countries, particularly Italy, are also major producers. Since the plant requires relatively warm weather and much sunlight, it is grown chiefly in hothouses in northern Europe and Great Britain. A large percentage of the world's tomato crop is used for processing; products include canned tomatoes, tomato juice, catsup, puree, paste, and "sun-dried" tomatoes or dehydrated pulp.

**tomato fruitworm:** *see* corn earworm.

**tomb,** in the strictest sense, a home or house for the dead; the term is applied loosely to all kinds of graves, funerary monuments, and memorials. In many primitive cultures the dead were buried in their own houses, and the tomb form may have developed out of this practice, as a reproduction in permanent materials of primeval house types. Thus prehistoric tomb barrows were usually built around a round hut, in which the body was placed, along with tools and other personal effects for use in the next life. With the more advanced technology of early civilizations, brick and stone tombs appeared, often of great size, but still preserving primitive house forms. They were sometimes domical and sometimes rectangular, depending on which form was in common domestic use when the tombs began to be built. Being thought of as houses, such tombs were often lavishly provided with clothes, utensils, and furniture, so that they are major sources of knowledge about the cultures that built them.



Tomb of the Stuccoes, or Grotta Bella, Etruscan tomb chamber at Caere (modern Cerveteri, Italy), 7th century BC
Alinari—Art Resource

In very early times, royal dead were apparently provided not only with all manner of necessary objects but also with actual servants, who were put to death at the time of the burial so that they might continue to serve their master. Typical is the tomb of Queen Shub-Ad of Ur (Early Dynastic Period in Mesopotamia, *c.* 2900–*c.* 2334 BC), which contained the bodies of more than 60 attendants. It became more common, however, to substitute statues or painted images for human beings. This was the practice in most Egyptian tombs; and from such painted pictures and statuettes, particularly in Old and Middle Kingdom tombs, a vivid picture of Egyptian life can be gained.

In many cultures and civilizations the tomb was superseded by, or coexisted with, monuments or memorials to the dead; sometimes, as in ancient Greece, the bodies were burned and the ashes put in funerary urns. In medieval Christian thought, the tomb was considered an earthly prototype and symbol of a heavenly home. This concept appeared in the Roman catacombs, the walls of which were decorated with scenes of the resurrected in paradise. The church building itself sometimes functioned as a tomb (*e.g.*, Hagia Sophia in Istanbul was the tomb of Justinian). Throughout the Middle Ages it was common to inter bodies in churches, monasteries, and chapels, with depictions of the deceased on carved or painted plaques, or as life-size gisants (reclining sculptured figures, usually lying on their backs) placed above them. The deceased were represented not as corpses but as souls living in heaven, with their hands pressed together in adoration and the symbols of their salvation beside them. During the 15th century it became a common Christian practice to represent such figures as dead (usually on biers). This foreshadowed a general revival of the Greek practice of erecting funerary monuments, rather than tombs, during the 16th century. Since the Renaissance, the idea in the West of the tomb as a home has died out, except as a faint reminiscence in the mausoleums sometimes erected above graves or serving as burial vaults in modern cemeteries. *See also* barrow; dolmen; effigy mound; gisant; sarcophagus.

**Tomb of Agamemnon:** *see* Atreus, Treasury of.

**Tombaugh, Clyde W.,** in full CLYDE WILLIAM TOMBAUGH (b. Feb. 4, 1906, Streator, Ill., U.S.—d. Jan. 17, 1997, Las Cruces, N.M.), American astronomer who discovered the planet Pluto in 1930 after a systematic search instigated by the predictions of other astronomers. He also discovered several clusters of stars and galaxies, studied the apparent distribution of extragalactic nebulae, and made observations of the surfaces of Mars, Venus, Jupiter, Saturn, and the Moon.

During his career, Tombaugh served at Lowell Observatory, Flagstaff, Ariz., as assistant astronomer; Arizona State College as science instructor; White Sands Missile Range as optical physicist and astronomer; and New Mexico State University as associate professor of the department of earth sciences (1961–65), full professor (1965–73), and professor emeritus from 1973. Among his publications are *The Search for Small Natural Earth Satellites* (1959) and *Out of Darkness: The Planet Pluto* (1980), with Patrick Moore.

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**Tombigbee River,** river formed in northeastern Mississippi, U.S., by the confluence of the West and East forks near Amory, Miss. The river flows south and southeast for nearly 525 miles (845 km) to merge with the Alabama River; the two form the Mobile River, about 45 miles (70 km) north of Mobile, Ala. Its chief tributary, the Black Warrior River, joins it at Demopolis, Ala. The Tombigbee drains about 21,100 square miles (54,600 square km).

In the 1800s the Tombigbee was important for navigation to and above Aberdeen, Miss., but after 1900 only the 185-mile (298-kilometre) stretch below Demopolis was used. In 1915 the last of a series of 17 locks and dams was opened on the lower Tombigbee and Black Warrior, providing a 426-mile- (685-kilometre-) long, 9-foot- (3-metre-) deep channel from Mobile to Port Birmingham, Ala. By the 1990s most of the original locks and dams had been replaced by those at Jackson, Demopolis, Warrior, Oliver, and Bankhead. The Tombigbee River Valley Water Management District has since 1964 been engaged in development of the upper Tombigbee and its tributaries. Aberdeen and Columbus, Miss., and Demopolis are the chief cities on the river. The river system carries heavy traffic between Mobile and Birmingham, Ala. The Tennessee-Tombigbee Waterway (*q.v.*) opened in 1985, linking those two rivers.

**tombo** (Portuguese: "register of grants"), register of landholdings in Ceylon, compiled in the early 17th century under the Portuguese, and in the late 17th and 18th centuries under the Dutch. The traditional system of land tenure in Ceylon was a complex one based on both obligatory service and a tax in the form of money or kind. To administer this system efficiently, the Portuguese began in 1608 to compile a detailed register, or *tombo,* of all their territories in Ceylon.

The *tombo* included a description of each holding, the title of those who held it, the income it yielded, and the dues (in tax or service) to which the holder was liable. By the time of Dutch rule, most of the Portuguese *tombos* had been destroyed in the ravages of war. By 1676 the Dutch, hoping to free themselves from reliance on the word of native chiefs whom they felt to be dishonest, succeeded in compiling new *tombos.* The new *tombos,* which called for both increased service and taxes, caused widespread discontent, resulting in a decrease in land yield, population migration, and even, in one case, open rebellion. By mid-18th century, many of these *tombos* had been destroyed and had to be compiled anew. The general effect of the *tombos* was not to change the traditional land tenure system but to depersonalize and regulate it.

**tombolo,** one or more sandbars or spits that connect an island to the mainland. A single tombolo may connect a tied island to the mainland, as at Marblehead, Mass. A double tombolo encloses a lagoon that eventually fills with sediment; fine examples of these occur off the coast of Italy. The shallower waters that occur between an island and the mainland are the loci of such features because sandbars form there.

Adam's Bridge, which connected Sri Lanka (Ceylon) with India across the 33-mile (53-kilometre) wide Palk Strait, was formerly the world's largest tombolo. It was destroyed several thousand years ago by a slight change in mean sea level, and only a chain of sandbanks that seriously hinder navigation exists there today.

**Tombouctou** (Mali): *see* Timbuktu.

**Tombstone,** city, Cochise county, southeastern Arizona, U.S. The site was ironically named by Ed Schieffelin, who discovered silver there in 1877 after being told that all he would find would be his tombstone. By 1881 a silver rush had set in with an estimated 7,000 persons in the area. Along with the prospectors came adventurers and outlaws, among whom were "Doc" Holliday and Johnny Ringo, whereupon Tombstone gained a reputation for lawlessness. Feuds were com-

mon, the most notable being the gun battle at the O.K. Corral in 1881 between the Earp and Clanton families. The boom days quickly ended with floodwaters in the mines, labour strikes, and low silver prices. Tombstone was the county seat from 1881 (when it was incorporated) until 1931. Now a tourist centre and health resort, it retains a pioneer atmosphere and was declared a National Historic Landmark in 1962. Restored sites include Boot Hill Cemetery, Bird Cage Theater, the O.K. Corral, and the *Tombstone Epitaph* (newspaper, 1880) office. Pop. (2000) 1,504.

**Tomioka,** city, Gumma Prefecture (*ken*), Honshu, Japan, on the Kabura-kawa (Kabura River), west of Takasaki. Situated on a local railway between Takasaki and Shimonita, it is the cultural, administrative, and economic hub of the river valley. Tomioka was an early trade centre for cocoons and raw silk and was the site of Japan's first silk mill (1872). Newly established industries now exceed the silk-reeling industry. Major products include electrical machinery, synthetic textiles, and rubber goods. Cocoons, *konnyaku* ("devil's tongue" seaweed paste), and *shiitake* (mushrooms) are special rural products. Pop. (1990) 49,000.

**Tomioka Tessai,** original name TOMIOKA DŌSETSU, also called TOMIOKA YŪSUKE, or HYAKUREN (b. Jan. 25, 1837, Kyōto—d. Dec. 31, 1924, Kyōto), Japanese artist of *bunjinga,* or "literati painting" (which originated in China and was also called Nanga, or the Southern school of Chinese art). Tomioka's philosophical view was deeply rooted in Confucianism; and, as a creative and original artist, he managed to avoid the turmoil experienced by most other Japanese painters when faced by the overwhelming influence of the West after 1868.



"Fuji sanchō zenzu" ("The peak of Fuji"), painting by Tomioka Tessai, colour on paper mounted on a 6-panel *byōbu* screen, 1903; in the Tomioka Tessai Showroom, Seichō-ji (Seichō Temple), near Amatsu-kominato, Japan

By courtesy of the Seichō-ji, Japan

The second son of a wealthy dealer in priests' robes, he studied the Japanese classics, Confucianism, the doctrines of the Chinese scholar Wang Yang-ming, and also Buddhism and poetics. For a time, he studied with the Buddhist nun and poetess Otagaki Rengetsuni and was influenced by her philosophical attitude toward life. Although he received basic lessons in painting from Osumi Nanko and Ukita Ikkei, he studied painting essentially by himself.

Toward the end of the Edo period, because of his association with supporters of the restoration of Imperial rule, Tomioka came under official displeasure and fled to Nagasaki in 1859. Remaining there even after the Meiji Restoration, he ultimately became a Shintō priest of the Isonokami Shrine (1876) and, later, of the Otori Shrine and made efforts toward their reconstruction. After 1882 he left the priesthood to live a life of painting and scholarly study, becoming a member of the Imperial Fine Arts Academy and the Japan Nanga Society.

Tomioka's paintings, some 20,000 in all, most of which were based on classical Japanese and Chinese literature and legends, are famous for their bold brushstrokes as well as their grand-scale composition. His free-spirited works, either in monochrome or in brilliant colours, convey a strong sense of vitality, with no trace of Western perspective. They won high esteem both at home and abroad, especially after his death, when exhibitions of his paintings were held in the United States, England, France, and other countries. Among his major works are "Gunsen kōkai-zu" (1908; "Hermits Meeting on a Mountain") and "Abe no Nakamaro meishū bōgetsu-zu" (1908; "The Poet Abe Nakamaro Contemplating the Moon in China").

**Tomkins, Thomas** (b. 1572, St. Davids, Pembrokeshire, Wales—buried June 9, 1656, Martin Hussingtree, Worcester, Eng.), English composer and organist, the most important member of a family of musicians that flourished in England in the 16th and 17th centuries.

A pupil of William Byrd, he served as organist of Worcester cathedral (1596–1646), and in 1621 he became one of the organists of the Chapel Royal. Tomkins was an extremely prolific composer of anthems and services for the church, and his best madrigals rank among the finest produced by the English madrigal school. His keyboard music includes pieces in free fugal forms, variation sets, and dances. He also wrote fine consort music for viols.

**Tomlin, Bradley Walker** (b. Aug. 19, 1899, Syracuse, N.Y., U.S.—d. May 11, 1953, New York City), American painter whose paintings introduced an elegiac tone to post-World War II abstract art. Following an independent path between improvisational freedom and premeditated control, he produced in the last five years of his life a body of works notable for its great originality and depth of feeling.

During most of his career, Tomlin painted lyrical Cubist still lifes while teaching at Sarah Lawrence College and assorted boys' schools. In the mid-1940s, he fell under the influence of the Abstract Expressionist painter Adolph Gottlieb. Experimenting with the semiautomatic methods used by many Abstract Expressionists, he created graceful works, such as "Tension by Moonlight" (1948), that reflect his interest in Japanese calligraphy. He soon regarded his newly found aesthetic freedom with suspicion and began to paint such pieces as "Number 9: In Praise of Gertrude Stein" (1950; Museum of Modern Art, New York City) in which calligraphic and typographic shapes form a floating, but controlled, network over the entire surface of the canvas. During the three remaining years of his life, he continued to produce paintings in subtle variations of this style, imbuing all his works with a distinctive melancholy.



"No. 10—1952–1953," oil painting by Bradley Walker Tomlin, 1952–53; in the Munson-Williams-Proctor Institute, Utica, N.Y.

Collection of Munson-Williams-Proctor Institute, Utica, N.Y.

**Tomlinson, (Alfred) Charles** (b. Jan. 8, 1927, Stoke-upon-Trent, Staffordshire, Eng.), English poet whose best work expresses his perceptions of the world with clarity and sensitivity.

After graduating from the University of Cambridge, Tomlinson traveled extensively, especially in Italy and in the United States, where he was visiting professor at the University of New Mexico, Albuquerque, and professor in literature at Colgate University, Hamilton, N.Y. He later became reader and then professor of English poetry at the University of Bristol, Eng. Less concerned with people and emotions than with the outside world, his poetry has much in common with that of the American poets Wallace Stevens and Marianne Moore. His poems are reinforced by his sensitivity to sound, and his writing expresses what he sees with rhythmic variety and subtlety. He is a "difficult" poet in that he often makes use of indirect quotation and intricate patterns of symbolism that can obscure his meaning.

Tomlinson's early published poetry included *Relations and Contraries* (1951) and *The Necklace* (1955; rev. ed. 1966). He has also written, among other volumes, *Seeing is Believing* (1960) and *American Scenes* (1966), in which he captures the haunting atmosphere of ghost towns in the desert. Other works include *The Poem as Initiation* (1968), *America West Southwest* (1969), and *Selected Poems 1951–1974* (1978). With Octavio Paz, Tomlinson wrote *Air Born/Hijos del aire* (1979), a bilingual English–Spanish volume for which each translated the other's poems.

Tomlinson's responsiveness to sounds has made him an outstanding translator. His verse translations (in collaboration with Henry Gifford) are *Versions from Fyodor Tyutchev* (1960), *Castilian Ilexes: Versions from Machado* (1963), and *Ten Versions from Trilce* (1970), from the work of César Vallejo. He has also edited a number of critical works, and his series of lectures delivered at Trinity College, Cambridge, in 1982 was published in 1983 under the title *Poetry and Metamorphosis.*

**Tomlinson, H(enry) M(ajor)** (b. June 21, 1873, London—d. Feb. 5, 1958, London), English novelist and essayist who wrote naturally and with feeling about London, the sea, the tropics, and the futility of war.

Tomlinson grew up in the East End docks, and from early childhood developed a love for things connected with the sea. He became a journalist and fulfilled his ambition to travel. His first book, *The Sea and the Jungle* (1912), was written after he had made an expedition up the Amazon. Though ignored at the time, it remains his most representative book and is often reminiscent in style, as are his other works, of Thoreau and Emerson. Among his novels are *Gallions Reach* (1927), *All Our Yesterdays* (1930), and *Morning Light* (1946), but he is perhaps better known for his travel books: *London River* (1921), *The Turn of the Tide* (1945), and *Malay Waters* (1950).

**Tommaso** (Italian personal name): *see under* Thomas.

**tommy gun:** *see* Thompson submachine gun.

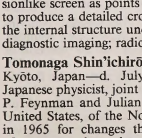
**tomography,** radiologic technique for obtaining clear X-ray images of deep internal structures by focusing on a specific plane within the body. Structures that are obscured by overlying organs and soft tissues that are insufficiently delineated on conventional X rays can thus be adequately visualized.

The simplest method is linear tomography, in which the X-ray tube is moved in a straight line in one direction while the film moves in the opposite direction. As these shifts occur, the X-ray tube continues to emit radiation so that most structures in the part of the body under examination are blurred by motion. Only those objects lying in a plane coinciding with the pivot point of a line between the tube and the film are in focus. A somewhat more complicated technique known as multidirectional tomography produces an even sharper image by moving the film and X-ray tube in a circular or elliptical pattern. As long as both tube and film move in synchrony, a clear image of objects in the focal plane can be produced. These tomographic approaches have been used to study the kidneys and other abdominal structures that are surrounded by tissues of nearly the same density and so cannot be differentiated by conventional X-ray techniques. They have also been employed to examine the small bones and other structures of the ear, which are surrounded by relatively dense temporal bone.

A still more complex technique, variously called computerized tomography (CT), or computerized axial tomography (CAT), was developed by Godfrey Hounsfield of Great Britain and Allen Cormack of the United States during the early 1970s. Since then it has become a widely used diagnostic approach. In this procedure a narrow beam of X rays sweeps across an area of the body and is recorded not on film but by a radiation detector as a pattern of electrical impulses. Data from many such sweeps are integrated by a computer, which uses the radiation absorption figures to assess the density of tissues at thousands of points. The density values appear on a televisionlike screen as points of varying brightness to produce a detailed cross-sectional image of the internal structure under scrutiny. *See also* diagnostic imaging; radiology.

**Tomonaga Shin'ichirō** (b. March 31, 1906, Kyōto, Japan—d. July 8, 1979, Tokyo), Japanese physicist, joint winner, with Richard P. Feynman and Julian S. Schwinger of the United States, of the Nobel Prize for Physics in 1965 for changes that made the theory of quantum electrodynamics fully consistent with the special theory of relativity.

Tomonaga became professor of physics at Bunrika University (later Tokyo University of



Tomonaga
By courtesy of the Japan Information Centre, London

Education) in 1941, the year he began his investigations of the problems of quantum electrodynamics. World War II isolated him from Western scientists, but in 1943 he completed and published his research. It was only after the war, in 1947, that his work came to the attention of the West, at about the same time that Feynman and Schwinger published the results of their research. It was found that all three had achieved essentially the same result from different approaches and had resolved the inconsistencies of the old theory without making any drastic changes.

Tomonaga was president of the Tokyo University of Education from 1956 to 1962, and the following year he was named chairman of the Japan Science Council. Throughout his life Tomonaga actively campaigned against the spread of nuclear weapons and urged that resources be spent on the peaceful use of nuclear energy. Most notable of his works available in English translation are *Quantum Mechanics* (1962) and his Nobel lecture *Development of Quantum Electrodynamics: Personal Recollections* (1966).

**Tompion, Thomas** (baptized July 25, 1639, Northill, Bedfordshire, Eng.—d. Nov. 20, 1713, London), most famous English clockmaker of his time, especially known for watchmaking improvements.

Tompion is believed to have worked as a blacksmith until 1664, when he was apprenticed to a London clockmaker. Admitted to the Clockmakers' Company in 1671, he became a master in 1704 and was appointed



Bracket clock with oak case, ebony veneer, and gilt bronze mounts by Tompion, *c.* 1690; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

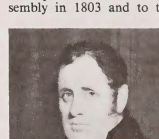
clockmaker for the new Royal Observatory, in Greenwich, in 1676.

Tompion worked closely with both the experimental physicist Robert Hooke and Edward Barlow, whose inventions contributed to improved clock and watch mechanisms. In 1675, following Hooke's design, Tompion made one of the first English watches regulated by a balance spring. In 1695, with Barlow and William Houghton, he patented the cylinder escapement (controlling device) that allowed use of a horizontal wheel, enabling Tompion to make the first of the flat and more compact watches. Working under the direction of Barlow, Tompion made an early repeating watch, a type that could be made to sound the nearest hour and nearest quarter hour by pushing two pieces extending from the sides of the watch.

Tompion devised improvements in pendulum clocks that allowed portability without damage to the mechanism and facilitated adjustment. He constructed several clocks made to run for a year without rewinding, and he produced barometers and sundials, including pieces for King William III.

**Tompkins, Daniel D.** (b. June 21, 1774, Scarsdale, N.Y.—d. June 11, 1825, Staten Island, N.Y., U.S.), liberal politician of the Jeffersonian Republican (later Democratic-Republican) Party who became U.S. vice president (1817–25) under President James Monroe.

Tompkins was elected to the New York Assembly in 1803 and to the U.S. House of



Daniel D. Tompkins, detail of a portrait by John Wesley Jarvis; in the collection of the New-York Historical Society
By courtesy of the New-York Historical Society

Representatives in 1804, from which he resigned to become an associate justice of the New York Supreme Court. As governor of New York (1807–17), he supported school improvements and a more liberal penal code and was largely responsible for the passage of legislation outlawing slavery in the state. An opponent of banking interests, he attempted to block the chartering in New York of the Bank of North America by proroguing the state legislature in 1812—the only instance of the exercise of this power in the history of New York state.

During the War of 1812 Tompkins was forced to borrow heavily, often on his own personal credit, in order to equip and arm the New York state militia. After the war there was much confusion over the money he had handled, and though Tompkins had personally gone into debt to pay state expenses, he was involved in legal wrangling that kept him from his duties much of the time during his years as vice president. The issue was not resolved until 1824, when Congress approved a grant to him of $95,000.

**Tompkins, Sally Louisa** (b. Nov. 9, 1833, Mathews County, Va., U.S.—d. July 25, 1916, Richmond, Va.), humanitarian and hospital administrator who was the only woman commissioned in the Confederate Army.

Tompkins converted a private home into a hospital in Richmond and, with her own funds, equipped and maintained it (1861–65). President Jefferson Davis, in order to retain Tompkins as administrator after he had placed all Southern hospitals under government control for military use, commissioned her a cavalry captain (Sept. 9, 1861). Serving without pay, she became known as "Captain Sally." She retained the rank of captain until her death, when she was buried with military honours.

**Tomsk,** *oblast* (province), central Russia, having an area of 122,350 square miles (316,900 square km) in the basin of the middle Ob River, which bisects it. The terrain is flat and monotonous, rising only slightly in the neighbourhood of the administrative centre, Tomsk. Almost the entire area is taiga, or coniferous forest, dominated by pine, fir, larch, and birch. Extensive swamps occupy the level watersheds. The severely continental climate and the swamps greatly hinder agriculture, which takes up only about 7 percent of the total area and is largely concentrated in the southeast. Rye, oats, and potatoes are the chief crops; some wheat and corn (maize) are also grown, while flax has increased in impor-

tance. Over most of the *oblast* timber working is the chief occupation and is well developed. Fur trapping and fishing are important in the forested north. Almost three-quarters of the urban dwellers live in the city of Tomsk, in which all significant industry is concentrated; other towns are small. Exploitation of oil and natural gas was under way in the early 1980s. Pop. (1991 est.) 1,011,700.

**Tomsk,** city and administrative centre of Tomsk *oblast,* central Russia, on the Tom River above its confluence with the Ob. Founded as a fort in 1604 to protect the river crossing, the city developed as a regional administrative centre. Once a focus for a wide area of Siberia, Tomsk has now largely been displaced by Novosibirsk, where the Trans-Siberian Railroad crosses the Ob; Tomsk lies on a branch line. The city is a major engineering centre, producing bearings and electrical equipment as well as matches, furniture, pencils, paints and dyes, and footwear. Tomsk is the site of the first Siberian university (founded 1888), a technological institute (1900), and institutes of teacher training, medicine, transport, and constructional engineering. Pop. (1991 est.) 506,600.

**tomtate,** any of certain fishes of the grunt (*q.v.*) family.

**ton,** unit of weight in the avoirdupois system equal to 2,000 pounds (907.18 kilograms) in the United States (the short ton) and 2,240 pounds (1,016.05 kilograms) in Britain (the long ton). The metric ton used in most other countries is 1,000 kilograms, equivalent to 2,204.6 pounds avoirdupois. The term derives from *tun,* denoting a large barrel used in the wine trade and named from the French *tonnerre,* or "thunder," in turn named for the rumbling it produced when rolled. *Ton* came to mean any large weight, until it was standardized at 20 hundredweights.

*Ton* may also refer to the cargo capacity of ships or to the freight itself. The register ton is defined as 100 cubic feet, the freight or measurement ton as 40 cubic feet; an older measure of a ship's displacement was based on the volume of a long ton of seawater, or 35 cubic feet. Variant tons of capacity have existed for specific commodities, such as the English water ton, used to measure petroleum products and equal to 224 British imperial gallons; the timber ton of 40 cubic feet; and the wheat ton of 20 bushels.

**Ton Duc Thang** (b. Aug. 19, 1888, Long Xuyen province, Vietnam—d. March 30, 1980, Hanoi), Communist leader who succeeded Ho Chi Minh as president of the Democratic Republic of Vietnam in 1969 and from 1976 was president of the reunited Socialist Republic of Vietnam.

In his youth Ton Duc Thang was an enthusiastic Communist. He joined the French Navy in 1912; and in 1918–19, while aboard the French warship *Waldeck-Rousseau* on its way to curb revolutionary activities in Russia, he took part in an unsuccessful plot to turn the battleship over to the Bolshevik revolutionaries. He also instigated strikes against French intervention in revolutionary China in 1925. As a result of such activities, the French imprisoned him at Poulo Condore (Con Son, island off the southern coast of Vietnam) in 1929, where he remained until 1945.

Ton Duc Thang reemerged as a public figure in 1946, after the August revolution of 1945 had swept Ho Chi Minh's Vietnam League for Independence (Viet Minh) into power. He presided over the new revolutionary government's permanent committee of the National Assembly, obtaining extensive legislative powers. During the resistance against the French in Indochina, 1946–54, Ton Duc Thang was the president of Hoi Lien Hien Quoc Dan Viet Nam (Lien Viet), the National Popular Front Association. Following the Geneva Conference of 1954, which placed the Viet Minh in control of North Vietnam, the Lien Viet was dissolved and reorganized under the name Mat-tran To-Quoc (Fatherland Front), with Ton Duc Thang as president. In 1955 the Fatherland Front took on the functions of the Lien Viet and the Viet Minh and tried to attract the allegiance of the South Vietnamese.

In 1960 Ton Duc Thang became vice president of the Democratic Republic of Vietnam (DRV) and was charged with winning over the south. The DRV supported the insurgent National Liberation Front (Viet Cong) in South Vietnam. Ton Duc Thang was awarded the Lenin Peace Prize in 1967.

**tonadilla** (diminutive of Spanish *tonada,* a type of solo song), genre of short, satirical musical comedy highly popular in 18th-century Spain. It originated as a song that was sung in the course of other short theatrical pieces. Dialogue for several characters was often written into the *tonadilla,* and it eventually expanded into an independent genre with presentations lasting from 10 to 20 minutes. It drew its personages from everyday life and included popular and folk music and dance. The *tonadilla* also influenced the development of the zarzuela, the characteristic form of Spanish musical drama or comedy.

**tonality,** in music, principle of organizing musical compositions around a central note, the tonic. Generally, any Western or non-Western music periodically returning to a central, or focal, tone exhibits tonality. More specifically, tonality refers to the particular system of relationships between notes, chords, and keys (sets of notes and chords) that dominated most Western music from *c.* 1650 to *c.* 1900 and that continues to regulate much music.

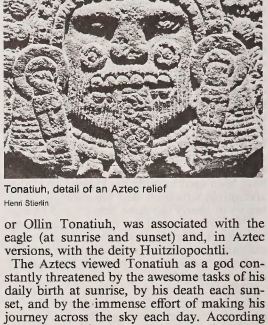
Sometimes called major–minor tonality, this system uses the notes of the major and minor scales (which are diatonic scales—*i.e.,* comprise five whole tones and two semitones) plus optional auxiliary, or chromatic, notes as the raw material with which to build melodies and chords. Within each key there is a specific hierarchy of strong and weak relationships of notes and chords both to the keynote, or tonic note, and to the chord built on that note, the tonic chord. Different keys are also closely or remotely related to the principal, or tonic, key.

In this system of tonal relations, the notes and chords within a given key can create tension or resolve it as they move away from or toward the tonic note and chord. Likewise, any modulation or movement away from the tonic key creates tensions that may then be resolved by modulation back to the tonic. The potential for contrast and tension inherent in the chord and key relationships of tonality became the basis for 18th-century musical forms such as the sonata.

Tonality is sometimes used as a synonym for the closely related concept of key. *See also* chord; key.

**tonalpohualli,** 260-day sacred almanac of many ancient Meso-American cultures, including the Maya, Mixtec, and Aztec. Used as early as the pre-Classic period (before *c.* AD 100) in Monte Albán (Oaxaca) and even earlier in the Veracruz (Olmec) culture, the almanac set the date for certain rituals and was a means of divination. It is a cycle of days resulting when the numbers 1 to 13 are juxtaposed with 20 day names: 1 Alligator, 2 Wind . . . 13 Reed, 1 Jaguar, etc. Each combination of name and number occurs once in 260 (20 × 13) days. The cycle is still observed in the 20th century by the Mixe (Oaxaca) and the Maya.

**Tonatiuh,** in Meso-American religion, Nahua sun deity of the fifth and final era (the Fifth Sun). In most myths of the Meso-American Nahua peoples, including those of the Aztecs, four eras preceded the era of Tonatiuh, each ended by cataclysmic destruction. Tonatiuh,



Tonatiuh, detail of an Aztec relief
Henri Stierlin

or Ollin Tonatiuh, was associated with the eagle (at sunrise and sunset) and, in Aztec versions, with the deity Huitzilopochtli.

The Aztecs viewed Tonatiuh as a god constantly threatened by the awesome tasks of his daily birth at sunrise, by his death each sunset, and by the immense effort of making his journey across the sky each day. According to Aztec traditions, the gods themselves were believed to practice voluntary sacrifice, first to create Tonatiuh, and then to feed him and encourage him on his path through the sky. The worship of Tonatiuh, whose sustenance required human blood and hearts, involved militaristic cults and the practice of frequent human sacrifice to ensure perpetuation of the world.

Tonatiuh is generally represented by a colourful disk. He is best known as he is depicted in the centre of the Aztec calendar, with his eagle's claw hands clutching human hearts.

**Tonawanda–North Tonawanda,** twin industrial cities, in Erie and Niagara counties, western New York, U.S., at the junction of the New York State Barge Canal and the Niagara River, and forming part of the Buffalo urban complex. Permanent settlement began in 1823, when labourers arrived to work on the Erie Canal. In 1836 Tonawanda Township was set off from Buffalo, and Tonawanda was separated as a village in 1854 and received a city charter in 1903. North Tonawanda, originally a ward of Tonawanda village, was separately incorporated (1865) and became a city in 1897.

After the decline of the lumber trade (which reached its peak in the 1890s), new industries (including chemicals, plastics, paints, and steel products) were established, stimulated by hydroelectric power from Niagara Falls. *Tonawanda* is an Iroquois word for "swift running water." The Tonawanda Indian Reservation lies to the east. Pop. (1990) Tonawanda, 17,284; North Tonawanda, 34,989.

**Tonbridge and Malling,** district, county of Kent, England, on the River Medway southeast of London. Its area of 93 sq mi (240 sq km) lies to the south of the North Downs and northeast of The Weald. Much of the district has developed as a residential area for London commuters. The main urban area is Tonbridge, an old market town at the southern edge of the district. Pop. (1991 prelim.) 99,100.

**Tønder,** city, Sønderjylland *amtskommune* (county), southwestern Jutland, Denmark, southwest of Åbenrå. Founded in the 13th century and chartered in 1243, it was a prosperous seaport in the Middle Ages until its harbour

silted up. From the 17th to early 19th century it was the centre of a lace industry, which was revived after 1920. Industries include brewing, meat-packing, and the production of margarine. Of historic interest are Christ Church (1592), with its medieval tower; many old gabled houses; and the gatehouse-museum of the 16th-century Tønderhus Castle (destroyed 1750). The main street of the nearby village of Møgeltønder, with its thatched cottages, is a national monument.

The city, within the border region of Sønderjylland (North Schleswig), passed to Germany in 1864 but was returned to Denmark by a plebiscite in 1920. Pop. (1984 est.) city, 8,001; (1987 est.) mun., 12,574.

**Tondern lace,** lace made at Tønder (German: Tondern), Den., in the late 18th and early 19th centuries. Bobbin-made laces with flower designs similar to those of Mechlin lace



Tondern lace from Denmark, 19th century; in the Institut Royal du Patrimoine Artistique, Brussels

By courtesy of the Institut Royal du Patrimoine Artistique, Brussels; photograph, © A.C.L., Brussels

were made. No original style was initiated at Tønder. The lace, however, was popular in England and was exhibited at the Great Exhibition of 1851.

**tondo** (Italian: "round"), plural TONDI, a circular painting, relief carving, plaque, or mural design. The tondo, which became popular in Italy during the 15th century, was derived from round reliefs of subjects such as the Madonna and Child that had been used in wall tombs.



"The Madonna of the Pomegranate," panel painting by Sandro Botticelli, c. 1487; in the Uffizi, Florence

SCALA—Art Resource/EB Inc

Circular reliefs were developed successfully as glazed terra-cotta medallions by Luca Della Robbia in the mid-15th century. Sandro Botticelli painted a number of tondi, including "The Madonna of the Magnificat" and "The Madonna of the Pomegranate" (both in the Uffizi, Florence). About 1503, Michelangelo used the form for a painting of the "Holy Family" (Uffizi).

**Tondou Massif,** French MASSIF DU TONDOU, plateau region in the eastern Central African Republic, near the Sudan border. Most of the plateau ranges between 2,600 and 3,300 feet (800 and 1,000 m) in elevation; it reaches 3,461 feet (1,055 m) at Mount Ngouo in the northeast. The Kotto River, a tributary of the Ubangi River, separates Tondou Massif from the higher Mongos (Bongo) chain to the north. To the south is the lowland plain of the upper Ubangi. The watershed between the Congo (Zaïre) and Nile river systems, defining most of the boundary between the Central African Republic and The Sudan, passes along the eastern edge of the plateau.

Savanna vegetation covers the treeless hills, and hot desert winds blow onto the plateau from The Sudan. The region is practically devoid of people and resources.

**tone,** in acoustics, sound that can be recognized by its regularity of vibration. A simple tone has only one frequency, although its intensity may vary. A complex tone consists of two or more simple tones, called partial tones. The partial tone of lowest frequency is called the fundamental tone; the others, the upper partial tones, or overtones. The frequencies of the overtones may be whole multiples (*e.g.*, 2, 3, 4, etc., of the fundamental frequency, in which case they are called the second, third, fourth, etc., harmonics of the fundamental tone, itself known as the first harmonic). A combination of harmonic tones is pleasant to hear and is therefore called a musical tone.

**tone,** in linguistics, a variation in the pitch of the voice while speaking. The word tone is usually applied to those languages (called tone languages) in which pitch serves to help distinguish words and grammatical categories—*i.e.*, in which pitch characteristics are used to differentiate one word from another word that is otherwise identical in its sequence of consonants and vowels. For example, *man* in Mandarin Chinese may mean either "deceive" or "slow," depending on its pitch.

In tone languages, pitch is a property of words, but what is important is not absolute pitch but relative pitch. Tone languages usually make use of a limited number of pitch contrasts. These contrasts are called the tones of the language. The domain of the tones is usually the syllable.

There are two main types of tone languages: register-tone, or level-tone, languages and contour-tone languages. Register-tone languages use tones that are level; *i.e.*, they have relatively steady-state pitches, which differ with regard to being relatively higher or lower. This is characteristic of many tone languages in West Africa. In contour-tone languages at least some of the tones must be described in terms of pitch movements, such as rises and falls or more complex movements such as rise–falls. This is characteristic of many tone languages of Southeast Asia.

**Tone, (Theobald) Wolfe** (b. Jan. 20, 1763, Dublin—d. Nov. 19, 1798, Dublin), Irish republican and rebel who sought to overthrow English rule in Ireland and who led a French military force to Ireland during the insurrection of 1798.

The son of a coach maker, Tone studied law and was called to the Irish bar (1789) but soon gave up his practice. In October 1791 he helped found the Society of United Irishmen, a predominantly Protestant organization that worked for parliamentary reforms, such as universal suffrage and Roman Catholic emancipation.

In Dublin (1792) he organized a Roman Catholic convention of elected delegates that forced Parliament to pass the Catholic Relief Act of 1793. Tone himself, however, was anticlerical and hoped for a general revolt against religious creeds in Ireland as a sequel to the attainment of Irish political freedom.

By 1794 he and his United Irishmen friends began to seek armed aid from Revolutionary France to help overthrow English rule. After an initial effort failed, Tone went to the United States and obtained letters of introduction from the French minister at Philadelphia to the Committee of Public Safety in Paris.



Tone, engraving by C. Hullmandel from a portrait by Catherine Sampson Tone, 1827

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

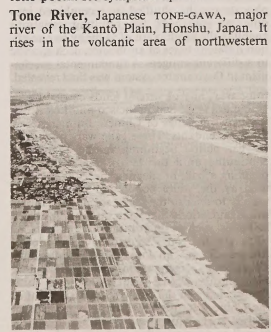
Arriving in the French capital (February 1796), Tone presented his plan for a French invasion of Ireland and was favourably received. The Directory then appointed one of the most brilliant young French generals, Lazare Hoche, to command the expedition and made Tone an adjutant in the French Army.

On Dec. 15, 1796, Tone sailed from Brest with 43 ships and nearly 14,000 men. But the ships were badly handled and, after reaching the coast of west Cork and Kerry, were dispersed by a storm. Tone again brought an Irish invasion plan to Paris in October 1797, but the principal French military leader, Napoleon Bonaparte, took little interest.

When insurrection broke out in Ireland in May 1798, Tone could only obtain enough French forces to make small raids on different parts of the Irish coast. In September he entered Lough Swilly, Donegal, with 3,000 men and was captured there. On November 10 at his trial in Dublin he defiantly proclaimed his undying hostility to England and his desire "in fair and open war to produce the separation of the two countries." Early in the morning of November 12, the day he was to be hanged, he cut his throat with a penknife and died seven days later.

**tone poem:** *see* symphonic poem.

**Tone River,** Japanese TONE-GAWA, major river of the Kantō Plain, Honshu, Japan. It rises in the volcanic area of northwestern



Tone River flowing through the Kantō Plain, Honshu, Japan

Kokunai Jigyo Kouku

Kantō *chihō* (region), about 35 miles (56 km) north of Maebashi in Gumma *ken* (prefecture). The river flows for 200 miles (320 km) south and southeast through the centre of the Kantō Plain to enter the Pacific Ocean at Chōshi in Chiba *ken*, near Cape Inubō. It was once known as Bandō Tarō, the principal river of Japan in the Bandō (now Kantō) region.

No other river in Japan has been so modified by human activity. Its entire length has been embanked with dikes, and the course itself often has been altered. The most notable alteration was completed in 1654, when the lower course was diverted from draining into Tokyo Bay and channeled into its present outlet.

The Tone River and its tributaries and distributaries are navigable for small boats. The river system formed a major transportation network in the Kantō Plain, giving rise to many small port towns. In competition with road and rail transport, most of the towns—such as Sawara, Sekiyado, Noda, and Nagareyama—lost their function as ports.

The Tone River is an indispensable source of water for irrigation throughout its populous drainage basin. Since 1950, dams have been constructed on its headwaters to produce hydroelectricity and to form reservoirs to supply water to the Keihin Industrial Zone.

**Tonegawa Susumu** (b. Sept. 5, 1939, Nagoya, Japan), Japanese molecular biologist and immunologist who was awarded the Nobel Prize for Medicine or Physiology in 1987 for his fundamental discoveries concerning the body's production of antibodies.

Tonegawa received a B.S. degree from Kyōto University in 1963 and earned a Ph.D. in biology from the University of California at San Diego in 1969. He was a member of the Basel Institute for Immunology in Switzerland from 1971 to 1981 and taught biology at the Massachusetts Institute of Technology from 1981.

Tonegawa's research explained how the immune system can produce a vast diversity of antibodies, each of which reacts with and counteracts the effects of a separate antigen (a foreign molecule or microbe). Prior to Tonegawa's work it was not known how the B lymphocytes (the cells that produce antibodies) could with their limited number of genes produce the millions of differently structured antibodies that are specific to a comparable diversity of antigens. In the 1970s Tonegawa proved in a series of experiments that approximately 1,000 pieces of genetic material in the antibody-manufacturing portion of the B lymphocyte can be shuffled or recombined into different sequences, the resulting variations enabling the production of as many as one billion different types of antibodies, each specific to a different antigen. A fundamental mechanism in the immune system was thus revealed.

**tong war**, any of several feuds carried on in U.S. cities (*e.g.*, San Francisco and Los Angeles) between gangs of Chinese immigrants or their descendants. These gang wars spanned a 70-year period beginning in the 1850s and continuing until the 1920s. The term tong, meaning a hall, or meeting place, came to be used by the white population in the 1880s, usually to refer to the secret societies or fraternal organizations that were involved in illegal activities, such as opium trade or gambling.

The original tongs were benevolent protective associations, an American form of a political-religious organization that originated in 17th-century China. The tendency to form such societies in the United States grew out of the Chinese immigrants' need for protection against lawless members of their own society as well as discrimination and criminal acts on the part of the white population. New, smaller, specialized tongs of merchants, craftsmen, and tradesmen grew up, and gradually along the Pacific Coast a society of organized criminals also developed. They specialized in opium and gambling, activities that were tolerated in China but were illegal in the United States. Criminal tong revenues came also from prostitution and selling "protection" to Chinese merchants. As their number grew, territorial and operational disputes developed, resulting in violent clashes between the criminal tongs. There were, however, tongs that remained free of strife and illegal activities. The criminal tongs began to disappear as the Chinese population became less susceptible to gang threats and intimidation.

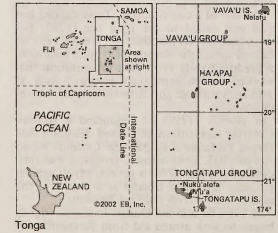
**Tonga,** Bantu-speaking people who inhabit the southern portion of Zambia and neighbouring areas of northern Zimbabwe and Botswana. Numbering more than one million in the late 20th century, the Tonga are concentrated along the Zambezi Escarpment and along the shores of Lake Kariba. They are settled agriculturists who grow corn (maize) primarily for subsistence but also for limited commercial purposes. The vast majority of Tonga live in small, dispersed villages; they are the only one of Zambia's major tribal groupings whose wealth and power are founded upon rural, agricultural activities as opposed to urban pursuits.

Descent is reckoned among the Tonga along matrilineal lines, and a newly married couple go to live near the bride's relatives. They attribute marked importance to spirits associated with rainfall, and thus rainmakers are prominent in Tonga society.

Before the British colonization of what is now Zambia, the Tonga were loosely organized into a number of matrilineal clans that had neither leaders nor defined political functions. These clans were subdivided into numerous small lineages that controlled property and arbitrated disputes among their members. The British appointed village chiefs from among prominent local Tongas, and gradually this network of local officials coalesced into a single, unified political structure comprising a hierarchy of chiefs. Both the tribal identity and political organization of the Tonga are thus ultimately the products of British attempts to administer them.

At the turn of the 21st century the Tonga proper constituted about one-seventh of Zambia's population, making them the third largest tribal grouping in the country.

**Tonga,** officially KINGDOM OF TONGA, Tongan PULE'ANGA FAKATU'I 'O TONGA, also called FRIENDLY ISLANDS, constitutional monarchy in the southwestern Pacific Ocean, 2,000 miles (3,000 km) northeast of Sydney, Australia, and about 400 miles (640 km) east of Fiji. It comprises an archipelago of 169 islands (only 36 of which are permanently inhabited) that extends north to south in two parallel chains for about 500 miles (800 km). With a total land area of 290 square miles (750 square km), they are divided into three main groups—Vava'u (in the north), Ha'apai (the central group), and Tongatapu (in the south)—together with several isolated islands to the far north and one to the south. The capital is Nuku'alofa, on the largest of the islands, Tongatapu, which has an area of 101 square miles (261 square km). Pop. (2000 est.) 100,000.



Tonga

A brief treatment of Tonga follows. For information about regional aspects of Tonga, *see* MACROPAEDIA: Pacific Islands.

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*The land.* The islands in the eastern chain are lower and of coral limestone formation, while those in the west are higher and of volcanic origin. Coral reefs are common throughout the archipelago. Four of the western islands have active volcanoes. The soils on the limestone islands are partly derived from volcanic ash and are generally fertile. The climate of the islands is warm, and rainfall is abundant. Typhoons may occur between December and April, particularly in the northern islands. Vegetation is luxuriant, and many cultivated tropical plants have been introduced.

*The people.* Polynesian Tongans constitute nearly all of the country's population. They live in a predominantly rural, rigidly stratified society that is based on traditional patterns but has incorporated many elements of Western civilization. Two-thirds of the total population live on the main island of Tongatapu. Apart from Nuku'alofa, which is the country's only urban and commercial centre, there are few other sizable towns, including Mu'a on Tongatapu and Neiafu on Vava'u. The official languages are Tongan, an Austronesian language, and English. About two-fifths of the people are Free Wesleyan (Methodist), and there are sizable numbers of Roman Catholics and Mormons, as well as members of the Free Church of Tonga and smaller Protestant groups.

*The economy.* Tonga has a developing free market economy based mainly on agriculture and services. Its gross national product (GNP) is growing more rapidly than the population; the GNP per capita is relatively low for a Pacific Islands country. Every male of age 16 or more is entitled to an allotment of about 7.5 acres (3 hectares) of land for cultivation, but land shortages deprive many of this privilege. The main cash crops include coconuts, bananas, and vanilla beans. Subsistence crops are yams, taro, cassava, peanuts (groundnuts), corn (maize), watermelons, and pineapples. Pigs, goats, cattle, and horses also are raised. Fish are abundant in the surrounding waters and are a staple source of protein. There is some light manufacturing, and handicrafts are produced for the tourist trade. Relatively high levels of unemployment have led to much temporary migration, particularly to New Zealand, the United States, and Australia.

Exports consist mostly of squash, fish, and vanilla beans; food and capital goods make up the bulk of imports. New Zealand, Japan, the United States, Fiji, and Australia are Tonga's main trading partners. The islands' chief ports are at Nuku'alofa and at Neiafu on Vava'u. International air service is available from Fua'amotu Airport on Tongatapu.

*Government and social conditions.* The Tongan constitution was granted by King George Tupou I in 1875 and has undergone relatively little amendment. It provides for a sovereign, who is head of state and of government, and for a Privy Council composed of the sovereign and the Cabinet. The Cabinet consists of a prime minister, other ministers (all appointed by the sovereign for life), and the governors of Ha'apai and Vava'u. There is also a unicameral Legislative Assembly, some of whose members are elected every three years and others of whom are appointed. Town and district officers are the only local government. The main source of revenue is import duties.

The government operates a public hospital on each of the islands of Tongatapu, Vava'u, and Ha'apai, as well as a number of dispensaries on other islands. The general health of the people is good, and life expectancy is 63 years. Primary education is compulsory between the ages of 6 and 14, and government schools are free.

*History.* Tonga was inhabited at least 3,000 years ago by Austronesian-speaking peoples who made elaborately decorated Lapita pottery similar to that found on Fiji. The Tongans developed a stratified social system headed by a paramount ruler whose dominion in the 13th century extended as far as the Hawaiian Islands.

The first European to visit Tonga was the Dutch navigator Jakob Le Maire, who sighted Tafahi (formerly Boscawen) in 1616. Abel Tasman made more extended visits in 1643. Effective contact, however, dates from 1773, when the British explorer Captain James Cook arrived and named the archipelago Friendly Islands. A Methodist mission was successfully established at Tonga in 1826. This mission effectively abolished the traditional religion and converted Chief Taufa'ahau, who eventually, as King George Tupou I, came to rule the entire island group. George, descended from the Tu'i Tonga, a line of sacred kings who had ruled from at least the 10th century, was able to establish a limited monarchy based on a code of laws (1862) and a constitution (1875). In separate treaties, Germany (1876), Great Britain (1879), and the United States (1888) recognized Tonga's independence.

King George Tupou I died in 1893. His great-grandson succeeded to the throne as King George Tupou II at a time of serious financial stress. By 1900 he had negotiated with Britain a treaty of friendship that provided Tonga with the assistance of the British consul in transacting foreign affairs. An amendment to the treaty (1905) gave the British consul veto power over Tongan decisions in foreign affairs and thus made Tonga a British protectorate. Upon George Tupou II's death in 1918, the crown passed to his daughter, Queen Salote Tupou III, who during her long reign (1918–65) endeared herself to her subjects and to Britain. She was followed by her son Prince Tungi as Taufa'ahau Tupou IV.

The protectorate was dissolved on June 4, 1970, when Tonga, the only ancient kingdom surviving from the pre-European period in Polynesia, achieved complete independence within the Commonwealth.

**Tongass National Forest,** forest region and wilderness area in southeastern Alaska, U.S., on the Gulf of Alaska. Established in 1909 by a bill passed in Congress and signed into law by President Theodore Roosevelt, the Tongass National Forest covers most of the Alaska panhandle and is the largest publicly owned forest in the United States. Its 16,800,000 acres (6,800,000 hectares), composed of mountainous offshore archipelagos and rugged fjord-indented coastline, include some of the most extensive intact remnants of virgin temperate rain forest in North America.

Found in association with barren alpine tundra (above the tree line), lowland muskeg, and scores of tidewater glaciers that descend to the coastline, the forest is dominated by towering species of western hemlock and Sitka spruce. Its rich understory includes blueberry, skunk cabbage, and a profusion of ferns and mosses. Brown and black bears, Sitka black-tailed deer, wolves, mountain goats, river otters, mink, northern flying squirrel, seals, and numerous species of birds, including bald eagles and the elusive marbled murrelet, are part of the unusual variety of wildlife. In 1980 about one-third of the Tongass—long a region of intense conflict between conservationists and logging companies—was designated a national wilderness area.

**Tongatapu Group,** also spelled TONGATABOO GROUP, southernmost island cluster of Tonga, in the southwestern Pacific Ocean, about 2,000 miles (3,000 km) northeast of Sydney. The group has a total area of 135 square miles (350 square km). Its administrative headquarters is at Nuku'alofa (*q.v.*), the national capital, on the northern coast of Tongatapu Island.

Tongatapu Island, the largest island (100 square miles [260 square km]) of Tonga, dominates the group. Its name means "sacred Tonga": the English word *taboo* is derived from "tabu," the Tongan word for "sacred." The coral island is level and triangular; its highest point is only 270 feet (80 m) above sea level. It receives 60 to 70 inches (1,500 to 1,800 mm) of rain annually. Because of its coral formation, there are no surface streams, and all freshwater must be collected in rain catchments or taken from wells. Copra and bananas produced on the island are exported from the deepwater wharves of Nuku'alofa. The island has schools, a hospital, and, at Fua'amotu, the kingdom's only international airport.

'Eua and 'Ata islands, both volcanic, were sighted in 1643 by the Dutch navigator Abel Tasman, who called them Middleburg and Pylstaert, respectively. 'Eua (34 square miles [88 square km]) is hilly, and its inhabitants depend economically upon its forests. The smaller and nearly uninhabited 'Ata, rising to an extinct volcanic peak of 1,165 feet (355 m), has guano deposits. Both islands produce some copra. Minor islands of the group include 'Atata, 'Euaiki, Kalau, and Kanatea. Pop. (1986 prelim.) 63,614.

**Tongcheng** (China): *see* T'ung-ch'eng.

**Tongeren** (Flemish), French TONGRES, municipality, Limburg *province,* northeastern Belgium. It lies along the Geer (Jaar) River, northwest of Liège. Important in Roman times as Aduatuca Tungrorum, capital of the Germanic Tungri tribe, it was the centre of a revolt against Rome in 54 BC. Tongeren is the oldest city in Belgium and was the seat of a bishopric by the 4th century. In its stormy past it was sacked by the Salic Franks in the 4th century, by Attila in 451, by the Normans in 881, by the duke of Brabant in 1212, and by the French in 1677.

Tongeren is situated in the fertile Hesbaye region and is a market for fruit (apples, cherries, plums) and cattle. The city's industries process food and manufacture fertilizer and agricultural machinery.

Remnants of the Roman walls and the medieval defenses survive. The Church of Our Lady (1240) has Romanesque cloisters, and there is a *béguinage* (retreat for secular nuns). There are several old castles in the area, notably Ouden Biesen, Betho, and Hex. The town hall (1737) is an example of the *style mosan,* a regional style of metalwork that flourished in the Meuse River valley. Pop. (1991) mun., 29,451.

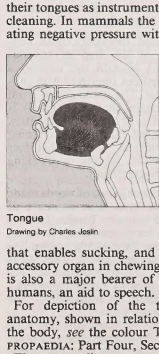
**Tonghua** (China): *see* T'ung-hua.

**Tongliao** (China): *see* T'ung-liao.

**Tongling** (China): *see* T'ung-ling.

**Tongsa,** town, fortress, and monastery, central Bhutan. It lies in the Himalayas on the Tongsa (or Mangde) River, about 5,500 feet (1,700 m) above sea level. It was the headquarters of the first hereditary maharaja of Bhutan and the historic seat of power over central and eastern Bhutan. The *dzong* (fortress, or castle) guards the main east-west route through the mountains. It houses a large number of state-supported monks of the Buddhist 'Brugpa order, as well as government officials. Pop. (1982 est.) 1,270.

**tongue,** in most vertebrates, an organ, capable of various muscular movements, located on the floor of the mouth. In some animals (*e.g.,* frogs) it is elongated and adapted to capturing insect prey. The tongues of certain reptiles function primarily as sensory organs, whereas cats and some other mammals use their tongues as instruments for grooming and cleaning. In mammals the tongue aids in creating negative pressure within the oral cavity



Tongue
Drawing by Charles Joslin

that enables sucking, and it is an important accessory organ in chewing and swallowing; it is also a major bearer of taste buds and, in humans, an aid to speech.

For depiction of the tongue in human anatomy, shown in relation to other parts of the body, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

The mammalian tongue consists of a mass of interwoven, striated muscles interspaced with glands and fat and covered with mucous membrane. In humans the front tips and margins of the tongue usually touch the teeth, aiding in swallowing and speech. The top surface, or dorsum, contains numerous projections of the mucous membrane called papillae. They contain taste buds sensitive to food flavours and serous glands that secrete some of the fluid in saliva, a substance that moistens the oral cavity and helps lubricate food particles. The base, or upper rear portion, of the tongue has no papillae, but aggregated lymphatic tissue (lingual tonsils) and serous and mucus-secreting glands are present. The inferior, or under, surface leads from the tip of the tongue to the floor of the mouth; its mucous membrane is smooth, devoid of papillae, and purple in colour from the many blood vessels present. The root, the remainder of the underside that lies on the mouth's floor, contains bundles of nerves, arteries, and muscles that branch to the other tongue regions.

Nerves from the tongue receive chemical stimulation from food in solution that gives the sensation of taste. There are four fundamental taste sensations, which derive from receptors that have specific topographical distribution: salt and sweet at the tip of the tongue, bitter at the base, and acid or sour along the borders. The total flavour of a food comes from the combination of taste, smell, touch, texture or consistency, and temperature sensations. Small taste buds situated on the tongue's top surface transmit these flavour sensations to the nervous system.

Among the disorders to which the tongue is subject are cancer, leukoplakia (white patches), fungus infection, congenital defects, and a variety of symptoms caused by disease elsewhere in the body. Surgical removal of this organ makes speech and swallowing difficult.

**Tongue River,** river rising on the eastern slopes of the Bighorn Mountains just west of Sheridan, Wyo., U.S., and flowing northeastward for 246 miles (396 km) to join the Yellowstone River at Miles City, Mont. From elevations of 8,000–10,000 feet (2,400–3,000 m), it drops to low, rugged mountains and badlands. Below the mountains the stream runs through a long, narrow valley confined by high bluffs and terraces. Tongue River Reservoir

in Montana, near the Wyoming border, furnishes irrigation water for downstream areas. Custer National Forest, east of the river near Ashland, Mont., occupies the centre of the drainage basin. The Northern Cheyenne Indian Reservation lies along the banks of the river in the area west of Ashland.

**tongue-tie,** also called ANKYLOGLOSSIA, congenital shortening of the flap of mucous membrane (frenum) beneath the tongue, a condition that sometimes interferes with protrusion of the tongue. The name comes from the belief, of folk origin, that the anomaly is the cause of speaking or feeding difficulties. Medical studies suggest that such shortening of the frenum is a normal variation that does not interfere with either feeding or speaking and usually needs no treatment.

**tongue twister,** word or group of words made difficult to articulate by a close sequence of similar consonantal sounds. Tongue twisters are often passed on for generations, becoming a rich part of folklore. Two widely known English-language twisters are "She sells sea shells beside the seashore" and one beginning "Peter Piper picked a peck of pickled peppers." Some are more difficult to enunciate—"The sixth sheik's sixth sheep's sick."

Tongue twisters have been recommended for curing hiccups and for curing lisps and other speech defects. They are also used for testing the fit of dentures and for screening applicants for broadcasting positions.

**tongues, gift of,** also called GLOSSOLALIA (from Greek *glōssa,* "tongue," and *lalia,* "talking"), utterances approximating words and speech, usually produced during states of intense religious excitement. The vocal organs of the speaker are affected, the tongue moves without the conscious control of the speaker, and unintelligible speech pours forth. According to religious interpretations of the phenomenon, the speaker is considered to be possessed by a supernatural spirit, is in conversation with divine beings, or is the channel of a divine proclamation. Glossolalia occurred in some of the ancient Greek religions and in various primitive religions. There are references to ecstatic speech in the Old Testament (1 Samuel 10:5–13, 19:18–24; 2 Samuel 6:13–17; 1 Kings 20:35–37), and in Christianity it has occurred periodically since the beginning of the church.

Glossolalia first occurred among the followers of Jesus at Pentecost (Acts 2) when "they were all filled with the Holy Spirit and began to speak in other tongues, as the Spirit gave them utterance" (Acts 2:4). The apostle Paul referred to it as a spiritual gift (1 Corinthians 12–14) and claimed that he possessed exceptional ability in that gift (1 Corinthians 14:18). The account in Acts (4:31, 8:14–17, 10:44–48, 11:15–17, 19:1–7) indicates that in the beginning of the Christian church the phenomenon reappeared wherever conversion and commitment to Christianity occurred. Paul urged restraint in the practice, however, since such a spectacular spiritual gift could be abused. Edification, as opposed to personal satisfaction, was set as the test of acceptable glossolalia.

The greatest emphasis upon the gift in the early church was made by followers of the 2nd-century prophet Montanus. His excommunication about 177 and the later decline of the sect probably contributed to a climate of opinion unfavourable to speaking in tongues, and the practice declined.

During later church history, glossolalia occurred in various groups. In modern times, it occurred during various Protestant revivals in the United States in the early 20th century. These revivals resulted in the establishment of many Pentecostal churches, which in the late 20th century had more than 8,000,000 members. During the 20th century speaking in tongues also occurred occasionally in some of the older Christian churches, including the Roman Catholic, Anglican, and Lutheran churches.

In addition to the religious interpretations of glossolalia as a supernatural occurrence, various psychological interpretations have attempted to explain it as a natural occurrence. It has been suggested that it is a charlatan's technique, a neurotic or psychotic symptom, a form of epilepsy, or, most commonly, a hypnotic phenomenon resulting from religious excitement.

**Tongwen guan** (Chinese school): *see* T'ungwen kuan.

**Tongzhi** (Chinese emperor): *see* T'ung-chih.

**tonic,** also called KEYNOTE, in music, the first note of the diatonic scale. It is the most important degree of the scale and dominates both melody and harmony. *See* tonality.

**Tönisson, Jaan** (b. Dec. 22, 1868—d. 1941 or after), Estonian statesman, lawyer, newspaper editor, and civic leader who opposed Russian (tsarist and communist) domination of his country.

In 1905, after a revolution had broken out in Russia, Tönisson founded the National Liberal Party in Estonia and in 1906 sat in the first Russian Duma (legislative assembly). Although he was expelled from Estonia by the Bolsheviks late in 1917, he took part in negotiations for Allied recognition of Estonian independence. During his term as prime minister (1919–20), Estonia, having repulsed the Red Army, obtained favourable peace terms from the Soviet Union. He later served Estonia as president (1927–28, 1933) and foreign minister (1931–32). Arrested by Soviet occupation forces in 1940, he was last heard of in a Tartu jail the following year.

**Tonk,** city, eastern Rājasthān state, northwestern India. It lies just south of the Banās River. The old walled town, which was capital of the former princely state of Tonk, was founded in 1643 and lies on the slopes of a small hill range. Just south are the fort and newer sectors. Tonk is the area's chief agricultural market and manufacturing centre. Cotton weaving, wool carding, leather tanning, and felt-handicraft production are the chief industries. The city has several hospitals and gardens and a government college affiliated with the University of Rājasthān.

The surrounding region consists mainly of a flat, open tract with scattered rocky hill ranges. Jowar (sorghum), wheat, gram, corn (maize), cotton, and oilseeds are the chief crops. There are poultry farms and fisheries, and mica and beryllium deposits are worked. The former princely state consisted of six separate areas in Rājasthān and central India acquired by the Pathān chieftain Amīr Khān between 1798 and 1817. It became part of the state of Rājasthān in 1948. Pop. (1991 prelim.) 100,020.

**Tonkawa,** nearly extinct North American Indian people of south-central Texas whose language is considered by some to belong to the Coahuiltecan family and by others to be a distinct linguistic stock in the Macro-Algonquian phylum. Satellite groups of the Tonkawa included the Ervipiame, Mayeye, and Yojuane. The Tonkawa belonged to the Plains group of nomadic bison-hunting Indians and lived in scattered villages of tepees. They were notable warriors; among their offensive weapons were firearms, bows and arrows, and spears. In battle they wore leather jackets and caps decorated with horns and brilliant plumage. At one time or another the Tonkawa fought most of their neighbours, from the Apache to the Caddo. They had a reputation for cannibalism. After 1770, when their relations with the Spanish became friendly, they obtained firearms in exchange for tallow, deerskins, and buffalo robes.

For a time they had friendly relations with the Texans. In 1858 they were employed as scouts against the Comanche and Wichita. In 1859, however, the Tonkawa were removed north from the Brazos River reservation to Indian Territory (present-day Oklahoma).

The Tonkawa population of perhaps 1,500 at the time of their first European contact (1691) decreased as a result of warfare and disease; by the late 20th century the Tonkawa reservation in Oklahoma was reported to have a total population of about 60.

**Tonkin,** also spelled TONGKING, northern Vietnam during the French colonial period. The term Tonkin was never officially used by the Vietnamese to describe their country.

Tonkin was centred on the densely populated and intensively cultivated Red River delta. It lay north of the Ma River, Ninh Binh being its southernmost major town, and extended northward to China's southern border.

Northern Vietnam had a long history of struggles between feudal rivals. It became a French protectorate in 1883 after years of dispute between France and China regarding its suzerainty, which alternated for centuries between the Vietnamese kingdoms and imperial China. Strongly influenced by the Chinese throughout its history, it was the chief focus of anti-French fighting after World War II.

**Tonkin, Gulf of,** northwest arm of the South China Sea, bounded by China (north and east), Hainan Island (east), and northern Vietnam (west). The gulf is 300 miles (500 km) long, 150 miles (250 km) wide, and up to 230 feet (70 m) deep. The main shipping route is via the Hainan Strait, between China and Hainan Island. The gulf receives the Red River, and its main ports include Ben Thuy and Haiphong in northern Vietnam and Peihai (Pakhoi) in China.

The report of North Vietnamese torpedo boats firing on two U.S. destroyers in 1964 resulted in the U.S. Congress adopting the Gulf of Tonkin Resolution to support increased American involvement in the Vietnam War. In 1972 the gulf was the scene of increased naval activity when the U.S. Navy mined the entrances to North Vietnamese ports.

**Tonkin Gulf Resolution:** *see* Gulf of Tonkin Resolution.

**Tonle Sap,** Khmer BĒNG TÔNLÉ SAB, natural floodplain reservoir, central Cambodia. The lake is drained during the dry season by the Sab River (Tônlé Sab) across the muddy Véal Pôc plain southeastward to the Mekong River. Called by the French Grand Lac ("Great Lake"), the lake is fed by numerous erratic tributaries and also by the Srĕng and Sĕn rivers, which are perennial northern tributaries. Many of the lake and river tributaries were dammed after 1975. During the June-to-November monsoonal regime, the swollen Mekong reverses the southeastward flow of the Sab River, which increases Tonle Sap's area from about 1,050 square miles (2,700 square km) to about 4,000 square miles (10,360 square km); its depth also increases from 3–10 feet (0.9–3 m) to 30–45 feet (9–14 m), permitting vessels with 9 feet (3 m) of draft to navigate it up through the various tributaries, on which are situated the towns of Kâmpóng Thum (Kompong Thom), Siĕmréab, Bătdâmbâng (Battambang), and Poŭthĭsăt (Pursat). During the rainy season the lake's width increases from about 22 miles (35 km) to 65 miles (105 km). At low water it is little more than a reed-infested swamp, with channels for fishing craft. The lake, the largest freshwater body in Southeast Asia, supports a large carp-breeding and carp-harvesting industry, with numerous floating fishing villages. The fermented and salted fish are staples of the Cambodian diet.

**tonnage,** in shipping, the total number of tons registered or carried, or the total carrying capacity.

Gross tonnage is a measurement of total capacity expressed in volumetric tons of 100 cubic feet; it is calculated by adding the underdeck tonnage and the internal volume of tween-decks and deck space used for cargo. The measurement is used in assessing harbour dues and canal transit dues for merchant ships.

Deadweight tonnage is a measurement of total contents of a ship including cargo, fuel, crew, passengers, food, and water aside from boiler water. It is expressed in long tons of 2,240 pounds (1,016 kilograms).

Displacement tonnage is used to define the size of naval ships. It refers to the weight of the volume of water displaced by a vessel in normal seagoing condition.

**tonnage and poundage,** two subsidies granted since medieval times to the English crown by Parliament. Tonnage was a fixed subsidy on each tun (cask) of wine imported, and poundage was an *ad valorem* (proportional) tax on all imported and exported goods. Though of separate origin, they were granted together from 1373 and were used for the protection of trade at sea. From 1414 they were customarily granted for life to each successive king.

Prior to the English Civil War (1642–51), their collection became an important issue in the constitutional struggle between Charles I and Parliament. The Parliament of 1625 had voted the subsidies to Charles for one year only; when the King later collected them without its consent, the Commons in 1629 passed two resolutions forbidding their collection and payment. In 1641, when the Long Parliament granted them for two months, it declared their levying to be illegal without Parliament's consent. At the Restoration of Charles II in 1660, they were again granted for life to the crown and under Anne and George I were made perpetual and mortgaged to the public debt. They were finally abolished in 1787.

**Tönnies, Ferdinand (Julius)** (b. July 26, 1855, near Oldenswort, Schleswig—d. April 9, 1936, Kiel, Ger.), German sociologist whose theory reconciled the organic and social-contract conceptions of society.

A teacher at the University of Kiel from 1881, Tönnies was best known for *Gemeinschaft und Gesellschaft* (1887; *Community and Society,* 1957). He was well known in Great Britain for his English-language editions of writings by the 17th-century philosopher Thomas Hobbes. Tönnies' conception of will was central to his sociological theory. He identified *Wesenwille* (natural will), which involves a judgment of the intrinsic value of an act rather than its practicality and which varies in degree of rationality, and *Kürwille* (rational will), which is a conscious choice of means to a specific end. In his view, *Wesenwille* is manifested in *Gemeinschaft* (community), which is maintained by traditional rules and a universal sense of solidarity and which fits the organic theory of social union. *Gemeinschaft* tends to change into the *Kürwille*-based *Gesellschaft* (society), in which rational self-interest is the stronger element. *Gesellschaft* must be held together by deliberately formulated prescriptions and may be explained in terms of the social-contract theory. In practice, all societies show elements of both kinds of will, because man's conduct is neither wholly instinctive nor wholly reasoned.

Although Tönnies disavowed totalitarianism (including Nazism in his own country) and found some degree of voluntarism in all social relationships, he believed that every social organization has a collective will, presenting aspects of both *Wesenwille* and *Kürwille.* He dealt with this subject in *Die Sitte* (1909; *Custom,* 1961) and *Kritik der öffentlichen Meinung* (1922; "Critique of Public Opinion"). To him, the "public opinion" of a total society expresses the communal will that certain social and political actions be performed or abstained from and implies the use of sanctions against dissidents.

In 1889 Tönnies, who in part owed his notion of *Kürwille* to Thomas Hobbes, produced English editions of Hobbes's *Behemoth* and *Elements of Law, Natural and Politic;* both were reissued in 1928. He also wrote *Thomas Hobbes Leben und Lehre* (1896; "Thomas Hobbes's Life and Doctrine").

**tonos** (Greek: "tightening"), plural TONOI, concept in ancient Greek music, pertaining to the placement of scale patterns at different pitches and closely connected with the notion of octave species (*q.v.*). Through transposition of the Greater Perfect System (comprising two octaves descending from the A above middle C to the second A below) to a higher or lower pitch level, each *tonos* causes a different octave species to fall within the octave e′–e (E above middle C to the E below), which is important in Greek performance. The names of the *tonoi* correspond to the names of the octave species that are created between e′ and e when the *tonoi* are used. In effect, a *tonos* can cause the octave species bearing its name to fall within the e′–e octave. For example, when the Greater Perfect System is begun on the pitch b′ (rather than a′, as in the abstract), the octave species falling between e′ and e is the Phrygian; hence, the *tonos* is also Phrygian. According to most modern scholars, the *tonoi* thus render the highly theoretical Greater Perfect System eminently practical in actual performance.

The concept of *tonos* first appeared in the 4th century BC and became the subject of controversy almost immediately. Aristoxenus (flourished 4th century BC) lists 13 *tonoi;* Ptolemy of Alexandria (2nd century AD), 7; other theorists, 15. The conflicting views of the Greek theorists have their modern counterparts. For example, some scholars believe the *tonoi* were real keys in the modern sense—*i.e.,* that they provided contrasting tonal centres of specific pitch (although the Greeks did not have an absolute pitch standard). Others insist that the *tonoi* were abstract theoretical concepts or that they were melodic frameworks (melody types).

**Tønsberg,** town and seat of Vestfold *fylke* (county), southeastern Norway, at the head of Tønsbergfjorden. Considered to be the oldest town in Norway, Tønsberg was founded *c.* AD 871 and became an important trading centre. In the 13th century King Håkon Håkonsson built his castle, Tønsberghus, there. The town was destroyed by fire in 1536 and only in the 18th and 19th centuries did it become a major port and one of Norway's major shipping and whaling centres. Until the late 1960s it was Norway's third largest maritime town. Tønsberg remains an industrial and shipping centre, with such diverse concerns as metal shops, shipyards, paper mills, leather processing, and breweries; it is noted especially for its silverware. Tourist sites include ruins of the Tønsberghus, St. Michael's Church (*c.* 1150), the Royal Castle (1276), Sem Church (*c.* 1100), and the Vestfold Museum. Pop. (1983 est.) mun., 8,921.

**tonsil,** small mass of lymphatic tissue located in the wall of the pharynx at the rear of the throat of man and other mammals. In man the term is used to designate any of three sets of tonsils, most commonly the palatine tonsils. These are a pair of oval-shaped masses protruding from each side of the oral pharynx behind the mouth cavity. The exposed surface of each tonsil is marked by numerous pits that lead to deeper lymphatic tissue. Debris frequently lodges in the pits and causes inflammation, a condition called tonsillitis. The function of the palatine tonsils is thought to be associated with preventing infection in the respiratory and digestive tracts by producing antibodies that help kill infective agents. Frequently, however, the tonsils themselves become the objects of infection, and surgical removal (tonsillectomy) is required. Usually, children are more prone to tonsillitis than adults, for the structures tend to degenerate and decrease in size as one gets older.

Another major tonsillar pair is the pharyngeal tonsils, more commonly known as adenoids. These are diffuse masses of lymphatic tissue located on the top wall of the nasal pharynx. Enlargement of these tonsils may obstruct breathing through the nose, interfere with sinus drainage, and lead to sinus and middle ear infections. When the nasal respiratory passage is blocked, mouth breathing becomes necessary. Continued mouth breathing puts stress on the developing facial bones in children and may cause facial deformities. Surgical removal, often in conjunction with a tonsillectomy, is frequently recommended in children. The adenoids tend to decrease in size during adulthood.

The third pair of tonsils are the lingual tonsils, aggregations of lymphatic tissue on the surface tissue at the base of the tongue. The surface of this tonsil has pits leading to lower lymphatic tissue as in the other two tonsil types, but these pits are effectively drained by small glands (mucous glands), and infection is rare.

**tonsillitis,** inflammatory infection of the tonsils caused by invasion of the mucous membrane by microorganisms, usually hemolytic streptococci or viruses. The symptoms are sore throat, difficulty in swallowing, fever, malaise, and enlarged lymph nodes on both sides of the neck. The infection lasts about five days. The treatment includes bed rest until the fever has subsided, isolation to protect others from the infection, and warm throat irrigations or gargles with a mild antiseptic solution. Antibiotics or sulfonamides or both are prescribed in severe infections to prevent complications.

The complications of acute streptococcal tonsillitis are proportional to the severity of the infection. The infection may extend upward into the nose, sinuses, and ears or downward into the larynx, trachea, and bronchi. Locally, virulent bacteria may spread from the infected tonsil to the adjoining tissues, resulting in a peritonsillar abscess (*see* quinsy). More serious are two distant complications—acute nephritis (kidney inflammation) and acute rheumatic fever, with or without heart involvement. Repeated acute infections may cause chronic inflammation of the tonsils, evidenced by tonsillar enlargement, repeated or persistent sore throat, and swollen lymph nodes in the neck. The treatment in this case is surgical removal (tonsillectomy). Scarlet fever, diphtheria and trench mouth may also produce acute tonsillitis. In diphtheria the tonsils are covered with a thick, whitish, adherent membrane; in trench mouth, with a grayish membrane that wipes off readily.

**Tonstall, Cuthbert** (English prelate): *see* Tunstall, Cuthbert.

**tonsure,** in various religions, a ceremony of initiation in which hair is clipped from the head as part of the ritual marking one's entrance into a new stage of religious development or activity.

Tonsure has been used in both the Roman Catholic and the Eastern Orthodox churches on occasions of solemn personal dedication to God. Until it was abolished by Pope Paul VI (effective in 1973), tonsure was the ceremony by which a man was initiated into the clerical state and became eligible for ordination to the

priesthood. In the Eastern Orthodox church tonsure is part of the ordination of the lector (reader). In certain of the Eastern churches tonsure has also been a part of the ceremony admitting a man to the monastic life. The origins of the Christian use of this rite are not clear, but early Christian ascetics may have imitated the ancient religious practice among the Greeks and Semites that involved the cutting of some of the hair and offering it to a deity as a sign of dedication.



Man with a tonsure, detail of "The Madonna and Child and St. Bernard," oil painting by an unknown artist, 1500; in the Wallraf-Richartz-Museum, Cologne

By courtesy of the Wallraf-Richartz-Museum, Cologne

Three tonsures have been more or less in use in the Christian churches. The Roman, or St. Peter's, tonsure involved the shaving either of the whole head, with the exception of a fringe of hair supposed to symbolize the crown of thorns, or of a small round area at the crown of the head. In the Greek (Eastern, or St. Paul's) tonsure the whole head was shaved, but the more recent practice in the Eastern church has considered the tonsure adequate when the hair is merely shorn close. In the Celtic tonsure (tonsure of St. John, or, in contempt, of Simon Magus) all the hair in front of a line drawn over the top of the head from ear to ear was shaved.

In Buddhism tonsure is performed as a part of the ceremony of ordination as a novice (*pravrajyā* ceremony) and as a monk (*upasaṃpadā* ceremony). Thereafter, the monk keeps his head and face clean-shaven. In Myanmar (Burma) and Thailand most male children undergo the *pravrajyā* ceremony at about the age of eight or older and spend a few days or months in a monastery; the rite of tonsure is a principal part of the ceremony.

Jaina monks also cut their hair as a sign of renouncing the worldly life and entering the monkhood, traditionally, by plucking out the hairs one by one. Both Jaina and Buddhist customs are theoretically in imitation of the act performed by their teachers Mahāvīra and Gautama, who cut off their hair upon leaving their households to embark on the spiritual life.

In Hinduism the first tonsure undergone by a young boy (the ceremony of *cuḍākaraṇa*) is one of the *saṃskāra*s, or personal sacraments, that mark the boy's transition from an infant to a child. It is usually performed when the boy is about two years old. The Hindu tonsure leaves a tuft of hair (the *cūḍa*) at the crown of the head. Tonsure formerly marked other rites of passage for the Hindu, such as the putting on of the sacred thread or the change of ritual status incurred by the death of the father (customs now largely observed only symbolically). Full tonsure is performed as part of the initiation rite into most Hindu ascetic orders.

**Tonty, Henri de,** Tonty also spelled TONTI (b. 1650?, Gaeta [Italy]—d. September 1704, Fort Louis, Louisiana [now in Alabama, U.S.]), Italian-born explorer and colonizer, companion of the Sieur de La Salle during his North American explorations.

Henri, the son of Lorenzo de Tonti, the Neapolitan financier who devised the tontine life insurance plan, joined the French army in 1668. Nine years later he lost his right hand in combat, and thereafter he wore an iron hand covered by a glove.

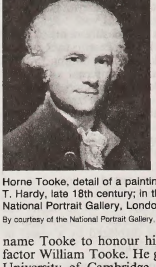
In 1678 the Prince de Conti recommended him to René-Robert Cavelier, Sieur de La Salle, who needed assistance in his North American explorations. Tonty became La Salle's devoted lieutenant, accompanying him on his return to his seignory at Fort Frontenac and overseeing construction of the *Griffon*, the first ship to sail the upper Great Lakes. Tonty sailed on the *Griffon* for part of a westward journey, ultimately joining La Salle at the St. Joseph River. He subsequently helped La Salle build Fort Crèvecoeur (present-day Peoria) during the winter of 1679–80, and he was left in charge of the Illinois region when La Salle departed for Canada in the spring. Tonty was deserted by his men and was thus unable to defend the area from marauding Iroquois, but, although wounded by their warriors, he and five survivors reached the safety of Green Bay in late 1680.

Tonty recuperated from his wounds, and in June 1681 he rejoined La Salle at Michilimackinac. The two then led an expedition southward that established a settlement at Fort St. Louis on the Illinois River. The next year, Tonty and La Salle explored the Mississippi River to its mouth, claiming the area for France. La Salle left Tonty in the Illinois country when he departed for France in 1683 to gather colonists for his ill-fated Louisiana venture. Three years later, Tonty led an unsuccessful expedition down the Mississippi River in a vain search for his missing commander. He then returned to Illinois to assist in colonization and fur trading. In 1700 he joined the Louisiana settlement of Pierre Le Moyne, sieur d'Iberville, and served him faithfully until his death.

**Tooele,** city, seat of Tooele county, north-central Utah, U.S. It lies 32 miles (52 km) southwest of Salt Lake City. Settled in 1849, it was a centre for mining operations in the 1860s and '70s after rich silver and gold veins were discovered in the nearby Oquirrh Mountains. Its name may refer to Tuilla, a local Indian chief, or to the abundant tules, or bulrushes, that grew by the local springs. The city is a rail and trading centre with smelting and mining (silver, lead, and copper), agriculture (grains and sugar beets), and defense installations (Tooele Army Depot, Dugway Proving Grounds, and the Deseret Chemical Depot) as the economic mainstays. A tunnel (constructed 1937–42) extends 4 miles (6 km) east through the Oquirrh Mountains to mines in Bingham Canyon. Several ghost towns, notably Mercur, and one of the world's largest open-cut copper mines are nearby. Inc. 1853. Pop. (1992 est.) 14,613.

**Tooke, John Horne,** original name JOHN HORNE (b. June 25, 1736, London, Eng.—d. March 18, 1812, Wimbledon, Surrey), radical politician, one of the most effective English agitators for parliamentary reform and freedom of dissent in the late 18th century. He attacked the powerful Whig magnates but stopped short of advocating democracy.

Born John Horne, the son of a poultry dealer, he assumed (1782) the additional surname Tooke to honour his friend and benefactor William Tooke. He graduated from the University of Cambridge and, in 1760, became a vicar. In 1769 he helped the embattled radical John Wilkes found the Society for the Supporters of the Bill of Rights, but two years later he broke with Wilkes and created his own Constitutional Society to agitate for parliamentary reform and self-government for the American colonies.



Horne Tooke, detail of a painting by T. Hardy, late 18th century; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Horne's outspoken support of the colonists led to his conviction and imprisonment (1778) for seditious libel. From 1782 to 1785 he rallied public support behind William Pitt's unsuccessful attempts to obtain reforms of Parliament. When the revolutionary events in France prompted the British government to suppress radicals, Horne Tooke was arrested in May 1794 and charged with high treason. Six months later he was acquitted by a London jury. The radical movement was dispersed by the end of the century, but Horne Tooke gained a seat in Parliament in 1801. An enthusiastic philologist, he was among the first to regard language as a product of historical development rather than as a fixed structure.

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**Tooke, Thomas** (b. Feb. 29, 1774, Kronshtadt, near St. Petersburg, Russia—d. Feb. 26, 1858, London, Eng.), British financier and economist who championed free trade.

Tooke was in business throughout most of his adult life, beginning in St. Petersburg at the age of 15 and finally retiring as governor of the Royal Exchange Assurance Corporation in 1852. He often gave evidence before Parliament on economic matters. In 1821 he helped found the Political Economy Club, whose members included David Ricardo, Thomas Malthus, and John Stuart Mill.

Tooke figured prominently in the great British monetary debates of the 19th century—bullionists versus antibullionists. He began as a supporter of the Bullion Report of 1810, which recommended a return to the gold standard, convertibility of the note issue, and control of the supply of paper money. His works *High and Low Prices* (1823) and *Considerations on the State of the Currency* (1826) traced the causes of low prices to underlying cyclic conditions. He continued work along these lines in his monumental *History of Prices*, 6 vol. (1838–57), in the last two volumes of which he collaborated with William Newmarch.

Although Tooke's support of the gold standard remained unwavering, his study of prices gradually led him to the view that bank-created money is a result and not a cause of price changes, thereby adopting one of the basic tenets of the antibullionist position. Thus, unlike the other bullionists and in contrast to his earlier views, Tooke opposed the Bank Charter Act of 1844, which greatly limited the discretion of the Bank of England over the supply of currency. Tooke held that its rigid limits neglected deposits and caused damaging fluctuations in the rate of interest.

**tool,** an instrument for making material changes on other objects, as by cutting, shearing, striking, rubbing, grinding, squeezing, measuring, or other process. A hand tool is a small manual instrument traditionally operated by the muscular strength of the user; a machine tool is a power-driven mechanism used to cut, shape, or form materials such as wood and metal. Tools are the primary means by which human beings control and manipulate their physical environment.

A brief treatment of tools follows. For full treatment, *see* MACROPAEDIA: Tools.

Dating back to approximately 2,600,000 years ago, the beginning of the Paleolithic Age, the earliest known tools consisted of variously sized examples of the pebble tool, or chopper. The chopper is thought to be the first tool made and used by human beings. The chopper typically consisted of a water-worn, fist-sized rock, which had been chipped away at one end to create a roughly serrated edge. It was used for Paleolithic man's most urgent necessity, cutting through the skin and sinews of the animals he hunted. The chopper was the only tool used by humanity for almost 2,000,000 years, until the appearance of the hand axe, a superior version of the chopper. In this tool the entire surface of the rock was worked. Because both faces were chipped, the edge of the hand axe was considerably sharper than that of the earlier chopper.

About 110,000 years ago, Neanderthal man evolved. An excellent toolmaker, Neanderthal man used many different types of hand axes, as well as the first borers, knives, and spears. The heavily serrated blades were sawlike, allowing them to be used for carving and cutting horn, bone, and wood.

Cro-Magnon man, the first modern man, appeared about 35,000 years ago and brought into existence new types of tools. Chief among these were the burin, or graver, this being a strong, narrow-bladed flint able to scrape narrow incisions into bone, which made possible the manufacture of needles, hooks, and projectiles. The most significant later innovation of the period was hafting, or the fitting of a handle to a tool. Knives without handles are merely awkward, but axes or hammers without them are almost impossible to use effectively.

The Neolithic Period began about 7000 BC, when the first ground and polished tools were made. Grinding stone tools makes them stronger and gives them an even cutting edge; the growth of ground tools enabled Neolithic axe-wielders to clear forests for agriculture, fuel, and shelter. Three thousand years later, however, the stone axes of the Neolithic Period began to give way to the first tools made from metal, usually beaten copper. Centuries later, people learned how to smelt copper and, much afterward, iron, and the use of metal tools spread throughout the world. For the first time, tools with designs approximating current usage were made, largely because the relative ease of ironworking made it possible for individuals to have specialized tools for particular tasks.

Modern hand tools were developed in the period after 1500 BC. They are now generally considered in the following classes: percussive tools, which deliver blows (the axe, adz, and hammer); cutting, drilling, and abrading tools (the knife, awl, drill, saw, file, chisel, and plane); the screw-based tools (screwdrivers and wrenches); measuring tools (ruler, plumb line, level, square, compass, and chalk line); and accessory tools (the workbench, vise, tongs, and pliers).

With the invention of the steam engine in the 18th century, mankind discovered how to drive tools mechanically. In particular, machine-driven tools became necessary to manufacture the parts for the machines that now made goods formerly produced by hand. Most common machine tools were designed by the middle of the 19th century. Today, scores of different machine tools are used in the workshops of home and industry. These are frequently classified into seven types: turning machines; shapers and planers; power drills; milling machines; grinding machines; power saws; and presses.

The most fundamental of all seven is the horizontal metal-turning machine called the lathe, which is employed in a vast number of turning, facing, and drilling operations.

Shapers and planers use single-point tools to machine flat surfaces. Shapers move the cutting tool back and forth over the material, peeling away the surface, whereas planers have stationary tools, and the surface is moved to encounter them. Power drills are usually known as drill presses and have a twist drill that cuts holes in metal and other substances. They can also be used for many of the countersinking, boring, tapping, and other purposes for which lathes are frequently used.

Milling machines have rotating cutting surfaces that abrade substances with which they come into contact. In standard milling machines, a sliding table with a workpiece on top is pushed against the whirling cutter. Grinding machines function in a similar manner, except that the cutter is replaced by a spinning abrasive disk called a grinding wheel or by a belt. The most accurate of all machining processes, grinding can create metal surfaces within .0001 inch (.0025 centimetre) of the desired dimension.

Power saws frequently consist of long thin moving belts or chains lined with teeth, as in band saws or chain saws. Presses are used to ram material against a hard surface; the surface often consists of a die, and the action of the press is to stamp out metal or plastic beaten into the shape of the die.

Some materials and metal alloys are too hard or too brittle to be machined by conventional tools; for these materials, several nonconventional methods have been devised. In electron- or ion-beam machining, a stream of highly energized electrons or ions is directed against the workpiece. In electrical-discharge and electrochemical machining, an electrical charge passing through a liquid medium across a tiny gap dissolves material from the workpiece. In ultrasonic machining a vibrating tool causes a liquid abrasive medium to remove material. Other nonconventional methods are laser, plasma-arc, chemical, photochemical, and water-jet machining.

Automatic machine tools can produce parts repetitively without operator assistance. Computer numerical control creates fully automatic machine-tool systems by feeding the machines instructions that have been reduced to digital or numerical values.

**tool and die making,** the industrial art of manufacturing stamping dies, plastics molds, and jigs and fixtures to be used in the mass production of solid objects.

The fabrication of pressworking dies constitutes the major part of the work done in tool and die shops. Most pressworking dies are utilized in the fabrication of sheet-metal parts that range in size from the finger stop on a dial telephone to the panels of an automobile body. Each pressworking die consists of two sections, called punch and die, or male and female. Both sections are mounted firmly in an electrically or hydraulically driven press. In a working cycle the press ram, on which the male section is mounted, descends into the fixed female section. Any metal interposed between the sections is cut or shaped to a prescribed form. Like the dies, the presses range in size from extremely small to gigantic. A bench press is often small enough to be picked up manually; but the press that stamps out the roof of a car is generally about three stories high and capable of exerting tons of force.

The tooling involved in plastic molding is quite similar to that of stamping dies. The principal difference is that stamping requires force, while molding does not. In plastic molding, two units are required whose design is such that, when brought together, they make up a system of closed cavities linked to a central orifice. Liquid plastic is forced through the orifice and into the cavities, or molds, and when the plastic solidifies, the molds open and the finished parts are ejected.

The development of modern tools and dies can be traced to the American inventor and manufacturer Eli Whitney, who first implemented the concept of the planned manufacturing of interchangeable parts. Each part was manufactured to prescribed dimensions with the aid of tooling, so that the highly skilled craftsmen previously required for manufacturing were no longer needed since no additional fitting or selective assembly of the parts was necessary. Whitney's tooling consisted of templates (tool-guiding patterns) and rudimentary fixtures—the antecedents of today's tools and dies—and he successfully demonstrated the feasibility of manufacturing interchangeable parts by mass-producing firearms for the War of 1812.

The successful introduction of interchangeable parts and the development of machine tools, both in the 19th century, brought the modern machine shop into being. Then, as now, the independent machine shop was called a job shop, which meant that it had no product of its own but served large industrial facilities by fabricating tooling, machines, and machinepart replacements. Eventually, some machine shops began to specialize in tooling to the exclusion of other work.

The development of the power press gave rise to a demand for another form of tooling, the press die, the function of which is to cut and form sheet metal into predetermined shapes and configurations. The work of fabricating press dies is similar to, but not identical with, that of producing jigs, fixtures, and other tooling, which led to many of the specialized machine shops labeling themselves tool and die shops. The 20th-century developments of die casting and injection molding have brought about the demand for still other forms of tooling—the dies used in die casting and plastic molding. The making of these tools has also been taken over by the tool and die shops.

In the second half of the 20th century, however, the traditional tool and die shop was gradually replaced by specialized job shops that produce only one form of tooling. This trend can be attributed to the growing sophistication of tooling, for shops with the skills and equipment necessary to fabricate one form of tooling are seldom equipped for another. Even the single form of toolmaking called diemaking is becoming specialized; some shops now limit themselves to dies for special applications, such as automotive body dies.

**Toombs, Robert A(ugustus)** (b. July 2, 1810, Wilkes County, Ga., U.S.—d. Dec. 15, 1885, Washington, Ga.), American Southern antebellum politician who turned ardently secessionist, served briefly as Confederate secretary of state, and later sought to restore white supremacy in Georgia during and after Reconstruction.

Born into a wealthy planter family, Toombs entered and withdrew from the University of Georgia before graduating in 1828 from Union College in Schenectady, N.Y. Admitted to the bar in 1830, he quickly developed a lucrative legal practice in Washington, Ga. In addition, he owned a plantation and many slaves in southwestern Georgia.

From 1837 to 1840 and again from 1842 to

1843, Toombs served in the Georgia legislature, establishing himself as an expert in fiscal matters. A Whig, he joined the U.S. House of Representatives in 1844. He was reelected to the House in 1846, 1848, and 1850.

In 1850 Toombs began to emerge as a states' rights, and ultimately secession, advocate. In his "Hamilcar" speech, he demanded that the South not be denied its rights in the newly acquired territories. Yet he worked for passage of the Compromise of 1850 and its acceptance in Georgia, and he helped organize the Constitutional Union Party in Georgia as a political vehicle for conservatives unhappy with the Whigs but not ready to support the secession-minded Democrats.

Running on the Constitutional Union ticket in 1852, Toombs won election to the U.S. Senate. Shortly thereafter he joined the Democrats, but he remained a moderate on the states' rights issue until 1860.

Not until Abraham Lincoln's election as president and the failure of the Crittenden Compromise of 1860 did Toombs publicly call for secession. He led the movement for a Georgia convention to vote to secede from the Union. In 1861 he resigned from the Senate and was a delegate to the Montgomery convention that established the Confederacy. Severely disappointed at not being selected president of the Confederate States of America, he nonetheless accepted appointment by Jefferson Davis to become secretary of state. Within a few months, however, he broke with Davis and left the government.

In July 1861 Toombs took command of a Georgia brigade as a brigadier general. His military experience was undistinguished, though he did take a bullet in his left hand at Antietam. When no promotion followed, Toombs angrily resigned his commission. He stayed out of the war until near the end, and he continually criticized Davis' leadership and Confederate policies—especially conscription, suspension of habeas corpus, and reliance upon credit to finance the war effort.

In May 1865 Toombs fled—by way of New Orleans and Havana—to London. He returned to Georgia in 1867, but he refused to seek a pardon or take the oath of allegiance. Instead, he devoted himself to rebuilding his law practice and to overthrowing Radical Reconstruction in Georgia. In 1877 he broke with other Democrats in welcoming President Rutherford Hayes's plans to end Reconstruction, and, the same year, he played a prominent role at the convention that revised the state constitution in favour of white supremacy.

Toombs's last major public activity was to seek legislation that would give the state control over railroads and corporations.

**Toomer, Jean** (b. Dec. 26, 1894, Washington, D.C.—d. March 30, 1967), American poet and novelist.

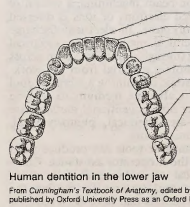
After attending the University of Wisconsin and the City College of New York, Toomer taught briefly in the Sparta, Ga., public schools and then turned to lecturing and writing. *Cane* (1923; reprinted 1967) is an experimental novel which celebrates the Negro through the symbol of the title. It is considered his best work. Toomer also wrote extensively for the *Dial* and other little magazines and was the author of several experimental plays. In 1926 he attended the Gurdjieff Institute in France, dedicated to the expansion of consciousness and meditation, and upon his return led Gurdjieff groups in Harlem and Chicago in the late 1920s and early '30s. He began a similar institution in Portage, Wis., in 1931. Although influential on black writers, only since his death has he been recognized as a writer of note, primarily for *Cane.*

**Tooro** (people): *see* Toro.

**tooth,** plural TEETH, any of the hard, resistant structures occurring on the jaws and in or around the mouth and pharynx areas of vertebrates. Teeth are used for catching and masticating food, for defense, and for other specialized purposes.

The teeth of vertebrates represent the modified descendants of bony dermal (skin) plates that armoured ancestral fishes. A tooth consists of a crown and one or more roots. The crown is the functional part that is visible above the gum. The root is the unseen portion that supports and fastens the tooth in the jawbone. The root is attached to the tooth-bearing bone—the alveolar processes—of the jaws by a fibrous ligament called the periodontal ligament or membrane. The "neck" of the root is embraced by the fleshy gum tissue (a specialized area of mucous membrane that lines the mouth cavity). The shape of the crown and root vary among different teeth and among different species of animals.

*The structure of teeth.* All true teeth have the same general structure and consist of three layers. In mammals an outer layer of enamel (*q.v.*), which is the hardest tissue in the body, covers part or all of the crown of the tooth. The middle layer of the tooth is composed of dentine (*q.v.*), which is less hard than enamel and similar in composition to bone. The dentine forms the main bulk, or core, of each tooth and extends almost the entire length of the tooth, being covered by enamel on the crown portion and by cementum on the roots. Dentine is nourished by the pulp, which is the innermost portion of the tooth. The pulp consists of cells, tiny blood vessels, and a nerve and occupies a cavity located in the centre of the tooth. The pulp canal is long and narrow with an enlargement, called the pulp chamber, in the coronal end. The pulp canal extends almost the whole length of the tooth and communicates with the body's general nutritional and nervous systems through the apical foramina (holes) at the end of the roots. Below the gumline extends the root of the tooth, which is covered at least partially by cementum (*q.v.*). The latter is similar in structure to bone but is less hard than dentine. Cementum affords a thin covering to the root and serves as a medium for attachment of the fibres that hold the tooth to the surrounding tissue (periodontal membrane). Gum is attached to the adjacent alveolar bone and to the cementum of each tooth by fibre bundles.




Human dentition in the lower jaw

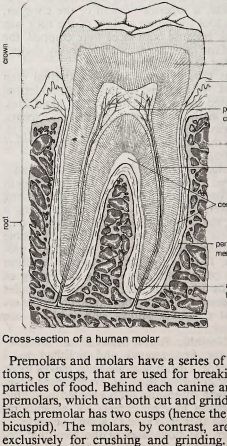
From *Cunningham's Textbook of Anatomy,* edited by G.J. Romanes and published by Oxford University Press as an Oxford Medical Publication

*Tooth form and function.* Like most other mammals, humans have two successive sets of teeth during life. The first set of teeth are called primary, or deciduous, ones, and the second set are called permanent ones. Humans have 20 primary and 32 permanent teeth.

Primary teeth differ from permanent teeth in being smaller, having more pointed cusps, being whiter and more prone to wear, and having relatively large pulp chambers and small, delicate roots. The primary teeth begin to appear about six months after birth, and the primary dentition is complete by age 2½; shedding begins about age 5 or 6 and is finished by age 13. The primary teeth are shed when their roots are resorbed as the permanent teeth push toward the mouth cavity in the course of their growth.

In humans the primary dentition consists of 20 teeth— four incisors, two canines, and four molars in each jaw. The primary molars are replaced in the adult dentition by the premolars, or bicuspid teeth. The 12 adult molars of the permanent dentition erupt (emerge from the gums) behind the primary teeth and do not replace any of these, giving a total of 32 teeth in the permanent dentition. The permanent dentition is thus made up of four incisors, two canines, four premolars, and six molars in each jaw.

Incisor teeth are the teeth at the front of the mouth, and they are adapted for plucking, cutting, tearing, and holding. The biting portion of an incisor is wide and thin, making a chisel-shaped cutting edge. The upper incisors have a delicate tactile sense that enables them to be used for identifying objects in the mouth by nibbling. Next to the incisors on each side is a canine, or cuspid tooth. It frequently is pointed and rather peglike in shape and, like the incisors, has the function of cutting and tearing food.




Cross-section of a human molar

Premolars and molars have a series of elevations, or cusps, that are used for breaking up particles of food. Behind each canine are two premolars, which can both cut and grind food. Each premolar has two cusps (hence the name bicuspid). The molars, by contrast, are used exclusively for crushing and grinding. They are the teeth farthest back in the mouth. Each molar typically has four or five cusps. The third molar in humans tends to be variable in size, number of roots, cusp pattern, and eruption. The number of roots for each type of tooth varies from one for incisors, canines, and premolars to two or three for molars.

*Teeth in other animals.* The teeth of many vertebrates have been adapted for special uses. Rodents have curved incisors that are set deep in the jaws and which grow continually throughout life; hares and rabbits have similar teeth. The tusks of elephants are enlarged upper incisors. The tusks of the walrus are enlarged canines, as are those of the wild boar. In the pig the lower incisors lie close together and project forward to form a digging instrument. Baboons have enlarged canines for defense and display. Certain snakes have hollow teeth that function as needles to insert venom. The sawfish, the only animal with true teeth outside its mouth, uses the teeth on both sides of its snout to slash its prey. The forms, patterns, and arrangements of teeth in different species of animals are of great importance in determining their phylogenetic (taxonomic) relationships.

*Diseases of teeth and gums.* Caries, or tooth decay, is the most common disease of the teeth among humans. Apart from the common cold, it is perhaps the most frequent disease in contemporary society. Tooth decay originates in the buildup of a yellowish film called plaque on teeth, which tends to harbour bacteria. The bacteria that live on plaque ferment the sugar and starchy-food debris found there into acids that destroy the tooth's enamel and dentine by removing the calcium and other minerals from them. Caries usually commences on surface enamel, especially in pits and fissures and between adjacent teeth. From the enamel the process of decay spreads to the underlying dentine, and may finally involve the tooth pulp. Aside from keeping the teeth clean through regular brushing and flossing, tooth decay can be greatly reduced by the addition of fluorides to drinking water. Caries is treated by removing decayed dental tissue and replacing it with inert filling substances.

The teeth may be subject to certain irregularities in their alignment, such as an abnormality in the relationship between the teeth in opposing jaws (malocclusion). In a less-severe irregularity, one or more teeth may be out of alignment. Both types of problems are best treated early in life through the use of special fixed or removable appliances (*i.e.,* braces).

Another common dental disorder is inflammation of the gum, or gingivitis. It usually commences at or close to the gum margin, often between adjacent teeth. Pockets form between the gum and the adjacent teeth, sometimes penetrating deeply into the tissues. This leads to further infection, with inflammation and bleeding from the infected gums. A principal cause of gingivitis is the buildup of plaque on teeth, which causes irritation of the gums and thus leads to their inflammation and infection.

**tooth decay:** *see* caries.

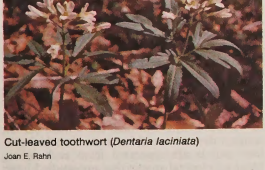
**tooth shell** (marine mollusk): *see* tusk shell.

**toothed herring:** *see* mooneye.

**toothed whale,** common name for members of the cetacean suborder Odontoceti, which includes the dolphin, sperm whale, narwhal, beluga, porpoise, and killer whale (*qq.v.*).

**toothless whale:** *see* baleen whale.

**toothwort,** any of about 10 species of perennial herbs belonging to the genus *Dentaria,* of the mustard family (Brassicaceae), native to northern temperate areas. The name tooth-



Cut-leaved toothwort (*Dentaria laciniata*)
Joan E. Rahn

wort refers to the plant's toothed, or scaly, rootstock. The four-petaled flowers, borne in a terminal cluster, are white, pink, or pale purple. Toothwort, pepperwort, or crinklewort (*D. diphylla*), native to moist woods of North America, bears one pair of stem leaves, each of which is divided into three broad leaflets. Cut-leaved toothwort (*D. laciniata*), from the same area, has a whorl of three stem leaves. Each leaf is deeply cut into three narrow, bluntly toothed segments.

**Toowoomba,** city, southeastern Queensland, Australia, on the Great Dividing Range. The principal inland city in the state, Toowoomba is a rail and road junction, tourist resort, service centre for Darling Downs (a livestock, grain, and dairying region of about 3,500,000 acres [1,400,000 hectares]), and site of the Perseverence Creek Water Supply Scheme. The town's industries include engineering works, railroad shops, and food processing. It was originally called The Swamps; its present name was probably derived from the Aboriginal *toowoom,* the name for a native melon. The city is well planned, with many parks, and has become an educational centre. Founded as a village in 1849, it became a town in 1858, a municipality in 1860, and a city in 1904. Pop. (1986) 71,362.

**top,** a toy having a body of conical, circular, or oval shape, often hollow, with a point or peg on which it turns or is made to whirl. If given a knock, a spinning top will go around in a circle at a slant; if spun with a slant at the start, it will quickly stand upright until halted by friction. Its physical properties are similar to those of the gyroscope. Some tops, as the common peg top, are spun by means of a cord. Whipping tops are kept spinning by whips with a lash. Other tops are spun by a twist of the hand or the action of a spring or a plunger. Some hollow tops, such as the thunder tops of Japan, have holes cut in them to produce a hum or roar.

Tops were known to the ancient Greeks, and the Romans constructed tops out of boxwood or terra-cotta. The top was known in Europe as early as the 14th century, and in Shakespeare's day a large village top was frequently kept for use in cold weather as a warming-up exercise.

Tops also have long been known in Asia, where they were made out of such natural materials as conch shells, gourds, nuts, bamboo, and stone. In Japan, top spinning has for centuries been a pastime of adults as well as of children.

Humming tops were made from small gourds by the Maori of New Zealand. Because of their loud wailing sound, they were used in ceremonial mourning of the dead or to avenge a defeated clan. During Napoleon's time, a Chinese game known for centuries as *Koen-gen* was introduced in Europe as diablo and became the rage. A spool ("devil") was whipped up by a cord, tossed up by the player, and caught again on the cord. The hexagonal teetotum (known to the ancient Greeks and Romans), marked distinctively on each on its six sides, has at times been used in place of dice.

Tops are still popular in a variety of forms—*e.g.,* a top of plastic and metal that plays choral reeds and changes colours while spinning.

**top moss,** common species of urn moss (*q.v.*).

**top shell,** any marine snail of the family Trochidae (subclass Prosobranchia, class Gastropoda), characterized by a spiral, conical shell. Although top shells are found from the intertidal zone to the deep open seas, they occur with greatest diversity in the shallow waters along rocky shores from the equator to the high latitudes. Species of the genera *Gibbula, Monodonta,* and *Calliostoma* are common along temperate Atlantic shores, while those of *Tegula* and *Calliostoma* are abundant in the Pacific. Tropical top shells such as *Trochus, Tectus,* and *Cittarium* tend to be larger and more colourful than the genera from other regions. All species are herbivorous, feeding on algae or films of spores on rock surfaces. Male and female organs occur in separate individuals, and fertilization is external, with most species having free-swimming larva.

The interiors of all top shells are nacreous. The largest species, *Trochus niloticus,* from the Indo-Pacific region, was, in fact, once extensively fished for its lustrous mother-of-pearl layer, which was used in the manufacture of pearl buttons.

**topaz,** silicate mineral that is valued as a gemstone. It is believed that the topaz of modern mineralogists was unknown to the ancients and that the stone called *topazos* was the mineral chrysolite or peridot. The "topaz" in the Old Testament also may have been chrysolite.

Topaz is an aluminum silicate containing fluorine and has a chemical formula of $Al_2(F,OH)_2SiO_4$. It is formed by fluorine-bearing vapours given off during the last stages of the crystallization of igneous rocks. It typically occurs in cavities in rhyolites and granite, in pegmatite dikes, and in high-temperature veins. Often associated with cassiterite, topaz may be useful to indicate the presence of that tin ore.

The finest British topaz is found in the Cairngorm Mountains in the Central Highlands, especially at Ben a Buird, Scot. The famous topaz rock of the Schneckenstein, in Germany, yields pale yellow crystals that were formerly cut for jewelry. Fine topaz occurs at several localities in the Urals and in Siberia, Russia, and beautiful crystals come from Takayama and Tanokamiyama in Japan. Brazil is a famous locality, the well-known sherry-yellow crystals coming from Ouro Preto, Minas Gerais, where they occur in a kaolinitic matrix. In the



Topaz from Minas Gerais state, Brazil
Lee Boltin

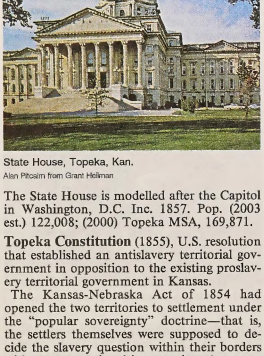
United States fine topaz has been worked near Pikes Peak, Colo., and in San Diego county, Calif. Common topaz occurs in coarse crystals at many localities. For detailed physical properties, *see* silicate mineral (table).

Pure topaz may be colourless and, when brilliant-cut, has been mistaken for diamond. It may also be coloured various shades of yellow, blue, or brown; the colour in many cases is unstable, and the brown topazes of Siberia are particularly liable to be bleached by sunlight. In 1750 a Parisian jeweler discovered that the yellow Brazilian topaz becomes pink on exposure to a moderate heat, and this treatment has since been extensively applied, so that nearly all the pink topaz occurring in jewelry has been heat-treated. Such "burnt topaz" is often known as Brazilian ruby, as is the very rare, natural red topaz. Cut topazes of large size are known, and it is said that the great "Braganza diamond" of Portugal is probably a topaz.

**topazolite,** yellowish andradite garnet, named for its resemblance to topaz. *See* andradite.

**Topeka,** city, capital (1861) of Kansas, U.S., seat (1857) of Shawnee county, on the Kansas (Kaw) River in the east-central part of the state. The name Topeka is of uncertain Indian origin; one interpretation is "smoky hill," and another is "a good place to dig potatoes." The present site was chosen in 1854 by a group of antislavery colonists from Lawrence, led by Charles Robinson, a resident agent of the

New England Emigrant Aid Company. Cyrus K. Holliday helped to found the city, which later became headquarters for the building of the Atchison, Topeka and Santa Fe Railway system, of which he was the first president. Before the Civil War, Topeka was the scene of several conflicts between the Free Soil groups (which opposed the extension of slavery into the West) and slave interests in the Kansas Territory, of which it was the temporary capital (1856). The city's economy is based on agriculture, manufacturing, and governmental services. From 1925 to 2003 Topeka was the home of the Menninger Foundation, an outstanding psychiatric training institution. The city is the seat of Washburn University of Topeka (1865) and of an Episcopal diocese.



State House, Topeka, Kan.
Alan Pitcairn from Grant Heilman

The State House is modelled after the Capitol in Washington, D.C. Inc. 1857. Pop. (2003 est.) 122,008; (2000) Topeka MSA, 169,871.

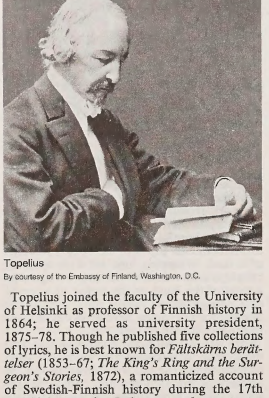
**Topeka Constitution** (1855), U.S. resolution that established an antislavery territorial government in opposition to the existing proslavery territorial government in Kansas.

The Kansas-Nebraska Act of 1854 had opened the two territories to settlement under the "popular sovereignty" doctrine—that is, the settlers themselves were supposed to decide the slavery question within their borders without congressional intervention. As a consequence, control of the territorial government was crucial, and proslavery elements (largely "border ruffians" from Missouri) succeeded in establishing a proslavery legislature in Kansas.

Antislavery settlers then met at Topeka, and from Oct. 23 to Nov. 12, 1855, they held a constitutional convention. The Topeka Constitution that resulted banned slavery; the question of admitting free blacks into the state was submitted to a popular vote as a separate issue. On December 15, antislavery Kansans ratified the Constitution and by a three-to-one margin voted to exclude free blacks from the territory.

On Jan. 15, 1856, a free state governor and legislature were elected, thus creating two competing territorial governments. Pres. Franklin Pierce condemned the Topeka government as an act of rebellion and committed himself to the support of the proslavery Kansas government. But the House of Representatives on July 3, 1856, voted to admit Kansas to statehood under the Topeka Constitution. The Senate blocked that move, however, and thereafter Kansas remained in a bloody territorial limbo until admitted to the Union in 1861.

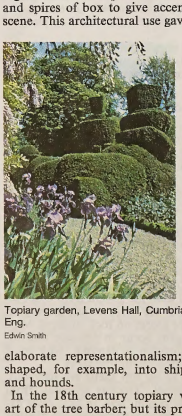
**Topelius, Zacharias** (b. Jan. 14, 1818, Kuddnäs, Russian Finland—d. March 12, 1898, Helsinki), the father of the Finnish historical novel. His works, written in Swedish, are classics of Finland's national literature.



Topelius
By courtesy of the Embassy of Finland, Washington, D.C.

Topelius joined the faculty of the University of Helsinki as professor of Finnish history in 1864; he served as university president, 1875–78. Though he published five collections of lyrics, he is best known for *Fältskärns berättelser* (1853–67; *The King's Ring and the Surgeon's Stories,* 1872), a romanticized account of Swedish-Finnish history during the 17th and 18th centuries. In later years he wrote stories based on Finnish folktales and fairy tales for children. All his works have been translated into Finnish.

**topiary,** the training of living trees and shrubs into artificial, decorative shapes. Thickly leaved evergreen shrubs are used in topiary; the best subjects are box, cypress, and yew, although others—such as rosemary, holly, and box honeysuckle—are used with success. Topiary is said to have been invented by a friend of the ancient Roman emperor Augustus and is known to have been practiced in the 1st century AD. Earlier references to it are lacking, but the art probably evolved over a considerable period from the necessary trimming, pruning, and training of trees. The earliest topiary was probably the simple shaping of dwarf-box edging and the development of cones, columns, and spires of box to give accent to a garden scene. This architectural use gave way early to



Topiary garden, Levens Hall, Cumbria, Eng.
Edwin Smith

elaborate representationalism; shrubs were shaped, for example, into ships, huntsmen, and hounds.

In the 18th century topiary was called the art of the tree barber; but its practitioners say it is, rather, the art of the tree mason and leafage sculptor. It has always been of limited application in places where sculpture in stone was cheap or expense was no object; the best examples are seen not in Italy or the princely gardens of France but rather in England and The Netherlands, where suitable plants flourished and where stonework was costly. The fashion reached its height in England in the late 17th and early 18th centuries but was displaced with the rise of the so-called natural garden (*see* jardin anglais).

Topiary is ephemeral. Although there are surviving examples that are probably several centuries old, most traditional topiary gardens are replacement plantings.

**Topkapı Palace Museum,** Turkish TOPKAPI SARAYI MÜZESI, in Istanbul, collection of classical antiquities, manuscripts, ceramics, armour, textiles, and other artifacts, housed in the sultans' Seraglio (Topkapı Saray). It was established in 1892 and later extended.

The library contains 18,000 manuscripts, more than 23,000 archival documents, and private papers of various sultans. It also contains a selection of Islāmic relics.

**topographic map,** cartographic representation of the Earth's surface at a level of detail or scale intermediate between that of a plan (small area) and a chorographic (large regional) map. Within the limits of scale, it shows as accurately as possible the location and shape of both natural and man-made features. Natural features include relief, which is sometimes mistakenly understood to be the sole feature characterizing a topographic map, and hydrographic features, such as lakes and rivers; man-made features include other characteristics of the subject area, such as cities, towns, and villages, and roads, railroads, canals, dams, bridges, tunnels, parks, and other features. International usage of the term varies; in the United States, for example, the term topographic is often limited to maps at scales of 1:500,000 or larger; in Russia, to scales of 1:1,000,000 or larger.

**topological space,** in mathematics, generalization of Euclidean spaces in which the idea of closeness, or limits, is described in terms of relationships between sets rather than in terms of distance. Every topological space consists of: (1) a set of points; (2) a class of subsets defined axiomatically as open sets; and (3) the set operations of union and intersection. In addition, the class of open sets in (2) must be defined in such a manner that the intersection of any finite number of open sets is itself open and the union of any, possibly infinite, collection of open sets is likewise open. The concept of limit point is of fundamental importance in topology; a point $p$ is called a limit point of the set $S$ if every open set containing $p$ also contains some point ($s$) of $S$ (points other than $p$, should $p$ happen to lie in $S$). The concept of limit point is so basic to topology that, by itself, it can be used axiomatically to define a topological space by specifying limit points for each set according to rules known as the Kuratowski closure axioms. Any set of objects can be made into a topological space in various ways, but the usefulness of the concept depends on the manner in which the limit points are separated from each other. Most topological spaces that are studied have the Hausdorff property, which states that any two points can be contained in nonoverlapping open sets, guaranteeing that a sequence of points can have no more than one limit point.

**topology,** branch of mathematics that deals with selected properties of collections of related physical or abstract elements, specifically, those properties that endure when the collection undergoes distortion (as long as it remains intact). A lump of clay, for example, may be regarded as a collection of physical points that can be deformed (say, into a ball

or a long, thin rod) without changing topologically.

A brief treatment of topology follows. For full treatment, *see* MACROPAEDIA: Topology.

The influence of topology extends to almost every other branch of mathematics and to disciplines that formerly were not considered susceptible to mathematical treatment. For example, aspects of topology are closely related to symbolic logic; topology bears upon the design of mechanical devices, geographic maps, distribution networks, and systems for planning and controlling complex activities.

Topology initially was classed as a type of geometry because it developed primarily from investigations of geometric topics carried out by Leonhard Euler in the 18th century and Bernhard Riemann and Henri Poincaré in the 19th. A broadening influence originated in Georg Cantor's studies of number theory and set theory. After the Dutch mathematician L.E.J. Brouwer redefined the scope of topology and established its generality early in the 20th century, mathematical researches began to make use of concepts that are evidently topological, but not geometric in the older sense.

Poincaré's publications are commonly regarded as the first systematic treatment of the subdiscipline called algebraic topology, in which algebraic methods are applied to topological problems. A celebrated example from this field is a formula first stated by René Descartes in about 1635 and rediscovered in 1752 by Euler. Both men noted that for any polyhedron without holes, the number of vertices plus the number of faces minus the number of edges is 2. For a polyhedron with one hole, the same expression equals 0. These numbers are algebraic quantities that are unaffected by topological distortion; they depend only on the topological nature of the object.

Many problems in graph theory (*q.v.*), such as the Königsberg-bridge problem and the four-colour-map theorem, are considered—with equal validity—to be topics in algebraic topology.

**toponymy,** taxonomic study of place-names, based on etymological, historical, and geographical information. A place-name is a word or words used to indicate, denote, or identify a geographic locality such as a town, river, or mountain. Toponymy divides place-names into two broad categories: habitation names and feature names. A habitation name denotes a locality that is peopled or inhabited, such as a homestead, village, or town, and usually dates from the locality's inception. Feature names refer to natural or physical features of the landscape and are subdivided into hydronyms (water features), oronyms (relief features), and places of natural vegetation growth (meadows, glades, groves).

Toponymy is concerned with the linguistic evolution (etymology) of place-names and the motive behind the naming of the place (historical and geographical aspects). Most toponymy, however, has concentrated on the etymological study of habitation names, often neglecting the study of feature names and the motive behind the naming of the place.

Habitation and feature names are either generic or specific, or a combination of the two. A generic name refers to a class of names such as river, mountain, or town. A specific name serves to restrict or modify the meaning of the place-name. Most of the world's languages can be divided into two groups based on the general tendency to have the specific either precede or follow the generic. In English the specific usually comes first, while in French the specific generally follows the generic. The influence of other languages creates exceptions to this generalization. The influence of French and Spanish created many exceptions to the tendency in English in the United States to have the specific first. This is most evident in the naming of many larger bodies of water, such as Lake Superior, Lake Michigan, or Lake Champlain, that were first explored and settled by the French. English settlers migrating into these areas accepted the French naming convention, but since the French did not colonize the areas heavily, many of the smaller bodies of water in these regions were named under the English convention of specific first.

Most toponymic studies have concentrated on the specific aspect of the place-name. The adjectival form of the specific is the dominant place-name type in English. Prepositional place-names used in a descriptive sense are more rare in English. The City of Chicago is an example of the prepositional place-name, but in common use the preposition and the generic are dropped.

Toponymy also involves the study of place-names within and between languages. Studies within a language usually follow three basic assumptions: every place-name has a meaning, including place-names derived from personal names; place-names describe the site and record some evidence of human occupation or ownership; once a place-name is established or recorded, its phonetic development will parallel the language's development.

The study of place-name transfer from one language to another is undertaken by investigating oral and written methods of place-name communication. Phonetic transfer is the most common means of place-name transfer between languages. This involves the spoken transfer of a place-name from one language to another. Little or no knowledge of the language from which the place-name originated is required. A person will listen to the place-name spoken and then phonetically render the place-name in his or her own language, creating at best a close approximation. Many of the early North American colonial place-names were transferred from native Indian languages in this manner. Oral translation requires at least some degree of bilingualism on the part of both parties communicating the place-name. Translations of place-names have usually occurred with more important place-names or with large features. Many of the names of the seas of the world, for example, have been translated from different languages. Folk etymology is based on the sound of the place-name and is therefore similar to phonetic transfer. Folk etymology occurs when the sounds of one language will not easily convert to the sounds of the second languag, as in phonetic transfer. The transfer of many place-names occurred between French and English settlers of North America through folk etymology.

The dominance of etymology in toponymy has limited the interest in writing as a means of place-name transfer. As printing became more important over the years, place-names were adopted between countries and languages directly from maps by visual transfer. Once the name had been adopted by visual transfer, it was pronounced according to the adopting language's standards.

Toponymy can uncover important historical information about a place, such as the period of time the original language of the inhabitants lasted, settlement history, and population dispersal. Place-name study can also provide insight to religious changes in an area, such as the conversion to Christianity. Information about the folklore, institutional conditions, and social conditions of a place can be understood as well. Linguistic information like words and personal names, not mentioned in literature, can also be found through toponymy.

**Toprakkala,** also spelled TOPRAQ-QAL'AH, or TOPRAK KALE, site of a Khwārezmian walled city near modern Tashauz in Uzbekistan. The city was inhabited from about the 1st century BC until the 6th century AD, a period during which Khwārezm was an independent feudal state. A palace at Toprakkala, which may have been the capital of that state, contained lifelike paintings and sculptures executed in a style reflecting the influence of the cultures of India, Central Asia, and Asia Minor.

*Consult the* INDEX *first*

**Toprakkale,** also spelled TOPRA KALEH, ancient Urartian fortress located near modern Van in southeastern Turkey. The walls of Toprakkale, erected in the 8th century BC, were of cyclopean masonry and sloped slightly inward, perhaps as a defense against earthquakes. Excavations at the site, carried out primarily by British and German teams, have revealed the high level of artistic achievement of ancient Urartu, especially in bronze but also in gold, silver, and ivory. Bronze objects of particular importance included a candelabrum about 53.5 inches (136 cm) high, decorated



Bronze model of a defensive tower, 8th–7th century BC, from Toprakkale
By courtesy of the trustees of the British Museum

shields, and building reliefs that have provided valuable information about Urartian domestic architecture. In addition, excavations have uncovered a basalt floor inlaid with limestone and marble, parts of a decorated marble frieze, and brilliantly polished red pottery vessels.

**toque,** small, round, close-fitting hat, brimless or with a small brim, once worn by both men



Woman wearing a toque, detail of "The Infanta Clara Eugenia," oil painting by Fernando de Llanos, 1580; in the Prado, Madrid
By courtesy of the Museo del Prado, Madrid

and women. In the 12th and 13th centuries, women wore embroidered toques, made of velvet, satin, or taffeta, on top of their head-veils.

In the late 16th century, brimless, black velvet toques were popular with men and women. Throughout the 19th century, women wore toques, often small, trimmed with fur, lace, bows, flowers, or leaves. The typical white baker's cap, traditionally worn by chefs, is a form of toque.

**tor,** exposed rock mass of jointed and broken blocks. Tors are seldom more than 15 metres (50 feet) high and often occur as residues at the summits of inselbergs and at the highest points of pediments. Tors usually overlie unaltered bedrock and are thought to be formed either by freeze–thaw weathering or by groundwater weathering before exposure. There is often evidence of spheroidal weathering of the squared joint blocks.

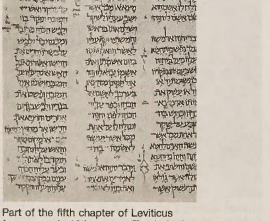
**Toradja,** group of peoples of central Celebes (Sulawesi), Indonesia. They are believed to be descendants of the invading Austronesian-speaking people that overran the island and absorbed or exterminated the aboriginal population. Later they were driven back from the coasts by Muslim Indonesians such as the Buginese. Their warfare and headhunting made it necessary to locate their villages on easily defended hilltops.

In modern times many have become Muslim and Christian and have developed more accessible villages. They are farmers with only a few industries such as plaiting, pottery, wood carving, and ironworking. Bark clothing is worn in remote districts, and Malayan-style cotton garments are worn where there is contact with more advanced cultures. They file their teeth and wear many ornaments.

Toradja population in the 1960s was estimated at 600,000. Their language, with many dialects, belongs to the Austronesian (Malayo-Polynesian) family.

**Torah,** in Judaism, in the broadest sense the substance of divine revelation to Israel, the Jewish people: God's revealed teaching or guidance for mankind. The meaning of "Torah" is often restricted to signify the first five books of the Old Testament, also called the Law or the Pentateuch. These are the books traditionally ascribed to Moses, the recipient of the original revelation from God on Mt. Sinai. Jewish, Roman Catholic, Eastern Orthodox, and Protestant canons all agree on their order: Genesis, Exodus, Leviticus, Numbers, and Deuteronomy.

The written Torah, in the restricted sense of the Pentateuch, is preserved in all Jewish synagogues on handwritten parchment scrolls that reside inside the ark of the Law. They are removed and returned to their place with special reverence. Readings from the Torah (Pentateuch) form an important part of Jewish liturgical services.



Part of the fifth chapter of Leviticus from an early 10th-century Torah; in the British Museum

By courtesy of the trustees of the British Museum

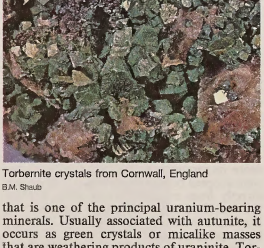
The term Torah is also used to designate the entire Hebrew Bible. Since for some Jews the laws and customs passed down through oral traditions are part and parcel of God's revelation to Moses and constitute the "oral Torah," Torah is also understood to include both the Oral Law and the Written Law.

Rabbinic commentaries on and interpretations of both Oral and Written Law have been viewed by some as extensions of sacred oral tradition, thus broadening still further the meaning of Torah to designate the entire body of Jewish laws, customs, and ceremonies.

**torbanite,** also called BOGHEAD COAL, mineral substance intermediate between oil shale and coal. Whereas destructive distillation of coals produces compounds of carbon and hydrogen with carbon atoms linked in six-membered rings, torbanite produces paraffinic and olefinic hydrocarbons (compounds with carbon linked in chains). As the hydrocarbon content of oil shale increases, torbanite becomes cannel coal. Torbanite occurs abundantly in France, New South Wales, South Africa, and the northeastern United States. It was named for its occurrence on Torbane Hill, Bathgate, West Lothian.

**Torbay,** unitary authority, geographic and historic county of Devon, England, on the English Channel coast. It comprises three old towns—Torquay, Paignton, and Brix—grouped around Tor Bay. A village existed at Torre before the foundation of a Premonstratensian abbey in 1196. Cockington Court (Elizabethan and later) and its estate are part of the municipal park system. Torbay's attractive setting and equable climate have made it a year-round resort and conference centre. Area 24 square miles (63 square km). Pop. (1998 est.) 123,000.

**torbernite,** hydrated copper uranate phosphate mineral, $Cu(UO_2)_2(PO_4)_2 \cdot 8\text{–}12H_2O$,



Torbernite crystals from Cornwall, England

B.M. Shaub

that is one of the principal uranium-bearing minerals. Usually associated with autunite, it occurs as green crystals or micalike masses that are weathering products of uraninite. Torbernite is abundant in Cornwall, Eng., and in Shaba province, Zaire. For detailed physical properties, *see* phosphate mineral (table).

**Torcello,** island-village in the Laguna Veneta (Venice Lagoon) and an eastern environ of Venice, Italy. Founded in AD 452 by refugees from Altino on the mainland, the bishopric of Altino was transferred there in the 7th century. The island, a flourishing city in ancient times, was the head of an association of the communes of the lagoon until the seat of government was moved to the Rialto in 811; the bishopric was removed to Murano. Notable landmarks are the remains of the Sta. Maria Assunta cathedral (founded 639, rebuilt 864–67 and 1008), with a 9th-century baptistery and fine Veneto-Byzantine mosaics, and the 12th-century church of Sta. Fosca. Two small 14th-century palaces house a museum.



Church of Sta. Fosca, Torcello, Italy

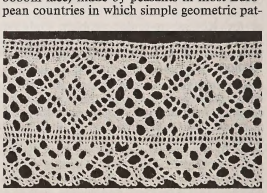
SCALA—Art Resource/EB Inc.

Torcello is inhabited mainly by fishermen and market gardeners.

**torch cactus,** any of several ribbed, cylindrical cacti, in the family Cactaceae, native to South America. *Trichocereus spachianus* has erect columnar stems, branching at the base and rising to about 1 metre (3 feet) in height; they are about 7.5 centimetres (3 inches) thick. It bears fragrant, white, funnel-shaped flowers, up to 20 cm long, which open at night.

*T. pasacana,* a stout tree up to 10.5 m in height, is sometimes called torch cactus. In a loose sense certain cacti of the genus *Cereus,* among them the well-known saguaro, are referred to as torch cacti for their characteristically large funnel-shaped flowers.

**Torchon lace,** coarse bobbin-made lace (*see* bobbin lace) made by peasants in most European countries in which simple geometric pat-



Torchon lace from Sweden, 19th century; in the Institut Royal du Patrimoine Artistique, Brussels

By courtesy of the Institut Royal du Patrimoine Artistique, Brussels; photograph, © A.C.L., Brussels

terns are carried out. With other simple kinds of lace it was the mainstay of the lace makers of the Austrian Tirol. It is the type of lace on which apprentices generally begin learning the craft.

**torchwood** (genus *Amyris*), any of 40 tropical species of large shrubs or trees found in the Americas that burn well due to the high resin content of its wood. Sea torchwood (*A. elemifera*) grows along the coasts of Florida, and balsam torchwood (*A. balsamifera*) is known especially from Cuba. Incense and aromatic oils are derived from torchwood, and extracts from the Mexican *A. plumieri* are used in lacquers.

The leaves of torchwood are glossy and grow in sets of three leaflets; the fruits are cherry-like. The wood is yellowish brown and streaked. When used as timber it is sometimes called candlewood. *Amyris* belongs to the family Burseracae.

**Torcy, Jean-Baptiste Colbert, marquis de** (b. Sept. 14, 1665, Paris—d. Sept. 2, 1746, Paris), French diplomat and foreign minister who negotiated some of the most important treaties of Louis XIV's reign.

The son of Charles Colbert, minister of foreign affairs, Torcy was a brilliant student, earning a law degree (1683) at so young an age that he needed special dispensation to receive it. His father initiated him into the art of diplomacy, and the young man followed him on his diplomatic missions. Torcy proved himself so able that in 1689 Louis XIV granted him the right to succeed to his father's position. He negotiated the treaty in which Charles II of Spain named the Duke d'Anjou, grandson of Louis XIV, as heir to the Spanish throne. In 1708 Torcy drafted the famous manifesto in which the king called on the nation to make a supreme effort to win the War of the Spanish Succession. Torcy was also the guiding spirit at the innumerable conferences that resulted in the treaties of Utrecht (1713) and Rastatt (1714).

The king, recognizing that Torcy had in actuality fulfilled many functions of a secretary of state, named him such in his will. But when Louis died (1715), the will was broken and the regent deprived Torcy of any political power. One of his contributions to historiography was the establishment in Versailles (1710) of a diplomatic archive.

**Tordesillas, Treaty of** (June 7, 1494), agreement between Spain and Portugal, which aimed at settling conflicts over lands explored by Christopher Columbus and other late 15th-century voyagers.

In 1493 Pope Alexander VI had issued bulls setting up a line of demarcation from pole to pole 100 leagues west of the Cape Verde Islands. Spain was given exclusive rights to the region west of the line; Portuguese expeditions were to keep to the east. Neither power was to occupy any territory already in the hands of a Christian ruler. No other European powers facing the Atlantic ever accepted this papal disposition or the subsequent agreement deriving from it. The Spanish rulers Ferdinand and Isabella had enlisted papal support for their claims to inhibit the Portuguese and other possible rival claimants. King John II of Portugal was dissatisfied because Portugal's rights were insufficiently affirmed, and the Portuguese would not have sufficient room at sea for their African voyages. Meeting at Tordesillas, in northwestern Spain, Spanish and Portuguese ambassadors reaffirmed the papal division, but the line itself was moved to 370 leagues west of the Cape Verde Islands, or between 48° and 49° W of Greenwich. Pope Julius II finally sanctioned the change in 1506. The new boundary enabled Portugal to claim the coast of Brazil after its discovery by Pedro Álvares Cabral in 1500. Brazilian exploration and settlement far to the west of the line of demarcation in subsequent centuries laid a firm basis for Brazil's claims to vast areas of the interior of South America.

*To make the best use of the Britannica, consult the* INDEX *first*

**Torelli, Giacomo,** also called JACOPO (b. Sept. 1, 1608, Fano, Papal States [Italy]—d. June 17, 1678, Fano), Italian stage designer and engineer whose innovative theatre machinery provided the basis for many modern stage devices.

Nothing is known of Torelli's early life. In 1641 he was a military engineer at Venice. Already known as an architect, he built two churches there. Having erected the Teatro Novissimo at Venice, he furnished it with ingenious machines, including a revolving stage. His inventions amazed 17th-century Europe and earned for him the title *il gran stregone* ("the great wizard"). He was called to France about 1645. There Torelli equipped the Théâtre du Petit-Bourbon in Paris with numerous devices such as the first effective machinery for rapid changes of heavy sets, which greatly encouraged the development of elaborate stage effects. Among his triumphs in Paris was the operatic production of *Andromède* (1650) by Pierre Corneille. Torelli later returned to Italy (*c.* 1662) and built an elaborately equipped theatre at Fano. His successor at the Petit-Bourbon, Gaspare Vigarani, destroyed his sets, apparently out of jealousy.

**Torelli, Salinguerra** (b. *c.* 1160—d. *c.* 1244, Venice [Italy]), 13th-century Italian ruler of Ferrara and brother-in-law and chief supporter of Ezzelino III da Romano, despot of Verona, a prominent leader of the Ghibelline (imperial) party.

Torelli was born into a noble family of Bolognese origin whose members were rivals of the Este in Ferrara from the end of the 12th century. He carried on an indecisive struggle with Azzo VI of Este until the latter's death in 1212. When Azzo's son Aldobrandino died three years later, Torelli seized Ferrara and, with Ezzelino's support, successfully resisted the efforts of Azzo VII of Este to recover the city.

Temporarily removed from power in Verona by a popular (democratic) government in 1227, Ezzelino engineered Torelli's election as *podestà* (chief magistrate) of that city in 1230, but the following year a Lombard League of northern Italian cities ousted both Ezzelino and Torelli. Forming an alliance with the Holy Roman emperor Frederick II, Ezzelino recovered Verona and helped Torelli regain Ferrara in 1236. In 1240, however, Ferrara surrendered to Guelf (papal) forces, and Torelli died in prison.

**toreva block,** landslide product consisting of a very large block of undisturbed material that has been tilted backward toward the parent cliff during movement down a gentle slope. In northeastern Arizona such blocks are thought to have formed during more humid periods of the last glacial advance of the Pleistocene Epoch (1,600,000 to 10,000 years ago). Toreva blocks also occur, however, as a simple product of gravitational gliding in the Swiss Alps and in other ranges in humid regions.

**Torez,** formerly (until 1964) CHISTYAKOVO, city, Donetsk *oblast* (province), Ukraine. Torez is a typical coal-mining centre of the Donets Basin coalfield, but in Soviet times its industrial base was considerably widened. It is now a centre for engineering industries, especially electrical engineering, and for building materials. The city of Torez has been replanned in modern style, and its streets have been widened. Pop. (1998 est.) 80,100.

**Torfaen,** county borough, historic county of Monmouthshire, southeastern Wales. Torfaen is centred on the urbanized and industrialized valley of the Afon Lywd (formerly called the River Torfaen), and it encompasses the surrounding wooded hills and moorlands. Pontypool was an early metalworking centre, with iron smelting dating back to 1577, and immigrants from Pontypool reputedly built the first forge in the United States in 1652. Pontypool became in 1720 the first town in Britain to produce tinplate. Many workers from the town were involved in the Chartist Riots (demonstrations for parliamentary reform) in Newport, Wales, in 1839.

Cwmbrân, located south of Pontypool, began as a small industrial town, but after World War II it became a focus of governmental development as one of the 32 "new towns" established in the United Kingdom to relieve congestion and decay in the older industrial areas.

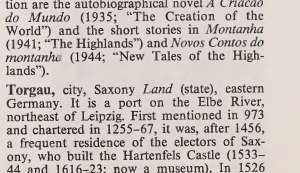
Most of Torfaen's traditional industries have ceased to operate. New industries include the manufacture of automobile components, food processing, nylon production, and electronics. Area 49 square miles (126 square km). Pop. (1998 est.) 90,200.

**Torga, Miguel,** pseudonym of ADOLFO CORREIA DA ROCHA (b. Aug. 12, 1907, São Martinho de Anta, Port.—d. Jan. 17, 1995, Coimbra), poet and diarist whose forceful and highly individual literary style and treatment of universal themes earned him an important position in 20th-century Portuguese literature.

Torga embarked on his literary career while a medical student at the University of Coimbra. After graduation he continued to write and publish while maintaining an active medical practice. In 1927 he was one of the founders of the literary magazine *Presença* ("Presence"); the next year his first volume of poetry, *Ansiedade* ("Anxiety"), was published.

Much of Torga's work—which includes novels, plays, and short stories as well as the poems and his *Diário,* 12 vol. (1941–77; "Diary"), for which he is best known—has as its subject the search for certainties in a changing world. His diary reveals a deeply religious man with a robust faith in the primitive virtues of humanity. Notable among his fiction are the autobiographical novel *A Criação do Mundo* (1935; "The Creation of the World") and the short stories in *Montanha* (1941; "The Highlands") and *Novos Contos do montanha* (1944; "New Tales of the Highlands").

**Torgau,** city, Saxony *Land* (state), eastern Germany. It is a port on the Elbe River, northeast of Leipzig. First mentioned in 973 and chartered in 1255–67, it was, after 1456, a frequent residence of the electors of Saxony, who built the Hartenfels Castle (1533–44 and 1616–23; now a museum). In 1526 the Torgauer Bund, a league of evangelical



Hartenfels Castle in Torgau, Ger.
W. Krammisch—Bruce Coleman Inc.

princes against the Roman Catholic princes, was formed there. During that period Martin Luther, the religious reformer, was active in the town, where he wrote the league's constitution (the *Torgau Articles,* 1530). His wife Katherina von Bora is buried in the Church of St. Mary (Marienkirche, begun 1390). The Castle Church (Schlosskirche) was the first Protestant church to be built (1543–44). Prisoners of war were held in the former Torgau fortress in World War II. A monument on the Elbe River near Torgau commemorates the first meeting between U.S. and Soviet troops during the closing days of World War II.

A railway junction, with an inland transshipment harbour, Torgau manufactures agricultural machinery, ceramics, glass, and paper and has iron foundries. Pop. (1992 est.) 21,772.

**Tori style,** in Japanese art, style of sculpture that emerged during the Asuka period (AD 552–645) and lasted into the Nara period (645–794). It was derived from the Chinese Northern Wei style (AD 386–534). It is called Tori after a sculptor of Chinese descent whose only known piece is a Buddhist triad, which

was made in AD 623 as a memorial to Prince Shōtoku. It represents the Buddha Śākyamuni (Shaka) seated on a throne that is flanked on either side by *bodhisattvas*, with a great mandorla behind.

Works in true Tori style are very reminiscent of Northern Wei sculpture found at the site of Lung-men in China. Stylistic characteristics include slender, elegant bodies, a strong linear interest in drapery, and a tendency toward



Bronze triad of Shaka with attendant figures (left figure lost) in the Tori style, Asuka period, 623; in the Hōryū-ji, Nara, Japan

By courtesy of the Horyu-ji, Nara, Japan

squatness in the proportion of the faces and also in the relationship of the body to the feet.

**torii,** ceremonial gateway marking the entrance to the sacred precincts of a Shintō shrine in Japan. The *torii,* which has many variations, characteristically consists of two cylindrical vertical posts topped by a cross-wise rectangular beam extending beyond the posts on either side and a second crosswise beam a short distance below. Some authorities relate it to the Indian gateway arch, the *toraṇa,* which reached Japan with the spread of Buddhism. Others connect the *torii* with traditional gates



Camphor wood *torii* at the shrine of Itsukushima, on Itsuku-shima, Japan

Paolo Koch—Rapho/Photo Researchers

in Manchuria and elsewhere in China. The *torii,* often painted bright red, demarcates the boundary between sacred space of the shrine and ordinary space. *Torii* also identify other sacred spots, such as a mountain or rock.

**Torii Kiyomasu,** also called SHŌJIRŌ (b. *c.* 1694, Japan—d. 1716, Japan), painter of Ukiyo-e (scenes from Japanese daily life).

He is thought to have been a relative of Torii



"Shibaraku," woodblock print by Torii Kiyomasu, early 18th century; in the Hiraki Collection, Tokyo

By courtesy of the Hiraki Collection, Tokyo

Kiyonobu, the first Japanese to paint actors. He made hand-coloured prints of the kind called *tan-e* (in which the dominant colour is supplied by *tan,* or red lead, a method used from the last quarter of the 17th century until the invention of colour printing in 1741); these were also called *urushi-e* or "lacquer pictures" when the black tone was given a stronger lustre by the addition of glue to the ink. Some of Kiyomasu's famous prints are the portrait of two actors, "Ichikawa Monnosuke, Tamazawa Rinya," and "The Actor Danjūrō as Gorō Pulling out a Bamboo."

**Torii Kiyonaga,** original name SEKIGUCHI SHINSUKE (b. 1752, Sagami Province, Japan—d. June 28, 1815, Edo [Tokyo]), one of the most important Japanese artists of the Ukiyo-e movement (paintings and wood-block prints of the "floating world").



"Enjoying the Evening Cool at the Riverside of the Sumida," polychrome woodblock print by Torii Kiyonaga, 1788; in the Hiraki Collection, Tokyo

By courtesy of the Hiraki Collection, Tokyo

He was the pupil of Torii Kiyomitsu and for a time headed the Torii school. So great, however, was his loyalty to the Torii family that he made his own son, a young painter with promise, stop painting in order not to interfere with the career of his master's nephew Torii Kiyomine.

Kiyonaga concentrated on the depiction of famous beauties. He designed many large *nishiki-e,* or polychrome prints, in diptych (two-panel) and triptych (three-panel) formats. Women in his prints were tall and stately, drawn with elegantly graceful lines in a realistic style. His best known works are "Minami jūniko" ("Twelve Months at the Gay Quarters"), "Tōsei yūri bijin awase" ("A Contest of Fashionable Beauties of the Gay Quarters"), and "Fūzoku azuma no nishiki" ("Life of Women Not Belonging to the Gay Quarters").

**Torii Kiyonobu,** also called SHŌBEI (b. 1664, Ōsaka—d. Aug, 22, 1729, Edo [Tokyo]), Japanese painter who founded the Torii school, the only Ukiyo-e school to have survived to this day. (Ukiyo-e is a popular style of painting and woodblock printing utilizing colour and based on themes of the "floating world.")

Torii learned painting from his actor-painter father, Kiyomoto, who once played female roles in Ōsaka. After the family moved to Edo (now Tokyo) in 1687, Torii became a signboard painter for the Kabuki theatre. He also illustrated books in the Ukiyo-e style; but with his Kabuki connections, he started designing



"Sinozuka Goro," woodblock print by Torii Kiyonobu, showing the Kabuki actor Ichikawa Ebizo playing Sinozuka Goro; in the Sakai Collection, Tokyo

By courtesy of the Sakai Collection, Tokyo

numerous portraits of actors to be reproduced as prints. The close association of the Torii family with the Kabuki theatre also was the key to the survival of the Torii school.

Torii's free and powerful style, nicknamed *hyotan mimizugaki* ("the gourd-earthworm style") because of its strong, tapering brush strokes, became popular because it reflected the general mood of the *aragoto* ("rough style") Kabuki plays of the period. He also excelled in drawing portraits of the beauties of his time in a realistic yet graceful style. *Shōgi gachō* ("Picture Album of Courtesans") and the two-volume *Fūryū shihō byōbu* ("Portraits of Famous Actors"), both printed in 1700, are his representative works.

**Torino** (Italy): *see* Turin.

**Torlonia Museum,** Italian MUSEO TORLONIA, in Rome, private archaeological museum founded in the 18th century by Giovanni Torlonia with sculptures from Roman collections, most originally found in the city of Rome. The Torlonia Museum contains about 600 items of sculpture, including a few Greek originals. The most important sculptures are the 5th-century-BC "Hestia Giustiniani," attributed to Kalamis, and a relief depicting Heracles liberating Theseus and Peirithöos, attributed to the school of Phidias and dating from the 4th century BC.

**Tormé, Mel,** in full MELVIN HOWARD TORMÉ (b. Sept. 13, 1925, Chicago, Ill., U.S.—d. June 5, 1999, Los Angeles, Calif.), American singer, songwriter, composer, arranger, pianist, drummer, actor, and author, who was one of the 20th century's most versatile, respected, and influential jazz vocalists.

Tormé began singing professionally when he was just four years old. At age 6 he was in vaudeville, at 8 he starred on radio, and at 15 he composed his first hit, "Lament to Love." Tormé began touring with Chico Marx's band just before he turned 17, and in 1943 he made his motion picture debut in *Higher and Higher.* The same year he formed a quintet, Mel Tormé and His Mel-Tones. Such other films as *Good News* (1947) and *Words and Music* (1948) followed, and Tormé became an idol of bobby-soxers. "Blue Moon," which he sang in *Words and Music,* became his first solo hit and one of his signature tunes. In 1949 Capitol Records chose Tormé's *California Suite* for its first long-playing album, and in 1954 he recorded *Mel Tormé at the Crescendo,* his first live album. With the rise of rock music Tormé's career faltered, but it rebounded in the late 1970s. Eventually Tormé earned two Grammy Awards for best male jazz vocalist, for the albums *An Evening with George Shearing and Mel Tormé* (1982) and *Top Drawer* (1983). His performing career lasted until he suffered a stroke in 1996.

Tormé wrote about his life in at least two of his books—*The Other Side of the Rainbow* (1970), about working on Judy Garland's television series, and *It Wasn't All Velvet* (1988), his autobiography.

Known—to his chagrin—as the "Velvet Fog" for his smooth vocal quality, he mastered a variety of styles from mellow love songs to scat, and he wrote more than 300 songs. His most familiar, "The Christmas Song"—co-written with Robert Wells and better known by its opening line, "Chestnuts roasting on an open fire"—was made famous by Nat King Cole in 1946 and subsequently recorded in more than 1,700 versions.

**tornado,** violent cyclonic storm, relatively small in diameter but with very rapidly rotating winds forming a vortex.

A brief treatment of tornadoes follows. For full treatment, *see* MACROPAEDIA: Climate and Weather.

A tornado is a violent cyclonic (low-pressure) storm with an intense updraft near its centre that is capable of lifting quite heavy objects such as trees and cars into the air and of upending even heavier objects, such as railway cars or aircraft. The relatively low pressure at the centre of the tornado's funnel-like vortex causes cooling and condensation, thus making the storm visible as a revolving column of cloud, called the funnel or vortex. The paths of tornadoes average only several hundred metres in width and 26 km (16 miles) in length, but large deviations from these averages have been measured. Tornadoes travel normally from 48 to 64 kilometres per hour (30 to 40 miles per hour). The winds around the vortex average nearly 480 km/h (300 mile/h) and have been known to reach 800 km/h (500 mile/h) in the most violent storms. Tornadoes often occur in groups.

The conditions required for the formation of tornadoes are basically the same as those for a severe thunderstorm—namely, great vertical instability of air near the ground, high humidity, and the horizontal convergence of winds at low levels followed by uplift in the storm. The precise atmospheric requirements involved in the generation of tornadoes, however, are not completely understood. Tornadoes often form from a line of thunderstorms along what is known as a squall line, especially in spring and early summer. Tornadoes are most frequent in the United States, east of the Rocky Mountains and especially in the central plains area of the Mississippi Basin, where about 150 occur each year. Both thunderstorms and tornadoes are associated with tropical air that moves north or northeast into central North America and clashes with cooler, drier air moving from the north. These fronts are often characterized by vorticities that tend to spawn tornadoes. Tornadoes also strike the southern United States in winter, particularly during severe thunderstorms, and they have even developed on rare occasions in the northeastern states. They may also develop around tropical cyclones, especially as they move inland and begin to disintegrate. Tornadoes generally travel from southwest to northeast, although those that develop from tropical cyclones travel from east to west. Other countries reporting tornadoes include, but are not limited to, Australia, Great Britain, Canada, China, France, Germany, The Netherlands, Hungary, India, Italy, and Japan.

Among the most destructive of tornado clusters in the United States was a group that developed on April 11, 1965, and wreaked devastation over Iowa, Illinois, Wisconsin, Indiana, Michigan, and Ohio, killing 271 persons, injuring thousands, and causing more than $300,000,000 in property damage. The death toll was surpassed only by that of a tornado that killed 689 persons in Missouri, Illinois, and Indiana on March 18, 1925.

**Torne River,** Swedish TORNEÄLVEN, or TORNEÄLV, Finnish TORNIOJOKI, northernmost river of Sweden. It rises near the Norwegian border west of Torne Lake, the largest lake in Swedish Lapland, and flows for 354 miles (570 km) to the Gulf of Bothnia, which it enters at a point between Haparanda and Tornio, Fin. The Torne River's lower course forms the boundary between Sweden and Finland. The drainage basin is 15,500 square miles (40,200 square km) in area, about one-third of which is in Finland and Norway. The upper course of the Torne has waterfalls, while the lower course of the river is strewn with rapids and is thus mostly non-navigable; it was formerly much used for logging, however, and is known for its salmon.

**Törnebohm, Alfred Elis** (b. Oct. 16, 1838, Stockholm—d. April 21, 1911, Strängnäs, Swed.), Swedish geologist and pioneer in the study and analysis of mountain structure. In 1888 he presented the first outlines of his theory of the overthrust of the Caledonian Range (the mountainous region in northwestern Europe extending from the British Isles to western Scandinavia) onto a foreland to the southeast and demonstrated (1896) that the overthrusting applied to the entire mountain range and exceeded 80 miles (130 km). He illustrated his completed description with a map of a 36,000-square-mile (93,000-square-kilometre) area.

Törnebohm was a member of the Geological Survey of Sweden from 1859 to 1873. After travel in central Europe, he returned (1878) to Stockholm as professor of mineralogy and geology at the Royal Institute of Technology. He then became director of the Geological Survey from 1897 to 1906.

An accomplished mineralogist and petrographer, Törnebohm gave special attention to the iron ores of Sweden and early presented an exhaustive account of the crystalline phases of portland cement (1897).

**Torngat Mountains,** range in northern Labrador, Newfoundland, Canada. The Torngat range extends northward for 120 miles (190 km) from Hebron Fjord to Cape Chidley, between the Quebec border (west) and the Atlantic Ocean (east). Named from an Eskimo (Inuit) term Torngarsuak, meaning "ruler of all sea animals," the mountains are sometimes locally referred to as Devil Mountains, or "home of the spirits." With elevations reaching 5,500 feet (1,700 m) at Cirque Mountain (the highest point in Newfoundland) near Ramah, the range is the loftiest in the Canadian Shield (the rocky, glaciated plateau of eastern Canada). Severely glaciated, the peaks rise abruptly from the sea, have a rugged fjord coastline, and are virtually without vegetation or inhabitants.

**Toro,** also spelled TOORO, also called BATORO, an interlacustrine Bantu-speaking people who inhabit a high plateau between Lakes Albert and Edward, bounded on the west by the Ruwenzori Range in southwestern Uganda. Toro lands include rainforest, dense bamboo stands, papyrus swamps, plains of elephant grass, and lakeshore.

The Toro believe that legendary Tembuzi kings created the earliest centralized political organization in the area and that these people were succeeded by the Cwezi and then by the Bito—a Nilotic people who had come from the north. The Toro seceded from the Bito-ruled Bunyoro kingdom in about 1830, led by Prince Kaboyo. Royal regalia were received from the Bunyoro rulers, and as Kaboyo consolidated and extended his kingdom, he gained Bito support. In the late 1880s the Bunyoro king Kabarega temporarily reconquered the Toro. A Toro prince escaped and was restored to the Toro throne by British colonizers in the 1890s in exchange for loyalty, taxation, and the cession of forest and mineral rights to British concerns. During colonial times, the Toro kingdom was a subordinate, African local government. The Toro kingdom, along with all the other kingdoms in newly independent Uganda, was abolished by the Ugandan central government in 1966.

The Toro live in settlements occupying demarcated lands; different clans are found in each. Most Toro families are monogamous and households small. Descent is patrilineal, and named lineages within a clan are not hierarchically organized. Lineage heads are "faderly advisers" who settle disputes; in former times they also maintained contact with the king.

The Toro kingdom had a cattle-owning class, the Hima, although most Toro, called Iru, were small-scale farmers. The Toro social organization is strongly stratified; the formerly pastoral Bito as well as the Hima claim greater privileges and wealth than the Iru. Millet, plantains, cassava, and yams are grown, and wheat, cotton, and coffee are raised as cash crops; fish are traded as well. The Toro also received tax benefits from the Kilembe copper mines. Queen Elizabeth (Ruwenzori) National Park, in Toro lands on the south, has significant numbers of many species, including elephants, hippopotamuses, and Ugandan kob (a variety of antelope). The Toro numbered about 750,000 at the end of the 20th century.

**Toro,** town, Zamora province, in Castile and León autonomous community of northwestern Spain. It lies along the north bank of the Duero (Portuguese Douro) River, 18 miles (29 km) east of Zamora city. Dating from Roman times, the town served as the meeting place for the Cortes (parliament) of 1371, 1442, and 1505, which made Toro and its code of laws famous. An agricultural trade centre, Toro is known for its red wine with a high alcoholic content. Pop. (1999 est.) 9,396.

**Toronto,** city, capital of the province of Ontario, southeastern Canada. Toronto has the most populous metropolitan area in Canada, and, as the most important city in Canada's most prosperous province, it is the country's financial and commercial centre. Its location on the northern shore of Lake Ontario, which forms part of the border between Canada and the United States, and its access to Atlantic shipping via the St. Lawrence Seaway and to major U.S. industrial centres via the Great Lakes has enabled Toronto to become an important international trading centre.

The following article treats briefly the modern city of Toronto. For full treatment, *see* MACROPAEDIA: Toronto.

The site of the city is almost uniformly flat. Toronto's climate is moderated somewhat by Lake Ontario, but it is not unusual for temperatures to rise above 90° F (32° C) on occasion during the summer and to reach below 0° F (−18° C) in the winter.

The city benefits significantly from Ontario's vast storehouse of raw materials (minerals, timber, agricultural products) and hydroelectric energy. The city and its environs produce more than half of Canada's manufactured goods, and Toronto's port handles the bulk of the country's manufactured exports. The Toronto Stock Exchange is one of the major exchanges in the Western Hemisphere. Construction, transportation, finance, government, recreation, and tourism are other important activities.

The streets of Toronto are laid out in a grid, with some modification to accommodate roads along the Lake Ontario shoreline. The central business district is located around the intersections of Yonge Street with Bloor and Queen streets. The financial district, headquarters for many insurance companies and banks as well as the Toronto Stock Exchange, is in the vicinity of King and Bay streets, south of the old City Hall. The downtown area is dominated by the CN Tower; two office and banking complexes, the Toronto Dominion Centre and Commerce Court; and the Harbourfront Centre. City Hall (opened in 1965) was designed by the Finnish architect Viljo Revell.

North of the business district lies a fashionable shopping area. The Ontario Parliament Buildings and the University of Toronto rise south of Bloor Street in a section with tall shade trees and grassy areas known for its parklike atmosphere. One of the most attractive residential areas is Rosedale, an older neighbourhood of distinguished homes set on winding, tree-lined streets.

During the population expansion of the 1950s and '60s, when metropolitan Toronto more than doubled its population, the area became home to several European immigrant groups, including German, Italian, Polish, Greek, and Portuguese. By the early 1960s these groups had transformed the character of the area so much that less than half the inhabitants of the city were of British extraction. During the 1970s and early '80s large numbers of immigrants came to Toronto from Asia and the West Indies. The variety of foreign cultures and cuisines contributed restaurants, forms of entertainment, and various cultural activities that converted Toronto in a decade from one of the most staid cities on the continent to one of the liveliest. The infusion also has helped revitalize the city's original role as the leading cultural centre of Ontario and as one of the most important in Canada.

Toronto has several major theatres, as well as numerous small experimental ones. Opera and ballet groups are active, particularly during the winter season, and the Toronto Symphony Orchestra has an international reputation. Excellent art collections are displayed at the Art Gallery of Ontario and the Royal Ontario Museum. The University of Toronto, York University, and Ryerson Polytechnic University are major centres of higher learning. Two other examples of Toronto's cultural fare are the Ontario Science Centre and Ontario Place. The latter, a complex of recreational facilities on man-made islands in the lake, is an extension of the permanent Canadian National Exhibition. This annual affair features an international air show; agricultural, animal, and horticultural displays; and theatrical and musical events. Its fairground attracts several million people during the late summer each year. The Skydome (1989) houses the city's professional baseball (Blue Jays) and Canadian football (Argonauts) teams, while the hockey (Maple Leafs) and basketball (Raptors) teams play at the Air Canada Centre (1999).

Subway lines run north–south and east–west, and a network of highways connects Toronto with eastern Canada, northern Ontario, and the U.S. states of New York and Michigan. Toronto International Airport, Canada's busiest, lies 17 miles (27 km) west of the city. Area city, 38 square miles (97 square km); metropolitan area, 246 square miles (630 square km). Pop. (2001) city, 2,481,494; metropolitan area, 4,682,897.

**Toronto, University of,** coeducational institution of higher learning that is the provincial university of Ontario and one of the oldest and largest universities in Canada. It is composed of federated, affiliated, and constituent colleges, a union based originally on British models, and of faculties, schools, institutes, centres, and divisions, modeled more on American lines. All are related to each other through an elaborate and unique Canadian university structure.

The university had its origins in the Anglican-founded state university of the Province of Upper Canada—the University of King's College at York (now Toronto), which was chartered in 1827 but was not established until 1843. In 1850, after bitter religious and political controversy, King's College was secularized and renamed the University of Toronto. In 1853 University College was created as the teaching body while the university itself became solely an examining and degree-granting body. As a result of the Federation Act of 1887 the university resumed teaching, and several institutions of higher learning became federated or affiliated with the university.

Currently federated or affiliated with the University of Toronto are three autonomous church-related colleges: Victoria (United Church of Canada), Trinity (Anglican), and St. Michael's (Roman Catholic); a graduate institute, the Ontario Institute for Studies in Education; a graduate residential college, Massey; and three theological colleges: Emmanuel (United Church), Wycliffe (Anglican), and Knox (Presbyterian). There are six undergraduate colleges: University, Woodsworth, Erindale, Scarborough, New, and Innis.

The University of Toronto offers 39 major teaching divisions. It is also the home of the Royal Conservatory of Music, the Banting and Best Department of Medical Research, Connaught Laboratories (which manufacture insulin, discovered by Frederick Banting and others at the university in 1921), the Pontifical Institute of Mediaeval Studies, and the University of Toronto Press, one of Canada's leading publishing houses. The library collections of the university and its related institutions total more than 8,000,000 volumes.

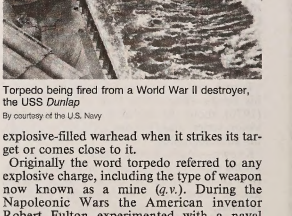
The main campus of the university is located on 165 acres (67 hectares) near the centre of downtown Toronto. Total enrollment is more than 55,000.

**Toronto Star, The,** influential Canadian newspaper established in 1892 as the *Evening Star* by 25 printers who had lost their jobs in a labour dispute. A four-page paper at the outset, it changed hands several times until 1899, when a group of leading citizens bought the paper and Joseph E. Atkinson took over its direction. The paper was renamed *The Toronto Daily Star,* and within five years its circulation rose from 7,000 to 40,000.

Liberal in editorial outlook, the *Star* in the early 20th century pressed for unemployment insurance, old-age pensions, and other social changes. It promoted stronger Canadian nationhood and a greater presence in international affairs. It established its own radio station, CFCA, in 1922. Its outspoken opposition to Nazi policies in Germany made it the first North American newspaper to be banned from Nazi Germany.

**Toros Dağları** (Turkey): *see* Taurus Mountains.

**torpedo,** cigar-shaped, self-propelled underwater missile, launched from a submarine, surface vessel, or airplane and designed for exploding upon contact with the hulls of surface vessels and submarines. A modern torpedo contains intricate devices to control its depth and direction according to a preset plan or in response to signals received from an outside source, as well as a device that detonates the explosive-filled warhead when it strikes its target or comes close to it.



Torpedo being fired from a World War II destroyer, the USS *Dunlap*
By courtesy of the U.S. Navy

Originally the word torpedo referred to any explosive charge, including the type of weapon now known as a mine (*q.v.*). During the Napoleonic Wars the American inventor Robert Fulton experimented with a naval mine and called it a torpedo, apparently deriving its name from a fish that emits an electric discharge that incapacitates its enemies. During the 19th century some naval vessels used the spar torpedo, which was simply an explosive charge attached to the end of a long pole or spar; it exploded when it touched the hull of an enemy vessel.

The modern torpedo was developed by Robert Whitehead, a British engineer. In 1864 the Austrian Navy asked him to work out an idea for an explosive-carrying, self-propelled boat that could be steered from its launching site by long yoke lines. After building a model of the device, Whitehead rejected the scheme as impracticable and began work on an idea of his own. By 1866 he had a successful torpedo.

One model of the Whitehead weapon—measuring about 14 feet (4 metres) in length and 14 inches (36 centimetres) in diameter, weighing about 300 pounds (including an 18-pound charge of dynamite in its nose)—was powered by a compressed-air engine driving a single propeller. Depth was controlled by a hydrostatic valve that operated rudders on the horizontal tail surfaces; there was no provision for lateral steering. Its speed was 6 knots (7 miles per hour), and its range was between 200 and 700 yards (180 and 640 m).

In 1895 the gyroscope came into use for directional control. Any deviation from the set course caused the gyroscope to apply correc-

tive movement to the vertical rudders. Further modifications permitted the introduction of a set angle (up to 90°) into the torpedo's course before the steering rudders took full control. This feature allowed a ship to launch torpedoes without having to face broadside to the target, greatly opening up the field of torpedo tactics.

Modern torpedoes are grouped according to source of propulsive power, method of control during water travel, type of target, and type of launching craft. Propulsion is usually by battery-powered electric motors. Underwater travel is controlled in several ways. Active-acoustic torpedoes generate sound signals similar to sonar and home in on the echo received from the target. Passive-acoustic torpedoes home in on noise generated by the target.

The submarine has been the naval vessel that used the torpedo most successfully, notably in the two world wars, when enormous tonnages of merchant shipping were sunk, mostly by German U-boats. World War II also saw the introduction of torpedo-carrying aircraft and homing, or acoustic, torpedoes. Torpedoes are an important element in antisubmarine warfare; attack submarines, designed to hunt missile submarines, are armed with torpedoes, including combination missile-torpedo weapons.

**torpedo,** also called TORPEDO FISH (zoology): *see* electric ray.

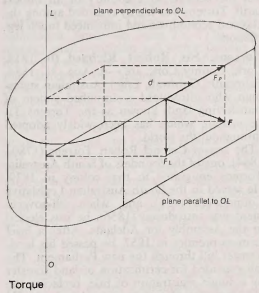
**torpedo plane,** also called TORPEDO BOMBER, aircraft designed to launch torpedoes. In about 1910 the navies of several countries began to experiment with torpedo launching from low-flying aircraft, usually seaplanes. The first effective use of this technique occurred on Aug. 12, 1915, when a British Short Type 184 seaplane sank a Turkish vessel in the Dardanelles. Other navies' torpedo planes also had some success during World War I.

Between the world wars most navies decided to operate torpedo bombers from aircraft carriers. In World War II the torpedo plane scored spectacular successes, among them the British night raid on the Italian fleet anchored at Taranto in November 1940, the Japanese attacks on Pearl Harbor and on the British battleships *Prince of Wales* and *Repulse* in 1941, and the U.S. victory at Midway in 1942. Like dive bombers, torpedo planes proved vulnerable to fighter aircraft and anti-aircraft fire and often suffered heavy losses. With the postwar development of air-launched missiles, aerial torpedoes were largely relegated to anti-submarine use and were carried by long-range patrol aircraft generally larger than the earlier specialized torpedo bombers.

**torque,** in jewelry, metal collar, neck ring, or armband consisting of a bar or ribbon of twisted metal curved into a loop, the ends of which are fashioned into knobs ornamented with motifs such as volutes or depicting animal heads, or drawn out and bent abruptly so as to hook into one another. The torque is a unique neck ornament in that it is not flexible and was often of great size and weight.

Achaemenidian jewelry made in Persia from the 6th to the 4th century BC contains examples of torques, the terminals of which are made in the form of lions, ibex, rams' heads, or purely fantastic animals. The torque was a characteristic male neck ornament of such peoples as the ancient Teutons, Gauls, and Britons. The Romans, when they invaded Britain, were so intrigued with the torques that they awarded them to their soldiers for brave acts.

**torque,** also called MOMENT OF A FORCE, in physics, the tendency of a force to rotate the body to which it is applied. The torque, specified with regard to the axis of rotation, is equal to the magnitude of the component of the force vector lying in the plane perpendicular to the axis, multiplied by the shortest distance between the axis and the direction of the force component. Regardless of its orientation in space, the force vector can always be located in a plane parallel to the axis. In the Figure,



Torque

the force vector $F$ lies in the plane parallel to the line $OL$; the component $F_L$, being parallel to $OL$, has no moment about $OL$, while the component $F_P$, lying in the plane perpendicular to $OL$, has a moment, or torque, about $OL$ equal to $F_P \times d$, in which $d$, the shortest distance between $F_P$ and $OL$, is the moment arm or lever arm.

**Torquemada, Tomás de** (b. 1420, Valladolid, Castile [Spain]—d. Sept. 16, 1498, Ávila, Castile), first grand inquisitor in Spain, whose name has become synonymous with the Christian Inquisition's horror, religious bigotry, and cruel fanaticism.

The nephew of a noted Dominican cardinal and theologian, Juan de Torquemada, the young Torquemada joined the Dominicans and in 1452 became prior of the monastery of Santa Cruz at Segovia, an office that he held for 22 years. He was closely associated with the religious policy of King Ferdinand II and Queen Isabella I, to whom he was both confessor and adviser (to Isabella, from her childhood). He was convinced that the existence of the Marranos (Jewish converts), Moriscos (Islāmic converts), Jews, and Moors


Torquemada, lithograph
By courtesy of the Biblioteca Nacional, Madrid

was a threat to the religious and social life of Spain, and his influence with the Catholic Monarchs enabled him to affect their policies. In August 1483 he was appointed grand inquisitor for Castile and León, and on October 17 his powers were extended to Aragon, Catalonia, Valencia, and Majorca.

In his capacity as grand inquisitor, Torquemada reorganized the Spanish Inquisition, which had been set up in Castile in 1478, establishing tribunals at Seville, Jaén, Córdoba, Ciudad Real, and, later, Zaragoza. In 1484 he promulgated 28 articles for the guidance of inquisitors, whose competence was extended to include not only crimes of heresy and apostasy but also sorcery, sodomy, polygamy, blasphemy, usury, and other offenses; torture was authorized in order to obtain evidence. These articles were supplemented by others promulgated between 1484 and 1498. The number of burnings at the stake during Torquemada's tenure has been estimated at about 2,000.

Torquemada's implacable hostility to the Jews probably exercised an influence on the decision of Ferdinand and Isabella to expel from their dominions all Jews who had not embraced Christianity. Under the edict of March 31, 1492, more than 160,000 Jews left Spain.

In his private life Torquemada seems to have been pious and austere, but his official career as inquisitor was marked by a harsh intransigence, which nevertheless was generally supported by public opinion, at least in the early years. Within his own order he was influential as visitator of the reformed Dominican priories of Aragon (1481–88), and his interest in the arts is evidenced in the monastery of St. Thomas at Ávila, where he died. In his final years, Torquemada's health and age, coupled with widespread complaints, caused Pope Alexander VI to appoint four assistant inquisitors in June 1494 to restrain him.

*To make the best use of the Britannica, consult the* INDEX *first*

**Torrance,** city, Los Angeles county, southern California, U.S., in the South Bay area. Once part of Rancho San Pedro, it was founded in 1911 by Jared Sidney Torrance and promoted as a planned industrial community. Spurred by the discovery of oil, it developed diversified manufacturing led by iron, steel, aluminum, and petroleum products. It is the seat of El Camino College (1947). Inc. 1921. Pop. (1990) 133,107.

**Torrance, Jack,** byname BABY JACK, or BABY ELEPHANT (b. June 20, 1912, Weathersby, Miss., U.S.—d. Nov. 11, 1969, Baton Rouge, La.), American world-record holder in the shot put (1934–48).

Torrance played tackle on the football team and was a member of the track team, the Fabulous Five, at Louisiana State University (Baton Rouge), the latter winning the 1933 National Collegiate Athletic Association (NCAA) championship. He broke the world shot-put record in 1934 and before the year was out had broken it twice more, his best throw being 17.40 m (57 feet 1 inch). He also set the Amateur Athletic Union record in 1934 that lasted until 1949. He set NCAA records in 1933 and 1934, but after 1934 he never bettered them. Though he put the shot in the 1936 Olympic Games at Berlin, he finished fifth with throws far short of his record.

Later he boxed professionally, played with the Chicago Bears professional football team in 1939–40, was a deputy sheriff, and worked for a rubber and chemical company.

**Torre, Francisco Serrano y Domínguez, duque de** (duke of): *see* Serrano y Domínguez, Francisco.

**Torre, Víctor Raúl Haya de la:** *see* Haya de la Torre, Víctor Raúl.

**Torre Annunziata,** city, Napoli *provincia,* Campania *regione,* southern Italy, a southeastern suburb of Naples on the Bay of Naples at the southern foot of Mount Vesuvius. The city takes its name from a chapel and hospital dedicated to the Virgin of the Annunciation, built there by William of Nocera in 1319. De-

stroyed by the eruption of Vesuvius in 1631, the city is now a bathing resort and thermal spa, with a small port. An important rail centre, it includes among its industries the manufacture of macaroni and firearms, as well as shipyards and iron and steelworks. Pop. (2000 est.) mun., 46,864.

**Torre del Greco,** city, Napoli *provincia,* Campania *regione,* southern Italy. It lies at the southwestern foot of Mount Vesuvius. It is located on the Bay of Naples and is a southeastern suburb of Naples. Two-thirds destroyed by the eruption of Vesuvius in 1631, Torre del Greco was rebuilt on the solidified lava. It suffered further damage in volcanic eruptions of 1737, 1794, and 1861 and during an earthquake of 1857. Essentially a maritime town, it is popular as a bathing resort, and many of its inhabitants are engaged in seafaring and fishing. Industrial development is slight, but the city is known for its craftsmanship in coral and cameo work and has a school of coral carving and a coral museum. Pop. (2000 est.) mun., 94,505.

**Torrelavega,** city, Cantabria *provincia* and *comunidad autónoma* ("autonomous community"), northern Spain. It lies southwest of Santander city, at the confluence of the Besaya and Saja rivers. The city is an industrial and rail communications centre, and its livestock fair is one of the most famous in Spain. Manufactures include chemicals (dyes and sulfuric acid), plastics, and synthetic fibres. The municipality has iron, lead, and zinc mines. Founded in the 14th century, the city owes its name to the Carcilaso de la Vega family, notable in medieval times. The caves of Altamira, famous for their prehistoric paintings, are in the vicinity. Pop. (1998 est.) 57,500.

**Torrens, Lake,** salt lake, lying west of the Flinders Ranges, east-central South Australia, 215 miles (345 km) northwest of Adelaide. About 150 miles (240 km) long and 40 miles (65 km) wide, the salt lake has an area of 2,300 square miles (5,900 square km). Normally a mud flat, it may fill only after heavy rains and has been known to overflow into Spencer Gulf, several miles to the south. The lake was visited in 1839 by Edward J. Eyre while he was seeking new grazing lands, and it was named in honour of Colonel Robert Torrens, chairman of the South Australian Colonization Commissioners.

**Torrens, Robert** (b. 1780, Hervey Hill, County Derry, Ire.—d. May 27, 1864, London, Eng.), British economist, soldier, politician, and promoter of schemes for the colonization of Australia.

Torrens joined the Royal Marines in 1796, achieving the rank of lieutenant a year later; by the time of his retirement (1837) he was a full colonel. Torrens was wounded in command of the defense of the island of Anholt (1811), and he began to study economics during the course of the siege. He was elected to the British House of Commons for various constituencies (1826–35), served as chairman of the South Australian Colonization Commissioners (1835), and was a major shareholder in the newspaper *Globe and Traveller.* He was a founding member of the influential Political Economy Club.

Torrens was best known as an economics writer. Initially he supported the case for paper money, but later he became a major spokesman for the currency school led by David Ricardo. This strict monetary approach, which basically incorporated the beliefs of the bullionists, advocated a gold standard and regulation of the banks' ability to issue currency, on the theory that prices are lowered when the supply of money is controlled. Torrens became one of the most able defenders of the Bank Act of 1844, which rigidly controlled the amount of currency. He also made some original contributions to the theory of comparative cost and to the principle of reciprocal demand. He was one of the first to point out the benefits to a country of an import tariff. Torrens was highly regarded among the classical economists and influenced much legislation.

**Torrens, Sir Robert Richard** (b. 1814, Cork, County Cork, Ire.—d. Aug. 31, 1884, Falmouth, Cornwall, Eng.), Australian statesman who introduced a simplified system of transferring land, known as the Torrens Title system, which has been widely adopted throughout the world.

The son of Colonel Robert Torrens (1780–1864), one of the founders of South Australia, Torrens emigrated to that colony in 1839. He served in the South Australian Legislative Council (1851–55), and, when self-government was introduced (1856), he was elected to the Assembly for Adelaide. After a brief term as premier in 1857, he passed his land-transfer bill through the new Parliament. The bill provided for certification of land transfer by a single registration of title, replacing the old, complicated system of tracing deeds. He implemented his system in South Australia, explained it in other parts of the country, and wrote several books on the subject. He returned to England in 1863, serving in Parliament from 1868 to 1874. He was knighted in 1872.

**torrent duck** (species *Merganetta armata*), long-bodied duck, found along rushing mountain streams in the Andes. It is usually classified as an aberrant dabbling duck (*q.v.*) but is sometimes placed in its own tribe, the Merganettini, family Anatidae (order Anseriformes). The torrent duck clings to slippery stones with its stiff tail or dives to probe beneath rocks with its narrow soft bill for insect larvae. All races show sex differences in plumage; drakes are white headed, with black eye and neck stripes, and are gray to black below, while hens are rusty and dark gray. All have a spur at the wing bend, as do many perching ducks.

**Torreón,** city, southwestern Coahuila *estado* ("state"), northeastern Mexico. It lies along the Nazas River at an elevation of 3,674 feet (1,120 m) above sea level. It lies northwest of Mexico City and is southeast of Ciudad Juárez and El Paso on the Mexican-U.S. border. The settlement, founded in 1893, did not prosper until President Lázaro Cárdenas began Laguna District, one of the largest state-operated agricultural cooperatives in Mexico, in 1936. Torreón is the metropolis of a vast cotton- and wheat-growing district that also supports dairying and livestock raising; the city is also an important centre for livestock-breeding by artificial insemination. Its industries, including cotton and flour mills and ironworks and steelworks, make it one of the most important manufacturing centres in northern Mexico. Torreón is also a mining centre for silver, zinc, copper, lead, and arsenic deposits located in the vicinity. The city is accessible by railroad, highway, and air. Pop. (1990 prelim.) 459,809.

**Torres Bodet, Jaime** (b. April 17, 1902, Mexico City, Mex.—d. May 13, 1974, Mexico City), Mexican poet, novelist, educator, and statesman.

Torres Bodet studied law and literature at the National University of Mexico. He later became secretary to the National Preparatory School, then chief of the department of public libraries in the Ministry of Education (1922–24), and was professor of French literature at the university (1924–29).

His first collection of verse, *Fervor* (1918), revealed Modernist tendencies. The theme of loneliness, his search for identity, and a longing for death expressed in these poems all foreshadowed the poet's later work. *El corazón delirante* (1922; "The Delirious Heart") and *Canciones* (1922; "Songs") included highly lyrical love poems. In *La casa* (1923; "The House"), he strove for clarity and examined the theme of the constant renewal of life in poems that reflected the influence of the Spanish poet Juan Ramón Jiménez. *Los días* (1923; "The Days") stressed the poet's anguish at a dehumanized environment. He employed Japanese verse forms in *Biombo* (1925; "The Folding Screen"). He was the first editor (1928–31) of *Contemporáneos,* a cultural and literary magazine influential among Mexican poets.

*Destierro* (1930; "Exile"), written shortly after he became secretary to the Mexican legation in Madrid, reflected the poet's attempt, often expressed in complex surrealist imagery, to rebel against a mechanized, hostile, and unfamiliar environment. *Cripta* (1937; "Crypt"), considered to include his most important poems, dealt with basic human concerns and revealed in compact, powerful language a preoccupation with time, solitude, and the absurdity of life.

After holding various diplomatic posts in Europe and at home, Torres Bodet became minister of public education (1943–46) and foreign minister (1946–48). He led the Mexican delegation to the United Nations preparatory commission (1945) and to the first sessions of the United Nations (1947). In 1948 he was one of the drafters of the charter of the Organization of American States. He served as director general of the United Nations Educational, Scientific and Cultural Organization (UNESCO) from 1948 to 1952.

In *Fronteras* (1954; "Frontiers") and *Sin tregua* (1957; "Without Truce"), the mature poet dwelt on the isolation prevalent in modern society. Torres Bodet also wrote much prose, including highly acclaimed essays on Marcel Proust and Leo Tolstoy; and in 1966 he was awarded the National Prize for Literature for a study of Rubén Darío. Of the six novels published between 1927 and 1937, *Sombras* (1937; "Shadows") is considered his best. *Obra poética* (1967; "Poetical Work") is a two-volume edition of his poetry. *Selected Poems of Jaime Torres Bodet* (1964) is a bilingual edition. Afflicted by cancer, Torres Bodet took his own life.

*Consult the* INDEX *first*

**Torres Islands,** northernmost group of Vanuatu, southwestern Pacific Ocean, 60 miles (100 km) north of Espiritu Santo. They extend for 35 miles (56 km) and comprise Hiu (Hiw), the largest (10 miles [16 km] long by 2 miles [3 km] wide), Tégua, Loh, Metoma, and Toga. Hiu rises to the highest point, 1,201 feet (366 m). The islands are fringed by coral reefs and are populated by Polynesians. Pop. (1989) 464.

**Torres Naharro, Bartolomé de** (b. 1484?, La Torre de Miguel Sesmero, Spain—d. 1525?, Seville?), playwright and theorist, the most important Spanish dramatist before Lope de Vega, and the first playwright to create realistic Spanish characters.

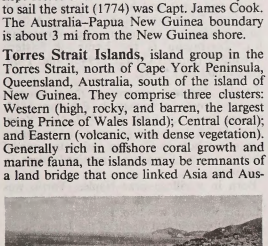
Little is known of his life; apparently he was a soldier and was held captive for a time in Algiers. He was ransomed, and he went to Rome in 1513 where he took holy orders. After ordination he became a favourite of Pope Leo X and other prominent churchmen and businessmen in Rome and Naples.

He published his collected works in 1517. Entitled the *Propalladia* ("The First Things of Pallas"), they were prefaced with a discourse on dramatic art that distinguished between tragedy and comedy, a distinction that was lost in later Spanish drama. He classified his own

plays as *comedias "a noticia,"* treating "things noted and seen in true reality," and *"a fantasia,"* concerning those "fantastic or feigned, which though not true have the colour of truth"—an implicit granting of equal validity to observation and imagination that represents a major advance in literary theory. His *Comedia tinellaria* ("Comedy of the Kitchen") is a brilliant satire on the corruption and intrigue in the palace of a Roman cardinal; the *Comedia Himenea,* based on the novel *La Celestina,* has been said to constitute the greatest single step toward the creation of the Golden Age *comedia.* His work, nevertheless, differs radically in spirit from that of his successors in the Golden Age.

**Torres Strait,** passage between the Coral Sea, on the east, and the Arafura Sea, in the western Pacific Ocean. To the north lies New Guinea and to the south Cape York Peninsula (Queensland, Australia). It is about 80 mi (130 km) wide and has many reefs and shoals dangerous to navigation, and its larger islands are inhabited. Discovered (1606) by the Spanish mariner Luis Vaez de Torres, its existence was kept secret until 1764. The second European to sail the strait (1774) was Capt. James Cook. The Australia–Papua New Guinea boundary is about 3 mi from the New Guinea shore.

**Torres Strait Islands,** island group in the Torres Strait, north of Cape York Peninsula, Queensland, Australia, south of the island of New Guinea. They comprise three clusters: Western (high, rocky, and barren, the largest being Prince of Wales Island); Central (coral); and Eastern (volcanic, with dense vegetation). Generally rich in offshore coral growth and marine fauna, the islands may be remnants of a land bridge that once linked Asia and Australia. Although the Spanish navigator Luis Vaez de Torres sailed through them in 1606, they did not become well known until the late 18th century, when fishermen came to hunt for mother-of-pearl shell and bêche-de-mer (sea cucumber). The islands were annexed by Queensland in the 1870s. Each island cluster has its own local government and sends representatives to a central council on Thursday Island. Pearl shelling, pearl culture, fishing, and tourism are the main sources of income. With the decline in demand for pearl shell, about one-half of the population has moved to mainland Australia. The inhabitants are a mixture of Polynesians, Melanesians, and Aborigines. Pop. (1981) local government area, 6,131.



Yule Point on Prince of Wales Island, Queensland, in the Torres Strait
Jocelyn Burt—Bruce Coleman Inc.

**Torres Vedras,** town and *concelho,* (municipality), Lisboa district, Portugal, north of Lisbon. Roman inscriptions were found there, but the Latin name of the town, Turres Veteres, is probably of medieval origin. It was frequently a royal residence until the 16th century, and the ruins of a royal castle still remain. During the Peninsular War (1808–14), the Duke of Wellington constructed his famous "lines" (a defense system to protect Lisbon against the French) there. Torres Vedras is an agricultural trade centre, and viticulture is important. Pop. (1981) town, 10,997; *concelho,* 64,977.

**Torres Villarroel, Diego de** (b. *c.* 1693, Salamanca, Spain—d. June 19, 1770, Salamanca), mathematician and writer, famous in his own time as the great maker of almanacs that delighted the Spanish public, now remembered for his *Vida,* picaresque memoirs that are among the best sources for information on life in 18th-century Spain.

The son of a bookseller, he ran away from home and school and began a remarkable career as a dancer, musician, bullfighter, poet, lockpicker, and seller of patent medicines. Returning home to Salamanca, he discovered a book on solid geometry and became a changed man. Mathematics was still viewed by some as related to magic, and for Torres Villarroel it had the power of a secret science. In 1721 he wrote his first almanac, and in 1726 he was made professor of mathematics at the University of Salamanca. He spent his final years in holy orders, spending his money on philanthropic enterprises.

The *Vida* (1743), modelled on the work of the great Spanish poet Francisco Gómez de Quevedo, is written in the style of the 17th-century picaresque novels. The true adventures of a man imbued with enormous energy and panache, the book is full of fascinating details about Spanish life and customs. A fertile lyric poet as well, Torres Villarroel left 15 volumes of works.

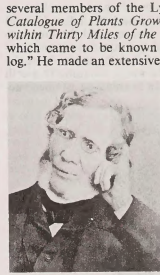
**Torrey, Charles Cutler** (b. Dec. 20, 1863, East Hardwick, Vt., U.S.—d. Nov. 12, 1956, Chicago), U.S. Semitic scholar who held independent and stimulating views on certain biblical problems.

Torrey studied at Bowdoin (Maine) College and Andover (Mass.) Theological Seminary and in Europe. He taught Semitic languages at Andover (1892–1900) and Yale (1900–32), and was founder and first director (1900–01) of the American School of Archaeology (later renamed the American School of Oriental Research) at Jerusalem.

Torrey's Islāmic studies are represented by *The Mohammedan Conquest of Egypt and North Africa* (1901), based on the Arabic work of Ibn ʿAbd al-Hakam, of which he subsequently published an edition (1922), and by *The Jewish Foundation of Islam* (1933). He offered a fresh critical appraisal and rearrangement of the books of Ezra and Nehemiah in *The Composition and Historical Value of Ezra-Nehemiah* (1896), which was followed up by his *Ezra Studies* (1910) and by *The Chronicler's History of Israel* (1954). In *The Second Isaiah: A New Interpretation* (1928), he argued that Isa. 34–35 and 40–66 should be dated *c.* 400 BC. His *Pseudo-Ezekiel and the Original Prophecy* (1930) presents his theory that the canonical book of Ezekiel is a revision of a 3rd-century pseudepigraphon. In *The Translations Made from the Original Aramaic Gospels* (1912), *The Four Gospels: A New Translation* (1933), and *Our Translated Gospels* (1936), Torrey held that the four Gospels were Greek translations from Aramaic originals. The posthumous *Apocalypse of John* (1958) argues that Revelation was a translation of an Aramaic original written in AD 68.

**Torrey, John** (b. Aug. 15, 1796, New York City—d. March 10, 1873, New York City), botanist and chemist known for his extensive studies of North American flora.

Torrey was educated at the College of Physicians and Surgeons in New York City (M.D., 1818), where he became a cofounder of the Lyceum of Natural History, later the New York Academy of Sciences. In 1817 he and several members of the Lyceum prepared *A Catalogue of Plants Growing Spontaneously within Thirty Miles of the City of New York,* which came to be known as "Torrey's catalog." He made an extensive study of the plants of the northeastern U.S., and the unidentified plants collected on government expeditions to the western states were sent to him for study. After publication of his *Flora of the Northern and Middle Sections of the United States* (1824), he held teaching positions at the United States Military Academy, West Point, N.Y. (1824–27), the College of Physicians and Surgeons (1827–55), and the College of New Jersey (later Princeton; 1830–54). teaching chemistry, natural history, mineralogy, and geology.



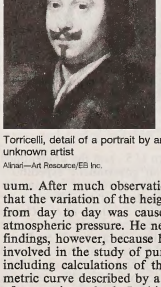
John Torrey
By courtesy of W.A. Archer and the Hunt Institute, Pittsburgh

In 1834 Torrey met a student from New York, Asa Gray, who was to become an important botanist. Together they completed materials for *A Flora of North America,* 2 vol. (1838–43), but the work was interrupted when Torrey became state botanist of New York (1836) and was thus obliged to begin work on his *Flora of the State of New York* (1843). He amassed one of the most valuable botanical libraries and herbaria in the United States. His collection was given to the New York Botanical Garden in 1899. Torrey's name is commemorated in Torreys Peak in Colorado.

**Torreya,** a genus of approximately six species of ornamental trees and shrubs in the yew family (Taxaceae), distributed in localized areas of North America, China, and Japan. Torreyas have persistent, linear, bristle-pointed leaves, arranged roughly in two rows, or ranks. The leaves are slightly convex and lustrous above; on the underside, two sunken, waxy-appearing bands parallel the midrib. Leaves, branchlets, and wood are often aromatic or foul scented, especially when bruised. Male and female flowers are borne on separate trees or on different branches of the same tree. Each large seed is completely surrounded by a fleshy covering, or aril. The California nutmeg, Japanese torreya, and stinking yew (*qq.v.*) are the commonly known ornamentals; the other three species are Chinese trees with local distributions, rarely found in cultivation.

**Torricelli, Evangelista** (b. Oct. 15, 1608, Faenza, Romagna—d. Oct. 25, 1647, Florence), Italian physicist and mathematician who invented the barometer and whose work in geometry aided in the eventual development of integral calculus. Inspired by Galileo's writings, he wrote a treatise on mechanics, *De Motu* ("Concerning Movement"), which impressed Galileo. In 1641 Torricelli was invited to Florence, where he served the elderly astronomer as secretary and assistant during the last three months of Galileo's life. Torricelli was then appointed to succeed him as professor of mathematics at the Florentine Academy.

Two years later, pursuing a suggestion by Galileo, he filled a glass tube 4 feet (1.2 m) long with mercury and inverted the tube into a dish. He observed that some of the mercury did not flow out and that the space above the mercury in the tube was a vacuum. Torricelli became the first man to create a sustained vac-



Torricelli, detail of a portrait by an unknown artist
Alinari—Art Resource/EB Inc.

uum. After much observation, he concluded that the variation of the height of the mercury from day to day was caused by changes in atmospheric pressure. He never published his findings, however, because he was too deeply involved in the study of pure mathematics—including calculations of the cycloid, a geometric curve described by a point on the rim of a turning wheel. In his *Opera Geometrica* (1644; "Geometric Works"), Torricelli included his findings on fluid motion and projectile motion.

**Torricelli's theorem,** also called TORRICELLI'S LAW, TORRICELLI'S PRINCIPLE, or TORRICELLI'S EQUATION, statement that the speed, $v$, of a liquid flowing under the force of gravity out of an opening in a tank is proportional jointly to the square root of the vertical distance, $h$, between the liquid surface and the centre of the opening and to the square root of twice the acceleration caused by gravity, $2g$, or simply $v = \sqrt{2gh}$. (The value of the acceleration caused by gravity at the Earth's surface is about 32.2 feet per second per second, or 9.8 metres per second per second.) The theorem is named after Evangelista Torricelli, who discovered it in 1643.

The speed of a portion of water flowing through an opening in a tank a given distance, $h$, below the water surface is the same as the speed that would be attained by a drop of water falling freely under the force of gravity alone (that is, neglecting effects of air) through the same distance, $h$. The speed of efflux is independent of the direction of flow; at the point of the opening the speed is given by this equation, whether the opening is directed upward, downward, or horizontally.

**Torridge,** district in the northwestern part of the historic and administrative county of Devon, England, with its eastern boundary at the mouth of the River Torridge, the site of its main town, Bideford.

The geology of the district is dominated by the Culm Measures, dark gray shale with intercollated bands of sandstones and grits. The rocks have been folded along an east-west alignment followed by a number of rivers. The main river, the Torridge, flows from south to north between steep forested slopes; its valley is deep but broad, with a wide floodplain that provides excellent meadow and pasture. Dairying is important, together with the rearing of beef cattle and sheep. Fodder crops include barley, roots, and ley grass. There are substantial markets at Bideford, Holsworthy, and Great Torrington.

The Atlantic coastline has been designated an Area of Outstanding Natural Beauty and attracts many tourists. The Culm Measures outcrop to form magnificent cliffs from Hartland to Westward Ho! Related to Charles Kingsley's novel of the same name, Westward Ho! has developed as a major coastal resort. North of it is a stretch of sand dunes called Northam Burrows. Clovelly is an old fishing port, and shipbuilding thrives at Appledore and Bideford.

In response to the problems of comparative isolation and limited employment, Torridge is included within the South West Development Area. Since 1970 many new light industries have been introduced. The area of the district is 380 square miles (985 square km). Pop. (2001) 58,985.

**Torrigiani, Pietro,** in full PEDRO FLORENTIN Y TORRIGIANO (b. Nov. 24, 1472, Florence—d. 1528, Seville, Spain), Florentine sculptor and painter who became the first exponent of the Italian Renaissance idiom in England.

He was a student, along with Michelangelo, of Bertoldo di Giovanni at the Academy of Lorenzo de' Medici. He left Florence and worked in Rome, Bologna, Siena, and Antwerp before making his reputation in England. His best-known works, the tombs in Westminster Abbey for King Henry VII and Elizabeth of York (1512–18), are full-length reclining figures cast in gilt bronze.

In 1521 Torrigiani went to Seville, where his style changed, as observed in "Virgin and Child" (*c.* 1521), which shows High Renaissance characteristics, and "St. Jerome" (*c.* 1525), a Mannerist-influenced work. Suggestions of Torrigiani's influence appear in the work of the Spanish artists Diego Velázquez, Francisco de Zurbarán, and Juan Martínez Montañés. He died in the Spanish inquisitor's prison.

**Torrijos (Herrera), Omar** (b. Feb. 13, 1929, Santiago de Veragua, Panama—d. Aug. 1, 1981, near Penonomé), virtual dictator of Panama (1968–78) who negotiated the Panama Canal treaties with the United States, leading to Panama's eventual assumption of control of the canal.

Educated at a military school in El Salvador, he also studied military-related subjects in the United States and Venezuela. In 1952 he was commissioned second lieutenant in the National Guard of Panama (Guardia Nacional; the country's only military force), becoming lieutenant colonel (1966), colonel (1968), and brigadier general (1969). In October 1968 he participated in a coup by the National Guard that overthrew President Arnulfo Arias, and he gradually emerged as leader of the new military junta with the title Chief of Government and Supreme Leader of the Panamanian Revolution. He became one of the few Latin-American leaders who visited Fidel Castro in Cuba; but he also suppressed leftist labour agitators and students in Panama.

Transfer of the Panama Canal and Canal Zone to Panamanian sovereignty became Torrijos's main objective, and he pursued it to a successful conclusion when on Sept. 7, 1977, he and President Jimmy Carter of the United States signed two treaties by which the transfer would take place gradually; Panama assumed full control of the canal on Dec. 31, 1999.

In the election of October 1978, Torrijos declined to run for the presidency, though he retained command of the National Guard. He died in an airplane crash in a jungle area while making a military inspection tour.

**Torrington,** city, coextensive with the town ("township") of Torrington, Litchfield county, northwestern Connecticut, U.S., on the Naugatuck River. Settled about 1735 as New Orleans Village or Mast Swamp (part of Windsor), the town was renamed in 1732 for Great Torrington, Eng., and was incorporated in 1740. For a time (1818–83) the town was called Wolcottville after the founder of its principal industry, a woolen mill. During the Revolution the entire male population over 20 years of age enlisted in the Continental Army. The town was a centre of abolitionist sentiment during the 19th century and was the birthplace of John Brown. Industry developed early in the area, with shipmast, textile, and brass production (1834), and it is now well diversified with machine-type products. In the 1850s Gail Borden made the first condensed milk there. A branch of the University of Connecticut is in Torrington. The borough of Torrington, incorporated in 1887, became a city in 1923; city and town were consolidated the same year. Pop. (2003 est.) 35,756.

**Torrington,** town, seat of Goshen county, southeastern Wyoming, U.S., on the North Platte River, near the Nebraska border. The site, 23 miles (37 km) east of Fort Laramie National Historic Site, was on the Texas and Oregon trails, and the Pony Express route. It was laid out in 1908 and named for Torrington, Conn. The town now serves as a trade centre for an irrigated farming and mining area (uranium and coal) and has two large livestock auctions. Food processing (including a beet-sugar refinery) is an important economic factor. Torrington is the home of Eastern Wyoming (junior) College (1948). Inc. 1908. Pop. (2003 est.) 5,581.

**Torrio, Johnny,** byname of JOHN TORRIO, Italian GIOVANNI TORRIO (b. February 1882, Orsara, Italy—d. April 16, 1957, New York, N.Y., U.S.), American gangster who became a top crime boss in Chicago and, later, one of the founders of modern organized crime in America.

Born in a village near Naples, Torrio was brought to New York City by his widowed mother when he was two. He became a brothel-saloonkeeper and leader of the James Street Boys, allying them with the Five Points Gang (1904–08). He then rose to become a rackets boss (*i.e.,* engaged in activities involving extortion) in Brooklyn before being called to Chicago in 1909 to operate and expand Big Jim Colosimo's chain of brothels. In 1919 Torrio summoned his old friend Al Capone from New York to manage one of the brothels and, in 1920, had either him or Frankie Yale murder Colosimo. Torrio thereby inherited Colosimo's empire and immediately expanded into big-time bootlegging (illegal manufacture, sale, and transport of alcohol) and gambling casinos of the Prohibition era.

In 1925, after successively being shot at and wounded by a rival gang and serving nine months in prison for operating a brewery, Torrio turned over his rackets to Capone and retired to Italy (1925–28). Returning to live in New York, he invested profitably in real estate and helped create a bootlegging combine, becoming a close associate of Lucky Luciano, Meyer Lansky, and other bosses. Torrio was one of the directors of the national crime syndicate or cartel formed in 1934.

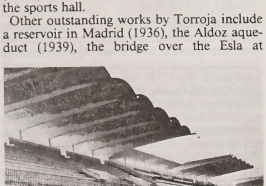
In 1936 he was charged with income tax evasion and, after a long trial and many appeals, went to prison (1939–41). He subsequently went into virtual retirement and died of a heart attack in a barber chair in 1957.

**Torroja (y Miret), Eduardo** (b. Aug. 27, 1899, Madrid, Spain—d. June 15, 1961, Madrid), Spanish architect and engineer notable as a pioneer in the design of concrete-shell structures.

Torroja graduated as an engineer in 1923 and began working with a contractor. He became a consulting engineer in 1927. His first concrete-shell structure, a covered market in Algeciras (1933), was followed two years later by two of his most admired shell structures, both in Madrid: the grandstand at the Zarzuela racecourse and the sports hall. The shell roof

of the racecourse cantilevers out some 43 feet (13 m). Double cylindrical shells characterize the sports hall.

Other outstanding works by Torroja include a reservoir in Madrid (1936), the Aldoz aqueduct (1939), the bridge over the Esla at



Grandstand at the Zarzuela racecourse, Madrid, by Eduardo Torroja, 1935
Archivo Mas, Barcelona

Zamora (1940), hangars at Torrejón de Ardoz (1942), the Las Corts soccer stadium, Barcelona (1943), and the Táchira Club, Caracas (1957). His churches at Xerrallo and Pont de Suert (both 1952) also show his flair for dramatic and graceful form. In 1951 he formed the Technical Institute of Construction and Cement and served as its director until his death.

His books *Philosophy of Structures* and *The Structures of Eduardo Torroja; An Autobiography of Engineering Accomplishment* (both 1958) were influential accounts of his approach to architectural engineering.

**Tórshavn,** also spelled THORSHAVN, port and capital of the Faeroe Islands. It is situated at the southern tip of Streymoy, the largest island of the Faeroe Islands. Tórshavn was founded in the 13th century, but it remained only a small village for several centuries thereafter. The ancient Lagting, or Faeroese parliament, used to meet on Tinganaes, a promontory that cuts Tórshavn harbour into two parts. The Lagting now meets in the centre of town. Tórshavn itself now houses about one-third of the total population of the Faeroe Islands. It is well connected by road to other settlements on Streymoy, and boats link it to settlements on other islands in the archipelago. Its main industries are fishing and the making of knitwear, the latter using wool from the large numbers of sheep on the islands. Tórshavn has secondary schools, the Faeroese Academy, and a local museum. Pop. (1989 est.) 14,547.

**torsion balance,** device used to measure the gravitational acceleration at the Earth's surface. Other such devices, using different methods to obtain the same result, are pendulums and gravimeters. The torsion balance consists essentially of two small masses at different elevations that are supported at opposite ends of a beam. The latter is suspended from a wire that undergoes torsion because the masses are affected differently by the force of gravity. When the wire is twisted, an optical system indicates the angular deflection ($\theta$), and the torque (T), or twisting force, involved can be calculated from the simple expression $T = k\theta$, in which $k$ is a constant that depends on the properties of the instrument. The amount of torque, in turn, is correlated with the gravitational force at the point of observation. The torsion balance was devised by Lóránt von Eötvös, a Hungarian physicist, in 1902; many scientists have contributed modifications to the basic instrument.

The term torsion balance also refers to a device used in weighing, an equal arm balance that uses horizontal steel bands instead of pivots and bearings.

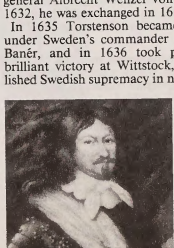
**torsion bar,** rod or bar that resists twisting and has a strong tendency to return to its original position when twisted. In automobiles a torsion bar is a long spring-steel element with one end held rigidly to the frame and the other end twisted by a lever connected to the axle. It thus provides a spring action for the vehicle. *See also* spring.

**torsk** (fish): *see* cusk.

**Torstenson, Lennart** (b. Aug. 17, 1603, Forstena, Swed.—d. April 7, 1651, Stockholm), Swedish field marshal and artillerist who transformed the use of field artillery, making it mobile to a previously unknown degree. He won important victories in the Thirty Years' War and in Sweden's war against Denmark (1643–45).

The son of a Swedish officer, Torstenson became a page to King Gustav II Adolf in 1618 and fought under that monarch against Poland (1621–23) in Livonia. After studying warfare with Maurice of Nassau, prince of Orange, he returned to serve in 1626–29 under Gustav II Adolf in his Prussian campaigns. He was already an artillery specialist, and in 1629 he was made colonel of the first purely artillery regiment to be formed in any army. He commanded the field artillery when Gustav intervened in the Thirty Years' War in Germany in 1630. His distinguished service in Sweden's crucial victory over imperial forces at Breitenfeld in 1631 led to his promotion to general. Captured by the forces of the imperial general Albrecht Wenzel von Wallenstein in 1632, he was exchanged in 1633.

In 1635 Torstenson became chief of staff under Sweden's commander in chief, Johan Banér, and in 1636 took part in Banér's brilliant victory at Wittstock, which reestablished Swedish supremacy in north and central



Torstenson, detail from a portrait by an unknown artist, 1648; in Gripsholm Castle, Sweden
By courtesy of the Svenska Portrattarkivet, Stockholm

Germany. Although his health was impaired, Torstenson assumed command of the Swedish forces in Germany after Banér's death (1641) and restored discipline to the mutinous and disorganized army. After gaining decisive victories at the second Battle of Breitenfeld and in Moravia, he was ordered by the chancellor, Count Axel Oxenstierna, to launch an attack on Denmark (1643) and conquered the Danish province of Jutland.

Returning to the central European war theatre, Torstenson won a brilliant victory (1645) at Jankov by his ability to shift his guns quickly in the course of the battle. He retired from the command the following year for reasons of health and was made a count in 1647. In his last years he used his position in the Swedish state council (of which he had been made a member in 1641) to oppose the policies of Oxenstierna and gained the confidence of Queen Christina.

**tort,** an instance of unlawful conduct that either is dangerous to life and limb, causes mental anguish, damages personal reputations, or violates certain rights, such as property rights or rights of privacy. The concept encompasses only those civil wrongs independent of contracts.

A brief treatment of torts follows. For a full treatment, *see* MACROPAEDIA: Torts.

The English word tort derives from the medieval Latin *tortum* (literally, something twisted, wrung, or crooked). In law, a tort is a civil wrong—*i.e.*, a wrong actionable in the courts independent of a breach of contractual obligation, a failure to observe a purely equitable duty, or a crime. Defamation (libel and slander), assault, trespass, nuisance, property damage, product defects, deceit, malicious prosecution, and negligence are all, apart from possible criminal and contractual aspects, torts.

The law of torts attempts to provide a means of redress for damage or injury suffered. For instance, in the event a ferocious bull charges through a fence and wreaks havoc in a neighbouring farmyard, the owner of the bull, who has a strict statutory duty to ensure that such an escape does not occur, is liable by the law of torts to compensate the neighbouring farmer who has suffered damage. The form of compensation is usually monetary (damages), assessed according to the loss incurred as a result of the tortious act or failure to act. The purpose of the law of torts is to delimit, in the event of damage or injury resulting from an act or omission, a right to compensation and the extent of the compensation that may be claimed.

That an act or omission may be deemed not to be tortious does not necessarily mean that a wronged party cannot seek redress in the form of compensation. A breach of contract, for example, will entitle the wronged party to damages, but the form of action in such a case is in the law of contract, not tort. It is possible, of course, for an act or omission to be both a tort and a breach of contract. Because of the overlap in such areas, the strict definition of tort has traditionally been a subject of keen academic debate.

The concept of negligence is of great importance in the law of torts. The main method of assessing whether or not a particular act or omission is negligent is through the concept of a duty of care. The extent of such a duty depends on a concept of reasonable foreseeability (the fictitious standards of the proverbial "man on the street"). For instance, is it reasonably foreseeable that the presence of a decomposed snail in a bottle of ginger beer will cause injury to the consumer (the celebrated British case of *Donoghue* v. *Stevenson*)? A prerequisite for the success of an action in the law of torts is that a duty should be present, that the duty should be owed to the particular person who has suffered injury or damage, and that actual injury or damage has been suffered.

Modern developments in the law of torts are much concerned with ideas of insurance (a system of loss-spreading through society generally) and social security provisions (state compensation for accidents and injuries at work). As these ideas take hold, the concept of no-fault liability is gradually becoming more widespread in the area of tort law.

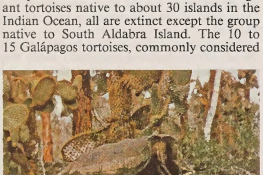
**torticollis,** also called WRYNECK, or STIFF NECK, abnormality in which the head is pulled to one side and twisted so that the chin points to the other side. In infants the most common causes include congenital shortening of muscles on one side of the neck, position of the child in the womb, and trauma to the sternocleidomastoid muscle during birth. In adults, poor posture, pathology of the cervical spine, and inflammation of cervical lymph nodes may cause it. Spasmodic torticollis is a specific disorder in which the muscles of one side

of the neck contract spasmodically; it may be incapacitating and is difficult to cure.

**tortoise,** any of the land-dwelling turtles of the family Testudinidae; in Great Britain the name refers to any nonmarine turtle. The land-dwelling tortoises are exclusively terrestrial, vegetarian reptiles. In folklore these animals represent slowness, determination, and long life. Tortoises are found in both the Old World and the New, but the majority of the 40-odd living species are confined to Africa and Madagascar. Tortoises are characterized by high, domed shells; heavy, elephant-like hind legs; and hard-scaled forelegs. They are placed in five to seven genera; one (*Pyxis*) is found only on Madagascar; all others, except *Geochelone* and *Gopherus,* are found only in Africa.

The common tortoise of southern Europe and the giant tortoises of the Galápagos and other islands are among the many members of the genus *Testudo.* The common, or European, tortoise (*T. graeca*) has a shell about 18–25 cm (7–10 inches) long, brownish in colour, marked with black.

The giant tortoises are now rare or extinct on many islands because they were slaughtered and their habitats destroyed by man and because of the introduction of animals (pigs, goats, rats, etc.) that prey on the young or compete with the adults for food. Of the giant tortoises native to about 30 islands in the Indian Ocean, all are extinct except the group native to South Aldabra Island. The 10 to 15 Galápagos tortoises, commonly considered



Galápagos tortoise (*Geochelone elephantopus*)
Francisco Erize—Bruce Coleman Ltd.

races of the species *Geochelone elephantopus,* are depleted and, in several cases, extinct. Giant tortoises attain very large sizes relative to most other living turtles. One captive Galápagos tortoise had a shell length (measured along the curve) of about 1.3 m (4.25 feet) and a weight of about 140 kg (300 pounds). Weights of about 180 kg have been recorded for specimens from Santa Cruz Island. Other members of the genus *Testudo* are found in Africa, Asia, and South America.

The genus *Gopherus* includes the four North American species known collectively as gopher tortoises. Gopher tortoises have brown shells about 20–35 cm long and have flattened front limbs that are adapted for burrowing. The desert tortoise (*G. agassizii*) is an inhabitant of deserts and open woods of the southwestern United States and Mexico. Berlandier's tortoise (*G. berlandieri*) frequents near-desert and wooded areas of Texas and northern Mexico. The gopher tortoise (*G. polyphemus*) inhabits sandy and wooded regions of the southern United States from Florida to Texas. The recently discovered *bophenus flavomorginatum* is known only from a small area in north-central Mexico.

**tortoise beetle,** any member of the insect subfamily Cassidinae of the leaf beetle family Chrysomelidae, order Coleoptera. Tortoise beetles range between 9 and 12 mm (less than 0.5 inch) in length and resemble a turtle be-



Tortoise beetle (Cassidinae)
Anthony Bannister from the Natural History Photographic Agency—EB Inc.

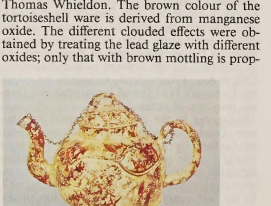
cause of the forward and sideways extensions of the body. Both adults and larvae are destructive to garden plants.

Tropical tortoise beetles are among the most brilliantly coloured coleopterans and are used in making jewelry. The pits and grooves covering the South American leaf beetle *Desmonota variolosa* give it an iridescent green colour with depth resembling that of an emerald. The colouring disappears at death because of the drying and shrinkage that occur, and the dead beetle turns dullish brown. The flat, spiny larvae have a forked appendage at the posterior end to which excrement and other debris are attached and carried, like an umbrella, as camouflage.

**tortoiseshell,** ornamental material obtained from the curved horny shields forming the shell of the hawksbill turtle (*Eretmochelys imbricata*). The marbled, varicoloured pattern and deep translucence of the plates have long been valued for manufacture of jewelry and other items. Tortoiseshell was imported to Rome from Egypt, and in 17th-century France, tortoiseshell work was raised to the level of artistry for jewel cases, trays, snuffboxes, and other decorated articles. The craft soon spread to other parts of Europe, where it was also highly developed.

Tortoiseshell is first separated from the bony skeleton by heat; the shields are flattened by heat and pressure, and irregularities are rasped away. Tortoiseshell is easily molded by heat and pressure and can be shaped on a lathe. The use of tortoiseshell, however, is illegal today in many parts of the world.

**tortoiseshell ware,** earthenware with variegated, surface colour made in Staffordshire, England, in the 18th century. It was a subdivision of the "clouded" (agate) ware made about 1755–60 at Staffordshire, especially by Thomas Whieldon. The brown colour of the tortoiseshell ware is derived from manganese oxide. The different clouded effects were obtained by treating the lead glaze with different oxides; only that with brown mottling is prop-



Whieldon type tortoiseshell earthenware teapot, Staffordshire, England, c. 1755; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London; photograph, EB Inc.

erly called "tortoiseshell," though the term is often used loosely to include multicoloured clouded ware in general.

**Tortola,** largest of the British Virgin Islands, part of the Lesser Antilles chain, which separates the Atlantic Ocean and Caribbean Sea. Its name is from the Spanish *tórtola,* meaning "turtle dove." It lies about 60 miles (100 km) east of Puerto Rico and has an area of 21 square miles (54 square km). Tortola is composed of a long chain of hills uninterrupted by any transverse valley; although the island is only 3 miles (5 km) wide, one has to ascend to 1,200 feet (365 m) to cross it. The highest peak is Mount Sage (1,781 feet [543 m]). There is a fragment of an unusual xerophytic forest, with flora like that of the Greater Antilles, which contains species not found elsewhere on Tortola.

The island is best suited by climate and topography to livestock raising. The export of livestock to the U.S. Virgin Islands is the principal economic activity. The government maintains a stock-breeding farm producing a hybrid that combines the heat resistance of tropical cattle with the greater production of breeds found in temperate climates. More than 80 percent of the population of the British Virgin Islands, mostly of African extraction, resides on Tortola. Pop. (1994) 14,700.

**Tortona,** Latin DERTONA, town and episcopal see, Alessandria *provincia,* Piemonte (Piedmont) *regione,* northwestern Italy, on the Scrivia River, east of the city of Alessandria. Founded by the Ligurians, it became a Roman colony in 148 BC. A Guelf stronghold in the Middle Ages, it was destroyed by the emperor Frederick I Barbarossa in 1155. It fell to the Milanese Visconti family in 1347 and passed to Savoy in 1738. Notable landmarks include the cathedral (1584), the church of Santa Maria Canali (9th century, rebuilt 13th), the ruins of the castle dismantled by Napoleon I in 1801, and the Roman Museum, with Roman relics. The centre of an agricultural region, Tortona is a rail junction and produces textiles, machinery, and wine. Pop. (2000 est.) mun., 26,543.

**Tortosa,** city, Tarragona *provincia,* in the *comunidad autónoma* ("autonomous community") of Catalonia, northeastern Spain, on the Ebro River, southwest of the city of Tarragona. Tortosa originated as the Dertosa of the Iberians; replanned by the Roman general Scipio Africanus, it was transformed into a *municipium* (town) by Julius Caesar and given colonial privileges by the emperor Augustus as Colonia Julia Augusta Dertosa. Under the Moors it was an important frontier city of the Caliphate of Córdoba and was for some time the capital of a small, independent Moorish kingdom. Ramón Berenguer IV, Count of Barcelona, captured Tortosa in 1148 and granted it a highly privileged charter. A Moorish attempt to recapture the city in 1149 was repulsed largely because of heroic fighting by the women. In the last period of the Spanish Civil War (1939), Tortosa suffered serious damage, but it has been largely restored. Important landmarks include the Gothic cathedral (1347), with a Baroque facade added in 1705; a Renaissance palace; and the remains of a medieval castle. Tortosa has a technical school and an observatory.

The city overlooks a wide plain of rice plantations, orchards, and olive trees. Olive oil is the principal product. Manufactures include chemical fertilizer, soap, cement, pharmaceuticals, hats, and knitwear; there are also rice milling, flour milling, and sawmilling. Pop. (1998 est.) 29,600.

**Tortuga Island,** French ÎLE DE LA TORTUE, Caribbean island off the northern coast of Haiti opposite Port-de-Paix. European adventurers settled Tortuga (Spanish: "Turtle") in 1629, in conjunction with trying to establish

a foothold on the neighbouring island of Hispaniola (now comprising Haiti and the Dominican Republic). Known as filibusters and buccaneers, these "Brethren of the Coast" harassed Spanish shipping. Englishmen, Frenchmen, and Spaniards, in turn, dominated Tortuga until the French gained permanent possession in 1665.

In the 1880s France, Britain, and the United States considered the island, which is 20 miles (32 km) long by 3 miles (5 km) wide, strategically important, but thereafter it became of little value either in international affairs or in the Haitian economy. On its highest point is the small village of Lan Palmiste.

**torture**, the infliction of excruciating physical or psychological pain for such reasons as the obtaining of information or confession, punishment, intimidation, or coercion. Modes of inflicting pain range from physical devices to chemical injections and to elaborate psychological techniques, all designed not only to break down resistance but also to subvert personality.



Depiction of a torture chamber during the Spanish Inquisition, *c.* 1520
Hulton Archive/Getty Images

Throughout history, governments have used torture against their enemies and as part of their legal systems. Individuals outside governments have also employed it—for example, criminals against their victims. Torture was reportedly common practice among many ancient civilizations. The ancient Greek practice of torturing slaves to obtain information influenced early Roman laws, in which torture gave the testimonies of slaves and those of lowly social status more validity. A renewed interest in Roman law, the dissatisfaction with earlier modes of securing reliable information, and the development of strong political authorities contributed to the increased use of torture in Europe beginning in the 12th century. Prior to this period, oaths, ordeals, and combat were common ways to resolve judicial conflicts, but by the 13th century confession became, along with the testimony of eyewitnesses, the means of determining guilt in most of Europe.

Because suspects could not be convicted solely on the basis of circumstantial evidence, torture was increasingly used to extract confessions but in general was legal only if there was considerable initial evidence against the suspect. From the mid-14th century to the end of the 18th century, torture was a common and sanctioned part of the legal proceedings of most European countries and the Roman Catholic church, which had approved its use by the Inquisition in cases of heresy. All governments, democratic or authoritarian, needed to acquire information to combat suspected subversive elements, and the means to achieve this were available because of two vital factors: first, that human beings, when confronted with either the threat or the sight of a torture device, are able to imagine what pain they are likely to experience and, second, that the human body is devastatingly susceptible to being mauled and mangled.

Because the over-enthusiastic application of torture in the early stages of the interrogation could result in the victim fainting or even dying without first divulging, it was essential that appliances could be operated a fraction of an inch at a time, and this became possible with the widespread manufacture of industrial artifacts such as the screw thread, the ratchet, and the pulley. This led to the use of such devices as the strappado, which hoisted the suspect's weighted body by a rope tied to his wrists, these being bound behind his back; the rack, which stretched and dislocated the limbs; in England, Skeffington's gyves, designed to compress the kneeling victim; the boots, which tightened and fractured the leg bones; and the thumbscrew, a vicelike instrument in which the fingernails were agonisingly crushed.

While the effectiveness of such torture has been defended by many people, notably Aristotle and Sir Francis Bacon, it was attacked as early as Roman times by Cicero and Seneca, who claimed that "it forces even the innocent to lie." Despite being innocent, even death can be preferable to unbearably excruciating pain.

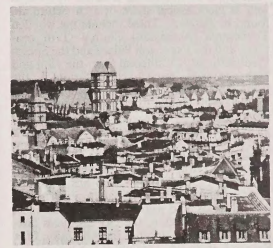
Legal and moral arguments against torture did not gain force until the Enlightenment, when there was not only a humanitarian movement but also a dramatic change in law. Eyewitness accounts and confessions became less important as new procedures allowed for convictions on the basis of strong suspicion from circumstantial evidence.

By 1800 most European countries had abolished the use of torture; France in 1798 at the time of the Revolution, Russia in 1801, Scotland in 1708. In the 20th century, however, it reappeared in unexpectedly high proportions. The political pressures of the modern state were blamed for the increase, particularly its use by armies during wartime and by intelligence services. It was in countries that used law as a means of imposing ideology, however, that torture became most widespread, notably in the fascist countries of Italy and Nazi Germany and under the communist governments of the Soviet Union. The *Universal Declaration of Human Rights* (1948) by the United Nations decried the use of torture, though it had become adaptable in many cultures in the late 20th century.

Despite the United Nations' *Convention Against Torture and Other Cruel, Inhuman and Degrading Treatment or Punishment*, the European *Convention on Human Rights*, and the International Covenant on Civil and Political Rights, Amnesty International, the leading movement against such maltreatment, reported that many countries, especially those in Latin America, the Middle East, and Africa, still employ methods of torture.

**Toruń**, former (1975–98) *województwo* (province), north-central Poland, now part of Kujawsko-Pomorskie and Warmińsko-Mazurskie (*qq.v.*) provinces.

**Toruń**, German THORN, city, one of two capitals (along with Bydgoszcz) of Kujawsko-Pomorskie *województwo* (province), north-central Poland, on the Vistula River. A river port,



Toruń, Pol.
Shostal

rail and road junction, and cultural centre, it is the birthplace (1473) of the astronomer Nicolaus Copernicus (Polish: Mikołaj Kopernik) and seat of Nicolaus Copernicus University (founded 1945), as well as scientific societies, museums, and theatres. The 13th-century Church of St. John contains one of the largest bells in Poland. Traditional industries include wool spinning and the baking of gingerbread; newer industrial development has made Toruń known for its precision instruments, electronics, and synthetic fibre and textiles produced at the "Elana" factory.

An important medieval trade centre, Toruń was ceded to the Teutonic Knights, who built a castle there (1230–31). The settlement acquired town rights in 1233, and the present town was laid out in 1236. During the 14th century, Toruń joined the Hanseatic League and sailed its own merchant fleet in trade with the Netherlands. In 1454 Teutonic rule was overthrown, and in 1466 Toruń was declared a free city under Polish administration. It flourished through economic favours bestowed upon it by a succession of Polish kings. In 1793 it was seized by Prussia; it was returned to Poland in 1919. Pop. (2002) 211,243.

**Tory** (political party): *see* Whig and Tory.

**Tory** (U.S. colonial history): *see* Loyalist.

**Tory, Geoffroy** (b. *c.* 1480, Bourges, France—d. *c.* 1533, Paris), publisher, printer, author, orthographic reformer, and prolific engraver who was mainly responsible for the French Renaissance style of book decoration and who played a leading part in popularizing in France the roman letter as against the prevailing Gothic. His important publications include a number of "Books of Hours" and his famous philological work *Champfleury* (1529). In this work Tory put forward the idea of accents, the apostrophe, the cedilla, and simple punctuation marks. He was appointed printer to the king by Francis I in about 1530.

**Torzhok**, city, Tver *oblast* (province), western Russia, on the Tvertsa River, 37 miles (60 km) west of Tver. The first recorded mention of Torzhok dates from 1139. In the 14th century it became the centre of a small rural district in the Novgorod Feudal Republic, on the trade route between Novgorod and the principality of Suzdal. In 1478 the Muscovite state incorporated Torzhok. During a military campaign of Władysław IV Vasa (lived 1595–1648), the Polish monarch, Poles largely destroyed the town. In the 18th

century it successively became part of Izhora Land (Russian territory after a war with Sweden in 1702–03), the province of Novgorod, and the Viceregency of Tver.

Examples of traditional Russian wooden as well as Neoclassical styles of architecture are found in Torzhok. These include the wooden Voznesenia (Ascension) Church (17th century), and the Excursion Palace and the Spaso-Preobrazhenskiy Cathedral from the 18th and 19th centuries, respectively. Of note is the Boris and Gleb Monastery complex built in the 18th- and 19th-century Neoclassical style.

The Torzhok technique of gold embroidery (raised floral patterns using gold and silver threads), which developed in the 13th century and flourished in the 18th, is still practiced. Since the 1950s, Torzhok also has manufactured machinery, railroad cars, printing inks, leather goods, and wood products. Situated in a flax-growing region, the city produces flax-retting machinery and has the All Union Flax Research Institute. Torzhok is the natural gas distribution centre on the Moscow–St. Petersburg pipeline. Pop. (1991 est.) 50,500.

**Tosa Mitsunobu** (b. 1434—d. 1525, Kyōto), painter generally regarded as the founder of the Tosa school of Japanese painting.

A member of an aristocratic family that had traditionally served as painters to the Imperial court, he was head of the court painting bureau from 1493 to 1496. In 1518 he was appointed chief artist to the Ashikaga shoguns (a family of military rulers who governed Japan from 1338 to 1573), thus securing for his school patronage that continued into the 19th century. The style that the Tosa school revived and preserved was the *Yamato-e* (Japanese painting), distinguished by delicate, precise contour lines and variegated colours. It is often used in narrative scrolls, such as those illustrating scenes from classical literature (especially *The Tale of Genji*).

A few extant works by Mitsunobu include a portrait of the emperor Go-En-yū dated 1492 and located in the Unryū-in, Kyōto, and narrative scrolls illustrating the histories and legends of temples and shrines—"Kiyomizu-dera engi emaki" ("The Illustrated History of the Kiyomizu Temple"), in the Tokyo National Museum.

**Tosa Mitsuoki,** original name TOSA FUJIMITSU, also called TSUNEAKI (b. 1617, Sakai, Japan—d. Nov. 14, 1691, Kyōto), Japanese painter of the early Edo period (1603–1867) who revived the Tosa school of painting (founded in the 15th century and devoted to the *Yamato-e,* or paintings specializing in subject matter and techniques derived from ancient Japanese art as opposed to schools influenced by Chinese art).

Mitsuoki left Sakai with his father, Tosa Mitsunori (1583–1638), also a painter, in 1634 and settled in Kyōto, where he hoped to revive the Tosa school. In 1654 he assumed a position as court painter that had traditionally been given to members of the Tosa family but had been vacant since the end of the Muromachi period (1338–1573). Mitsuoki's style is known for its delicate lines and fine delineation, typical of the Tosa school, but he also adopted some techniques and Chinese subject matter from the popular and powerful Kanō school. Among his works are "Kitano Tenjin engi emaki" (a picture scroll depicting the chronicle of the Kitano Shrine), "Itsukushima Matsushima zu-byōbu" ("Picture Screens of Itsukushima and Matsushima"), and "Kiku jun zu" ("A Quail and Chrysanthemums"). This last is typical of Li An-chung, a Chinese painter whose style he adopted. In 1681 he made his son Mitsunari (1646–1710) successor to his office and took the tonsure.

**Tosa school,** hereditary school of Japanese artists, consisting of members of the Tosa clan and other artists adopted into the clan, forming an official school contemporary with that of the Kanō family. Both lineages claim descent from great 15th-century masters of Japanese art. The two schools lasted until the end of the Edo period (1603–1867). The Tosa school devoted its talents to subjects and techniques traditional to the indigenous art of Japan and, in theory, provided the official painters attached to the court.

The illustration of Japanese literary classics, especially the *Genji monogatari* ("Tale of Genji"), were subjects especially favoured by Tosa artists. Delicate ink drawing combined with a decorative use of colour create a precious effect in the small-scale treatment of the Tosa style.

**tosafot,** also spelled TOSAPHOTH (Hebrew: "additions"), critical remarks and notes on selective passages of the Talmud that were written mostly by unknown Jewish scholars in Germany, in Italy, and especially in France during the 12th to 14th century. Experts are undecided whether *tosafot* were meant to be direct commentaries on the two elements that comprise the Talmud—the Mishna (the codification of Jewish oral law) and the Gemara (expositions of the Mishna)—or were intended to supplement the great French rabbinical scholar Rashi's systematic commentary on the text of the Babylonian Talmud.

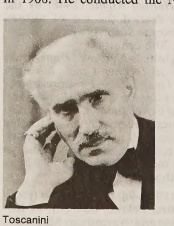
The first tosafists (*ba'ale ha-tosafot*) were Meir ben Samuel and Judah ben Nathan, two of Rashi's sons-in-law who lived in northern France. The most highly regarded tosafist, however, was Rabbenu Tam (Jacob ben Meir Tam), Rashi's grandson. All editions of the Babylonian Talmud (since its first printing in Venice, 1520–23) carry Rashi's commentaries on the inside margin of the page, with the *tosafot* located on the outside margin. This arrangement, however, is not followed in some modern editions in translation. Extensive learning is required to understand the subtleties discussed in all these commentaries.

**Toscana** (Italy): *see* Tuscany.

**Toscanella** (Italy): *see* Tuscania.

**Toscanini, Arturo** (b. March 25, 1867, Parma, Italy—d. Jan. 16, 1957, New York City), Italian conductor, considered one of the great virtuoso conductors of the first half of the 20th century.

Toscanini studied at the conservatories of Parma and Milan, intending to become a cellist. At the age of 19, when playing at the opera house at Rio de Janeiro, he was called upon to fill in for the conductor and performed Verdi's *Aida* from memory. He came into prominence as a conductor in Italy and elsewhere and was appointed musical director of La Scala, Milan, in 1898, and of the Metropolitan Opera, New York City, in 1908. He conducted the New York Philharmonic-Symphony Orchestra from 1928 to 1936 and appeared with orchestras all over the world, except those of Italy and Germany during the Fascist regimes. From 1937 to 1954 he directed the NBC Symphony, an orchestra sponsored by the U.S. radio network.



Toscanini
By courtesy of NBC

Toscanini remained principally known for his readings of the operas of Verdi and the symphonies of Beethoven, and he gave remarkable performances of the music of Wagner. His interpretations were notable for detail of phrasing, dynamic intensity, and an essentially classical conception of form. His phenomenal memory stood him in good stead when, suffering from poor eyesight, he was obliged always to conduct from memory. He commanded from the artists who worked under him a devotion that often made them reach something like his own fervour.

**Tosefta** (Aramaic: Supplement, or Addition), a collection of oral traditions related to Jewish oral law. In form and content the Tosefta is quite similar to the Mishna, the first authoritative codification of such laws, which was given its final form early in the 3rd century AD by Judah ha-Nasi. Both the Tosefta and the Mishna represent the work of Jewish scholars called *tannaim,* who, for the most part, lived in Palestine and spent some 200 years gathering, evaluating, correlating, and selecting the most important traditions from a vast and heterogeneous mass of material that developed from the time of Ezra (*c.* 450 BC).

Though experts are not quite sure why two separate collections came into existence, it is probable that the Tosefta was meant to complement the Mishna by preserving certain traditions, proofs, examples, and explanations of oral law that came to light during the years of research. This theory would explain also why some of the traditions mentioned in the Tosefta not only contradict the Mishna but sometimes make the Tosefta inconsistent with itself.

**Toshiba Corporation,** Japanese TŌKYŌ SHIBAURA DENKI KK, major Japanese manufacturer of electrical and electronics products for consumers and industry. Headquarters are in Tokyo.

The company was incorporated in 1939 as Tokyo Shibaura Electric Company, Ltd., in the merger of Shibaura Engineering Works, Ltd., and Tokyo Electric Company, Ltd. It adopted its present name in 1978.

The original Shibaura company, formed in 1875, grew out of inventor Tanaka Hisashige's factory, with primary concentration on manufacturing engines for ocean vessels. It was taken over by the Mitsui business combine (*zaibatsu*; *q.v.*) and set to making heavy, high-horsepower steam engines. It began making machine tools in the mid-1890s. Tokyo Electric Light Company began manufacturing bamboo-filament electric light bulbs in 1890, with Mitsui financing. The merged corporation separated from Mitsui with the dissolution of the *zaibatsu* after World War II, but became reaffiliated with the Mitsui group (*q.v.*) in 1973.

Both predecessor companies also had close ties with the General Electric Company of the United States. General Electric (GE) first obtained an interest in Tokyo Electric in 1907 in return for GE's aid in updating that company's technology, which led to the mass production of Mazda electric lamps in Japan. In 1909 GE entered into a similar arrangement with Shibaura. Such association represented the first significant infusion of western technology into Japan, and was a major success. GE is still one of Toshiba's largest shareholders.

Toshiba manufactures a variety of consumer products, including television and audio products, home appliances, and lighting products. It also produces plants and equipment for the

generation of electric power, transportation equipment, industrial motors, and industrial electronics and communications equipment. It has a number of subsidiaries in other countries.

**Tōshūsai Sharaku,** original name SAITŌ JŪRŌBEI, pseudonym SHARAKU (fl. 1794–95, Japan), one of the most original Japanese artists of the Ukiyo-e movement (paintings and prints of the "floating world").

His extant works consist of fewer than 160 prints, chiefly of actors. These prints of actors, especially the *okubi-e,* or half-length portraits, are striking for their intensity and for an exaggeration verging on caricature. Unlike other Ukiyo-e artists, Sharaku did not make idealized portraits but tried to penetrate the actors' characters and to show them in poses revealing their ways of acting. Even the most handsome actor of the time, Matsumoto Yonesaburō, who played female roles, appears in Sharaku's portrait as a thick-necked, ungainly male.

Sharaku was not a very popular artist; only after his work became highly regarded by Westerners was he fully recognized by the Japanese. He used a mica ground with black sheen for his portraits until the practice was prohibited by the government.

**Tostig,** EARL OF NORTHUMBRIA (d. Sept. 25, 1066, Stamford Bridge, Yorkshire [now in East Yorkshire], Eng.), Anglo-Saxon earl who became a mortal enemy of his brother Earl Harold, who became King Harold II of England.

Tostig was a son, probably the third, of Godwine, Earl of Wessex and Kent, and in 1051 married Judith, sister or daughter of Baldwin V, count of Flanders. In the year of his marriage he shared the short exile of his father, returning with him to England in 1052, and he became Earl of Northumbria after the death of Earl Siward in 1055. By stern and cruel measures Tostig introduced a certain degree of order into the wild northern district under his rule; this severity made him exceedingly unpopular, and in 1065 Northumbria broke into open revolt. Declaring Tostig an outlaw and choosing Morkere in his stead, the rebels marched southward and were met at Oxford by Earl Harold, who, rather against the will of King Edward the Confessor, granted their demands.

Tostig sailed to Flanders and thence to Normandy, where he offered his services to Duke William (the future William the Conqueror), who was related to Tostig's wife and who was preparing for his invasion of England. Tostig then harried the Isle of Wight and the Kentish and Lincolnshire coasts and, after a stay in Scotland and possibly a visit to Norway, joined another invader, Harald III Hardraade, king of Norway, in the River Tyne. Together they sailed up the Humber and at Gate Fulford, near York, defeated Earls Morkere and Edwine and entered York. But his brother Harold, now king, was hurrying to the north. Taking the Norwegians by surprise at Stamford Bridge, he destroyed their army on Sept. 25, 1066, and in this battle both Tostig and the king of Norway were slain.

Tostig's two sons apparently took refuge in Norway, and his widow Judith married Welf, duke of Bavaria.

**Tosu,** city, Saga *ken* (prefecture), Kyushu, Japan, in the Tsukushi Plain, on the Chikugo River. It was a post town for centuries, connecting northern Kyushu and the Nagasaki area until the Tokugawa era (1603–1867). Modern Tosu is a railway junction for the Kagoshima and Nagasaki lines. Because of its location, Tosu began to develop as an industrial city, major industries being food processing, grain milling, and production of tobacco, medicines, bicycles, construction materials, and chemicals for agricultural and industrial use. Pop. (1985) 55,791.

**TOTAL Compagnie Française des Pétroles** (TOTAL CFP), formerly COMPAGNIE FRANÇAISE DES PÉTROLES (French: "French Petroleum Company"), one of the world's major petrochemical companies. It was formed in Paris on March 28, 1924, on the initiative of the French government but administered wholly by private interests. TOTAL CFP is now a holding company owned 35 percent by the French government and 65 percent by other investors, the chief known shareholders being Abu Dhabi Investment Authority, Caisse des Dépôts et Consignations, and Paribas. It commands a group of some 190 subsidiary companies worldwide. The group's major products since 1954 have been traded under the name of the TOTAL Group (Groupe TOTAL). Headquarters are in Paris.

TOTAL CFP is one of the world's major oil companies and is one of the most prestigious French industrial concerns. It heads an internationally integrated group, primarily engaged in exploration, production, shipping, refining, distribution, and marketing of oil and gas. TOTAL CFP also does business in chemicals, uranium ore, coal mining, solar energy, and gold and other precious metals. The company explores for and produces oil and gas in some 30 countries or regions, chiefly in the North Sea (both British and Norwegian sectors), The Netherlands, Algeria, Egypt, the United Arab Emirates, Canada, the United States, Argentina, Indonesia, and Australia.

**total war,** military conflict in which the contenders are willing to make any sacrifice in lives and other resources to obtain a complete victory, as distinguished from limited war. Throughout history, limitations on the scope of warfare have been more economic and social than political. Simple territorial aggrandizement has not, for the most part, brought about total commitments to war. The most deadly conflicts have been fought on ideological grounds in revolutions and civil and religious wars.

The modern concept of total war can be traced to the writings of the 19th-century Prussian military strategist Carl von Clausewitz, who denied that wars could be fought by laws. In his major work *Vom Kriege* (*On War*), he rejected the limited objectives of 18th-century warfare, in which winning local military victories was regarded as the key to advantageous diplomatic bargaining, and described wars as tending constantly to escalate in violence toward a theoretical absolute. Clausewitz also stressed the importance of crushing the adversary's forces in battle. His 19th-century admirers tended to overlook his insistence that the conduct of war must be strictly controlled by attainable political objectives. The classic 20th-century work on total war was Erich Ludendorff's *Der totale Krieg* (1935; *The "Total" War*), based on the author's experience in directing Germany's war effort in World War I. The two 20th-century world wars are usually regarded as total, or at least the most total of history's wars, although they were, of course, limited in numerous ways.

After World War II, especially during the Cold War, the prospect of all-out nuclear war raised a conceptual problem in that such a war presumably would short-circuit the processes of all-out mobilization of resources and regimentation of national effort—that is, the very mobilization and regimentation that had made the 20th-century world wars seem more total than earlier ones. The fear of nuclear war, in any case, severely inhibited the major powers in waging wars themselves and in allowing their client states to do so, thus substituting deliberate restraint for the more impersonal constraints that limited warfare in the past. Among smaller powers the fear of nuclear war has had little restrictive effect; most wars between small countries since 1945 have been limited.

**totalitarianism,** form of government that theoretically permits no individual freedom and that seeks to subordinate all aspects of the individual's life to the authority of the government. Italian dictator Benito Mussolini coined the term *totalitario* in the early 1920s to describe the new fascist state of Italy, which he further described as: "All within the state, none outside the state, none against the state." By the beginning of World War II, "totalitarian" had become synonymous with absolute and oppressive single-party government.

In the broadest sense, totalitarianism is characterized by strong central rule that attempts to control and direct all aspects of individual life through coercion and repression. Examples of such centralized totalitarian rule include the Maurya dynasty of India (*c.* 321–*c.* 185 BC), the Ch'in dynasty of China (221–206 BC), and the reign of Zulu chief Shaka (*c.* 1816–28). The totalitarian states of Nazi Germany under Adolf Hitler (1933–45) and the Soviet Union under Joseph Stalin (1924–53) were the first examples of decentralized or popular totalitarianism, in which the state achieved overwhelming popular support for its leadership. This support was not spontaneous; its genesis depended on a charismatic leader; and it was made possible only by modern developments in communication and transportation.

Totalitarianism is often distinguished from dictatorship, despotism, or tyranny by its supplanting of all political institutions with new ones and its sweeping away of all legal, social, and political traditions. The totalitarian state pursues some special goal, such as industrialization or conquest, to the exclusion of all others. All resources are directed toward its attainment regardless of the cost. Whatever might further the goal is supported; whatever might foil the goal is rejected. This obsession spawns an ideology that explains everything in terms of the goal, rationalizing all obstacles that may arise and all forces that may contend with the state. The resulting popular support permits the state the widest latitude of action of any form of government. Any dissent is branded evil, and internal political differences are not permitted. Because pursuit of the goal is the only ideological foundation for the totalitarian state, achievement of the goal can never be acknowledged.

Under totalitarian rule, traditional social institutions and organizations are discouraged and suppressed; thus the social fabric is weakened and people become more amenable to absorption into a single, unified movement. Participation in approved public organizations is at first encouraged and then required. Old religious and social ties are supplanted by artificial ties to the state and its ideology. As pluralism and individualism diminish, most of the people embrace the totalitarian state's ideology. The infinite diversity among individuals blurs, replaced by a mass conformity (or at least acquiescence) to the beliefs and behaviour sanctioned by the state.

Large-scale, organized violence becomes permissible and sometimes necessary under totalitarian rule, justified by the overriding commitment to the state ideology and pursuit of the state's goal. In Nazi Germany and Stalin's Soviet Union, whole classes of people, such as the Jews and the kulaks (wealthy peasant farmers) respectively, were singled out for persecution and extinction. In each case the persecuted were linked with some external enemy and blamed for the state's troubles, and thereby public opinion was aroused against them and their fate at the hands of the military and the police was condoned.

Police operations within a totalitarian state often appear similar to those within a police state, but one important difference distinguishes them. In a police state the police operate according to known, consistent procedures. In a totalitarian state the police operate without the constraints of laws and regulations. Their actions are unpredictable and directed by the whim of their rulers. Under Hitler and Stalin uncertainty was interwoven into the affairs of the state. The German constitution of the Weimar Republic was never abrogated under Hitler, but an enabling act passed by the Reichstag in 1933 permitted him to amend the constitution at will, in effect nullifying it. The role of lawmaker became vested in one man. Similarly, Stalin provided a constitution for the Soviet Union in 1936 but never permitted it to become the framework of Soviet law. Instead, he was the final arbiter in the interpretation of Marxism–Leninism–Stalinism and changed his interpretations at will. Neither Hitler nor Stalin permitted change to become predictable, thus increasing the sense of terror among the people and repressing any dissent.

**totem pole,** carved and painted log, mounted vertically, constructed by the Indians of the Northwest Coast of the United States and Canada. There are seven principal kinds of



Totem pole from Kitwancool Creek, British Columbia
W.E. Ferguson—Shostal/EB Inc.

totem pole: memorial, or heraldic, poles, erected when a house changes hands to commemorate the past owner and to identify the present one; grave markers (tombstones); house posts, which support the roof; portal poles, which have a hole through which a person enters the house; welcoming poles, placed at the edge of a body of water to identify the owner of the waterfront; mortuary poles, in which the remains of the deceased are placed; and ridicule poles, on which an important individual who had failed in some way had his likeness carved upside down.

The carving on totem poles separates and emphasizes the flat, painted surfaces of the symbolic animals and spirits depicted on them. Each pole generally has from one (as with a grave marker) to many (as with a family legend) animal images on it, all following standardized forms which are familiar to all Indians of the Northwest Coast; beavers, for example, always include cross-hatched tails, and eagles show downward curved beaks.

The word totem refers to a guardian or ancestral being, usually supernatural, that is revered and respected, but not always worshipped. The significance of the real or mythological animal carved on a totem pole is its identification with the lineage of the head of the household. The animal is displayed as a type of family crest, much as an Englishman might have a lion on his crest, or a rancher a bull on his brand. More widely known, but in fact far less common, are the elaborately carved tall totem poles that relate an entire family legend in the form of a pictograph. This legend is not something that can be read in the usual sense of the word; only with an understanding of what the symbols mean to the Indians and a knowledge of the history and customs of the clan involved can the pole be interpreted. Each animal or spirit carved on the pole has meaning, and when combined on the pole in sequence, each figure is an important symbol constituent of a story or myth. An exact interpretation of any set of symbols, however, would be almost impossible without the help of a knowledgeable narrator from the family.

The totem pole was also a sign of the owner's affluence, for hiring an artist to make a pole was an expensive proposition. The carving of totem poles reached its peak in the early and middle 19th century, when the introduction of good metal tools and the wealth gained from the fur trade made it possible for many chiefs to afford these displays. Few examples of this period remain, however, as the moist coastal atmosphere causes the cedar poles to rot and fall in about 60 to 70 years.

**totemism,** a complex of ideas and practices based on the belief in kinship or a mystical relationship between men and natural objects, such as animals and plants. The term totem derives from the Ojibwa (Algonkian Indian) word *ototeman*, signifying a brother–sister blood relationship. Totemism refers to a wide variety of relationships, including the reverential and genealogical, between social groups or individual persons and animals or other natural objects, the so-called totems. It has been centrally important in the religion and social organization of many primitive peoples.

A brief treatment of totemism follows. For full treatment, *see* MACROPAEDIA: Religious and Spiritual Belief, Systems of.

The designation totemism was initially restricted by anthropologists to the association of a group of persons with the totem object. A totem was not to be confused with an animal associated only with one person, whether as guardian spirit, animal familiar, or source of supernatural power. Neither was any random association (*e.g.*, human transformations as in the werewolf, shamanistic "possession" by an animal spirit, supernatural "owners" of animals) to be designated as totemism. In the late 20th century, however, the term individual totemism has been applied to many of these phenomena.

A society may be said to exhibit totemism if it is divided into an identifiable and apparently fixed number of clans, each of which has a specific relationship to an animate or inanimate species (totem); if a member of such a clan ordinarily cannot change his membership; and if people living in the same locality belong to different totemic clans. A totem may be a feared, emulated, or dangerous hunted animal; an edible plant; or any staple food. Very commonly connected with origin legends and with instituted morality, the totem is almost invariably hedged about with taboos of avoidance or of strictly ritualized contact. Membership in the totemic group is in some sense inherited and lifelong, regulating relationships of the child to his blood kin, and designating families that provide acceptable partners for procreation. Totem, taboo, and exogamy (marriage outside the group) are inextricably intertwined. No known society may be said to meet all the criteria of ideal totemism, yet many groups show enough of them to warrant the totemic designation.

Of the principal contributors to the discussion of totemism, J.F. McLennan did the first significant theoretical work in his study "The Worship of Animals and Plants" (1869). The first comprehensive treatment of totemistic phenomena was provided by Sir James Frazer in his *Totemism* (1885; republished in *Totemism and Exogamy*, 1910). Totemism attracted wide attention during the flowering of sociology and cultural anthropology in the first decades of the 20th century. The most incisive critique, one that denied the reality of totemism, was supplied by the French ethnologist Claude Lévi-Strauss in *Le Totémisme aujourd'hui* (*Totemism*, 1963).

**Totila,** original name BADUILA (d. 552), Ostrogoth king who recovered most of central and southern Italy, which had been conquered by the Eastern Roman Empire in 540.

Chosen king by Gothic chiefs in the autumn of 541, after King Witigis had been carried off prisoner to Constantinople, Totila proved himself both as a general and as a political leader, winning the support of the lower classes by freeing slaves and distributing land to the peasants. By 543, fighting on land and sea, he had retaken the bulk of the lost territory. Rome held out, and Totila appealed fruitlessly to the Senate there in a letter reminding them of the loyalty of the Romans to his predecessor, Theodoric. In the spring of 544 the Eastern Roman emperor Justinian I sent his general Belisarius to Italy to counterattack; but Totila, at the head of an army of Goths and Italians, captured Rome in 546 after a three-month siege. When Totila left to fight the Byzantines in Lucania, south of Naples, Belisarius retook Rome and rebuilt its fortifications.

Shortly after Belisarius was recalled in 549, Totila recaptured Rome, going on to complete the reconquest of Italy and Sicily. By the end of 550 the Goths had occupied all but Ravenna and a few coastal towns. The following year Justinian sent his general Narses to Italy in a march around the top of the Adriatic to Ravenna. In a decisive battle (summer 552) in the Apennines near present-day Fabriano, the Gothic army was defeated, and Totila was mortally wounded.

**Totius:** *see* Du Toit, Jakob Daniel.

**Totnes,** parish (town), South Hams district, county of Devon, England, on the River Dart. Totnes dates from Saxon times and is listed in Domesday Book (1086). Its earliest charter is dated 1205, and it became a walled town commanding the lowest crossing of the river. The keep and upper walls of the Norman castle still stand, and close by are the remains of St. Mary's priory. Industries include brewing and food processing. Pop. (1981 prelim.) 5,627.

**Totnes, George Carew, earl of,** also called (1586–1605) SIR GEORGE CAREW, OF (1605–26) BARON CAREW OF CLOPTON (b. May 29, 1555—d. March 27, 1629, London), English soldier, administrator, and antiquary noted for his service in Ireland during the reign of Queen Elizabeth I of England.

He was the son of George Carew, dean of Windsor. In 1574 he went to Ireland as a soldier and distinguished himself in 1577 in defending Leighlin Castle, County Carlow, from the Irish rebels. Well liked by Elizabeth and the powerful Cecil family, he was in 1586 knighted and made master of the ordnance in Ireland. He became lieutenant general of



Earl of Totnes, detail of an oil painting after a portrait, c. 1615-20; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

the ordnance in England in 1592, in which capacity he accompanied Robert Devereux, 2nd Earl of Essex, on the English naval raid on Cádiz, Spain, in 1596 and on the expedition to the Azores in 1597. In 1598 he attended Sir Robert Cecil, the ambassador, to France. He was appointed treasurer at war to Essex in Ireland in March 1599, and, on the latter's sudden departure in September of the same year, leaving the island in disorder, Carew was appointed a lord justice.

In 1600 Carew was appointed president of the province of Munster, where his military leadership and stern administrative measures contributed to the suppression of the Irish rebels under Hugh O'Neill, 2nd Earl of Tyrone, and won the admiration of Queen Elizabeth. In 1605, two years after Carew's return to England, King James I made him Baron Carew of Clopton. He was master of the ordnance from 1608 to 1617, and in 1618 he tried unsuccessfully to prevent the execution of his close friend Sir Walter Raleigh for treason. After the accession of Charles I in 1625, Carew was made Earl of Totnes (Feb. 5, 1626).

As an antiquary, Totnes collected many Irish historical and genealogical materials, from which Sir Thomas Stafford, who was probably his illegitimate son, compiled *Pacata Hibernia* (1633; "Pacified Ireland"), an account of the Irish rebellion. Totnes had a daughter but no legitimate male issue, and his titles became extinct upon his death.

**Totò,** byname of ANTONIO DE CURTIS GAGLIARDI GRIFFO FOCAS (b. Nov. 7, 1898, Naples, Italy—d. April 15, 1967, Rome), Italian comic, most popular for his film characterization of an unsmiling but sympathetic bourgeois figure, likened by international film critics to the American film comic Buster Keaton.

Totò was born to a family of impoverished Italian nobility. He served in the military during World War I and then began his stage career by working in music halls. He appeared extensively on the legitimate stage prior to his 1936 film debut in *Fermo con le mani* ("Keep Your Hand Still"). From that time on, the screen was his medium, and, as Totò, he became one of Italy's favourite comics.

Most of his 100 films were made in Italy and include 29 in the "Totò" series, such as *Totòtarzan* (1950) and *Totò e Cleopatra* (1963). Other films include *Guardie e ladri* (1951; *Cops and Robbers*), *L'oro di Napoli* (1954; *Gold of Naples,* a four-part comedy drama directed by Vittorio De Sica), *La Loi c'est la loi* (1958; *The Law is the Law,* with the French comic Fernandel), *La Mandragola* (1965; *The Love Root and the Mandragola*), and the allegorical *Uccellaci e uccellini* (1966; "Big Birds and Small Birds"; Eng. trans. *The Hawks and the Sparrows*), a film written and directed by Pier Paolo Pasolini.

**Totonac,** Middle American Indian population of east-central Mexico. Totonac culture is in many ways similar to other Middle American cultures, but it possesses certain features not seen elsewhere in Middle America and more likely related to the circum-Caribbean cultures. The Totonac inhabit two types of environment—high mesa, cool and rainy, and coastal lowland, hot and usually humid—and there are corresponding differences in cultural patterns.

Both groups are agriculturists, growing corn (maize) and squash as staple crops. Lowland Totonac also keep bees, poultry, and hogs and raise a variety of cash crops. Highland Totonac keep poultry and raise some livestock; to augment their rather meagre farm production, they also engage in peddling and wage labour in the off-season.

Lowland Totonac live primarily in scattered farmhouses, while the highlanders live in central villages with their farmlands around them. The Totonac generally purchase their tools from commercial outlets, and only a little weaving and pottery making is still practiced by the women.

Highland Totonac wear basically traditional homemade clothing—white cotton shirts and pants for men, black wool skirts and cotton overblouses for women. Lowland men wear similar clothing or commercially produced garments, and women wear cotton skirts and blouses or cotton housedresses.

While each family generally farms its own land or follows a trade, highland men frequently go to the lowlands as seasonal wage labourers on the lowland farms. Communal labour on collectively owned village land is required in both the highlands and the lowlands.

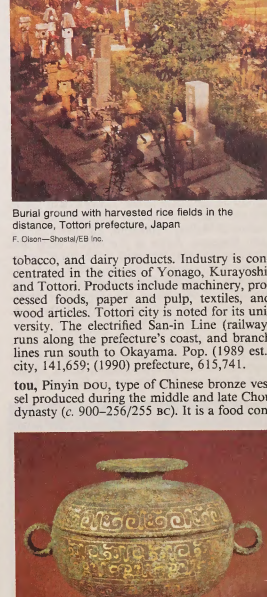
A system of ritual kinship is practiced by the Totonac; this institution is related to the *compadrazgo,* or institution of godparenthood, commonly seen in Middle America, but among the Totonac the kinship ties are felt to be primarily between the adults involved, rather than between adult and child. The Totonac are nominally Roman Catholic but have adapted Christianity to their traditional beliefs, and many pagan ceremonies and rituals are still practiced.

**Totonicapán,** city, west-central Guatemala, at 8,200 feet (2,500 m) above sea level. One of Guatemala's largest cities, Totonicapán has a population composed largely of Maya Indians. Before the European conquest, it was the second most important city of the Quiché nation. It serves as an important commercial and manufacturing centre for the agricultural hinterland, in which Indians grow corn (maize), wheat, beans, and potatoes and raise sheep. The chief industry is flour milling; cottage industries produce pottery, leather goods, woolen textiles, and furniture. The city is situated on the Pan-American Highway, some 100 miles (160 km) from Guatemala City. Pop. (1990 est.) 13,444.

**Totowa,** town ("borough"), Passaic county, northern New Jersey, U.S., a largely residential suburb west of Paterson, on the west bank of the Passaic River. During the American Revolution, American troops were encamped here, and the nearby Theunis Dey Mansion was General George Washington's headquarters. Dutch scholars translated Totowa, or Totua, as "where you begin"; other sources indicate it was derived from an Indian word meaning "between mountains and waters." It has light manufacturing and is the site of the North Jersey Training School for mentally deficient children. Inc. 1898. Pop. (1990) 10,177.

**Tottori,** *ken* (prefecture), western Honshu, Japan, occupying 1,348 square miles (3,492 square km) along the Sea of Japan. The coastal plain is bounded (south) by the Chūgoku Range. The mountains, including Mount Dai, form part of Daisen-Oki National Park, and the coast is included in San-in-kaigan National Park. Tourists also visit the Tottori Sand Dunes, which stretch for 10 miles (16 km) along the coast near the capital city, Tottori.

The prefecture is basically an agricultural area, producing rice, fruit (especially pears),

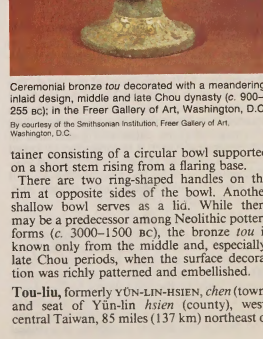


Burial ground with harvested rice fields in the distance, Tottori prefecture, Japan

F. Olson—Shostal/EB Inc.

tobacco, and dairy products. Industry is concentrated in the cities of Yonago, Kurayoshi, and Tottori. Products include machinery, processed foods, paper and pulp, textiles, and wood articles. Tottori city is noted for its university. The electrified San-in Line (railway) runs along the prefecture's coast, and branch lines run south to Okayama. Pop. (1989 est.) city, 141,659; (1990) prefecture, 615,741.

**tou,** Pinyin DOU, type of Chinese bronze vessel produced during the middle and late Chou dynasty (*c.* 900–256/255 BC). It is a food con-



Ceremonial bronze *tou* decorated with a meandering inlaid design, middle and late Chou dynasty (*c.* 900–255 BC); in the Freer Gallery of Art, Washington, D.C.

By courtesy of the Smithsonian Institution, Freer Gallery of Art, Washington, D.C.

tainer consisting of a circular bowl supported on a short stem rising from a flaring base.

There are two ring-shaped handles on the rim at opposite sides of the bowl. Another shallow bowl serves as a lid. While there may be a predecessor among Neolithic pottery forms (*c.* 3000–1500 BC), the bronze *tou* is known only from the middle and, especially, late Chou periods, when the surface decoration was richly patterned and embellished.

**Tou-liu,** formerly YÜN-LIN-HSIEN, *chen* (town) and seat of Yün-lin *hsien* (county), west-central Taiwan, 85 miles (137 km) northeast of

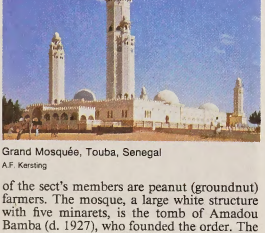
Kao-hsiung city, in the middle of the western coastal plain. The town, which developed in the early 17th century, is a marketing centre for rice, sweet potatoes, peanuts (groundnuts), and fruits produced in the fertile plains of the Hu-wei River to the north and of the Yün-lin River to the south. Industries include sugar milling and textile manufacturing. Tou-liu is an important station on Taiwan's north–south freeway and the West Line railway. Pop. (1998 est.) 98,900.

**Touareg** (people): *see* Tuareg.

**Touat,** also spelled TUAT, oasis group, west-central Algeria. Situated along the Wadi Messaoud (called Wadi Saoura farther north), the Touat oases are strung beadlike in a north-west–southeast orientation west of the Plateau of Tademaït. The area was brought under Islāmic control in the 10th century AD. In modern times the mixed population of Arabs, Berbers, and Ḥarāṭīn (Negroid Berbers descended from former slaves) effectively resisted French subjugation until the early 1900s. The area passed to independent Algeria when the French surrendered control in 1962.

Touat proper extends about 75 miles (120 km) along the wadi, from the Gourara oasis group on the north to the Tidikelt oasis group on the south and east. It includes the settlements of Adrar, Fenoughil, Zaouiet Kounta, and Reggane. Adrar is the largest oasis and chief settlement. Irrigated by foggaras (man-made subterranean irrigation conduits), the oases produce high-quality dates, as well as grains and vegetables. An important trans-Saharan motor route passes through the area. Pop. (1977 prelim.) 59,023.

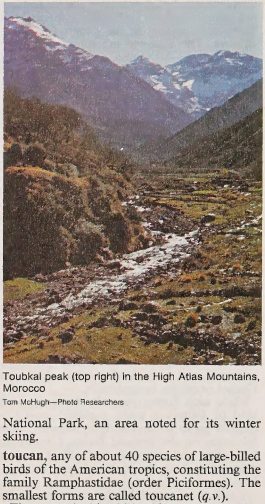
**Touba,** in full TOUBA MOSQUÉE, town, west-central Senegal, West Africa. The town takes its name from the Grand Mosquée of the Murid sect, the largest Muslim sect in Senegal. Most



Grand Mosquée, Touba, Senegal
A.F. Kersting

of the sect's members are peanut (groundnut) farmers. The mosque, a large white structure with five minarets, is the tomb of Amadou Bamba (d. 1927), who founded the order. The cooperative efforts of the Murid brotherhood have made it an economic force. The town is located in an agricultural (peanuts and millet) and pastoral (zebu cattle and goats) area of the Senegalese Sahel; it is connected by paved road and rail with Diourbel, the regional capital, about 30 miles (50 km) southwest, and has a school and a regional marketplace. Pop. (latest est.) 3,594.

**Toubkal, Mount,** mountain peak that is the highest point (13,665 feet [4,165 m]) in Morocco and in the Atlas Mountains. The peak is situated 40 miles (60 km) south of Marrakech (Marrakesh) in the High Atlas. Juniper forests covering the mountain's higher slopes are succeeded by alpine meadows, whereas the lower slopes have been extensively overgrazed. The peak is the central attraction of Toubkal



Toubkal peak (top right) in the High Atlas Mountains, Morocco
Tom McHugh—Photo Researchers

National Park, an area noted for its winter skiing.

**toucan,** any of about 40 species of large-billed birds of the American tropics, constituting the family Ramphastidae (order Piciformes). The smallest forms are called toucanet (*q.v.*).

The toucan's thick bill, which may be a third of the bird's length, is saw-edged and very light. It is brightly and distinctively coloured, probably for species recognition—many toucans have similar body patterns, mainly black with a bold breast colour. The bill is believed to have a frightening effect on other birds, including hawks. In feeding, a toucan must juggle pieces of fruit in its bill and then toss back its head before swallowing. The wings of toucans are short and rounded and the tail is usually long.

Toucans are somewhat gregarious, tending to roost in treetop bands. They are also among the noisiest of forest birds, their repertoire of sounds including loud barks, bugling calls, and harsh croaks. They feed on fruit, large insects, lizards, and nestling birds. Toucans nest in high tree holes. Two to four glossy white eggs, deposited in an unlined cavity, are incubated for about 16 days; the naked hatchlings



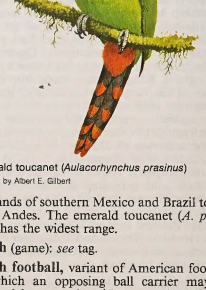
Gray-breasted mountain toucan (*Andigena hypoglauca*)
Painting by John P. O'Neill

require at least three weeks before their eyes open. After about 45 days the nestlings begin life on their own.

The largest toucans, up to 60 cm (24 inches) long, are *Ramphastos* species. An example common in zoos is the red-breasted, or green-billed, toucan (*R. dicolorus*) of Amazonia. Another common zoo inhabitant is the keel-billed toucan (*R. sulfuratus*), which is about 50 cm (20 inches) long. It is mainly black with lemon yellow on the face, throat, and chest, bright red under the tail, and multicoloured markings on the bill. *Andigena* species move seasonally up and down the Andes in search of fruit.

Among the more colourful toucans are the aracaris. A common species, frequently seen in pet shops and zoos, is the collared aracari (*Pteroglossus torquatus*), one of about 11 members of the genus. It is a slender bird about 40 cm (16 inches) long, and occurs in rain forests from southern Mexico to Venezuela.

**toucanet,** any of about 12 species of small and relatively short-billed toucans of the genera *Aulacorhynchus* and *Selenidera*, 25–35 cm (10–14 inches) long, belonging to the toucan family, Ramphastidae. Mainly green with touches of bold colour, they range from the



Emerald toucanet (*Aulacorhynchus prasinus*)
Painting by Albert E. Gilbert

lowlands of southern Mexico and Brazil to the high Andes. The emerald toucanet (*A. prasinus*) has the widest range.

**touch** (game): *see* tag.

**touch football,** variant of American football in which an opposing ball carrier may be stopped by a touch, with one or both hands depending on the rules in effect, instead of by a tackle. In another form of the game, called flag, or tail, football, each player carries a handkerchief or towel dangling from his belt or hip pocket, and gaining possession of the flag is substituted for touching. Touch football may be played by varying numbers of players using little or no protective equipment.

Either 6-man or 11-man rules may be followed generally, often with the following variations: The field may be marked into four zones, and a team receiving the ball in one zone is allowed four plays (downs) to move it into the next (in a more wide-open game, with passing allowed beyond the line of scrimmage, a team may be allowed only four downs to score). The ball becomes dead whenever it strikes the ground. A team that intends to punt must announce its intention before the down begins and must then actually punt the ball, neither team being allowed to cross the line of scrimmage until after the kick. If a game ends in a tie, the ball is taken to midfield and each team is allowed one series of four downs. One point is scored by the team making the longest total advance during this overtime series.

Touch football has long been popular in the United States as a playground game and a school and college intramural sport.

**touch reception,** also called TANGORECEPTION, perception by an animal when in con-

tact with a solid object. Two types of receptors are common: tactile hairs and subcutaneous receptors.

Many animals, including some coelenterates, annelid worms, insects and many other arthropods, birds, and mammals, have hairs or hairlike projections richly supplied with nerves and serving to indicate to the animal that it is in contact with some object. Such hairs may be specially modified (*e.g.*, vibrissae, or whiskers) in certain areas of the body, such as the face or toes, to provide more sensitive discrimination among stimuli.

A second type of touch receptor, the subcutaneous receptor, lies in the skin. Receptors of this type are found in nearly all animals and may consist of free nerve endings or complex corpuscles. *See also* mechanoreception; sense; thermoreception.

**touchstone,** black siliceous stone used to ascertain the purity of gold and silver. Assaying by "touch" was one of the earliest methods employed to assess the quality of precious metals. The metal to be assayed is rubbed on the touchstone, adjacent to the rubbing on the touchstone of a sample of a metal of known purity. The streaks of metal left behind on the touchstone are then treated with nitric acid, which dissolves impurities, and thus, when the streaks are compared, the contrast between pure and impure metal is heightened. Because other metals, such as copper, can be alloyed to silver without significantly changing its colour, the touchstone method is not usually employed now to assay silver. It is still used, however, to assay gold and provides a reasonably accurate guide to quality.

**Toucouleur** (people): *see* Tukulor.

**Toucouleur Empire** (West African history): *see* Tukulor Empire.

**Touggourt,** chief town of the Wadi R'Hir region, northeastern Algeria. It lies in the Wadi Igharghar Valley with sand dunes and chotts (salt lakes) to the north and south and small hills to the west. It is a typical Saharan town of dried mud or clay-stone buildings, winding streets, and dazzlingly white archways. A massive fortress minaret and the Casbah's clock tower rise above low houses; and the tombs of the Touggourt kings (the Ben Djellab) are clustered under a large dome. The oasis, fed by artesian wells, grows date palms, cereals, and vegetables. Located at the junction of ancient trans-Saharan caravan routes, Touggourt ships dates and trades in livestock, carpets, and woven cloth. It is the terminus of the railway from Skikda and the head of the motor track to Djanet in southern Algeria.

The inhabitants include people from the Ouled Naïl region to the northwest, the Medjara (Jewish converts to Islām), and the Rouarha (of Berber origin, resembling black Africans). Pop. (1998 est.) mun., 113,625.

**Tougué,** also called TONGUÉ, town, north-central Guinea, western Africa, on the Fouta Djallon plateau. It is a trading centre (rice, millet, oranges, cattle, and goats) among the Fulani (Peul) people in a savanna region. Bauxite deposits have been discovered south of the town. Pop. (2001 est.) 30,600.

**Touhy, Roger,** byname THE TERRIBLE (b. 1898, Chicago—d. Dec. 17, 1959, Chicago), Chicago-area bootlegger, brewer, and gambling boss during the Prohibition era.

In 1934 Touhy was convicted, on perjured testimony, of kidnapping one John "Jake the Barber" Factor in June–July 1933, a period when Factor, as it was later proved, had been hiding out to avoid extradition to England on a swindling charge. Allegedly, the Al Capone mob (then headed by Frank Nitti) had framed Touhy in order to take over his rackets.

Touhy, sentenced to 199 years, spent the years 1934–59 in Stateville Penitentiary near Joliet, Ill. (he escaped in a jailbreak in October 1942 but was caught 12 weeks later). After lengthy appeals, the federal courts deemed the kidnapping a hoax, and on Nov. 25, 1959, he was released. A few weeks later he was killed outside his sister's home in Chicago, felled by shotgun blasts from unknown gunmen in the street. An autobiography, *The Stolen Years,* was published in 1959.

**Toul,** town, Meurthe-et-Moselle *département,* Lorraine region, northeastern France. It lies between the left bank of the Moselle River and the Marne au Rhin Canal, 12 miles (19 km) west of Nancy. The former fortress town was rebuilt after World War II, during which whole sections were devastated by fire. Notable churches have survived, including the restored former cathedral of Saint-Etienne, dating from the 13th century, and the 13th–14th-century church of Saint-Genouit.

Once named Tullum and originally the capital of the Leuci tribe in the Belgic Confederation, the town acquired importance under the Romans. Toul was evangelized in the 4th century. The bishops of Toul were sovereign counts in the 10th century; the town became linked with Verdun, Metz, and their domains to form the Trois-Évêchés territory. In 1545 it placed itself under French protection and later became part of the kingdom of France. Toul lost its bishopric late in the 18th century but gained increasing importance as a garrison town. Its fortifications, rebuilt by the military engineer Sébastien Le Prestre de Vauban in 1700, were strengthened after the Franco-Prussian War of 1870. Porcelain is manufactured in the town. Pop. (1999) 16,945.

**Toulmin, Stephen Edelston** (b. March 25, 1922, London), English philosopher and educator noted for his study of the history of ideas. He was concerned with describing prescriptive language—that is, imperative sentences and value judgments used for ethical statements—while holding that ethics, or the logical study of moral language, cannot be reduced to subjective or objective facts but is a unique expression of duty or right.

Educated at Cambridge University (D.Phil. in philosophy, 1948), he lectured at Oxford before becoming department head and professor at the University of Leeds (1955–59) and then director of the Nuffield Foundation (1960–64). Moving to the United States, Toulmin taught at Brandeis University (1965–69), Michigan State University (1969–72), the University of California, Santa Cruz (1972–73), the University of Chicago (1973–86), and Northwestern University, Evanston, Ill. He was the author or coauthor of *An Examination of the Place of Reason in Ethics* (1950), *The Ancestry of Science,* vol. I, *The Fabrics of the Heavens* (1961), vol. II, *The Architecture of Matter* (1962), and vol. III, *The Discovery of Time* (1965), *Human Understanding* (1972), *Knowing and Acting* (1976), *An Introduction to Reasoning* (1979), and *The Return of Cosmology* (1982).

**Toulon,** town and port, capital of Var *département,* Provence-Alpes-Côte d'Azur region, southeastern France. It is France's principal naval base and has an arsenal, the most important of the Mediterranean drydocks, and shipbuilding yards. Toulon's fine bay opens to the east. The most sheltered part, the Petite Rade and the Darse Vieille, in the west, is largely under control of the French Navy, with a well-protected anchorage. The Grande Rade, to the east, is easier of access. The Faron Mountains form an imposing backdrop to the town.

Toulon's naval arsenal was founded by Henry IV (reigned 1589–1610), but the Romans originally had a naval signal station on the shores of the gulf. The French statesmen Cardinal de Richelieu and Jean-Baptiste Colbert and the engineer Sébastien Le Prestre de Vauban all strengthened the forts. It resisted a siege by Allied forces (1707) during the War of the Spanish Succession and was the scene of a famous battle of the French Revolutionary Wars (*see* Toulon, Siege of). After 1815 Toulon increased in importance and was the port of embarkation for most of the French military expeditions of the 19th century. By the 20th century it was the most powerful naval base of France and was the centre for the Allied naval forces in the Mediterranean in World War I.

In World War II the Franco-German Armistice of 1940 left the Vichy collaborationist government in control of the French fleet, the bulk of which it concentrated at Toulon. But the Allied invasion of northwest Africa on Nov. 8, 1942, prompted Hitler to abrogate the terms of the armistice, and he ordered the German Army to take over the rest of unoccupied France, including Toulon. While the Allies were trying to obtain the departure of the Toulon fleet for North Africa in order to keep it out of German hands, German troops attempted to seize the fleet on November 27. But the French were prepared for such a move, and Admiral Jean-Baptiste Laborde, the Mediterranean fleet commander, scuttled 73 ships, including cruisers, destroyers, torpedo boats, submarines, and one battleship. Toulon was liberated in August 1944 by French troops.

In the old town, which was largely destroyed during World War II, are the cathedral of Sainte-Marie Majeure, the rebuilt church of Saint-Louis, and the naval museum; on the quay, on the site of the old town hall, is the new town hall. Toulon's principal traditional industries, apart from the arsenal and shipbuilding, were fishing and wine making. The location of a French national aerospace centre brought many new industries, however, and the city now produces aeronautical equipment, maps, weaponry, tobacco, paper, printing, shoes, and electronic equipment. Pop. (1999) 159,400.

**Toulon, Siege of** (Aug. 28–Dec. 19, 1793), military engagement of the French Revolutionary Wars, in which the young artillery officer Napoleon Bonaparte won his first military reputation by forcing the withdrawal of the Anglo-Spanish fleet, which was occupying the city of Toulon and its forts.

On August 27–28 French royalist counter-revolutionaries handed over this major French naval base and arsenal to an Anglo-Spanish fleet under the command of Vice Admiral Lord Hood and Admiral Juan de Lángara. The British fleet also seized more than 70 French ships, almost half of the French Navy. Both the strategic importance of the naval base and the prestige of the Revolution demanded that the French recapture Toulon. Both sides brought up reinforcements, and the siege began.

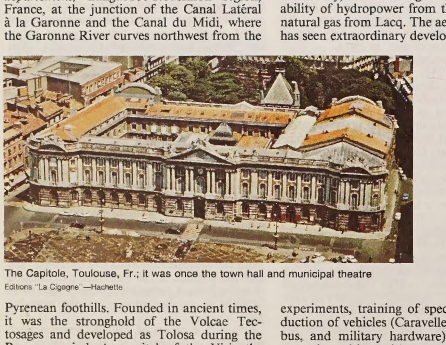
Although a series of French generals were nominally in command of the siege operation, the man responsible for its success was the previously unknown artillery officer Napoleon Bonaparte. After months of preparations, the revolutionary troops, under cover of intense bombardment, successfully assaulted the allied-held forts commanding the anchorage. By late afternoon of December 18 a battery of French guns, commanded by Bonaparte, was able to open fire on the British fleet. Lord Hood immediately evacuated the inner harbour. After British and Spanish troops blew up the arsenal and burned 42 French ships that evening, they sailed from Toulon and took with them as many of the royalist citizens as they could carry. When the Revolutionary troops took possession of the city on December 19, several hundred royalists were rounded up, tried by special tribunal, and

shot. Napoleon Bonaparte was promoted to the rank of brigadier general.

**Toulouse,** medieval county of southern France from the 8th to the 13th century. The countship can be dated from AD 778, when Charlemagne attempted to create bulwarks against the Muslims of Spain. The great dynasty, however, dates from 849, when Count Fredelon, a vassal of King Pepin II of Aquitaine, delivered Toulouse to Charles II the Bald of France, who thereupon confirmed him as count. Dying in 852, Fredelon left a heritage including Rouergue (around Rodez) and the Pyrenean countships of Pallars and Ribagorza as well as the Toulousain to his brother Raymond I, who added Limousin to it; but Septimania was then probably detached.

Marriages and partitions changed the extent of the counts' dominion. By 1053 it included Quercy, the Albigeois (around Albi), and Rouergue. Raymond IV (died 1105) added the marquisate of Provence but pawned Rouergue. The crusaders Raymond IV and his son Bertrand (died 1112) won the countship of Tripoli in the Holy Land; but at home the dynasty was weakened by quarrels with the House of Barcelona over Provence and with William IX of Aquitaine, who usurped the countship in 1098–1100 and again in 1114–19. Towns such as Toulouse and vassals such as the Trencavel viscounts of Béziers and Carcassonne became practically autonomous. Raymond VII (died 1249) left the countship to his son-in-law Alphonse of Poitiers, on whose death in 1271 it was annexed to the French crown.

**Toulouse,** city, capital, Haute-Garonne *département,* Languedoc-Roussillon region, France, at the junction of the Canal Latéral à la Garonne and the Canal du Midi, where the Garonne River curves northwest from the



The Capitole, Toulouse, Fr.; it was once the town hall and municipal theatre
Editions "La Cigogne" —Hachette

Pyrenean foothills. Founded in ancient times, it was the stronghold of the Volcae Tectosages and developed as Tolosa during the Roman period. As capital of the Visigoths (AD 419–507) it was taken (508) by Clovis and included in the Merovingian kingdom. It successfully withstood a siege by Saracens in 721, was chief town of the Carolingian kingdom of Aquitaine, and after 778 became the seat of the feudal countship of Toulouse. Its counts adhered to the Cathari heresy and resisted the anti-heretic crusade in the 13th century. Afterward, many religious houses and the university (1229) were founded. Its Parlement, established in 1420, had jurisdiction over Languedoc until the French Revolution. During the Wars of Religion in the 16th century, the city sided with the Catholic League. Marshal Soult unsuccessfully fought the last battle of the Peninsular War against the Duke of Wellington outside the city on April 10, 1814.

The old city (*vieux quartier*), on the right high bank and surrounded by medieval *faubourgs* (incorporated suburbs), embraces the business section. On the left low-lying bank is the *faubourg* of Saint-Cyprien. Toulouse, a bishopric (since the 4th century) and an archbishopric (since 1317), abounds in medieval churches—notably the Gothic cathedral of Saint-Étienne, the Romanesque basilica of Saint-Sernin, and the Gothic Église des Jacobins (mother church of the Dominican order and site of the tomb of St. Thomas Aquinas).

Many Renaissance and 16th–17th-century buildings (built by prosperous woad [pastel] dye merchants) form one of the most splendid series in France and include the hôtels de Bernuy, du Vieux Raisin, d'Espie, and de Pierre. The Hôtel d'Assézat houses the Académie des Jeux Floraux, founded in 1323 to encourage literary talent. The Duc de Montmorency was executed (1632) in the interior courtyard of the Capitole (town hall).

Noteworthy art museums are those of Saint-Raymond, des Augustins, and Paul Dupuy. The École des Beaux-Arts is on an 18th-century riverside embankment and, nearby, the Catholic Institute occupies a 16th-century convent. The city's architecture was long characterized by rose-red brick. The most run-down portions of the old centre have been demolished and replaced by an ultra-modern commercial centre, which clashes sharply with the older architecture. To make room for the vigorous population growth of the city, a new town, named Mirail (Miracle), was constructed to the southwest of the older neighbourhood of Saint-Cyprien.

Toulouse progressed commercially with the advent of railways in the 19th century. Diversified industrial development (which includes the manufacture of chemicals, aircraft, and machinery) has been augmented by the availability of hydropower from the Pyrenees and natural gas from Lacq. The aerospace industry has seen extraordinary development: research, experiments, training of specialists, and production of vehicles (Caravelle, Concorde, Airbus, and military hardware). Because of its strategic position, with routes converging from north and south, it acts as a trading centre between the Mediterranean and the Aquitaine Basin, whose farm produce it markets. Pop. (1982) 344,917.

**Toulouse I, II, and III, Universities of,** French UNIVERSITÉS DE TOULOUSE I, II, ET III, three autonomous coeducational state institutions of higher learning founded at Toulouse, Fr., in 1970 under the 1968 law reforming higher education, to replace the former University of Toulouse founded in 1229: the University of Social Sciences, specializing in law and economics; the University of Toulouse-le-Mirail, a liberal arts institution; and the University Paul-Sabatier, specializing in science and technology, including medicine, dentistry, pharmacy, and engineering.

The University of Toulouse had its origins in a Dominican school set up to combat heresy in the early 13th century, and reinforced by migrations of scholars from the University of Paris after Pope Honorius III forbade the study of Roman law at Paris in 1219. Its founding as a university 10 years later, by Pope Gregory IX (the first founding of a university by a pope), followed the peace treaty ending the war against the Albigensians. After a struggle to shake off its reputation as an instrument for repression and persecution, the university gradually attained distinction as a law school.

Suppressed by the French Revolution, it was replaced by separate faculties of law, theology, science, and letters; a medical faculty was added in 1808, and the faculties were reconstituted as a university in 1896.

**Toulouse, Louis-Alexandre de Bourbon, comte de** (count of) (b. June 6, 1678, Versailles, Fr.—d. Dec. 1, 1737, Rambouillet), French admiral general, a son of Louis XIV and his mistress Mme de Montespan.

Legitimized in 1681, he was an admiral of France at 5, and at 12 he accompanied his father to Holland, where he was wounded in the siege of Naumur. In 1702 Toulouse was in charge of a squadron that fought at Messina and Palermo to have the rights of Louis XIV's grandson recognized as Philip V of Spain. On Aug. 24, 1704, he fought the British at Malaga; and, although the battle was indecisive, the English sustained heavy casualties. In all his battles, Toulouse demonstrated great courage.

He married (1723) Marie-Victoire-Sophie de Noailles, marquise de Gondrin, who was considered one of the most beautiful and intelligent women of the court and who presided over a famous salon. His father had made his illegitimate children princes of the blood, giving them preference and ranking over other nobles, an act that caused great dissension among the aristocracy. Although Toulouse was a partisan of the Duc de Maine, his brother, he did not interest himself enough in court intrigues, and remained a member of the council of regency (1715–23), which gave him approval to rebuild the navy.

Toulouse was well liked at court. The memoirist Louis de Saint-Simon said of Toulouse that "he knew how to win over hearts by his gentle and agreeable manners, by his sense of fairness and generosity." The daughter of Toulouse married the Duc de Chartres and was the mother of the future king Louis-Philippe.

**Toulouse-Lautrec, Henri de,** in full HENRI-MARIE-RAYMONDE DE TOULOUSE-LAUTREC-MONFA (b. Nov. 24, 1864, Albi, Fr.—d. Sept. 9, 1901, Malromé), French artist who observed and documented with great psychological insight the personalities and facets of Parisian night life and the French world of entertainment in the 1890s. His use of free-flowing, expressive line, often becoming pure arabesque, results in highly rhythmical compositions (*e.g.,* "In the Circus Fernando: The Ringmaster," 1888). The extreme simplification in outline and movement and the use of large colour areas make his posters some of his most powerful works.

*Childhood and education.* Toulouse-Lautrec's family was wealthy and had a lineage that extended without interruption back to the time of Charlemagne. He grew up amid his family's typically aristocratic love of sport and art. Most of the boy's time was spent at the Château du Bosc, one of the family estates located near Albi. Henri's grandfather, father, and uncle were all talented draftsmen, and thus it was hardly surprising that Henri began sketching at the age of 10. His interest in art grew as a result of his being incapacitated in 1878 by an accident in which he broke his left thighbone. His right thighbone was fractured a little more than a year later in a second mishap. These accidents, requiring extensive periods of convalescence and of-



"At the Moulin Rouge," oil on canvas by Henri de Toulouse-Lautrec, 1892; in the Art Institute of Chicago
By courtesy of the Art Institute of Chicago

ten painful treatments, left his legs atrophied and made walking most difficult. As a result, Toulouse-Lautrec devoted ever greater periods to art in order to pass away the frequently lonely hours.

Toulouse-Lautrec's first visit to Paris occurred in 1872, when he enrolled in the Lycée Fontanes (now Lycée Condorcet). He gradually moved on to private tutors, and it was only after he had passed the baccalaureate examinations, in 1881, that he resolved to become an artist.

His first professional teacher in painting was René Princeteau, a friend of the Lautrec family. Princeteau's fame, such as it was, arose from his depiction of military and equestrian subjects, done in a 19th-century academic style. Though Toulouse-Lautrec got on well with Princeteau, he moved on to the atelier of Léon Bonnat at the end of 1882. In Bonnat, Toulouse-Lautrec encountered an artist who fought vehemently against deviation from academic rules, condemned the slapdash approach of the Impressionists, and judged Toulouse-Lautrec's drawing "atrocious." His work received a more positive reaction in 1883, when he joined the studio of Fernand Cormon.

In the early 1880s, Cormon enjoyed a moment of celebrity, and his studio attracted such artists as Vincent van Gogh and the Symbolist painter Émile Bernard. Cormon gave Toulouse-Lautrec much freedom in developing a personal style. That Cormon approved of his pupil's work is proved by his choosing Toulouse-Lautrec to assist him in illustrating the definitive edition of the works of Victor Hugo. In the end, however, Toulouse-Lautrec's drawings for this project were not used.

Despite this approval, Toulouse-Lautrec found the atmosphere at Cormon's studio increasingly restrictive. "Cormon's corrections are much kinder than Bonnat's were," he wrote his uncle Charles on Feb. 18, 1883. "He looks at everything you show him and encourages one steadily. It might surprise you, but I don't like that so much. You see, the lashing of my former master pepped me up, and I didn't spare myself." The academic regimen of copying became insufferable. He made "a great effort to copy the model exactly," one of his friends later recalled, "but in spite of himself he exaggerated certain details, sometimes the general character, so that he distorted without trying or even wanting to." Soon Toulouse-Lautrec's attendance at the studio became infrequent at best. He then rented his own studio in the Montmartre district of Paris and concerned himself, for the most part, with doing portraits of his friends.

*The documenter of Montmartre.* Thus it was that in the mid-1880s Toulouse-Lautrec began his lifelong association with the bohemian life of Montmartre. The cafés, cabarets, entertainers, and artists of this area of Paris fascinated him and led to his first taste of public recognition. He focussed his attention on depicting popular entertainers such as Aristide Bruant, Jane Avril, Loie Fuller, May Belfort, May Milton, Valentin le Désossé, Louise Weber (known as La Goulue, or the Glutton), and clowns such as Cha-U-Kao and Chocolat.

In 1884 Toulouse-Lautrec made the acquaintance of Bruant, a singer and composer who owned a cabaret called the Mirliton. Impressed by his work, Bruant asked him to prepare illustrations for his songs and offered the Mirliton as a place where Toulouse-Lautrec could exhibit his works. By this means and through reproductions of his drawings in Bruant's magazine *Mirliton,* he became known in Montmartre and started to receive commissions.

Toulouse-Lautrec sought to capture the effect of the movement of the figure through wholly original means. For example, his contemporary Edgar Degas (whose works, along with Japanese prints, were a principal influence on him) expressed movement by carefully rendering the anatomical structure of several closely grouped figures, attempting in this way to depict but one figure, caught at successive moments in time. Toulouse-Lautrec, on the other hand, employed freely handled line and colour that in themselves conveyed the idea of movement. Lines were no longer bound to what was anatomically correct; colours were intense and in their juxtapositions generated a pulsating rhythm; laws of perspective were violated in order to place figures in an active, unstable relationship with their surroundings. A common device of Toulouse-Lautrec was to compose the figures so that their legs were not visible. Though this characteristic has been interpreted as the artist's reaction to his own stunted, almost worthless legs, in fact the treatment eliminated specific movement, which could then be replaced by the essence of movement. The result was an art throbbing with life and energy, that in its formal abstraction and overall two-dimensionality presaged the turn to schools of Fauvism and Cubism in the first decade of the 20th century.

The originality of Toulouse-Lautrec also emerged in his posters. Rejecting the notion of high art, done in the traditional medium of oil on canvas, Toulouse-Lautrec in 1891 did his first poster, "Moulin Rouge—La Goulue." This poster won Toulouse-Lautrec increasing fame. "My poster is pasted today on the walls of Paris," the artist proudly declared. It was one of more than 30 he would create in the 10 years before his death. Posters afforded Toulouse-Lautrec the possibility of a widespread impact for his art, no longer restricted by the limitations of easel painting. They also enhanced the success he had enjoyed in the preceding year when his works were shown in Brussels at the Exposition des XX (the Twenty), an avant-garde association, and in Paris at the Salon des Indépendants.

Toulouse-Lautrec is most important for his success in going beyond a representation of superficial reality to a profound insight into the psychological makeup of his subjects. He turned to the lithograph after 1892 as a medium well suited to this goal. Among more than 300 lithographs produced in the final decade of his life were an album of 11 prints entitled "Le Café Concert" (1893); 16 lithographs of the entertainer Yvette Guilbert (1894); and a series of 22 illustrations for Jules Renard's *Les Histoires naturelles* (1899). But none of these works is more significant than "Elles," a series done in 1896, presenting a sensitive portrayal of brothel life. Toulouse-Lautrec spent lengthy periods observing the actions and behaviour of prostitutes and their clients. The resulting 11 works revealed these individuals as human beings, with some of the same strengths and many of the weaknesses of other members of society. A masterpiece of this genre is "Au salon de la rue des Moulins" ("At the Salon"). This painting evokes sympathy from the spectator as he observes the women's isolation and loneliness, qualities which the young Toulouse-Lautrec had so often experienced himself. "At the Salon" is a brilliant demonstration, therefore, of his stated desire to "depict the true and not the ideal," in which truth is based not on a careful representation of detail but rather on capturing, in a few brief brushstrokes, the essential nature of a subject.

The appearance of "Elles" coincided with a growing deterioration in his physical and mental condition. Toulouse-Lautrec's figure, even among the great human diversity found in Montmartre, remained unmistakable. His fully developed torso rested on dwarfish legs. Not quite five feet one inch tall, his size seemed further diminished because of his practice of associating with unusually tall men, such as his fellow students Maxime Dethomas and Louis Anquetin and his cousin and close friend Gabriel Tapié de Céleyran. His frequently ironic tone failed to mask a fundamental dislike of his physical appearance, and his letters contain many derogatory remarks about his body and references to an increasing number of ailments, including syphilis. Drinking heavily in the late 1890s, when he reputedly helped popularize the cocktail, he suffered a mental collapse at the beginning of 1899. The immediate cause was the sudden, unexplained departure of his mother from Paris on January 3. He was always close to his family, particularly to his mother, who had always supported his ambitions; and he interpreted her leaving as a betrayal. The effect on his weakened system was severe, and he was committed shortly thereafter to a sanatorium in Neuilly-sur-Seine. This decision was made by the artist's mother, against the advice of relatives and friends of the artist, in the hope of avoiding a scandal.

Toulouse-Lautrec remained formally committed until March 31, 1899, though he chose to stay on at the sanatorium until mid-May. While there he was able to demonstrate his lucidity and power of memory by preparing a number of works on the theme of the circus. These works, however, lack the force and intensity of his earlier compositions. In the spring of 1900 he started drinking heavily

again. Less than three months before his 37th birthday, he died at Château de Malromé.

*Assessment.* Toulouse-Lautrec greatly influenced French art of the late 19th and early 20th centuries by his use of new kinds of subjects, his ability to capture the essence of an individual with economical means, and his stylistic innovations. Despite his deformity and the effects of alcoholism and mental collapse later in life, Toulouse-Lautrec helped set the course of avant-garde art well beyond his early and tragic death at the age of 36.

Toulouse-Lautrec was not a profound intellectual. Tapié de Céleyran wrote that he read little and when he did it was usually at night, because of insomnia. But he was a great satirist of pretense and convention. In typical fashion, he passed off his initial, unsuccessful attempt at the baccalaureate by having name cards printed "Henri de Toulouse-Lautrec, flunker of the arts." This iconoclasm surfaced also when he parodied Puvis de Chavannes's serious Symbolist work "The Sacred Grove" by turning it into a boisterous scene filled with rowdy friends (1884). Yet he also could push himself in pursuits like swimming and boating, and toward the end of his life he installed a rowing machine in his studio. In his enthusiasm for sports he once accompanied a French bicycling team on a trip through England. Toulouse-Lautrec was, as two observers have concluded, a "sensitive, deeply affectionate man, conscious of his infirmity but wearing a mask of joviality and irony."

Although recognized today as a major figure in late 19th-century art, Toulouse-Lautrec's status in his lifetime was disputed. Indeed, the artist's father, who took slight interest in his son after his disabling injuries, regarded his son's work as only "rough sketches" and could never accept the idea of a member of the aristocracy betraying his class by turning from a "gentleman" artist to a professional one. Stung by such criticism and hampered by his infirmities, Toulouse-Lautrec persevered to emerge as a prolific artist whose work eventually helped shape the art of decades to come. (A.C.Bi.)

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**Toungoo,** town, south-central Myanmar (Burma). On the right bank of the Sittang River, it was founded as Ketumadi in 1510 by King Mimkyinyo and was capital of the Toungoo dynasty until 1540, when the seat of government was moved to Pegu (Bago), 125 miles (200 km) south. Parts of the old moat and wall remain; official buildings and minor industries are outside the wall. There are rice mills and sawmills, and timber and coffee are processed. The town has an institute for training elementary teachers. The Shwesandaw and Myasigon pagodas date from the mid-16th century.

The hill range of Pegu Yoma to the west of Toungoo holds valuable timber reserves. The middle Sittang valley is devoted largely to rice cultivation and contains the main Yangôn (Rangoon) to Mandalay road and railway. There is also a road west to Pyè. Pop. (1993) 83,500.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

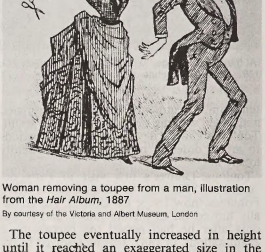
**Toungoo** DYNASTY, also spelled TAUNGU, ruling house in Myanmar (Burma) from the 15th or 16th to the 18th century, whose reign is known as the Second Burmese Empire. King Minkyinyo (1486–1531) of Toungoo is usually considered the founder of the dynasty, but many authorities believe that the distinction of founder should be reserved for his son Tabinshwehti (1531–50), who more surely welded the empire together. Thus the dating of the dynasty may be considered either 1486–1752 or 1531–1752.

Tabinshwehti first conquered the Mohnyin Shan peoples in northern Myanmar and thus eliminated one element of the fragmentation that had existed in Myanmar since the demise of the Pagan dynasty (1287). Consolidating his power in Toungoo, far up the Sittang River, Tabinshwehti pushed southward, overrunning the Irrawaddy delta region and crushing the Mon capital of Pegu (Bago). After defeating a Shan-led counterattack at Pyè (Prome) in 1544, Tabinshwehti was crowned as king of all Myanmar at the ancient capital of Pagan (Nyaung-U). He then began assembling an army for an attack on coastal Arakan to the west; although the Myanmar forces were defeated at Arakan, Tabinshwehti led his retreating army eastward to Ayutthaya to subdue rebellious Thai forces there. Again he was defeated. A period of unrest and rebellions among other conquered peoples followed, and Tabinshwehti was assassinated in 1551.

Bayinnaung (reigned 1551–81), Tabinshwehti's brother-in-law, ascended the throne. An energetic leader and effective military commander, he made Toungoo Myanmar the most powerful state in Southeast Asia. After repeated campaigns, his conquests extended from Tavoy (Dawei) in the south to Shwebo in the north and from Ava eastward to Chieng Mai. Myanmar suzerainty even encompassed much of Laos and extended down the Mae Nam Chao Phraya valley to Ayutthaya, near Bangkok. Siam remained under Myanmar domination for 15 years.

Bayinnaung was poised to deliver a final, decisive assault on the kingdom of Arakan when he died in 1581. His successors were forced to quell rebellions in other parts of the kingdom, and the victory over Arakan was never achieved. Instead, the Myanmar empire gradually disintegrated. The Toungoo dynasty, however, survived for another century and a half, until the death of Mahadammayaza (reigned 1733–52), but never again ruled all of Myanmar.

**toupee,** also spelled TOUPET, originally, any raised roll of hair just above the forehead, either natural or artificial; today, a small hairpiece generally covering a bald spot. The toupee developed during the 18th century, when men and women began to comb the front hair over the top line of the wig to create a natural-looking hairline.



Woman removing a toupee from a man, illustration from the *Hair Album*, 1887

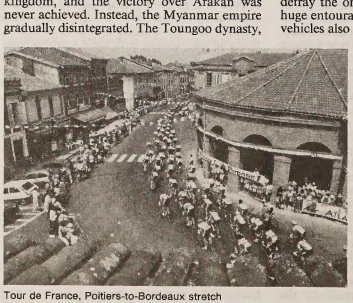
By courtesy of the Victoria and Albert Museum, London

The toupee eventually increased in height until it reached an exaggerated size in the 1770s, the front hair being built over wire frames, pads, or felt cushions. Toward the end of the century, the toupee diminished in height, and it began to pass out of fashion as the French Revolution ushered in an age of naturalism.

**Tour, Charles (Turgis de Saint-Étienne de) La:** *see* La Tour, Charles (Turgis de Saint-Étienne de).

**Tour, Maurice-Quentin de La** (French painter): *see* La Tour, Maurice-Quentin de.

**Tour de France,** bicycle race, considered to be the world's most prestigious, that was established in 1903 by Henri Desgrange (1865–1940), a French cyclist and journalist. The annual race involves 120 or more professional contestants and covers about 4,000 km (2,500 miles) of flat and mountainous country, mostly in France and Belgium but with occasional brief visits to Spain, Italy, Germany, and Switzerland. The racers are preceded on the road by a publicity caravan of vehicles whose sponsors' contributions help defray the organizational costs of the tour. A huge entourage of official, press, and technical vehicles also follows the riders. The race is di-



Tour de France, Poitiers-to-Bordeaux stretch

Daniel Nouvel—Gamma/Liaison

vided into some 20 day-long stages; each stage is timed, and the rider with the lowest aggregate time for all stages at the completion of the race is the winner.

Part of the difficulty of the Tour de France is that it includes time-trial racing stages as well as both flat-land and mountainous racing stages. It is a rare cyclist who can perform well in both time trials and climbing. The team aspect of the Tour is also important because, although only one rider is awarded the win, lead riders are dependent on their team members in order to succeed. Teammates help with tactics such as letting the leader ride (draft) behind them to protect him from the wind and setting a strong pace for him in the mountains.

In 2004 Lance Armstrong of the United States became the first rider to win the Tour six times (1999–2004). Four riders have won five times each: Jacques Anquetil of France (1957 and 1961–64), Eddy Merckx of Belgium (1969–72 and 1974), Bernard Hinault of France (1978–79, 1981–82, and 1985), and Miguel Indurain of Spain (1991–95). A Tour de France for women was held between 1984 and 1989.

In 1998 the Tour's popularity was shaken by a drug scandal that included the expulsion of the Festina team, frequent police raids on riders' hotels in search of evidence, and protests by the riders in which all of the racers deliberately rode slowly or stopped during certain stages. But the event soon recovered. The Tour de France is still regarded as the supreme achievement in the sport of cycling and one of the premier athletic events in the world.

*See* Sporting Record: *Cycling*.

**tour en l'air** (French: "turn in the air"), in ballet, a complete single, double, or triple turn in the air, usually beginning from and ending in the fifth position (the feet are turned out and pressed closely together, the heel of the right foot against the toe of the left and vice versa). Performed almost exclusively by male dancers, it is usually a brilliant display linked by softer, less spectacular movements that require great style and control.

**touraco** (bird): *see* turaco.

**Touraine,** historical and cultural region encompassing the central French *département* of Indre-et-Loire and coextensive with the former province of Touraine. The historical province of Touraine was bounded northeast by Orléanais, southeast by Berry, southwest by Poitou, west by Anjou, and north by Maine.

In Roman times the country was inhabited by the Gallic tribe of the Turones, from whom the name of the province and also that of its capital, Tours, are derived. The Turones were unwarlike and offered practically no resistance to the invader, though they joined in the revolt of Vercingetorix in 52 BC. The capital city, Caesarodunum, which was built on the site of the eastern part of the present city of Tours, was made by Valentinian the metropolis of the 3rd Lyonnaise, which included roughly the later provinces of Touraine, Brittany, Maine, and Anjou. Christianity seems to have been introduced into Touraine not much earlier than the beginning of the 4th century AD, although tradition assigns St. Gatien, the first bishop of Tours, to the 3rd. The ecclesiastical province dates from the episcopate of the great St. Martin of Tours, who in the 4th century founded the Abbey of Marmoutier, near Tours, and whose tomb in the city became a celebrated shrine. In the 5th century the country was incorporated in the Visigothic kingdom, which stretched from the Loire River into Spain. When Clovis overthrew the Visigothic power in Gaul in 507, Touraine became part of the Frankish kingdom. During the partitions of the kingdom between the successors of Clovis, Touraine was much disputed. Local counts did less to civilize the country than churchmen did; and under Charlemagne the abbot Alcuin enhanced its cultural prestige. In the second half of the 9th century Touraine was dominated by Robert the Strong and his successors or by their nominees. In the 10th century it was fiercely contested between the counts of Blois and of Anjou. The Angevin Geoffrey Martel won the country in 1044.

Philip II Augustus of France, during his long struggle against the Angevin kings of England, reconquered Touraine in 1203–05. In 1360 it was raised to a peerage duchy, remaining on the French side of the frontier drawn by the Treaty of Brétigny between France and England. In that crucial phase of the Hundred Years' War characterized by the campaigns of Joan of Arc, Touraine was the principal base of King Charles VII. Louis XI made Plessinlès-Tours his favourite seat. The magnificent châteaus—in fact, palaces—at Amboise, Azay-le-Rideau, and Chenonceaux bear witness to the splendour of the province in the latter period of the Renaissance.

The establishment of the royal residence at distant Versailles and the forced emigration of its Huguenot silk weavers led to the area's decline after 1700. The province was abolished in 1790, during the French Revolution, when France was reorganized into *départements.* The districts of northern Touraine (Chemillé, Saint-Cyr-du-Gault, and Montrichard) went to Loir-et-Cher, the southeast (Brenne, with Châtillon-sur-Indre and Azay-le-Ferron) to Indre, and the extreme southwest (La Roche-Posay and Saint-Romain) to Vienne; but the formerly Poitevin Richelieu and the formerly Angevin Bourgueil, Gizeux, and Château-la-Vallière were annexed to the greater part of Touraine to form the *département* of Indre-et-Loire.

The traditional large estates of Touraine have for the most part disappeared. The communes of Bourgueil, Saint-Nicolas-de-Bourgueil, Restigné, Benais, and Ingrandes produce fine red wines. The red wines of Joué-lès-Tours, Saint-Avertin, Sainte-Radegonde-en-Touraine, Larçay, and Chambourg-sur-Indre come from vineyards on the left bank of the Loire River and along the Indre River.

Much of the population of Touraine is of Celtic origin. Roman Catholicism predominates, but immigrants from The Netherlands have augmented the Calvinist population. The langue d'oïl (*i.e.,* the forerunner of modern French) was the dominant language from the 17th century.

**Touraine, Archibald Douglas, duke** (duc) **de:** *see* Douglas, Archibald Douglas, 4th earl of.

**Tourcoing,** town, Nord *département,* Nord-Pas-de-Calais *région,* northern France, just northeast of Lille and near the Belgian frontier. Sheep were grazed on this portion of the plain of Flanders long before the Romans came. There is record of consignment to Germany at the end of the 12th century. In the 15th century Tourcoing's supremacy in textiles was assured. Emperor Maximilian of Austria licensed a trade fair for the town in 1491. Louis XIV incorporated the town into the French kingdom in 1668. In 1794, at Tourcoing, the French defeated a combined army of Austrians and English. The 19th-century neo-Gothic Church of Saint-Christophe dominates the central square, the Grande Place. Together with Roubaix, its neighbouring city, Tourcoing is a centre for wool and cotton textiles. Both towns, with their suburbs, have become part of the urban agglomeration of Lille. Pop. (1999) 93,540.

**Touré, Samory:** *see* Samory.

**Touré, Sékou,** in full AHMED SÉKOU TOURÉ (b. Jan. 9, 1922, Faranah, French Guinea [now Guinea]—d. March 26, 1984, Cleveland, Ohio, U.S.), first president of the Republic of Guinea (1958–84) and a leading African politician.

Although his parents were poor and uneducated, Touré claimed to be the grandson of Samory, a military adventurer who resisted French rule at the end of the 19th century, long after most other Guineans had surrendered. Reared as a Muslim, Touré attended a French technical school at Conakry, from which he was expelled after one year for leading a food riot (1936). In 1940 Touré was hired as a clerk by a business firm, the Niger Français, and the following year took



Sékou Touré
Camera Press

an administrative assignment in the postal service. There he developed a strong interest in the labour movement and organized the first successful strike (76 days) in French West Africa. In 1945 he became secretary-general of the Post and Telecommunications Workers' Union and helped to found the Federation of Workers' Unions of Guinea, linked to the World Federation of Trade Unions, of which he later became vice president.

Touré became active in politics when Félix Houphouët-Boigny of Côte d'Ivoire (Ivory Coast) formed the Rassemblement Démocratique Africain (RDA) in 1946. Touré proved to be a powerful orator and was elected to the French National Assembly in 1951, but he was not allowed to take his seat. Reelected in 1954, he was again barred. After being elected mayor of Conakry by a large majority in 1955, he was finally permitted to take his place in the National Assembly the following year. By the end of 1957 Touré had become vice president of the Executive Council of Guinea.

When French President Charles de Gaulle in 1958 offered French territories a referendum on whether to join a new federal community or to become independent, Touré led a successful campaign for independence. On Oct. 2, 1958, Guinea became the first independent French-speaking state in Africa, and shortly afterward Touré was elected its president. The French reacted by recalling all their professional people and civil servants and by removing all transportable equipment. Threatened by an economic breakdown, Touré accepted support from the communist bloc and at the same time sought help from Western nations.

In African affairs Touré was an ardent supporter of Ghana's president Kwame Nkrumah and his program for African political unity, but a union of the two nations proclaimed in 1958 never became effective. When Nkrumah was deposed in 1966, Touré granted him asylum. After an unsuccessful invasion from neighbouring Portuguese Guinea (now Guinea-Bissau) in 1971, he undertook a political purge and imposed severe restrictions on opposition forces in his country. He was reelected without opposition in subsequent elections and ruled with an iron hand.

Despite his harsh domestic policies, Touré was viewed in international politics as a moderate Islāmic leader. In 1982 he led the delegation sent by the Islāmic Conference Organization to mediate in the Iran-Iraq war;

he played a key role in the Franco-African summit in Vitrell, France, and he was a member in the Organization for African Unity (OAU).

**Tourette's syndrome,** also called TOURETTE'S DISORDER, or GILLES DE LA TOURETTE'S SYNDROME, rare neurological disease characterized by recurrent motor and phonic tics (involuntary and purposeless muscle spasms and vocalizations). The syndrome occurs worldwide in all races, is usually inherited, and is three times more prevalent in males than in females.

It is named for Georges Gilles de la Tourette, who first described it in 1885; it has been suggested that the English author Samuel Johnson may have suffered from a form of the disease, based on contemporary descriptions of his facial tics and of the strange vocalizations interrupting his normal speech.

Tourette's syndrome usually begins between the ages of 2 and 15 and usually continues into adulthood. Motor tics occur first in about 80 percent of the cases, while compulsions to utter abnormal sounds precede motor tics in the remaining cases. Individuals with milder forms may exhibit either motor or phonic tics but not both.

Coprolalia, the compulsion to utter obscenities, was once considered a characteristic symptom, but it is often absent. Echolalia (a compulsion to repeat words heard) and palilalia (spontaneous repetition of one's own words) are two distinctive symptoms of Tourette's syndrome. Other vocalizations that may occur include grunts, barks, hisses, whistles, and other meaningless sounds. Motor tics may be simple actions that are virtually unnoticeable. More complex tics usually involve the shoulders, head, and face and may include apparently intentional behaviour, such as hopping, clapping, and fist clenching. Sleep, intense concentration, and physical exertion tend to suppress the symptoms, while emotional stress exacerbates them.

Unlike other forms of compulsive behaviour, Tourette's syndrome has a neurological rather than a psychiatric origin and may improve under treatment with psychoactive drugs; haloperidol has been the traditional agent, but pimozide and fluphenazine among the dopamine blockers and clonidine have also been effective.

Abnormalities of one or more chemical neurotransmitters in the brain are implicated in Tourette's syndrome, but the disease's underlying cause remains uncertain, as does its relationship to other, similar disorders.

**Tourist Trophy races,** best known and most demanding of the European motorcycle races. First run in 1907 on the Isle of Man off the northwestern coast of England, the race attracted many riders from all over England and the European continent. The race was originally intended for motorcycles "similar to those sold to the public," called touring machines, and soon became known as the Tourist Trophy. In 1911, the course was changed to a 37½-mile (60.5-kilometre), later a 37¾-mile, route from sea level into the mountains and back, with over 200 bends along the way. The race has been run in various divisions determined by cycle size and racer experience. Sidecar races have also been held. English riders' skill on the course helped create that nation's early lead in motorcycle racing and manufacturing. From the late 1930s on, Italian machines also won, and, beginning in the 1960s, Japanese machines. From 1976 the Tourist Trophy was no longer a world-championship event. The term tourist trophy is now sometimes used for any dirt-track motorcycle race in which there are both right- and left-hand turns as well as steeplechase-style jumps.

**tourmaline,** borosilicate mineral of complex and variable composition. Three types of tourmaline, distinguished by the predominance of certain elements, are usually recognized: iron tourmaline (schorl), black in colour; magnesium tourmaline (dravite), brown; and alkali tourmaline, which may be pink (rubellite), green (Brazilian emerald), or colourless (achroite). Some crystals are pink at one end and green at the other; concentric colour zoning may also occur. The coloured varieties, when transparent and free from flaws, are cut as gems.

Tourmaline is very abundant and has the best-developed crystals in pegmatites and in metamorphosed limestones in contact with granitic magmas. Because tourmaline is resistant to weathering, it accumulates in detrital deposits and is a common accessory mineral in sedimentary rocks. Gem-quality pegmatites are found in the United States (southern California and Maine), Brazil, and Madagascar.

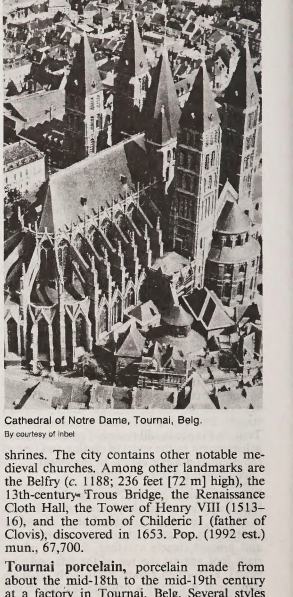
In addition to its use as a gem, tourmaline is employed in pressure devices because of its piezoelectric properties—*i.e.*, its ability to generate electric charge under mechanical stress or its change in shape when voltage is applied. It has been used in depth-sounding apparatus and other devices that detect and measure variations in pressure.

Coloured crystals of tourmaline are very strongly dichroic—*i.e.*, they are of different colour when viewed in the direction of different axes; the ordinary ray is almost completely absorbed. Plates cut parallel to the vertical axis of a tourmaline crystal allow only the extraordinary ray through; if two such plates are placed in crossed position, the light is entirely blocked. A pair of these plates form a very simple polarizing apparatus known as tourmaline tongs.

**Tournai** (French), Flemish DOORNIK, municipality, Hainaut *province*, southwestern Belgium. It lies along the Schelde (Scheldt, or Escaut) River, northwest of Mons. Tournai has changed hands many times. As Turnacum, it was important in Roman times. Seized by the Salic Franks in the 5th century, it was the birthplace of the Frankish king Clovis I (*c.* 466) and became a Merovingian capital. A bishop's see from the early 6th century, it was largely controlled by the counts of Flanders from the 860s until it was recovered by France and granted a charter in 1188. Under French protection but remote from French interference, it was a virtually republican zone. It fell to Henry VIII of England in 1513, was returned to France in 1518, and in 1521 was taken by Charles V, who attached it to the Netherlands, then a Spanish Habsburg province. From 1543 it was a centre of Calvinism and favoured the anti-Spanish rebels of the 1560s until Alessandro Farnese broke the defense of Christine de Lalaing, princess of Espinoy, and recaptured it for Spain after the siege of 1581. Taken by Louis XIV (1667) during the War of Devolution, it was transferred to the Austrian Habsburgs by the Treaty of Utrecht (1713), recaptured by the French in 1745, and restored to Austria in 1748. During the Revolutionary and Napoleonic periods, it was again French from 1794 to 1814.

Tournai was notable for tapestry and copperware in the Middle Ages and for carpet weaving in the 18th century—crafts that have been revived there. Quarrying is important locally, and steel, leather goods, and hosiery are manufactured. The city's cultural institutions include several specialized schools and museums of archaeology, natural history, fine arts, and folklore. Tournai was also renowned for a medieval school of sculptors, and the painter Rogier van der Weyden was a native.

Tournai's Cathedral of Notre Dame is a cruciform 11th–12th-century basilica, one of the finest in Europe, with five massive towers, a Gothic choir, and 13th-century reliquary



Cathedral of Notre Dame, Tournai, Belg.
By courtesy of Inbel

shrines. The city contains other notable medieval churches. Among other landmarks are the Belfry (*c.* 1188; 236 feet [72 m] high), the 13th-century Trous Bridge, the Renaissance Cloth Hall, the Tower of Henry VIII (1513–16), and the tomb of Childeric I (father of Clovis), discovered in 1653. Pop. (1992 est.) mun., 67,700.

**Tournai porcelain,** porcelain made from about the mid-18th to the mid-19th century at a factory in Tournai, Belg. Several styles prevailed: figures in fanciful landscapes, cupids, and other decorative motifs were outlined in plain crimson on white, especially by the painter Henri-Joseph Duvivier (during 1763–71); landscapes with ruins, war scenes, and the like were painted also in green, blue, brown, and reddish brown. In 1787 a service with birds, based on Georges-Louis-Leclerc Buffon's *Natural History of Birds* (1771), was painted by Jean-Ghislain-Joseph Mayer. The service consists of panels with naturalistically coloured birds that alternate on the rim of the plates with panels of dark blue, diapered with gold. The blue was similar to the *bleu de roi*



Tournai porcelain group of children "bird's-nesting" by Nicolas Lecreux, *c.* 1770; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

("royal blue") of Sèvres. Flowers and insects were also naturalistically rendered on Tournai ware. In the latter part of the 18th century, plates were produced with plain decoration in blue, ranging from royal to blue black, sometimes with gilt; the key pattern—festoons—and other formal patterns were used. Some examples were decorated in plain gold on a white background.

Some Tournai plates of differing styles have, as a common characteristic, fine fluting or reeding of the rim, sometimes dense, sometimes wide apart, but nearly always swirled rather than straight, which were inspired by the moldings of some Meissen ozier pattern borders. Figures in white-glazed (and occasionally coloured) porcelain were made, notably by Nicolas Lecreux. They are usually of rustic groups and seem to be composed in a sort of spiral, the effect of which is that the view of them is perfect from every angle. Their bases have detailed and delicate modelling of such motifs as flowers, berries, and latticework.

**tournament,** also called TOURNEY, series of military exercises, probably of medieval French origin and confined to western Europe, in which knights fought one another to display their skill and courage. Tournaments had become more pageantry than combat by the end of the 16th century, and the term is still used somewhat in this sense, for instance,



*Medieval tournament activities*
(Top) The joust, manuscript illumination from the *Hystoire et plaisante chronique du petit Jehan de Saintré, c.* 1459; in the British Library (Cotton MS. Nero D.IX); (bottom) the *mêlée,* manuscript illumination from the *Livre de Messire Lancelot du Lac,* early 15th century; in the Bibliothèque de l'Arsenal, Paris (MS. 3479-3480)
(Top) Reproduced by permission of the British Library. (bottom) Giraudon—Art Resource/EB Inc.

in the Royal Tournament, an annual naval and military display held in London, and the New Year's Day Tournament of Roses parade in Pasadena, Calif.

In the early 20th century, the word tournament also came to be applied to certain methods of conducting sports competitions. In the most common modern tournament, the contestants are matched in pairs, with the losers in each test eliminated and the winners paired anew until only one remains as the champion of the tournament. In some tournaments, called double-elimination tournaments, the contestant is not eliminated until defeated a second time. In a third form, called a round robin, each contestant opposes every other contestant and the one with the highest percentage of victories is declared the champion.

The tournament in its earliest form apparently originated in France about the middle of the 11th century. Several chroniclers credit a French baron, Geoffroi de Preully, with having invented tournaments.

The early tournament was a mock battle between two bodies of armed horsemen and was called the *mêlée.* (This term is also applied to a predecessor of modern football. *See* mêlée.) Later came the joust, a trial of skill in which two horsemen charged each other with levelled lances from either end of the lists (the palisades enclosing the jousting ground), each attempting to unhorse the other; the *mêlée,* however, continued side by side with it.

About 1292 a *Statutum Armorum* ("Statute of Arms") enacted that swords with points were not to be used (nor were pointed daggers, clubs, or maces). Fallen knights were to be helped up only by their own squires, wearing their heraldic device. The squire who offended was to lose horse and arms and be imprisoned for three years. Disputes were to be settled by a court of honour of princes and earls.

Some tournaments were harmless and some rough. For the Tournament of Peace held at Windsor Park, Eng., in 1278, the sword blades were of whalebone and parchment, silvered; the helms of boiled leather; and the shields of light wood. At others, however, contestants were often killed or wounded. Blunted, or rebated, lance points came into use early, and by the 14th century a crown-shaped coronal head was often fitted in place of the point.

By the 1400s, jousters usually ran their courses separated by a cloth-covered barrier, or tilt, to prevent the collision of their horses. Armourers began to devise special armour that was heavier and less flexible than armour for the field, being used only for tilting.

In the 16th century, fighting on foot at the barrier with short spears became popular. Poleaxes also were used, and there were mounted combats with swords or maces. Prizes were presented to the victors by ladies.

In continental Europe, lists were jealously closed to all combatants except those of noble birth. In the German lands, questions as to the purity of descent of a candidate for admission to a noble order were often settled by appeal to an ancestor's having taken part in a tournament.

The tournament eventually degenerated into the carrousel, a kind of equestrian polonaise, and the more harmless sport of tilting at a ring. In modern times there have been occasional romantic revivals, the most famous perhaps being the tournament at Eglinton Castle, in Scotland, in 1839, described in Disraeli's novel *Endymion* (1880). Later tournaments were theatrical reenactments.

**Tournament Bridge** (card game): *see* Duplicate Bridge.

**Tournefort, Joseph Pitton de** (b. June 5, 1656, Aix-en-Provence, Fr.—d. Dec. 28, 1708, Paris), French botanist and physician, a pioneer in systematic botany, whose system of plant classification represented a major advance in his day and remains, in some respects, valid to the present time.

Tournefort's interest in botany began early, but only after the death of his father, who was forcing him toward the priesthood, was he able to drop theology and study botany. He became a physician to support himself but continued his botanical studies. In 1688 he received an appointment as professor at the Jardin des Plantes in Paris, a position he held until his death. He collected many plant species on scientific expeditions to the Pyrenees, Asia Minor, and Greece and acquired a wide reputation for his botanical works, particularly the beautifully illustrated *Éléments de botanique* (1694).

Tournefort placed primary emphasis on the classification of genera, basing his classification entirely upon the structure of the flower and fruit. He excelled in observation and description, and some of his generic descriptions are still acceptable. He was less innovative in theory, however, for he denied the sexuality of plants, and the classifications that he put forward above the level of the genus were often artificial. By his use of a single Latin name for the genus, followed by a few descriptive words for the species, he provided a major step in the development of the binomial nomenclature—that is, the use of a two-word Latin name to denote each species.

**Tourneur, Cyril** (b. *c.* 1575—d. Feb. 28, 1626, Kinsale, County Cork, Ire.), English dramatist whose reputation rests upon *The Atheist's Tragedie* and *The Revenger's Tragedie,* both in verse rich in macabre imagery.

In 1625 Sir Edward Cecil appointed him secretary to the council of war. This appointment was cancelled by the Duke of Buckingham, but Tourneur sailed with Cecil on an expedition to Cádiz. On the return voyage, he was put ashore at Kinsale, with other sick men, and died there. His poetical satire, *The Transformed Metamorphosis,* was published in 1600.

*The Atheist's Tragedie: Or The honest Man's Revenge* was published in 1611. *The Revenger's Tragedie* had appeared anonymously in 1607. In 1656 the bookseller Edward Archer entered it as by Tourneur on his list. This attribution is not decisive, and internal evidence of authorship is conflicting; many attribute it to Thomas Middleton. The plays differ in their attitude toward private revenge; and *The Revenger's Tragedie,* although earlier, is more mature in its structure and sombre brilliance, which causes its authorship to remain doubtful.

**Tours,** city, capital of Indre-et-Loire *département,* Centre region, west central France, on the Loire River. It is the chief tourist centre for the Loire Valley and its historic châteaus.

Tours offers sharp contrasts in buildings and architectural styles. Its town hall, finished in 1904, is typical of its time, pompous and slightly overpowering. Away from the central square the cathedral of Saint-Gatien sums up four centuries of French religious architecture: the choir is of the 13th century; the nave marks a transition between Flamboyant Gothic and Renaissance styles; the facade was built from 1426 to 1547. Another contrast is found south of the Loire River and west of the rue Nationale, in the town's old section where cobbled streets and ancient houses are preserved. The Musée des Beaux-Arts in the former 17th–18th-century archiepiscopal palace has a rich collection of paintings. A university was established at Tours in 1952 and was linked with the educational divisions of Orléans and Poitiers. To the south of the Cher River, a virtual new town has been constructed to house new residents of the city. Tours entered the 1980s in a strong stage of growth, with the decentralization from the Paris region of machinery assembly, chemical products, and pharmaceutical industries. It is also an important road and railroad junction.

Early records show that a Gallic settlement, and the capital of the Turons (a pre-Roman tribal group), was on the right bank of the Loire. The Romans moved it across the river. Originally it was called Caesarodunum but, from the 5th century, Civitas Turonorum.

The settlement was evangelized in the mid-3rd century by the early Christian ecclesiastic and missionary Gatien, who founded the bishopric, but the Christian community remained small until the second half of the 4th century, when St. Martin, the great apostle of the Gauls, was persuaded to become their bishop. A magnificent basilica was raised above his tomb in the late 5th century, and for hundreds of years it attracted pilgrims to Tours. When the city became part of the Frankish dominion under Clovis I (reigned 481/482–511), he accepted for himself and his successors the title of canon of St. Martin. At the end of the 6th century the bishopric was held by St. Gregory of Tours, author of the *Historia Francorum* (an important contemporary chronicle), who had an abbey built around St. Martin's basilica. The abbey grew immensely rich. The emperor Charlemagne (reigned 768–814) reestablished discipline in the monastery and developed the intellectual life under the English scholar Alcuin. After pillaging incursions by the Normans, a protective wall was built around the St. Martin's district, which 400 years later was united to the borough of Tours when a common wall was built around both Tours and Châteauneuf (originally St. Martin's district and known as Martinopolis). Tours continued to maintain its prosperity in the Middle Ages in spite of involvement in the strife between the French and English kings in the 12th century and later during the Hundred Years' War (1337–1453). In 1462 Louis XI endowed the town with an elected civic council and established a silk industry that thrived for more than a century. The emigration of Huguenots (a Protestant group) after the revocation of the Edict of Nantes (1685) resulted in industrial decline. During the French Revolution of the late 18th century, the town was a base for operations against the royalist Vendée rebels. In World War II the French government had its headquarters there from June 13 to 15, 1940, and British statesman Winston Churchill met French premier Paul Reynaud there in a vain attempt to dissuade France from negotiating an armistice with Germany. In the 1944 bombardments that preceded the German retreat and the liberation, one-fourth of the town was destroyed.

At a point somewhere between Tours and Poitiers is the site of the Battle of Tours (or Poitiers); there, in 732, Charles Martel, master of the Frankish kingdom, defeated Moorish invaders from Spain in a battle that proved to be the turning point in the advance of Islàm into western Europe. The battle is believed by some historians to have been fought at Moussais-la-Bataille, 6 mi (10 km) southwest of Châtellerault. Pop. (1982) 131,265.

**Tours, Battle of** (732): *see* Poitiers, Battle of.

**Tourville, Anne-Hilarion de Cotentin, comte de** (count of) (b. Nov. 24, 1642, château de Tourville, Manche, Fr.—d. May 28, 1701, Paris), French admiral, the outstanding commander of the period when Louis XIV's navy was on the point of winning world supremacy.

Born into the old Norman nobility, Tourville learned seamanship on a Maltese frigate in the Mediterranean. He entered the Royal Navy in 1666 and took part in Louis XIV's war against the Dutch (1672–78). Promoted to lieutenant general in 1682, he supervised shipbuilding and naval schools and participated in attacks on the Barbary pirates in Algiers and Tripoli.

At the outbreak (1689) of the War of the Grand Alliance between France and the other major European powers, Tourville broke the English blockade of Brest, preventing an invasion of Brittany. For this he was promoted to vice admiral of the Mediterranean fleet and naval commander in chief. His victory over the Anglo-Dutch fleet off Beachy Head, near Sussex, on July 10, 1690, caused panic in London but was not followed up. After a skillful sea campaign in 1691, Tourville in 1692



Tourville, detail of an engraving, 17th century
H. Roger-Viollet

was required to collaborate in an ill-planned landing in England; his fleet was annihilated at the Battle of La Hogue. He had, nevertheless, conducted a masterful fight; as a reward, Louis XIV made him a marshal of France (1693). He retired from the navy after the war ended in 1697.

**Toussaint-Louverture,** Louverture also spelled L'OUVERTURE, original name (until *c.* 1793) FRANÇOIS DOMINIQUE TOUSSAINT (b. *c.* 1743, Bréda, near Cape François, Saint-Domingue [Haiti]—d. April 7, 1803, Fort-de-Joux, Fr.), leader of the Haitian independence movement during the French Revolution, who emancipated the slaves and briefly established Haiti as a black-governed French protectorate.

*Rise to power.* Toussaint was the son of an educated slave; he acquired through Jesuit contacts some knowledge of French, though he wrote and spoke it poorly, usually employing the Creole patois and African tribal language. Winning the favour of the plantation manager, he became a livestock handler, healer, coachman, and finally steward. Legally freed in 1777, he married a humble woman who bore him two sons. Toussaint was homely, short, and small framed. He was a fervent Catholic, opposed to voodoo. He dressed simply and was abstemious and a vegetarian. Although he slept little, his energy and capacity for work were astonishing. As a leader he inspired awe and adulation.

A sudden slave revolt in the northern province (August 1791) found him uncommitted. After hesitating a few weeks, he helped his former master escape and then joined the black forces who were burning plantations and killing many whites and mulattoes. He soon discerned the ineptitude of the rebel leaders and scorned their willingness to compromise with white radicals. Collecting an army of his own, Toussaint trained his followers in the tactics of guerrilla warfare. In 1793 he added to his original name the name of Louverture.

When France and Spain went to war in 1793, the black commanders joined the Spaniards of Santo Domingo, the eastern two-thirds of Hispaniola. Knighted and recognized as a general, Toussaint demonstrated extraordinary military ability and attracted such renowned warriors as his nephew Moïse and two future monarchs of Haiti, Jean-Jacques Dessalines and Henry Christophe. Toussaint's victories in the north, together with mulatto successes in the south and British occupation of the coasts, brought the French close to disaster. Yet, in May 1794, Toussaint went over to the French, giving as his reasons that the French National Convention had recently freed all slaves, while Spain and Britain refused, and that he had become a republican. He has been criticized for the duplicity of his dealings with his one-time allies and for a slaughter of Spaniards at a mass. His switch was decisive; the governor of Saint-Domingue, Étienne Laveaux, made Toussaint lieutenant governor, the British suffered severe reverses, and the Spaniards were expelled.

By 1795 Toussaint-Louverture was widely renowned. He was adored by the blacks and appreciated by most whites and mulattoes for he did much to restore the economy. Defying French Revolutionary laws, he allowed many émigré planters to return, and he used military discipline to force the former slaves to work. Convinced that people were naturally corrupt, he felt that compulsion was needed to prevent idleness. Yet the labourers were no longer whipped: they were legally free and equal, and they shared the profits of the restored plantations. Racial tensions were eased because Toussaint preached reconciliation and believed that blacks, a majority of whom were African born, must learn from whites and Europeanized mulattoes.

*Elimination of Rivals.* Though he worked well with Laveaux, Toussaint eased him out in 1796. Léger-Félicité Sonthonax, a terrorist French commissioner, also allowed Toussaint to rule and made him governor general. But the ascetic black general was repelled by the proposals of this white radical to exterminate the Europeans, and he was offended by Sonthonax's atheism, coarseness, and immorality. After some devious manoeuvres, Toussaint forced Sonthonax out in 1797.

Next to go were the British, whose losses caused them to negotiate secretly with Toussaint, notwithstanding the war with France. Treaties in 1798 and 1799 secured their complete withdrawal. Lucrative trade was begun with Britain and also with the United States. In return for arms and goods, Toussaint sold sugar and promised not to invade Jamaica and the American South. The British offered to recognize him as king of an independent Haiti, but, scornful of pompous titles, and distrustful of the British because they maintained slavery, he refused.

Toussaint soon rid himself of another nominal French superior, Gabriel Hédouville, who arrived in 1798 as representative of the Directory. Knowing that France had no chance of restoring colonialism as long as the war with England continued, Hédouville attempted to pit against Toussaint the mulatto leader André Rigaud, who ruled a semi-independent state in the south. Toussaint divined his purpose and forced Hédouville to flee. Succeeding Hédouville was Philippe Roume, who deferred to the black governor. Then a bloody campaign in 1799 eliminated another potential rival to Toussaint by driving Rigaud out and destroying his mulatto state. A purge that was carried out by Jean-Jacques Dessalines in the south was so brutal that reconciliation with the mulattoes was impossible.

*Command of Hispaniola.* Controlling all Saint-Domingue, Toussaint turned to Spanish Santo Domingo, where slavery persisted. Ignoring commands to the contrary by Roume and by Napoleon Bonaparte, who had become first consul of France, Toussaint overran it in January 1801, freed the slaves, and amazed the nonblacks with his magnanimity.

In command of the entire island, Toussaint dictated a constitution that made him governor general for life with near absolute powers. Catholicism was the state religion, and many revolutionary principles received ostensible sanction. There was no provision for a French official, however, because Toussaint professed himself a Frenchman and strove to convince Bonaparte of his loyalty. He also described his success in restoring order and prosperity in epistles that, like all his writings, were ungrammatical yet testify to the grasp, incisiveness, and depth of a formidable intellect.

Bonaparte had confirmed Toussaint-Louver-

ture's position but saw him as an obstacle to the restoration of Saint-Domingue as a profitable colony. Toussaint knew Bonaparte despised Negroes and planned to reinstitute slavery. He was also aware that Bonaparte would seek to intimidate the island upon making peace with England; therefore, he drilled a huge army and stored supplies. Yet Toussaint behaved ambiguously: venerating France, fearing Bonaparte, aging and growing weary, he trusted no one and failed to clarify his purposes. He desired above all to prevent a restoration of slavery while preserving the society he had built. Whites and mulattoes looked hopefully to France to repress the huge black majority; on the other hand, many black leaders, like Moïse, wanted to expel all whites and divide the plantations. Some blacks were alienated by Toussaint's perfidies and equivocations, his mysteriousness, and the occasional atrocities he thought necessary amid such dangers.

A French invasion under General Charles Leclerc began in January 1802 in far greater force than expected. Most whites and mulattoes defected to him; after a few weeks of furious fighting, the chief black leaders, even Christophe and Dessalines, sided with Leclerc as well. In May, Toussaint formally agreed to lay down his arms, in exchange for Leclerc's promise not to restore slavery. Perhaps he foresaw that yellow fever would destroy the French, as it did in the following year.

Leclerc gave Toussaint a spectacular welcome. The black leader retired in honour to a plantation. A few weeks later he attended a parley to discuss his personal situation. Suspected of plotting an uprising, he was seized and sent to Fort-de-Joux in the French Alps, where he was confined and interrogated repeatedly, and where he died in April 1803.

(J.E.F.)

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**Tout, Thomas Frederick** (b. Sept. 28, 1855, London, Eng.—d. Oct. 23, 1929, London), English historian and teacher who specialized in medieval studies and, with James Tait, was a founder of the Manchester school of historiography, which stressed the importance of records and archives.

Tout taught history at St. David's College, Lampeter (1881–90), and at Owens College, later the University of Manchester, until 1925. After 1908 he devoted himself to the specialty in which he made his principal contribution, the study of administrative history. His reputation rests chiefly on *The Political History of England, 1216–1377* (1905), *The Place of the Reign of Edward II in English History* (1914), and his comprehensive *Chapters in the Administrative History of Medieval England*, 6 vol. (1920–33).

**Toutates** (Celtic deity): *see* Teutates.

**Toutin, Jean; and Toutin, Henri** (respectively, b. 1578, Châteaudun, Eure-et-Loire, France—d. June 14, 1644, Paris; b. July 28, 1614, Châteaudun—d. *c.* 1683, Paris), French enamelworkers, father and son, known for their fine enamel miniature paintings. Jean Toutin was one of the first artists to make enamel portrait miniatures.

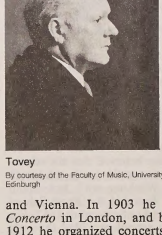
Although the art of enamelwork was hundreds of years old, the elder Toutin developed a revolutionary new technique for enamel painting. Toutin discovered that coloured enamels, when applied to a previously fired white enamel ground, would not run together when the piece was refired. Existing enamel techniques had relied on small bands of gold to separate the colours or small surface indentations to prevent pigments from blending during firing. Toutin's method enabled the artist to apply enamel to a surface almost as paint is applied to canvas. It also permitted the use of a wider range of colours. Thus was gained the precision of colour and detail that made possible miniature portraits in enamel.

The new procedure was laborious, but the works of the Toutins proved popular with French royalty and courtiers. Students came from other parts of the Continent to learn the technique, and the Toutins' art thus spread throughout Europe. It was a particular success in England, where the Swiss-born enamelworkers Jean Petitot and Jacques Bordier moved after studying with the French masters.

Perhaps the most popular of the Toutins' works were their highly elaborate enameled watchcases, in great demand at the court of King Louis XIII, where the Toutins produced enameled miniatures of virtually every member of the French royal family. None of Jean Toutin's work survives today.

**Tovey, Sir Donald Francis** (b. July 17, 1875, Eton, Berkshire, Eng.—d. July 10, 1940, Edinburgh, Scot.), English pianist and composer, known particularly for his works of musical scholarship.

Tovey studied the piano and counterpoint and graduated from the University of Oxford in 1898. Between 1900 and 1902 he gave recitals of his works in London, Berlin,



Tovey

By courtesy of the Faculty of Music, University of Edinburgh

and Vienna. In 1903 he played his *Piano Concerto* in London, and between 1906 and 1912 he organized concerts of chamber music at Chelsea. Besides the *Piano Concerto* his compositions include two string quartets, the opera *The Bride of Dionysus* (first produced in 1929), and a cello concerto (1934). In 1914 he was appointed Reid professor of music at the University of Edinburgh, and in 1917 he founded there the Reid Symphony Orchestra. For the concerts given by this orchestra Tovey wrote analytical notes dealing with problems of composition in a perspicacious and lively manner; these notes were published as *Essays in Musical Analysis*, 6 vol. (1935–39).

Among other historical studies were his articles on music written for *Encyclopædia Britannica* and reprinted as *Musical Articles from the Encyclopædia Britannica* (1944) and his *Essays and Lectures on Music*, edited by H.J. Foss (1949). Though later writers surpassed Tovey in psychological perception, the elegance and wit of his style broadened the appeal of music criticism and helped to establish it as a literary genre. He was knighted in 1935.

**Towada, Lake,** Japanese TŌWADA-KO, lake, on the border of Aomori and Akita *ken* (prefectures), northern Honshu, Japan. Located in the northern extremity of the Ōu Range, the lake occupies a volcanic crater. It is 27 miles (44 km) in circumference and covers an area of 23 square miles (60 square km). Lake Towada is the third deepest lake in Japan, reaching 1,096 feet (334 m) in depth at its centre. It receives water from several mountain streams and drains in the northeast through the Oirase River. Its circular shape is broken in the south by the Ogura and Nakayama promontories.



Lake Towada, central feature of Towada-Hachimantai National Park, Japan

Asao Fujita—Bon

The lake is included in Towada-Hachimantai National Park, a popular recreation area served by such tourist centres as Yasumiya.

**tower,** any structure that is relatively tall in proportion to the dimensions of its base. It may be either freestanding or attached to a building or wall. Modifiers frequently denote a tower's function (*e.g.,* watchtower, water tower, church tower, and so on).

Historically, there are several types of structures particularly implied by the name. Defensive towers served as platforms from which a defending force could rain missiles down upon an attacking force. The Romans, Byzantines, and medieval Europeans built such towers along their city walls and adjoining important gates. The Romans and other peoples also used offensive, or siege, towers, as raised platforms for attacking troops to overrun high city walls. Military towers often gave their name to an entire fortress; the Tower of London, for example, includes the entire complex of buildings contiguous with the White Tower of William I the Conqueror.

Towers were an important feature of the churches and cathedrals built during the Romanesque and Gothic periods. Some Gothic church towers were designed to carry a spire, while others had flat roofs. Many church towers were used as belfries, though the most famous campanile, or bell tower, the Leaning Tower of Pisa (1174), is a freestanding structure. In civic architecture, towers were often used to hold clocks, as in many hotels de ville (town halls) in France and Germany. The use of towers declined somewhat during the Renaissance but reappeared in the more flamboyant Baroque architecture of the 17th and 18th centuries.

The use of steel frames enabled buildings to reach unprecedented heights in the late 19th and 20th centuries; the Eiffel Tower (1889) in Paris was the first structure to reveal the true vertical potential of steel construction. The ubiquity of modern skyscrapers has robbed the word *tower* of most of its meaning, though the Petronas Twin Towers in Kuala Lumpur, Malaysia, the Sears Tower in Chicago, and

other skyscrapers still bear the term in their official names.

The world's tallest freestanding structure is the CN Tower (1976), an observation and broadcasting tower in Toronto, Ont., that rises to more than 1,815 feet (553 m). The tallest supported structure is a 2,063-foot (629-metre) stayed television broadcasting tower, completed in 1963 and located between Fargo and Blanchard, N.D., U.S.

**Tower Hamlets,** inner borough of Greater London, extending eastward from the Tower of London and including most of the East End of inner London. The meandering River Thames forms the southern boundary, the City of London lies to the west, Hackney borough is to the north, and Newham borough lies beyond the River Lea to the east.

The Thames brought successive waves of immigrants to Tower Hamlets: French Huguenots established silk weaving in Spitalfields after 1685; Irish labourers came to build London's expanding wet docks after about 1800; and from the 1880s Jews fled the pogroms of eastern and central Europe and established clothing and footwear crafts on Middlesex Street (Petticoat Lane), Commercial Street, and in Whitechapel. Bengalis, originally drawn to the area as seamen, settled there in increasing numbers from the 1960s. The poverty and attendant social problems of the East End have long drawn attention; in the late 19th century William Booth founded the Salvation Army there.

Traditionally the life of the area centred on the wharves along the Thames. Isambard Kingdom Brunel's steamship *Great Eastern* was launched at Millwall in 1858, and shipbuilding flourished there until the 1890s. Various roads were cut to the docks, and the now recreational Regent's Canal linked the borough to northern England by way of the Grand Union Canal. Heavy damage inflicted by German bombing during World War II prompted a first wave of urban renewal, which was dominated by public housing. Dock and wharf closures after the late 1960s prompted a second, privately driven, development boom. In the 1980s Canary Wharf and the area of the Isle of Dogs saw much innovative construction. Near the Tower of London, the area of St. Katharine Docks (1825–28), abandoned after being bombed, has been transformed since 1968 by the construction of a hotel, a trade centre, apartments, and a marina. Several historic buildings survived the bombings, including the Tower, the Royal Mint (no longer in use), and two churches designed by Nicholas Hawksmoor: St. Anne (1714–30) in Limehouse and Christ Church (1714–29) in Spitalfields.

There is only one bridge across the Thames, Tower Bridge, but the borough is linked to Southwark by underground rail (the Thames Tunnel) and road (Rotherhithe Tunnel, 1904–08). Farther east, both a pedestrian tunnel and the Blackwall Tunnel provide links with Greenwich. Area 8 square miles (20 square km). Pop. (1992 est.) 168,500.

**tower mustard,** herb of the mustard family, a species of rock cress (*q.v.*).

**Tower of ——— :** *see under* descriptive word (*e.g.,* London, Tower of).

**towhee,** any of several North American birds of the family Fringillidae (sometimes Emberizidae), order Passeriformes, that are long-tailed skulkers in thickets, where they noisily scratch for food on the ground. The name is from the call of the rufous-sided towhee (*Pipilo erythrophthalmus*), known as chewink in the southeastern United States; it ranges from Canada to Central America. It is about 20 cm (8 inches) long, with dark hood, white-



Rufous-sided towhee (*Pipilo erythrophthalmus*)
John H. Gerard from The National Audubon Society Collection/Photo Researchers

cornered tail, and rusty flanks; western races have white-spotted wings. A plain-looking towhee of the western United States is the brown towhee (*P. fuscus*). The green-tailed towhee (*Chlorura chlorura*), also western, is gray, white, and greenish, with red-brown cap.

**town meeting,** in the United States, an assembly of local qualified voters in whom is vested the governmental authority of a town. Town meetings are a particularly popular form of governmental administration in New England, where a town is a geographic unit, the equivalent of a civil township elsewhere. In New England, towns are granted powers that are granted only to counties elsewhere, as well as their ordinary municipal powers. County government is therefore comparatively insignificant.

At the meetings, which may be held periodically or on demand, officials and school boards may be elected or chosen to govern between meetings; ordinances may be adopted; and taxes and expenditures may be debated and voted upon. Because of the extraordinary autonomy granted each town, New England state legislatures end up being among the largest in the United States.

**Towne, Laura Matilda** (b. May 3, 1825, Pittsburgh, Pa., U.S.—d. Feb. 22, 1901, Frogmore, S.C.), American educator known for founding one of the earliest and most successful of the freedmen's schools for former slaves after the American Civil War.

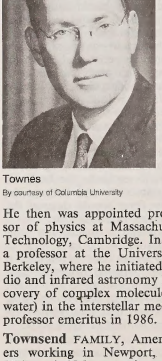
Towne was a charity school teacher and student of homeopathic medicine. She sailed for the coastal islands of South Carolina in 1862 after the Union forces defeated the Confederacy there because she believed that the education of former slaves would prove the worth of emancipation. Working with her friend Ellen Murray, she founded the Penn School on St. Helena's Island in September 1862. For several decades the school provided the only secondary education available to blacks on the Sea Islands. After 1870, it became a teacher-training institution.

Towne also worked as a public health officer, temperance advocate, and legal adviser to the newly freed islanders.

**Townes, Charles Hard** (b. July 28, 1915, Greenville, S.C., U.S.), American physicist, joint winner with the Soviet physicists Aleksandr Mikhaylovich Prokhorov and Nikolay Gennadiyevich Basov of the Nobel Prize for Physics in 1964 for his investigations into what later became known as quantum electronics and specifically for his role in the invention of the maser and the laser.

Townes studied at Furman University (B.A., B.S., 1935), Duke University (M.A., 1937), and the California Institute of Technology (Ph.D., 1939). In 1939 he joined the technical staff of Bell Telephone Laboratories, Inc., where he worked until 1948, when he joined the faculty of Columbia University. Three years later he conceived the idea of using ammonia molecules to amplify microwave radiation. Townes and two students completed the first such device in December 1953 and gave it the name maser, an acronym for "microwave amplification by stimulated emission of radiation." In 1958 Townes and A.L. Schawlow showed that it was possible to construct a similar device using light—*i.e.,* a laser.

From 1959 to 1961 Townes served as vice president and director of research of the Institute for Defense Analyses, Washington, D.C.



Townes
By courtesy of Columbia University

He then was appointed provost and professor of physics at Massachusetts Institute of Technology, Cambridge. In 1967 he became a professor at the University of California, Berkeley, where he initiated a program of radio and infrared astronomy leading to the discovery of complex molecules (ammonia and water) in the interstellar medium. He became professor emeritus in 1986.

**Townsend** FAMILY, American cabinetmakers working in Newport, R.I., during the 17th and 18th centuries and forming with the Goddard family the Goddard-Townsend group, known for case furniture characterized by block fronts (divided into three panels, with the central panel recessed) and decorative carved shell motifs, frequently in the graceful and somewhat ornate style developed by the English cabinetmaker Thomas Chippendale.

Job Townsend (1699–1765) and his brother Christopher Townsend (1701–73) were the first generation involved in cabinetmaking. Job's daughter married John Goddard, then his apprentice and the first of the Goddard family associated with the Townsends. The only known piece bearing Job's label is a desk-bookcase at the Rhode Island School of Design, Providence. Other pieces attributed to him include a chest of drawers and a dressing table. Christopher's work was apparently much like that of his brother, although no existing pieces are definitely attributed to him.

Five of Job's sons became cabinetmakers. The account books of Job Edward Townsend, Jr. (1726–1818), list various pieces made to order. A bureau bears the label of Edmund Townsend (1736–1811). Thomas Townsend (1742–1822), a carpenter, was banished to Massachusetts by the British from 1775 to 1780. He later became an innkeeper. Robert M. Townsend (d. 1805) left a cabinetmaking business that was taken over by his brother Job. James Townsend (d. 1827) is considered by some authorities to be responsible for much of the carving that decorates pieces made by the Goddard-Townsend group.

Christopher's son John Townsend (1732–1809), recognized as one of the outstanding craftsmen of the group, was held by the British for several weeks in 1777 and is believed to have worked in Connecticut after his release, returning to Newport in 1782. About nine pieces bearing his label have been found. Labeled pieces of John's work include a chest of drawers, a breakfast table, a clock case, and other tables. The William Rockhill Nelson Gallery of Art, Kansas City,

Mo., has two matching card tables, one bearing his label. John's brother, Jonathan (1745–72), also worked as a cabinetmaker.

Edmund's son Job E. (1758–78) was apparently apprenticed as a cabinetmaker, but he died at the age of 20. There is no indication that his two brothers became cabinetmakers.

John F., known to be living in 1829, was John's son. A desk at the Newport Historical Society is attributed to him, but his work is not considered equal in quality to that of his father.

**Townsend, Sir John Sealy Edward** (b. June 7, 1868, Galway, County Galway, Ire.—d. Feb. 16, 1957, Oxford), British physicist who pioneered in the study of electrical conduction in gases and made the first direct measurement of the unit electrical charge (*e*).

In 1895 he entered Trinity College, Cambridge, becoming a research student at the Cavendish Laboratory under J.J. Thomson. In 1899 he became a fellow of Trinity College and the following year was appointed the first Wykeham Professor of Experimental Physics at Oxford University.

In 1897 Townsend developed the falling-drop method for measuring *e*. His procedure, which used saturated clouds of water, was later improved and ultimately led to the highly accurate oil-drop method developed by Robert A. Millikan of the U.S. In 1901 he discovered that gas molecules can be ionized by collision with ions.

After 1908 Townsend concentrated on the study of the properties of electron swarms. He also deduced the collision cross section (probability) for momentum transfer in terms of the mean energy. Independently of the German physicist Carl Ramsauer, he discovered the Ramsauer–Townsend effect: that the mean free path of electrons depends on their energy. This effect was later of extreme importance in understanding the electron's wavelike nature as described in the quantum theory.

Although Townsend retired in 1941 (the year that he was knighted), he continued his work and writing. His books include *The Theory of Ionisation of Gases by Collision* (1910); *Motion of Electrons in Gases* (1925); *Electricity and Radio Transmission* (1943); and *Electromagnetic Waves* (1951).

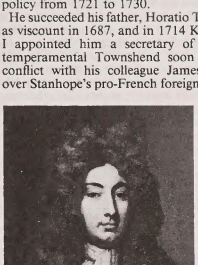
**Townshend, Charles** (b. Aug. 27, 1725—d. Sept. 4, 1767, London), British chancellor of the Exchequer whose measures for the taxation of the British-American Colonies intensified the hostilities that eventually led to the U.S. War of Independence.

He was the second son of the 3rd Viscount Townshend. As a member of the Board of Trade from 1749 to 1754, he showed an interest in increasing British powers of taxation and control over the Colonies. In 1754 and 1755 he served on the Board of Admiralty. He was secretary at war in 1761–62 and paymaster general from May 1765 to July 1766, when he became chancellor of the Exchequer in the ministry of William Pitt, the Elder. Soon Pitt became severely ill, and Townshend assumed effective control of the administration.

Townshend proved to be financially brilliant and determined but devoid of sound political judgment. In his last official act before his death, he obtained passage (June–July 1767) of four resolutions that threatened American colonial traditions of self-government and imposed revenue duties on a number of items necessary to the Colonies. The provision that customs revenue would be used to pay officials caused concern among the colonists because it reduced the dependence of such officials on the colonial assemblies. Townshend estimated that the acts would produce the insignificant sum of £40,000 for the British Treasury; shrewder observers correctly prophesied that they would lead to the loss of the Colonies. *Charles Townshend* by Sir Lewis Namier and John Brooke was published in 1964.

**Townshend (of Rainham), Charles Townshend, 2nd Viscount** (b. April 18, 1675—d. June 21, 1738, Raynham, Norfolk, Eng.), Whig statesman who directed British foreign policy from 1721 to 1730.

He succeeded his father, Horatio Townshend, as viscount in 1687, and in 1714 King George I appointed him a secretary of state. The temperamental Townshend soon came into conflict with his colleague James Stanhope over Stanhope's pro-French foreign policy and



Lord Townshend, detail of a painting by Sir Godfrey Kneller, *c.* 1704; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

as a consequence was demoted in December 1716 to lord lieutenant of Ireland. He and his brother-in-law Robert Walpole (later earl of Orford) then formed an effective opposition movement within the Whig Party.

After the two Whig factions were reconciled in 1720, Townshend became president of the Privy Council and (in 1721) secretary of state. By 1724 he and Walpole were the leading figures in the ministry. Townshend's major diplomatic achievement was the formation of the League of Hanover (1725), which brought England, France, and Prussia into an alliance against Austria and Spain. Nevertheless, in 1730 Townshend resigned because Walpole—by now the dominant minister—would not allow him to pursue an aggressive policy against Austria.

Townshend earned his nickname "Turnip Townshend" for his contribution to the development of the use of turnips in crop rotation.

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**Townshend Acts** (June 15–July 2, 1767), in U.S. colonial history, series of four acts passed by the British Parliament in an attempt to assert what it considered to be its historic right of colonial authority through suspension of a recalcitrant representative assembly and through strict collection provisions of additional revenue duties. The British-American colonists named them after Charles Townshend who sponsored them.

The Suspending Act prohibited the New York Assembly from conducting any further business until it complied with the financial requirements of the Quartering Act (1765) for the expenses of British troops stationed there. The second act, often called the Townshend duties, imposed for the second time in history direct revenue duties, payable at colonial ports, on lead, glass, paper, paint, and tea. The third act established strict and often arbitrary machinery of customs collection in the American Colonies, including additional officers, searchers, spies, coast guard vessels, search warrants, writs of assistance, and a Board of Customs Commissioners at Boston, all to be financed out of customs revenues. The fourth Townshend Act lifted commercial duties on tea, allowing it to be exported to the Colonies free of all British taxes.

The acts posed an immediate threat to established traditions of colonial self-government, especially the practice of taxation through representative provincial assemblies. They were resisted everywhere with verbal agitation and physical violence, deliberate evasion of duties, renewed nonimportation agreements among merchants, and overt acts of hostility toward British enforcement agents, especially in Boston. Such colonial tumult, coupled with the instability of frequently changing British ministries, resulted, on March 5, 1770 (the same day as the Boston Massacre), in repeal of all revenue duties except that on tea, lifting of the Quartering Act requirements, and removal of troops from Boston, which thus temporarily averted hostilities.

**township,** unit of government found primarily in the northeast and north central United States; it is a subdivision of a county and is usually 36 square miles (about 93 square kilometres) in area. The term civil township is sometimes used to distinguish it from the congressional, or survey, township of six miles by six miles, which is not a unit of government.

In some states a township meeting, patterned after the New England town meeting, levies township taxes, makes appropriations, enacts bylaws, and serves in general as the policy-determining organ of the township. A township board, either elected or ex officio, ordinarily appoints certain officers and performs other administrative duties. If there is no township meeting the board customarily acts as the township's policy-determining agency. In some states there is a principal administrative officer, usually known as supervisor or trustee. Other township offices commonly include those of clerk, treasurer, assessor, road commissioner, and supervisor of public assistance. Justices of the peace and constables, although they are state rather than local officers, are commonly elected from the townships. Township functions vary widely, but the major services most commonly performed are maintenance of local roads and administration of public assistance. Property assessment is a township function in some instances, and in a few states the township serves as an area for school administration.

In the second half of the 20th century the U.S. township system as a unit of local government has declined steadily. In some areas it has been eliminated and its functions have been transferred to the county.

**Townsville,** city and major port, eastern Queensland, Australia, at the mouth of Ross Creek on Cleveland Bay of the Coral Sea. Founded in 1864 and named after Robert Towns, it was gazetted a town in 1865 and served as a centre for trade with the Pacific Islands. Proclaimed a municipality in 1866, it became a city in 1903. Lying close to Flinders Passage through the Great Barrier Reef offshore, it has one of Queensland's finest artificial harbours. The confluence of rail lines from Brisbane (690 mi [1,110 km] southeast), Cairns, Charters Towers, Mount Isa, and Cloncurry, the city also has air links to major cities and is the junction of the Bruce and Flinders highways. Townsville is the seat of James Cook University of North Queensland (1970) and of the Australian Institute of Marine Science. It is now the commercial centre for northern Queensland and handles beef cattle, sheep, sugar and other agricultural crops, and ores. Major industries include meat and sugar processing, copper refining, railroad repair, timber milling, boatbuilding, and the manufacture of steel, cans, and cement. A large prawning and fishing fleet operates out of Townsville. A tourist base for the Great Barrier Reef and the Atherton Plateau, the city is dominated by the 938-ft (286-m) Castle

Hill, which overlooks Magnetic Island. Pop. (1991) 101,398.

**Towson,** unincorporated community, Baltimore county, Maryland, U.S. Named for Ezekiel Towson, who settled the area about 1750, it was made county seat in 1854 and evolved as a northern residential-industrial suburb of Baltimore. It is the seat of Goucher College (1885) and Towson State University (1866; formerly Maryland State Teachers College, which moved from Baltimore in 1915). The Hampton National Historical Site, preserving a Georgian mansion (1783–90), is just to the north. Pop. (1990) 49,445.

**Towton, Battle of** (March 29, 1461), battle fought on Palm Sunday, near the village of Towton about 10 miles (16 km) southwest of York, now in North Yorkshire. The largest and bloodiest battle of the Wars of the Roses, it secured the English throne for Edward IV against his Lancastrian opponents. The Lancastrians had failed to seize London after their victory at the Second Battle of St. Albans on Feb. 17, 1461, and were forced to retreat before the converging armies of Edward and Richard Neville, the earl of Warwick. The Yorkists swiftly pursued them, crossed the River Aire on March 28, and attacked the following day. The two sides had been battling for 10 hours in a raging snowstorm when the arrival of fresh troops under John Mowbray, 3rd duke of Norfolk, broke the Lancastrians' morale and dispersed their ranks. The fugitives were slaughtered mercilessly by the pursuing Yorkists. Although the estimates vary widely, the numbers engaged and the numbers killed were far greater than in any other battle of the Wars of the Roses.

**toxaphene,** a dense, yellowish, semisolid mixture of organic compounds made by chlorination of camphene (a hydrocarbon obtained from turpentine) and used as an insecticide. Toxaphene, which contains 67–69 percent chlorine, is insoluble in water but highly soluble in several organic solvents; under the influence of light, heat, or strong alkalies, it decomposes, forming hydrogen chloride and losing its toxicity to insects.

Strobane, a straw-coloured liquid made by the reaction of chlorine with a mixture of camphene and pinene, is an insecticide similar to toxaphene. Both are toxic to a wide variety of insects and are used in combating pests that attack cotton and other field crops.

**toxemia of pregnancy,** term formerly used to describe hypertensive conditions that can be induced by pregnancy. This term, once commonly used, reflected the belief that toxins caused the hypertensive conditions. Research, however, failed to identify any toxins, and the term is now regarded as a misnomer. *See* preeclampsia and eclampsia; pregnancy.

**toxic diffuse goitre:** *see* Graves' disease.

**toxic multinodular goitre** (endocrine disorder): *see* Plummer's disease.

**toxic shock syndrome,** disease first described in 1978 and characterized by high fever, headache, diarrhea, vomiting, irritability, sore throat, and rash. Abdominal tenderness, severe hypotension, shock, respiratory distress, and renal failure sometimes develop. The condition has been ascribed to a newly recognized exotoxin—that is, a toxin formed by bacteria, in this case, *Staphylococcus aureus.*

At the time of its identification the disease was associated primarily with menstruating women who used tampons. Scientists later found that several types of highly absorbent material (polyacrylate rayon and polyester foam), which are no longer used in tampons, latch onto magnesium from the body. The higher the absorbancy the greater the risk. The resulting low-magnesium environment promoted the bacterial production of toxin.

Toxic shock syndrome has been reported in men as well as women and was found to be linked to a broad range of causes, including postsurgical infections. Because there is no effective antibiotic, treatment consists primarily of intensive support therapy. Most patients recover in 7 to 10 days; the mortality rate is 10–15 percent. In many patients the syndrome recurs up to eight months later but often in a milder form.

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**toxicology,** study of poisons and their effects, particularly on living systems. Because many substances are known to be poisonous to life (whether plant, animal, or microbial), toxicology is a broad field, overlapping biochemistry, histology, pharmacology, pathology, and many other disciplines.

The study and classification of toxic substances was first systematized by Matthieu Orfila (1787–1853) in the 19th century. Traditionally, the toxicologist's functions have been to identify poisons and to search for antidotes and other means of treating toxic injuries. An area related to the ancient practice of toxicology, forensic toxicology, dealing with the criminal use of poisons, also has a long history. With the proliferation of new, potentially toxic substances, however, the practical applications of toxicology have multiplied. In the ecological sciences, toxicologists play a part in the identification and elimination of environmental contaminants. Evaluation of occupational exposure to toxic substances is another aspect of the toxicologist's work. In the United States toxicologists work with the federal government's Food and Drug Administration, attempting to identify potential dangers to public health posed by chemical additives in food and cosmetics; along with pharmacologists, toxicologists also participate in the safety testing of new drugs.

Perhaps the area of largest expansion is the study of toxic waste. Environmental toxicology has taken on great importance as toxic wastes from a variety of industrial processes foul the air, water, and soil, creating many hitherto unknown, and often (to the average citizen) undetectable, hazards. Among the concerns of toxicologists and scientists worldwide are the use of chlorofluorocarbons (which affect the ozone layer in the atmosphere), the effects of acid rain on the world's forests, and the release of harmful radioactive substances into the soil, groundwater, oceans, and air.

**toxin,** any substance poisonous to an organism. The term is sometimes restricted to poisons spontaneously produced by living organisms (biotoxins). Besides the poisons produced by such microorganisms as bacteria, dinoflagellates, and algae, there are toxins from fungi (mycotoxins), higher plants (phytotoxins), and animals (zootoxins). The name phytotoxin may also refer to a substance, regardless of origin, poisonous to plants.

Some biotoxins appear to be of little use to the organisms producing them but may play unknown roles in the organisms' metabolism, or they may be waste products. Many others, however, confer obvious advantages on their producers, such as depressing the growth of competitors or preventing predation. Many of the thousands of known phytotoxins are known to protect their producers against certain animals, especially insects. Similar defensive secretions are numerous among animals and may be either widely distributed among the tissues or concentrated in certain tissues, in which case there is often some sort of delivery system, such as spines or fangs.

Numerous animals (*e.g.,* spiders and some snakes) have evolved poisons as aids in securing prey and often use the same poison for defense.

Many normally edible fishes and shellfishes become poisonous after feeding on toxic plants or algae. When a toxic fish or shellfish is eaten, the poison attacks the consumer's nervous system and causes a sometimes fatal condition called ciguatera. *See* poison.

**Toxodon,** genus of extinct mammals of the Late Pliocene and Pleistocene epochs in South America (the Pliocene Epoch preceded the Pleistocene and ended about 1.6 million years ago). The genus is representative of a large group of extinct animals that dominated the South American fauna before the end of the Pleistocene Epoch. A large animal about 2.75 m (9 feet) long and about 1.5 m high at the shoulder, *Toxodon* resembled a short rhinoceros. The nasal openings, on top of the skull, indicate a large, well-developed snout. The massive skeleton suggests that it supported a large, heavy body. The front, or incisor, teeth were separated from each other by large gaps and from the cheek teeth by even larger gaps. The feet were short and broad and had three functional toes; the major stresses were directed through the axis of the central toe. *Toxodon* was probably the most common large hoofed mammal in South America during the Pleistocene.

**toxoid,** bacterial poison (toxin) that is no longer active but retains the property of combining with or stimulating the formation of antibodies. In many bacterial diseases the bacteria itself remains sequestered in one part of the body but produces a poison (exotoxin) that causes the disease manifestations. Heating this poison or treating the poison with chemicals converts the exotoxin into a harmless toxoid; when the toxoid is injected into the body, it causes the formation of antibodies that will also react with the active toxin and thus confer immunity from subsequent infection.

Toxoids are used extensively in the production of vaccines, the most prominent examples being the toxoids of diphtheria and tetanus, which are often given in a combined vaccine. Toxoids used in modern vaccines are commonly obtained by incubating toxins with formaldehyde at 37° C (98.6° F) for several weeks.

**toxoplasmosis,** infection of tissue cells of the central nervous system, spleen, liver, and other organs by a parasite, *Toxoplasma gondii.* Infection occurs in domestic and wild animals, birds, and humans and is worldwide in distribution. It is estimated that 30 to 50 percent of the world's human population carries demonstrable antibodies (indicating previous exposure), but overt symptoms are rare in adults. Swollen glands and fever are the most common findings in those who have any symptoms.

Organisms of the genus *Toxoplasma* reproduce by fission or internal budding. They move by a gliding motion, lacking either flagella or pseudopodia. Of uncertain taxonomic position, they are considered to be related to the sporozoa and possibly to the fungi. They are generally placed in the sporozoan class Toxoplasmea, although they may more properly be classed as coccidian parasites under the order Eucoccidia.

The mode of transmission of the organisms is unknown, although they can be passed from mother to fetus through the placenta. Congenital toxoplasmosis may result in stillbirth or abortion; infected infants may show various symptoms including jaundice, encephalitis, mental defects, and eye disease. Siblings of an infected infant are usually normal.

**toy,** plaything for an infant or child. A toy is often an instrument used in a game. Toys, playthings, and games survive from the most remote past and from a great variety of cultures. They vary from the simplest to the most complex, from the natural stick selected by a child and imagined to be a hobbyhorse to sophisticated and complex mechanical devices that entertained both young and old in the courts of 18th-century Europe. Museums in many countries exhibit antique objects, the original purpose of which may be unknown but which children may have used or adopted for playthings. A clay animal figure on wheels, from an early Mexican culture in which no other record of the wheel has been discovered, may have been a toy. One of the most ancient toys is the ball.

Play with toys follows two main directions, imitative and instructive. The earliest types of play probably developed from the instinct for self-preservation. In many human cultures, one of the first things taught to the young was the use of weapons, and the natural club or stick was the prototype of toy swords, guns, tanks, airplanes, ships, and other military instruments of play. Most games and sports requiring physical action derived from practice of the skills of warfare, and the instruments of the game or sport were regarded as weapons. Toy soldiers and weapons dating from the Middle Ages are extant. The latest developments in warfare are represented among contemporary toys, as are those weapons and machines fantasized in science fiction books and motion pictures.

A basic toy is the doll (*q.v.*). Every epoch and culture has provided its children with miniatures of human beings or animals and of the artifacts used in daily living. Many static toys are of this type: miniature versions of real beings or objects that lend themselves to an imaginative or imitative use.

Moving toys include a wider variety. It is probable that many experiments with basic physical principles were first realized in the form of moving toys known through literary description. Explosive toy weapons and rockets developed from the early use of gunpowder for fireworks by the Chinese. Balance and counterbalance, the wheel, the swing, the pendulum, flight, centrifugal force, magnetism, the spring, and a multitude of other devices and principles have been utilized in toys. Modern technological developments have made possible the production of such sophisticated moving toys as scale-model electric railroad trains and auto-racing tracks and cars, radio-controlled model aircraft, and dolls that walk, talk, and perform other stunts when activated by a beam of light.

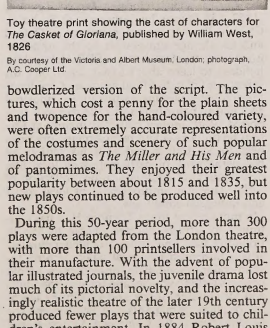
Coordination and other manual skills develop from cumulative childhood experiences received during the manipulation of toys—marbles, jackstones, and other toys requiring use of hands and bodies. Mental agility, beginning with childhood, is challenged by puzzles of spatial relationships.

Roman children and adults threw knucklebones, which were probably the precursors of dice as well as of jackstones. Dice, in turn, are essential in a host of other games of chance. Other forms of toys probably derive from magical artifacts and fetishes that played a prominent part in primitive religions. In celebrating the Mexican festival of the Day of the Dead, sugar is formed into elaborate and beautiful skulls, tombs, and angels; they are essentially religious symbols, but in the hands of children they become toys that are played with and finally eaten. Christmas-tree decorations, Easter eggs, the Neapolitan *presepio* (crèche) with its wealth of elaborate figures representing the birth of Jesus are other examples of toys of religious origin. A modern relic of early culture, the kachina doll of the Pueblo Indians, while essentially an instructive sacred object, inevitably is played with by children. Under the pressure of industrialization, folk culture and tradition are rapidly disappearing, but in many countries a variety of folk or homemade toys can still be found. Toys in developed countries are usually mass-produced, with technology providing their locomotion and other actions.

**Toy Bulldog, The** (boxer): *see* Walker, Mickey.

**toy theatre,** also called JUVENILE DRAMA, popular 19th-century English children's toy that provides modern theatre historians with a valuable record of the plays and playhouses of its day.

Most scholars believe the juvenile drama to have originated with the engraved sheets that began to be printed in London around 1810 as souvenirs of current plays. Each sheet depicted the principal characters of the plays in their most dramatic attitudes, and the names and fairly accurate portraits of the actors who played them were often given. The figures, which could be cut out and mounted on pasteboard, soon became a popular children's plaything, and the souvenir sheets began to include pictures of scenery as well. The success of this idea resulted in a series designed especially for children, with from 10 to 20 cutout sheets depicting all the characters and scenery of a play, together with a condensed and often



Toy theatre print showing the cast of characters for *The Casket of Gloriana,* published by William West, 1826

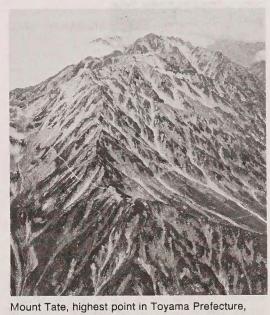
By courtesy of the Victoria and Albert Museum, London; photograph, A.C. Cooper Ltd.

bowdlerized version of the script. The pictures, which cost a penny for the plain sheets and twopence for the hand-coloured variety, were often extremely accurate representations of the costumes and scenery of such popular melodramas as *The Miller and His Men* and of pantomimes. They enjoyed their greatest popularity between about 1815 and 1835, but new plays continued to be produced well into the 1850s.

During this 50-year period, more than 300 plays were adapted from the London theatre, with more than 100 printsellers involved in their manufacture. With the advent of popular illustrated journals, the juvenile drama lost much of its pictorial novelty, and the increasingly realistic theatre of the later 19th century produced fewer plays that were suited to children's entertainment. In 1884 Robert Louis Stevenson wrote an essay entitled "Penny Plain, Twopence Coloured," a nostalgic tribute to the entire genre of juvenile drama. Germany, Austria, France, and Denmark, among other nations, had a similar type of juvenile drama.

A few publishers kept the old stock in print until the 20th century, and, after World War II, there was a revival of interest in toy theatre.

**Toyama,** *ken* (prefecture), central Honshu, Japan. It lies along the Sea of Japan and occupies an area of 1,642 square miles (4,252 square km). The coastal plain is indented by Toyama Bay. Watered by numerous rivers,



Mount Tate, highest point in Toyama Prefecture, Japan

Photos Pack—EB Inc.

including the Shō, Jinzū, and Kurobe, the prefecture is an important rice-producing area. The mountainous interior rises to 9,892 feet (3,015 m) in Mount Tate, which lies in Chūbu-sangaku National Park. The mountains are a source of hydroelectric power and minerals that serve as a basis for the chemical, textile, machinery, pulp and paper, and steel industries.

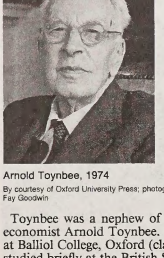
Toyama, the prefectural capital, is an old castle town located at the mouth of the Jinzū River. Since the 17th century it has been the chief centre for the production of patent medicines and drugs. In 1964 Toyama was joined with Takaoka to form the Toyama–Takaoka New Industrial City. The city is also an important educational, chemical, and textile centre. Other important towns on the coast include Shimminato, Namerikawa, Uozu, and Kurobe. Pop. (1985) city, 314,111; prefecture, 1,118,364.

**Toynbee, Arnold** (b. Aug. 23, 1852, London—d. March 9, 1883, Wimbledon, Eng.), English economist and social reformer noted for his public service activities on behalf of the working class.

The son of a surgeon, Toynbee graduated from Balliol College, Oxford, in 1878. He was then appointed a tutor at Balliol, where his lectures on the economic history of the Industrial Revolution in Britain proved widely influential. The collection of his lectures, published posthumously as *The Industrial Revolution* in 1884, was one of the first economic histories of Britain's industrial development in the 18th and 19th centuries.

Toynbee was also a practical social reformer. He encouraged the development of trade unions and lectured to working-class audiences in large industrial cities. His interest in and desire to help Britain's growing proletariat led him into a close association with the poor working-class district of Whitechapel in East London, and his attempts to establish housing and libraries there were commemorated after his death by Toynbee Hall, a pioneering social settlement in East London. Toynbee died after suffering a complete breakdown in health owing to overwork.

**Toynbee, Arnold (Joseph)** (b. April 14, 1889, London—d. Oct. 22, 1975, York, North Yorkshire, Eng.), English historian whose 12-volume *A Study of History* (1934–61) put forward a philosophy of history, based on an analysis of the cyclical development and decline of civilizations, that provoked much discussion.



Arnold Toynbee, 1974
By courtesy of Oxford University Press; photograph, Fay Godwin

Toynbee was a nephew of the 19th-century economist Arnold Toynbee. He was educated at Balliol College, Oxford (classics, 1911), and studied briefly at the British School at Athens, an experience that influenced the genesis of his philosophy about the decline of civilizations. In 1912 he became a tutor and fellow in ancient history at Balliol College, and in 1915 he began working for the intelligence department of the British Foreign Office. After serving as a delegate to the Paris Peace Conference in 1919 he was appointed professor of Byzantine and modern Greek studies at the University of London. From 1921 to 1922 he was the *Manchester Guardian* correspondent during the Greco-Turkish War, an experience that resulted in the publication of *The Western Question in Greece and Turkey* (1922). In 1925 he became research professor of international history at the London School of Economics and director of studies at the Royal Institute of International Affairs in London.

Toynbee began his *Study of History* in 1922, inspired by seeing Bulgarian peasants wearing fox-skin caps like those described by Herodotus as the headgear of Xerxes' troops. This incident reveals the characteristics that give his work its special quality—his sense of the vast continuity of history and his eye for its pattern, his immense erudition, and his acute observation.

In the *Study* Toynbee examined the rise and fall of 26 civilizations in the course of human history, and he concluded that they rose by responding successfully to challenges under the leadership of creative minorities composed of elite leaders. Civilizations declined when their leaders stopped responding creatively, and the civilizations then sank owing to the sins of nationalism, militarism, and the tyranny of a despotic minority. Unlike Spengler in his *The Decline of the West*, Toynbee did not regard the death of a civilization as inevitable, for it may or may not continue to respond to successive challenges. Unlike Karl Marx, he saw history as shaped by spiritual, not economic forces.

While the writing of the *Study* was under way, Toynbee produced numerous smaller works and served as director of foreign research of the Royal Institute of International Affairs (1939–43) and director of the research department of the Foreign Office (1943–46); he also retained his position at the London School of Economics until his retirement in 1956. A prolific writer, he continued to produce volumes on world religions, western civilization, classical history, and world travel throughout the 1950s and 1960s. After World War II Toynbee shifted his emphasis from civilization to the primacy of higher religions as historical protagonists. His other works include *Civilization on Trial* (1948), *East to West: A Journey Round the World* (1958), and *Hellenism: The History of a Civilization* (1959).

Toynbee has been severely criticized by other historians. In general, the critique has been leveled at his use of myths and metaphors as being of comparable value to factual data and at the soundness of his general argument about the rise and fall of civilizations, which relies too much on a view of religion as a regenerative force. Many critics complained that the conclusions he reached were those of a Christian moralist rather than of a historian. His work, however, has been praised as a stimulating answer to the specializing tendency of modern historical research.

**Toynbee, (Theodore) Philip** (b. June 25, 1916, Oxford—d. June 15, 1981, St. Briavels, near Lydney, Gloucestershire, Eng.), English writer and editor best known for novels that experiment with time and symbolical elements.

Philip Toynbee was the son of the historian Arnold Toynbee and grandson of the classical scholar Gilbert Murray. He was educated at Rugby School and the University of Oxford. In 1938–39 he edited a newspaper, the *Birmingham Town Crier*. After service in World War II he worked in publishing and, from 1950, was on the editorial staff of the newspaper *The Observer*.

Of Toynbee's experimental, subjective novels, the best known are *The Savage Days* (1937), *The Barricades* (1943), and *Tea with Mrs. Goodman* (1947). Later he wrote novels in verse, notably the "Pantaloon" series: *Pantaloon or the Valediction* (1961), *Two Brothers* (1964); *A Learned City* (1966), *Views from a Lake,* (1968). With his father, Arnold, he wrote *Comparing Notes: A Dialogue Across a Generation* (1963).

*Articles are alphabetized word by word, not letter by letter*

**Toynbee Hall,** pioneering social settlement in East London, founded in 1884 by Canon Samuel Augustus Barnett and named after the English social reformer Arnold Toynbee (1852–83). During his early years at St. Jude's Church, Barnett invited members of Oxford and Cambridge universities to the impoverished working-class district of Whitechapel for holidays to learn about social conditions; his subsequent plan to found a house of residence for graduates wishing to live in an industrial area and to contribute to its life was well supported. With money collected mainly at Oxford he purchased and reconstructed premises next to St. Jude's; and with his settlers he began the work of participation in local life, development of adult education, collection of social data, and improvement of local social and industrial conditions.

In more recent times Toynbee Hall has continued to attract educated people to live in London's East End. It has provided a citizens' advice bureau, a free legal advice centre, invalid children's aid, help for alcoholics, an old people's welfare service, and theatres for adults and for children. It has undertaken the teaching of adult immigrants and has become the headquarters of the Campaign Against Racial Discrimination, of the Community Service Volunteers, and of the East London Society of Arts.

**Tōyō Kōgyō Company:** *see* Mazda Motor Corporation.

**Toyohashi,** city, Aichi *ken* (prefecture), Honshu, Japan. The city is situated on Atsumi Bay. Formerly called Yoshida, the old castle town was the scene of much fighting during the 16th century, and it changed hands often during the Tokugawa period (1603–1867). After the late 19th century, it became one of the largest silk manufacturing centres of Japan. Main production shifted to cotton and synthetic textiles following the decline in silk consumption after World War II. Pop. (1985) 322,142.

**Toyokawa,** city, Aichi *ken* (prefecture), Honshu, Japan. It is situated along the lower reaches of the Toyo River. The city developed around the Toyokawa Inari Shrine and served as a post town on the Tōkaidō (Eastern Sea Highway) during the Tokugawa era (1603–1867). The city's munitions industry, established in 1939, led to a rapid increase in population, but it declined after World War II. The former military installations were converted into an industrial site in 1957, and automobile parts, optical instruments, toys, and lumber are now produced.

The Toyokawa shrine celebrates several festivals during the year, attracting pilgrims throughout Japan. The city also houses the Research Institute of Atmospherics of Nagoya University. Pop. (1985) 107,430.

**Toyokuni** (artist): *see* Utagawa Toyokuni.

**Toyonaka,** city, Ōsaka *fu* (urban prefecture), Honshu, Japan. It lies just north of Ōsaka city. A former rural town set amid rice paddies, it became a residential suburb of Ōsaka after the opening of a railway to that city in 1910. Ōsaka's northern industrial zone has extended into Toyonaka, with machinery, metal, and knitting plants and petroleum refineries. Part of the Ōsaka International Airport lies within the suburb's boundaries. Pop. (1985) 413,219.

**Toyota,** formerly (until 1938) KOROMO, city, Aichi *ken* (prefecture), Honshu, Japan. It lies along the middle reaches of the Yahagi River. It originated as a castle town, with its commercial quarter serving as a collection and distribution centre for silk cocoons. The head office of the Toyota Motor Company was moved to the city from Kariya in 1938, and Toyota subsequently developed rapidly. Particularly after 1955, Toyota built large factories for the production of passenger vehicles and auto parts, using steel from Tokai. Pop. (1985) 308,106.

**Toyota Motor Corporation,** Japanese TOYOTA JIDŌSHA KK, Japanese parent company of the Toyota group and one of the largest automobile manufacturers in the world. Most of its subsidiary companies are involved in the production of automobiles, automobile parts, and commercial and industrial vehicles. Headquarters are in Toyota City.

Toyota Motor Corporation began in 1933 as a division of the Toyoda Automatic Loom Works, Ltd., now a subsidiary. It was incorporated as the Toyota Motor Company, Ltd., in 1937. Since then Toyota has established several related companies, including Toyoda Machine Works, Ltd. (1941), and Toyota Auto Body, Ltd. (1945). During the 1960s and '70s the company expanded at a rapid rate and began exporting large numbers of automobiles to foreign markets. Toyota also acquired such companies as Hino Motors, Ltd. (1966), which manufactures buses and large trucks, Nippondenso Company, Ltd., which makes electrical auto components, and Daihitsu Motor Company, Ltd. (1967). For several decades Toyota has been Japan's largest automobile manufacturer. The company took its present name in 1982, when the motor company was merged with Toyota Motor Sales Company, Ltd.

Toyota has assembly plants and distributors in many foreign countries, and its vehicles, some in the form of unassembled units, are exported to more than 140 countries. In addition to automotive products, subsidiaries

manufacture rubber and cork materials, steel, synthetic resins, automatic looms, and cotton and woolen goods. Others deal in real estate, prefabricated housing units, and the import and export of raw materials.

**Toyotomi Hidetsugu** (b. 1568, Japan—d. Aug. 20, 1595, Kōyasan, Kii Province), nephew and adopted son and heir of Toyotomi Hideyoshi, the renowned warrior who in 1590 unified Japan after more than a century of civil war. The eventual disinheritance and murder of Hidetsugu by Hideyoshi left Hideyoshi with no mature heir when he died in 1598.

Hidetsugu showed early promise as a warrior, and he proved to be a valiant aide to his uncle in many battles. As a result, in 1592 Hideyoshi, who was then without an heir, adopted Hidetsugu, in whose favour he abdicated the office of *kampaku,* or chancellor to the emperor, assuming for himself the title of *taikō* (chief councillor, retired). But the power and high office turned the young man's head, and the dissolute life he adopted thoroughly disillusioned and finally enraged Hideyoshi.

The birth of his natural son in 1593 enabled Hideyoshi to banish Hidetsugu from the capital and then to force him to commit suicide in 1595. Still not satisfied, he had Hidetsugu's three small children and more than 30 women from his household killed.

**Toyotomi Hideyori** (b. Aug. 29, 1593, Ōsaka—d. June 4, 1615, Ōsaka), son and heir of Toyotomi Hideyoshi (1537–98), the great warrior who unified Japan after more than a century of civil unrest. Hideyori's suicide at 22 removed the last obstacle to Tokugawa Ieyasu's bid to establish his own family as the preeminent power in Japan.

Since Hideyori was only five years old when his father died in 1598, the country was actually governed by a council of five warriors whom Hideyoshi had appointed co-regents for his son in the event of his own death. Quarrels among the regents soon erupted in bloodshed, and at the Battle of Sekigahara (1600), Tokugawa Ieyasu emerged as the dominant military power in Japan.

Although all the major feudal lords pledged themselves to Ieyasu, many actually remained loyal to Hideyori. To mollify them, Ieyasu allowed Hideyori to maintain his father's castle at Ōsaka and to govern the large surrounding fief. He also united the two families by giving Hideyori his granddaughter in marriage.

Not until 1611, when the last of the old warriors loyal to the memory of Hideyoshi died, did Ieyasu dare to move against Hideyori. His opportunity came in 1614 in the form of a bronze bell that Hideyori had restored and hung in the Hōkō-ji (Hōkō Temple). Inscribed on the bell were two ideographs also used in writing Ieyasu's name. Accusing Hideyori of attempting to jinx him, Ieyasu called for an attack on Hideyori's castle. None of the great feudal lords came to his aid, but Hideyori managed to assemble an army of more than 90,000 *rōnin,* masterless warriors dispossessed during the Tokugawas' consolidation of power. Although the Tokugawa forces vastly outnumbered the defenders, the walls of the great Ōsaka castle proved impregnable.

Early in 1615 Ieyasu arranged a truce. The terms, to which Hideyori agreed, allowed the outer ring of moats protecting the castle to be filled in and the outer perimeter of barricades to be torn down. A few months later, Ieyasu attacked the defenseless castle, and the desperate Hideyori and his family committed suicide.

**Toyotomi Hideyoshi,** original name HIYOSHIMARU, also called HASHIBA CHIKUZEN NO KAMI (b. 1536/37, Nakamura, Owari Province, Japan—d. Sept. 18, 1598, Fushimi), feudal lord and chief Imperial minister (1585–98), who completed the 16th-century unification of Japan begun by Oda Nobunaga.

*Early career.* He was the son of a peasant; when he was still a boy, he left home for Tōtōmi Province (present-day Shizuoka Prefecture) and became page to a retainer of the Daimyo (feudal baron) of Tōtōmi. After a short period, he returned home to become a foot soldier for the great Japanese leader Oda Nobunaga. His cheerful nature, tactful manner, and intelligence helped him to be promoted to samurai (a military retainer of a daimyo). When Nobunaga began his campaign to subjugate central Japan in 1568,



Toyotomi Hideyoshi, detail of a portrait, 1599; in a private collection

By courtesy of the International Society for Educational Information, Tokyo, Inc.

Hideyoshi fought in many of the important battles. In September 1573, by overthrowing two powerful daimyos, Hideyoshi became a lord of Nagahama, Ōmi province, and subsequently took the name of Hashiba Chikuzen no kami (Hashiba, Lord of Chikuzen).

From 1577, by order of Nobunaga, Hideyoshi embarked on the suppression of San-in and San-yo (Chugoku district), in the course of which he invaded Bitchū province. Operating from a base at Himeji Castle in Harima Province, he besieged the daimyo Mōri Terumoto at Takamatsu. In 1582, Oda Nobunaga committed suicide after an attack by his retainer Akechi Mitsuhide; Hideyoshi immediately made peace with Mōri, and then moved east to avenge Nobunaga by killing Mitsuhide, which he accomplished at the Battle of Yamazaki.

At a conference of the Oda family's chief retainers, Hideyoshi insisted that Nobunaga's grandson succeed as head of the Oda family in opposition to two powerful vassals of their late leader who supported Nobunaga's third son. In 1583, Hideyoshi defeated one of these vassals in a battle and allowed him to commit suicide. After subduing a number of important strongholds, Hideyoshi in the same year built a castle in Ōsaka. He then embarked on his attempt to conquer the whole of Japan in an effort to complete Nobunaga's work of unifying the country after more than two centuries of feudal warfare. In the following year he fought a battle with Tokugawa Ieyasu, a powerful daimyo and a supporter of Nobunaga's second son. After an inconclusive fight, the two leaders concluded an alliance.

In 1585 Hideyoshi was appointed *kampaku* (chancellor to the emperor) and later became *dajō-daijin* (chief minister). He was awarded the family name of Toyotomi by the Emperor, and he thus came to bear the name Toyotomi Hideyoshi. Shortly thereafter, he made peace with Mōri Terumoto, who had again become his antagonist, and then conquered the large islands of Shikoku and Kyushu, which constituted most of western Japan. He achieved some of his victories with Tokugawa Ieyasu's assistance. After subduing, with Ieyasu's aid, the Kantō and Ōu districts in the east in 1590, he became head of an alliance of daimyo that constituted a government of national unification.

*Administrative innovations.* At first he imposed such measures as *katana kari* ("sword hunting") in order to enforce the prohibition of the use of arms by farmers, merchants, and monks and *shiro wari* (destruction of castles or reducing the number of castles), to destroy unnecessary strongholds throughout Japan. He also introduced *shi-nō-kō-shō,* freezing class distinctions by rigidly separating warriors, farmers, artisans, and tradesmen, and by allowing each class to live in different areas of a town or village to promote the orderly establishment of a feudal society. In addition, he conducted *kenchi* (land surveys) and abolished road checkpoints in order to promote transportation. Development of mineral resources was encouraged so that the resulting coinage would help to further trade.

Upon conquering the whole of Japan, Hideyoshi entrusted the position of *kampaku* to his nephew, Toyotomi Hidetsugu, henceforth assuming the title of *taikō,* the designation of a retired *kampaku.* He then prepared to invade Korea. His ultimate purpose was reportedly the conquest of China, the Philippines, and India, but even control of the Korean peninsula, which he first invaded in 1592, was not possible because of Japan's entirely inadequate forces for an undertaking of such magnitude. After a temporary peace with China, which eventually broke down, Hideyoshi in 1597 staged a second invasion of Korea. He died at the age of 62, deeply perturbed by the unfavourable results of the Korean war.

There were no children born to Hideyoshi by his formal wife, but he had a son by a concubine. At Hideyoshi's death, however, the son was only six years old; two years later Tokugawa Ieyasu took the reins of government and in 1603 founded the Tokugawa shogunate, or military government.

*Assessment.* Because of Hideyoshi's lowly beginnings, he was said to be illiterate and uncultured. He did, however, secretly attempt to educate himself, showing a facility for composing poetry. He performed well in Nō plays and avidly studied tea ceremony with the master Sen Rikyū, frequently holding such ceremonies to demonstrate his skill. After his death his policies of national unification were followed by Tokugawa Ieyasu, and they became the basis of the peaceful Tokugawa era. (T.Ku.)

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**tozama daimyo** (Japanese: "outside daimyo"), nonhereditary feudal lord or daimyo in Japan during the Tokugawa period (1603–1867), whose house had been equal to the Tokugawa house before the establishment of the shogunate (hereditary military dictatorship). Despite their lack of hereditary ties to the shogunate, these houses, because of their importance and status, were allowed to retain their domains.

As potential rivals, the *tozama* daimyo were excluded from participation in the government, and many of their estates were reduced in size. Their numbers declined from 119 in 1602 to 97 by the mid-19th century, when some of them began to acquire Western armaments to use against the shogunate. The

Tokugawa attempted to counter this movement by opening their government to participation from some of the *tozama* houses, but it was too late. In 1868 discontented daimyo, led by men from the two large anti-Tokugawa fiefs of Satsuma and Chōshū, overthrew the regime and established the new centralized Imperial state under the emperor Meiji (*see* Meiji Restoration).

**Tozeur** (Tunisia): *see* Tawzar.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**Tozzer, Alfred M(arston)** (b. July 4, 1877, Lynn, Mass., U.S.—d. Oct. 5, 1954, Cambridge, Mass.), U.S. anthropologist and archaeologist who made substantial contributions to knowledge of the culture and language of the Maya Indians of Mexico and Central America.

Hoping to find the key to deciphering Maya hieroglyphic writing, Tozzer examined the culture and language of a Maya group in the Yucatán Peninsula in Mexico. His dissertation, based on his work (published as *A Comparative Study of the Mayas and the Lacandones* in 1907), earned him his Ph.D. (1904) from Harvard University. Following studies with Franz Boas at Columbia University (1904), he returned to the country of the Lacandón people for further linguistic explorations. For Harvard's Peabody Museum he directed an expedition to Guatemala (1909–10), finding correlations between stylistic changes in Mayan architecture and dated inscriptions and discovering important ruins at Holmul.

Tozzer considered it essential for a comprehensive assessment of a culture to integrate ethnology, archaeology, and linguistic study. Shortly after World War I he was appointed chairman of the department of anthropology at Harvard. His *Maya Grammar* (1921) is a report of his findings at Santiago Ahuizolta, Mex., the site of his final Middle American field efforts. In *Social Origins and Social Continuities* (1925) he rejected widely held views on the necessity of migration and cultural diffusion to effect cultural change and asserted that the socially learned behaviour basic to a culture must be examined independently of biological phenomena. A definitive contribution to Maya ethnohistory is his edition and translation (1941) of the *Relación de las cosas de Yucatán* (*c.* 1566; "On the Things of Yucatán") by the Spanish bishop Diego de Landa. This major source on 16th-century Yucatán ethnology made possible the decipherment of Maya inscriptions dealing with chronology and divination.

Following a period of government service in Hawaii during World War II, Tozzer returned to Harvard in 1945 and remained there until his retirement in 1948. Just before his death he completed *Chichén Itzá and Its Cenote of Sacrifice* (1957), a major work synthesizing the Yucatán history prior to Spanish conquest.

**Trabzon,** also called TREBIZOND, historically TRAPEZUS, city, capital of Trabzon *il* (province), northeastern Turkey. It lies on a wide bay on the southeastern shore of the Black Sea backed by high ranges of the Pontic Mountains, which separate it from the central Anatolian Plateau. The heart of the city is on a triangle of tableland between two deep ravines, with remains of an ancient Roman-built harbour at its base. At its southern end stands a ruined citadel. The city centre is enclosed on the east and west by walls that date from Byzantine times. The commercial quarter is centred around a bazaar and park in the eastern part of the city near the old Genoese castle of Leontocastron; east of this lies the harbour.

Trapezus, one of the most easterly of ancient Greek settlements, was probably founded in 756 BC by colonists from Sinope. Like many other Black Sea sites, it is associated in legend with the Amazon women warriors. Trabzon is said to be the site on which the army called the Ten Thousand by the writer Xenophon, one of its members, reached the sea after its long march that followed defeat in 401 BC. The city prospered under Roman rule until sacked by the Goths after their victory over Emperor Valerian's forces *c.* AD 257. As the Byzantine port nearest to Armenia, lying on a critical frontier of the empire, the city was rebuilt and figured prominently in the eastern campaigns of the emperor Justinian I (reigned 527–565). The see of Trapezus was supposedly founded by St. Andrew the Apostle; Eugenius, its patron saint, was martyred under the Roman emperor Diocletian (reigned 284–305). In the 9th century the city was made the capital of a new military province of Chaldia.

After the sack of Constantinople by the crusaders in 1204, two grandsons of the emperor Andronicus I Comnenus escaped and founded an independent offshoot of the Byzantine Empire at Trapezus, with Prince Alexius Comnenus as emperor. His successors, the Grand Comneni, reigned longer than any other Byzantine family, forming extensive alliances through marriage with foreign rulers and promoting their prestige through the cult of St. Eugenius and the glorification of their real or legendary achievements. Although subject to brief periods of domination by the neighbouring Seljuq Turks, Mongols, and Byzantines, the empire based at Trapezus was largely bypassed by both the Seljuqs and the Mongols because of its relative isolation, difficulties of access, and conflict among its enemies. Its prosperity lay partly in export of its own products—silver, iron, alum, cloth, and black wine—and partly from taxes on transit trade to western Iran. The end of the dynasty came when its territories were annexed to the Ottoman Empire in 1461. Thereafter, Trabzon remained under Turkish rule except for a brief Russian occupation (1916–18) during World War I.

Modern Trabzon retains much of its medieval aspect. Monuments include most of the city walls, a part of the palace of the Grand Comneni, and several Byzantine churches preserved as mosques. Among the churches the best preserved and most remarkable is the church Aya Sofya (Hagia Sophia), now used as a museum, which overlooks the sea just west of the city centre. The church is a domed basilica with superb 13th-century wall paintings that were revealed and cleaned during 1957–63. One of the finest Ottoman monuments is the mosque and mausoleum of Gülbahar, wife of Sultan Bayezid II (reigned 1481–1512).

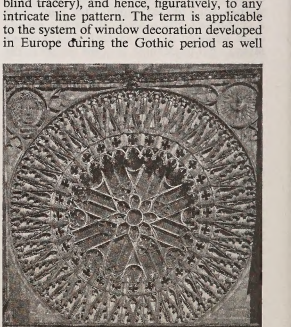
Trabzon is the terminus of the most practicable route over the mountains from Erzurum. For centuries it was on one of the leading trade routes between Europe and Central Asia, and it prospered particularly after the 13th century, when it served as the chief port for Tabriz and western Iran. Its significance declined, however, with the construction of the Ankara–Erzurum railway *c.* 1900 and the development of the southern Iranian port of Khorramshahr. The city's later revitalization has largely resulted from improvement in its port facilities and communications. Trabzon is the site of the Black Sea Technical University, established in 1963. It is linked by air with Ankara and by steamer service with Istanbul.

Trabzon *il*, with an area of 1,907 sq mi (4,938 sq km), is well forested and densely populated. The large variety of crops grown include tobacco, fruits, and hazelnuts. Small deposits of copper, lead, and iron are worked. Pop. (1997 est.) city, 182,552; province, 846,900.

**trace element,** also called MICRONUTRIENT, in biology, any chemical element required by living organisms in minute amounts, usually as part of a vital enzyme, a cell-produced catalytic protein. Exact needs vary among species, but commonly required plant micronutrients include copper, boron, zinc, manganese, and molybdenum. Animals also require manganese, iodine, and cobalt. Lack of a necessary plant micronutrient in the soil causes plant deficiency diseases; lack of animal micronutrients in the soil may not harm the plants, but, without them, animals feeding solely on those plants develop deficiency diseases.

**tracer,** detectable substance added to a chemical, biological, or physical system to follow its process or to study distribution of the substance in the system. Tracer dyes have long been used to follow the flow of underground streams. Incendiary rounds included at intervals in a belt of machine-gun bullets make the paths of the bullets visible. In scientific work, the use of tracers has increased and, because of the sensitivity of modern methods, has helped solve many problems. Particularly effective modern methods utilize isotopic tracers. *See* isotopic tracer.

**tracery,** in architecture, bars, or ribs, used decoratively in windows or other openings; the term also applies to similar forms used in relief as wall decoration (sometimes called blind tracery), and hence, figuratively, to any intricate line pattern. The term is applicable to the system of window decoration developed in Europe during the Gothic period as well as to the pierced marble screens common in Mughal India and the pierced cement windows of Persia, Turkey, and Egypt.



Gothic tracery in the rose window (1350) above the west portal of the church of St. Lorenz, Nürnberg, Ger.

Authenticated News International

European tracery probably originated in Byzantine work, in which pierced marble screens and groups of two or three narrow, arched windows were placed close together under a single, large arch. After the Romanesque period, during which the tympanum (section of wall between the tops of the smaller arches and the great arch over the whole group) was pierced for decorative effect, tracery flourished. In plate tracery, found in early French and English Gothic work, the tympanum is pierced with a single circular or four-lobed opening. Later, the number and complexity of the piercings was increased, adding size and beauty to the entire unit. The climax of plate tracery appears in the magnificent windows of Chartres cathedral (12th century) and in the rose window (*q.v.*) at Lincoln cathedral (*c.* 1225), known as the Dean's eye.

After 1220 English designers began to conceive of the tympanum as a series of openings separated only by thin, stone, upright bars (bar tracery). In France a developed type of bar tracery with cusped circles (having pointed bars of stone projecting in toward the centre of the circle) was executed in the apse chapels of Reims cathedral (prior to 1230). From about 1240 on, bar tracery became common, and it quickly exhibited increased lightness and complexity.

In contrast to earlier tracery, which had moldings of only one size, French Rayonnant tracery used two molding types, differing according to the size of the mullions, or ribs. Notable examples of French Rayonnant tracery can be seen in rose windows such as those of Notre-Dame de Paris (*c.* 1270).

By the late 14th century in England, the Perpendicular style, which was based on a striving for verticality, replaced the flowing lines of curvilinear tracery with mullions that were straight and unbroken from bottom to top. At intervals they were connected by horizontal bars running across the windows. The climax of the Perpendicular style in tracery was reached in windows such as those of the King's College Chapel at Cambridge (1446–1515).

Twentieth-century tracery has introduced modern materials, which are freely combined with more traditional forms, and new tracery techniques have been devised, such as precast cement tiles pierced in geometric patterns, glazed, and built up into large windows, as in Notre-Dame at Le Raincy, Fr. (1922–23), by Auguste Perret.

In Islāmic architecture tracery was generally constructed by filling the window area with a pierced sheet of cement and inserting pieces of coloured glass into the openings, a technique that yielded windows of jewel-like intensity and brilliance. Typical designs consisted of floral and leaf shapes that were arranged to give a sense of flow and growth. Fine examples are the jewelled windows in the 17th-century Mosque of Süleyman, Constantinople (modern Istanbul). In the great Mughal palaces and tombs, large, pointed arch openings are filled with sheets of white marble pierced in elaborate patterns. The most delicate example of this tracery is the sarcophagi screen in the 17th-century Tāj Mahal (*q.v.*), at Āgra, India.

**trachea,** in vertebrates and invertebrates, a tube or system of tubes that carries air. In insects, a few land arachnids, and myriapods, the trachea is an elaborate system of small, branching tubes that carry oxygen to individual body cells; in most land vertebrates, the trachea is the windpipe, which conveys air from the larynx to the two main bronchi, with the lungs and their air sacs as the ultimate destination. In some birds, such as the swan, there is an extra length of tracheal tube coiled under the front of the rib cage. The cartilaginous structures that ring most mammalian tracheae are reduced to small irregular nodules in amphibians.

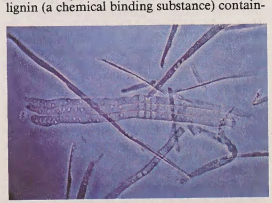
In man the trachea is about 15 centimetres (6 inches) long and 2 to 3 centimetres in diameter. The trachea serves as passage for air, moistens and warms it while it passes into the lungs, and protects the respiratory surface from an accumulation of foreign particles. The trachea is lined with a moist mucous-membrane layer composed of cells containing small hairlike projections called cilia. The cilia project into the channel (lumen) of the trachea to trap particles. There are also cells and ducts in the mucous membrane that secrete mucus droplets and water molecules. At the base of the mucous membrane there is a complex network of tissue composed of elastic and collagen fibres that aid in the expansion, contraction, and stability of the tracheal walls. Also in this layer there are numerous blood and lymphatic vessels; the blood vessels control cellular maintenance and heat exchange, while the lymphatic vessels remove the foreign particles collected by the wall's surface. Around the tracheal wall there is a series of 16 to 20 horseshoe-shaped cartilage rings. They encircle the front part of the trachea but are open where the trachea lies next to the esophagus. Here the free ends of the cartilage are connected by muscle bands. Since the cartilage is in individual rings, rather than one continuous sheath, the trachea can stretch and descend with the breathing movements. The cartilage bands are replaced with fibrous scar tissue in advanced age.

Muscle fibres run over and alongside the cartilage, as well as through the mucous membrane. They serve to narrow and shorten the passageway in breathing. They also may contract in cold weather and when smoke, dust, or chemical irritants are in the inhaled air. During coughing, which is a forced exhalation, the muscle bands connecting the free cartilage ends press inward so that the tracheal lumen is about one-sixth of its normal size. Air rushing through this narrow channel travels at high velocities and is thus able to dislodge foreign elements from the trachea.

For a depiction of the trachea in human anatomy, shown in relation to other parts of the body, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

**trachea** (botany): *see* vessel.

**tracheid,** in botany, primitive element of xylem (fluid-conducting tissues), consisting of a single elongated cell with pointed ends and a secondary, cellulosic wall thickened with lignin (a chemical binding substance) containing numerous pits but having no perforations in the primary cell wall. At functional maturity, the cell is dead and empty; its former protoplast is represented, if at all, by a warty layer on the wall. Tracheids serve for support and for upward conduction of water and dissolved minerals in all vascular plants and are the only such elements in conifers and ferns. *See also* vessel.



Tracheid
J.M. Langham

**tracheitis,** inflammation and infection of the trachea (windpipe). Most conditions that affect the trachea are bacterial or viral infections, although irritants like chlorine gas, sulfur dioxide, and dense smoke can injure the lining of the trachea and increase the likelihood of infections.

Acute infections occur suddenly and usually subside quickly. Common bacterial causes of acute infections are pneumococci, streptococci, *Neisseria* organisms, and staphylococci. The infections produce fever, fatigue, and swelling of the mucous membrane lining the trachea. Infections may last for a week or two and then pass; they generally do no great damage to the tissue unless they become chronic. Chronic infections recur over a number of years and cause progressive degeneration of tissue. Irritants such as heavy smoking and alcoholism may invite infections. The walls of the trachea during chronic infection contain an excess of white blood cells; the blood vessels increase in number; and there is thickening of the walls because of an increase in elastic and muscle fibres. The mucous glands may become swollen; small polyplike formations occasionally grow; and degenerated tissue is eventually replaced by a fibrous scar tissue.

Some of the specific diseases afflicting the trachea are diphtheria, smallpox, tuberculosis, and syphilis. Diphtheria usually involves the upper mouth and throat, but the trachea may also be attacked. A false membrane composed of white blood cells and fibrin (clotting protein) coat the surface of the trachea. Typhoid causes swelling and ulceration in the lymph tissue. It can occasionally ulcerate the cartilage of the trachea and destroy tissue. In smallpox, pustules and ulcers, like those on the external skin, form in the mucous membrane. Intense blood congestion, hemorrhages, and degeneration of the tracheal tissue can occur. Tuberculosis causes nodules and ulcers which start on the membrane and progress through the tissue to the cartilage. The cartilage deteriorates and sometimes breaks apart causing severe pain and swelling. Syphilis forms lesions that erode the tissue, and can cause thickening and stiffening of the spaces between the cartilage.

**tracheophyte,** any of the vascular plants, members of the division, or phylum, Tracheophyta, numbering some 260,000 species and including all of the conspicuous flora of the Earth today. Tracheophyte, meaning "tracheid plant," refers to the water-conducting cells (called tracheids, or tracheary elements) that show spiral bands like those on the walls of the tracheae, or air tubes, of insects.

The division comprises a tremendous diversity of plants among its four subgroups: psilopsids, leafless and rootless primitive forms commonly known as whisk ferns (though not true ferns); sphenopsids, feathery leaved plants commonly called horsetails; lycopsids, low-lying plants called club mosses; and pteropsids, comprising the ferns, gymnosperms (pines, spruces, firs, etc.), and flowering plants.

The vascular system consists of xylem (wood), concerned mainly with the conduction of water and dissolved minerals, and phloem, which functions mainly in the conduction of foods, such as sugar.

Tracheophytes are believed to have originated from the green algae (Chlorophyta). The earliest fossils are from Silurian rocks more than 400,000,000 years old.

**Trachodon** (dinosaur): *see* Anatosaurus.

**trachoma,** chronic inflammatory disease of the eye caused by *Chlamydia trachomatis*, a bacterium-like microorganism that grows only within tissue cells of the infected host. The conjunctiva becomes thickened and roughened, and deformation may result. Extension of inflammation to the cornea occurs in varying degree; resultant scarring can lead to corneal opacity and blindness. Transmission occurs by personal contact with infective ocular secretions or indirectly by common use of a towel.

Trachoma occurs especially under conditions of poverty, overpopulation, or poor sanitation and is often complicated by other eye infections of bacterial origin. One of the oldest diseases known to man, trachoma is present in most areas of the world and is especially prevalent in Asia and North Africa. In the United States after about mid-20th century, most cases were limited to a few localities, particularly among native Indian populations. A conjunctival infection of newborns (inclusion conjunctivitis) is caused by a similar disease agent found in the birth canal of the mother. Beginning in 1957 with the discovery that the trachoma microorganism could be grown in the laboratory, fundamental studies

on the disease agent, as well as development of experimental vaccines, became possible.

The sulfonamide drugs, as well as some of the antibiotics, are curative.

**trachyandesite** (rock): *see* latite.

**trachyte,** light-coloured, very fine-grained extrusive igneous rock that is composed chiefly of alkali feldspar with minor amounts of dark-coloured minerals such as biotite, amphibole, or pyroxene. Compositionally, trachyte is the volcanic equivalent of the plutonic (intrusive) rock syenite. Most trachytes show porphyritic texture in which abundant, large, well-formed crystals (phenocrysts) of early generation are embedded in a very fine-grained matrix (groundmass). The phenocrysts are usually sanidine, a glassy potash feldspar commonly rich in sodium, and may range up to two to five centimetres (one to two inches) across; smaller phenocrysts of other minerals may also occur. Rapid cooling and solidification of trachytic lava produces the fine texture of the groundmass, and cooling may be so rapid locally that small quantities of glass are formed.

Trachyte is commonly associated with other lavas in volcanic regions and is thought to have been formed by the crystallization and abstraction of iron, magnesium, and calcium minerals from a parent basaltic lava.

Two types of trachyte are commonly recognized. In potash, or normal, trachyte, sanidine or orthoclase is the dominant feldspar, and the plagioclase feldspar is generally oligoclase. In soda, or alkali, trachyte, both the alkali feldspar and the dark minerals are rich in sodium. As the ratio of alkali feldspar to plagioclase decreases, trachyte passes into latite. Brown biotite is a common constituent, as is amphibole. Normal trachytes may contain diopside; alkali types may show pyroxene crystals with diopsidic cores.

Silica-rich trachyte may have small amounts of quartz that is interstitial to feldspar; tridymite and cristobalite are commonly found lining the small cavities that developed as expanding gas bubbles in the molten lava. As the free silica content increases, trachyte passes into rhyolite. Marked decrease in silica favours the formation of such feldspathoids as leucite, nepheline, sodalite, and analcime; as the quantity of feldspathoids increases, trachyte passes into phonolite.

Like many volcanic rocks, trachyte shows a streaked or banded structure due to flowage of the congealing lava. This structure may be revealed by a conspicuous parallel arrangement of large tabular phenocrysts. Microscopic examination of thin sections reveals the trachytic texture of the fine matrix; tiny lath-shaped sanidine crystals are closely packed in parallel fashion and form flow lines that tend to wrap around the large phenocrysts.

**track-and-field athletics:** *see* athletics.

**tracker action,** in music, on the organ, mechanical system that transmits the organist's action in depressing a key to the pallet valve that admits air into the pipes that the key controls. It consists of cranks, levers, and trackers (thin strips of wood connecting, under tension, parts of the organ action and conveying motion from one part to another).

On large organs with many stops and couplers, considerable manual strength is needed to operate the system and overcome wind pressure against the valve. In contrast to lighter 19th- and 20th-century pneumatic and electric actions, however, tracker action gives the player direct contact with the valve, resulting in a more sensitive touch. A revival of tracker action began in about 1925.

**trackless trolley:** *see* trolleybus.

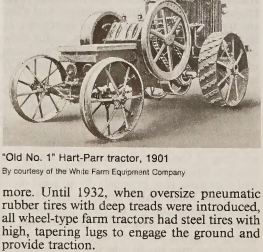
**Tractatus Coislinianus,** statement of a Greek theory of comedy found in a 10th-century manuscript (published 1839) in the collection of Henri Charles du Cambout de Coislin. The treatment of comedy displays marked Aristotelian influence, even to the point of paralleling the model offered in the *Poetics*. The *Tractatus* is assumed to be either a version of a lost Aristotelian original or a statement of the Aristotelian tradition. Accordingly, as with tragedy, comedy must bring about a catharsis but through the use of laughter and pleasure. Comic plots include ludicrous mishaps, deception, unexpected developments, and clumsy dances. Characters include impostors, self-deprecators, and buffoons. While the language of comedy should be realistic, it may attain added comic force through the use of puns, dialect, and word malformations.

**tractor,** high-power, low-speed traction vehicle and power unit mechanically similar to an automobile or truck but designed for use off the road. The two main types are wheeled, which is the earliest form, and continuous track. Tractors are used in agriculture, construction, road building, etc., in the form of bulldozers, scrapers, and diggers. A notable feature of tractors in many applications is the power-takeoff accessory, used to operate stationary or drawn machinery and implements.

The first tractors, in the sense of powered traction vehicles, grew out of the stationary and portable steam engines operated on farms in the late 19th century and used to haul plows by the 1890s. In 1892 an Iowa blacksmith, John Froehlich, built the first farm vehicle powered by a gasoline engine. The first commercially successful manufacturers were C.W. Hart and C.H. Parr of Charles City, Iowa. By World War I the tractor was well established, and the U.S. Holt tractor was an inspiration for the tanks built for use in the war by the British and French.

Belt and power takeoffs, incorporated in tractors from the beginning, were standardized first in the rear-mounted, transmission-derived power takeoff and later in the independent, or live-power, takeoff, which permitted operation of implements at a constant speed regardless of the vehicular speed. Many modern tractors also have a hydraulic power-takeoff system operated by an oil pump, mounted either on the tractor or on a trailer.

Most modern tractors are powered by internal-combustion engines running on gasoline, kerosine (paraffin), LPG (liquefied petroleum gas), or diesel fuel. Power is transmitted through a propeller shaft to a gearbox having 8 or 10 speeds and through the differential gear to the two large rear-drive wheels. The engine may be from about 12 to 120 horsepower or more. Until 1932, when oversize pneumatic rubber tires with deep treads were introduced, all wheel-type farm tractors had steel tires with high, tapering lugs to engage the ground and provide traction.



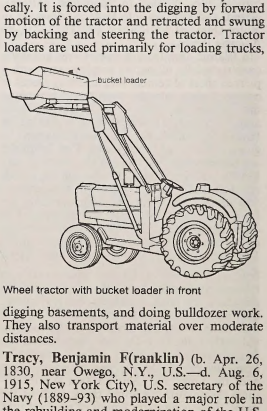
"Old No. 1" Hart-Parr tractor, 1901
By courtesy of the White Farm Equipment Company

Crawler, caterpillar, or tracklaying tractors run on two continuous tracks consisting of a number of plates or pads pivoted together and joined to form a pair of endless chains, each encircling two wheels on either side of the vehicle. These tractors provide better adhesion and lower ground pressure than the wheeled tractors do. Crawler tractors may be used on heavy, sticky soil or on very light soil that provides poor grip for a tire. The main chassis usually consists of a welded steel hull containing the engine and transmission. Tractors used on ground of irregular contours have tracks so mounted that their left and right front ends rise and fall independently of each other.

Four-wheel-drive tractors can be used under many soil conditions that immobilize two-wheel-drive tractors and caterpillars. Because of their complicated construction and consequent high cost, their use has grown rather slowly.

The single-axle (or walking) tractor is a small tractor carried on a pair of wheels fixed to a single-drive axle; the operator usually walks behind, gripping a pair of handles. The engine is usually in front of the axle, and the tools are on a bar behind. This type of machine may be used with a considerable range of equipment, including plows, hoes, cultivators, sprayers, mowers, and two-wheeled trailers. When the tractor is coupled to a trailer, the operator rides.

**tractor loader,** tractor carrying a front-mounted bucket that can be raised, lowered, and tilted forward and backward hydraulically. It is forced into the digging by forward motion of the tractor and retracted and swung by backing and steering the tractor. Tractor loaders are used primarily for loading trucks, digging basements, and doing bulldozer work. They also transport material over moderate distances.




Wheel tractor with bucket loader in front

**Tracy, Benjamin F(ranklin)** (b. Apr. 26, 1830, near Owego, N.Y., U.S.—d. Aug. 6, 1915, New York City), U.S. secretary of the Navy (1889–93) who played a major role in the rebuilding and modernization of the U.S. fleet.

Tracy began his career as a lawyer; he was admitted to the bar in 1851 and served as district attorney of Tioga County, N.Y., from 1853 to 1859. A founder of the local Republican Party, he served briefly in the state legislature (1862) and fought for the Union during the Civil War, rising to the rank of brigadier general of volunteers. After the war he was U.S. district attorney for eastern New York (1866–73) before returning to private practice. In a sensational 1875 trial, Tracy successfully defended the Rev. Henry Ward Beecher against charges of adultery. He later went on to serve briefly as a justice of the New York Court of Appeals in 1881–82.

In 1889 Tracy was appointed secretary of the Navy by Pres. Benjamin Harrison. During his four years in that post, Tracy accelerated the naval expansion program begun by his predecessor, William C. Whitney, authorizing construction of new battleships and cruisers that were to figure prominently in the war

with Spain and promoting reorganization and reform with the Department of the Navy.

**Tracy, Spencer** (b. April 5, 1900, Milwaukee—d. June 10, 1967, Beverly Hills, Calif., U.S.), one of Hollywood's greatest male leads and the only actor ever to receive two consecutive Academy Awards for best actor.

After serving in the U.S. Navy during World War I, Tracy attended Ripon College in Wisconsin. His success in a school play took him to New York City, where he spent a number of difficult years trying to establish his career. It was not until 1930 that Tracy was cast in a leading role, but his performance in *The Last Mile* so impressed movie director John Ford that he featured Tracy in *Up the River* (1930), which launched his film career.

Not having the traditional appearance of a leading man, Tracy was typecast as a tough character. Despite his craggy features, his sincere and expert acting performances soon established him as one of the top stars of the 1930s. After switching studios Tracy appeared in *Captains Courageous* (1937), which won him his first Oscar from the Academy of Motion Picture Arts and Sciences. A year later he won again for his performance in *Boys Town.* In addition he was nominated for Academy Awards for seven other roles. In 1942 he began what was to be a lifelong relationship with actress Katharine Hepburn. Tracy and Hepburn costarred in nine motion pictures, and their contrasting acting styles created such memorable films as *Adam's Rib* (1949) and *Guess Who's Coming to Dinner* (1967), Tracy's last film.

**trade, balance of,** difference in value over a period of time between a nation's imports and exports of goods and services, usually expressed in the unit of currency of a particular nation (*e.g.*, dollars for the United States, pounds sterling for the United Kingdom). The balance of trade is part of a larger economic unit, the balance of payments (the sum total of all economic transactions between residents of one country and those of other countries), which includes capital movements (money flowing to a country paying high interest rates of return), loan repayment, expenditures by tourists, freight and insurance charges, and other payments.

If the exports of a nation exceed its imports, the nation is said to have a favourable balance of trade, or a trade surplus. Conversely, if the imports exceed exports, an unfavourable balance of trade, or a trade deficit, exists. According to the economic theory of mercantilism, current in Europe from the 16th to the 18th century, a favourable balance of trade was viewed as an absolute necessity. This was to be achieved by establishing colonies that would buy the products of the mother country and would export raw materials, particularly precious metals, seen as the indispensable source of a nation's wealth and power.

According to the Classical economic theory of the mid-18th century, a nation need not maintain an even exchange or build a surplus in its balance of trade (or in its balance of payments), over time, to finance its purchase of foreign goods and to maintain its export trade. A continuing surplus may, in fact, be viewed as economically undesirable, as it may represent underutilized resources that might have been directed towards the purchase or production of goods or services as a means of increasing a nation's wealth. Furthermore, a surplus accumulated by a nation (or group of nations) may have the potential of producing sudden and uneven changes in the economies of those nations in which the surplus is eventually spent. Such a situation developed in the 1970s and '80s when the member nations of the Organization of Petroleum Exporting Countries (OPEC) suddenly and rapidly increased the price of petroleum. Because the OPEC prices were established in dollars, importers were forced to acquire dollars to pay for their purchases, and the OPEC member states accumulated vast surpluses of dollars. Generally, the so-called third world, or developing, nations (unless they have a monopoly on a vital commodity) have particular difficulty maintaining surpluses since the terms of trade during periods of recession work against them; that is, they have to pay relatively higher prices for the finished goods they import but receive relatively lower prices for their exports of raw materials or unfinished goods.

For international statistical data on balance of trade, *see* the *Britannica World Data* section in the BRITANNICA BOOK OF THE YEAR.

**trade, board of:** *see* commerce, chamber of.

**Trade, Board of,** also called LORDS COMMISSIONERS OF TRADE AND PLANTATIONS, English governmental advisory body established by William III in May 1696 to replace the Lords of Trade (1675) in the supervision of colonial affairs. The board was to examine colonial legislation and to recommend disallowance of those laws that conflicted with imperial trade policies, to nominate governors and other high officials for royal colonies and to write the instructions for appointed governors, to recommend laws affecting the colonies to Parliament and the Privy Council, and to hear and to make reports on complaints from the colonies regarding imperial administration. These responsibilities were more extensive than those that had been delegated to the Lords of Trade. Memberships in the Board of Trade consisted of two groups: eight permanent salaried commissioners who conducted the regular duties of the board and eight ex-officio unpaid members who were nominally selected from the Privy Council.

The board itself lacked executive or legislative powers but it became in effect the primary policy-making and administrative agency of the British government in its mercantilist endeavours to make the American colonies profitable to the mother country. The Board of Trade continued to manage colonial affairs until 1779 and was abolished three years later.

**Trade, Board of,** the first grain futures exchange in the United States, organized in 1848 in Chicago. The Board of Trade began as a voluntary association of prominent Chicago grain merchants. In 1849 it received a charter from the Illinois legislature, and in 1859 it was incorporated by a special legislative act. At first grain was sold by sample, but soon a system of inspection and grading was introduced to standardize the market and facilitate trading. By 1858 access to the trading floor, known as the "pit," was limited to members with seats on the exchange, who traded either for their own account or for their clients. The Board of Trade was eventually to become the largest of the world's futures markets in terms of volume and value of business.

**trade, terms of,** relationship between the prices at which a country sells its exports and the prices paid for its imports. If the prices of a country's exports rise relative to the prices of its imports, one says that its terms of trade have moved in a favourable direction, because, in effect, it now receives more imports for each unit of goods exported. The terms of trade, which depend on the world supply of and demand for the goods involved, indicate how the gains from international trade will be distributed among trading countries. The concept is also applied to different sectors within an economy (*e.g.*, agricultural and manufacturing sectors).

An abrupt change in the terms of trade of a country (*e.g.*, a drastic fall in the price of a primary product that is a country's main export) can cause serious balance-of-payments problems if the country is dependent on the foreign exchange earned by its exports to import its manufactured goods and capital equipment.

Many theories have been postulated to explain movements in the terms of trade, but none of them is really confirmed by close examination of trade statistics. One of the more popular and politically important beliefs is that the terms of trade tend to move against the less developed countries because their exports consist predominantly of primary products and their imports are largely of manufactured goods from the developed countries.

**trade agreement,** any contractual arrangement between states concerning their trade relationships. Trade agreements may be bilateral or multilateral, that is, between two states or more than two states.

A brief treatment of trade agreements follows. For full treatment, *see* MACROPAEDIA: International Trade.

For most countries international trade is regulated by unilateral barriers of several types, including tariffs, nontariff barriers, and outright prohibitions. Trade agreements are one way to reduce these barriers, thereby opening all parties to the benefits of increased trade.

In most modern economies the possible coalitions of interested groups are extremely numerous. Additionally, the variety of possible unilateral barriers is great. Further, there are other, noneconomic reasons for some observed trade barriers, such as national security or the desire to preserve or insulate local culture from foreign influences. Thus, it is not surprising that successful trade agreements are very complicated. Some common features of trade agreements are: (1) reciprocity, (2) a most-favoured-nation clause, and (3) national treatment of nontariff barriers.

Reciprocity is a necessary feature of any agreement. If each required party does not gain by the agreement as a whole, it has no incentive to agree to it. If agreement takes place, it may be assumed that each party to the agreement expects to gain at least as much as it loses. Thus, for example, Country A, in exchange for reducing barriers to Country B's products, thereby benefitting A's consumers and B's producers, will insist that Country B reduce barriers to Country A's products, benefitting Country A's producers and perhaps B's consumers.

The most-favoured-nation clause protects against the possibility that one of the parties to the current agreement will subsequently selectively lower barriers further to another country. For example, Country A might agree to reduce tariffs on some goods from Country B in exchange for reciprocal concessions and then further reduce tariffs for the same goods from Country C in exchange for other concessions. But if A's consumers can get the goods in question more cheaply from C because of the tariff difference, B gets nothing for its concessions. Most-favoured-nation status means that A is required to extend the lowest existing tariff on specified goods to all its trading partners having such status. Thus, if A agrees to a lower tariff later with C, B automatically gets the same lower tariff.

A "national treatment of nontariff restrictions" clause is necessary because most of the properties of tariffs can be easily duplicated with an appropriately designed set of nontariff restrictions. These can include discriminatory regulations, selective excise or sales taxes, special "health" requirements, quotas, "voluntary" restraints on importing, special licensing requirements, etc., not to mention outright prohibitions. Instead of trying to list and disallow all of the possible types of nontariff restrictions, signatories to an agreement insist on similar treatment to that given to domestically produced goods of the same type.

Even without the constraints imposed by most-favoured-nation and national treatment

clauses, sometimes general multilateral agreements are easier to reach than separate bilateral agreements. In many cases the possible loss from a concession to one country is almost as great as that which would result from a similar concession to all or many countries. The gains to efficient producers from worldwide tariff reductions are large enough to warrant substantial concessions. The most successful and important multilateral trade agreement in modern times is the General Agreement on Tariffs and Trade (GATT). It includes provisions for reciprocity, most-favoured-nation status, and national treatment of nontariff restrictions. Since GATT took effect in 1948, world tariff levels have dropped substantially and world trade has rapidly expanded.

**trade fair,** temporary market organized to promote trade, where buyers and sellers gather to transact business. Trade fairs are organized at regular intervals, generally at the same location and period of the year, and usually last for several weeks. Such fairs assumed an increasingly important role in international trade during the 20th century. This was particularly evident in Europe and Asia, where nearly every country has at least one major annual international exposition, ranging in scope from those dealing with one industry or branch of industrial production to general exhibits of goods and merchandise.

Historically, trade fairs with displays of many types of products and services were common, but fairs confined to exhibitors representing one industry or even a specialized segment of an industry are more widespread today.

Among the well-known commercial fairs are the international Leipzig Fair (Germany), the Swiss Industries Fair, and the Pakistan International Fair. Others include the Milan Fair (Italy), the International Trade Fair of Thessaloniki (Greece), the Zagreb International Trade Fair (Croatia), and the Paris International Fair (France). Popular specialized fairs include the International Textile and Clothing Industry Exhibition (Ghent, Belg.), the Canadian Chemical and Process Equipment Exhibition (Toronto, Can.), and the International Furniture Fair (Cologne, Ger.).

**trade organization,** voluntary association of business firms organized on a geographic or industrial basis to promote and develop commercial and industrial opportunities within its sphere of operation, to voice publicly the views of members on matters of common interest, or in some cases to exercise some measure of control over prices, output, and channels of distribution.

The oldest and most widespread trade organizations are chambers of commerce, also known as commercial associations, boards of trade, and development associations. Although in most countries their focus is the development of business opportunity and community improvement, in France the chambers of commerce have served as agencies of official administrative control of public commercial institutions. In 1599 the city of Marseille established the first *chambre de commerce* and empowered it to settle the merchant law and to send consuls, embassies, and commercial missions to certain countries. Modern French *chambres* have owned and administered sections of the stock exchanges, bonded warehouses, public salesrooms, and port, dock, inland-waterway, and airfield facilities.

The first British chamber of commerce, which was a voluntary association of independent firms in industry, commerce, and trade to protect and promote their common local interests, was organized in 1768 in Jersey, Channel Islands. Many new chambers were formed both in Britain and abroad as economic development went forward—*e.g.,* in New York state in 1768, in Calcutta in 1834, and in Paris in 1873. Today, many countries have chambers of commerce in important cities throughout the world in addition to their local domestic ones.

The one organization truly international in scope is the International Chamber of Commerce, a world federation of business organizations, business firms, and businessmen founded in 1920.

Trade associations organized according to industries or products have been significant in their impact upon prices, sales, output, and technology, although they rarely extend their activities beyond national boundaries. They had their beginning in modern form during the late 19th century in many countries, including the United States, Britain, and Japan, but existed as early as 1821 in France. Most trade associations confine themselves to voicing their members' views on matters of common interest; particularly in the United States, this exercise has included legislative lobbying. In some countries they may also have some control over prices and production levels, but, in those with strong antitrust legislation (*e.g.,* the United States), this type of organization has been short-lived.

Separate employers' organizations have been founded in some countries, including Britain, Australia, and India, to deal with labour questions. French industrial federations, on the other hand, represent the interests of the members both as manufacturers and as employers.

**trade rat:** *see* wood rat.

**trade union,** also called LABOUR UNION, an association of labourers in a particular trade, industry, or plant, formed to obtain by collective action improvements in pay, benefits, working conditions, and social and political status. Trade unionism as a movement originated in Great Britain, Europe, and the United States in the 19th century. It is, in many countries, synonymous with the term labour movement.

A brief treatment of trade unionism follows. For full treatment, *see* MACROPAEDIA: Work and Employment.

The first fraternal and self-help associations of workingmen appeared in Great Britain in the 18th century. As such organizations turned their attention to political and economic matters they began to encounter organized hostility on the parts of employers and government. In Britain and the United States workingmen's associations remained sporadic and short-lived phenomena through much of the 19th century; unions and unionists were regularly prosecuted under various restraint-of-trade and conspiracy statutes. A marked difference between British and American trade unionism appeared early as the British movement exhibited a strong inclination to political activity that culminated in the formation of the Labour Party in 1906.

British unionism received its legal foundation in the Trade-Union Act of 1871. In the United States the same effect was achieved, albeit more slowly and uncertainly, by a series of court decisions that whittled away at the use of injunctions, conspiracy laws, and other devices against unions. The founding of the American Federation of Labor (AFL) by several unions of skilled workers in 1886 marked the beginning of a successful, large-scale labour movement in the United States. During the 20th century the strength of the labour movement at any given moment has depended largely upon general economic conditions; in times of full employment and rising wages unionism has tended to lose some of its appeal, particularly among younger workers, while in recessionary times it has tended to attract more members.

In both the United States and Great Britain the earliest unions were of skilled workers, and among them there was a widespread belief that unskilled workers were unsuitable subjects for union organization. Later, however, the idea of general unions, embracing large numbers of unskilled or semiskilled workers, was shown to be viable, and such mass unions appeared in Britain and several European countries. In the United States the AFL opposed attempts to organize the unskilled and in 1935 expelled a small group of member unions that were attempting to do so. The expelled unions formed the Congress of Industrial Organizations (CIO), which by 1941 had assured the success of industrial unionism by organizing the steel and automobile industries. The AFL and the CIO merged in 1955 and between them represented some 15 million workers.

The principles and practices of trade unionism are firmly embedded in the economic systems of all noncommunist industrial countries. Favourable legislation and, in some countries, direct political action have established collective bargaining as the principal means of settling wages, conditions, and disputes. The success of trade unionism in winning a strong voice for its members has been silently acknowledged in the adoption of many of its goals and tactics by professional associations and other groups traditionally thought to be beyond the scope of unionism.

**trade wind,** very steady wind that blows westward and toward the equator from the subtropical high-pressure belts at latitudes near 30° N and 30° S toward the intertropical convergence zone. It is stronger and more consistent over the oceans than over land and produces fairly clear skies that make trade-wind islands popular tourist resorts. Its average speed is about 5 to 6 m per second (11 to 13 miles per hour). The trade winds were named by the crews of sailing ships that depended on the winds during westward ocean crossings.

**trademark,** any visible sign or device used by a business enterprise to identify its goods and distinguish them from those made or carried by others. Trademarks may be words or groups of words, letters, numerals, devices, names, the shape or other presentation of products or their packages, colour combinations with signs, combinations of colours, and combinations of any of the enumerated signs.

By indicating the origin of goods and services, trademarks serve two important purposes. They provide manufacturers and traders with protection from unfair competition (one person representing or passing for sale his goods as the goods of another), and they provide customers with protection from imitations (assuring them of a certain expected quality). In terms of the protection of the rights of trademark holders, the law in most countries extends beyond the rule of unfair competition, for a trademark is considered the property of the holder; and, as such, unauthorized use of the trademark constitutes not only misrepresentation and fraud but also a violation of the holder's private property rights.

In most countries, registration is a prerequisite for ownership and protection of the mark. In the United States, however, the trademark right is granted by the mere use of the mark; registering the mark provides the owner only with certain procedural advantages and is not a prerequisite for legal protection.

It is not necessary for the mark to be in use before a registration application is filed, although most countries require applicants to have a bona fide intent to use the mark after registration. Formerly, the United States was one of the few countries requiring actual use prior to registration. Under the Trademark Law Revision Act of 1988, the United States permits registration upon application attesting to an intent to use the trademark in the near future.

In many countries, ownership of a trademark is not acknowledged until the mark has been

registered and gone uncontested for a given period of time, so as to afford protection to a prior user of the mark. Even after that period has passed, the prior user may move to have the registration canceled. After a certain number of years (from three to seven, depending on the country), the registration and ownership become uncontestable.

For a mark to be registered, it must be distinctive. In many cases a mark, when first brought into use, may not have been distinctive, but over time the public may have attached a secondary meaning to it, forming a specific association between the mark and the product, thus making the mark distinctive, hence registrable.

When a question of infringement (unauthorized use) of a trademark arises, the primary legal question addressed in court is whether the accused infringer's use of the mark is likely to confuse the purchasing public. In most countries, including the United States, protection against infringement extends to goods or services similar to those covered by the registration. In countries following British law (some 66 nations), an infringement action can, however, be brought only for the precise goods identified in the registration.

For a long time the rights of a trademark could not be transferred separately from the business to which it was attached. Now, however, because trademarks are deemed property, they may be sold, inherited, or leased, as long as such a transfer of rights does not deceive the public. In most countries a public notice of such a transfer must be given. A common form of transfer is international licensing, whereby a trademark holder allows the use of his mark in a foreign country for a fee. Often in such instances the foreign licensee must meet certain product quality requirements so that his use of the mark does not deceive the consumer.

There are some instances in which the right of trademark may be lost. The two most serious reasons for loss of trademark are the failure to use a registered trademark and the use of a trademark that becomes a generic term. In many countries if a trademark is not used within a certain number of years, the rights of protection of the mark are forfeited. In the United States when a trademark becomes a generic term in the public's mind (such as Aspirin, Kleenex, or Linoleum) the courts may decide that the trademark holder no longer has rights of protection. In other countries the courts are not concerned if the mark is considered generic, and the original trademark holder retains all rights and privileges of the mark.

Although each nation has its own trademark law, there are increasingly multinational efforts to ease registration and enforcement practices. The first international agreement was the Paris Convention for the Protection of Industrial Property of 1883, which has been regularly revised ever since. It sets minimum standards for trademark protection and provides similar treatment for foreign trademark holders as for nationals. Approximately 100 countries are party to the Paris Convention.

**Trades Union Congress** (TUC), national organization of British trade unions. Although it is the sole national trade union centre, three other related bodies also exist: the Scottish Trades Union Congress, the Wales Trade Union Council, and the Irish Congress of Trade Unions (Northern Ireland Committee).

Founded in 1868, the TUC held annual conferences of independent unions for the exposition of trade union principles. From 1871 it had a permanent standing committee, the Parliamentary Committee, whose principal function was to lobby Parliament for legislation favourable to unions. The TUC was composed almost exclusively of unions of skilled workers until 1889, when it began to accept the first affiliations of "new" or unskilled general unions. But the TUC's organization remained extremely rudimentary, and rather than enlarge its own role, it helped to establish two new, separate bodies: the General Federation of Trade Unions, founded in 1899 as an insurance fund for strikes, and the Labour Representation Committee, founded in 1900 and in 1906 renamed the Labour Party. The latter first acted as a body for sponsoring candidates for Parliament until after 1918, when it became a national political party.

The TUC began to assume its modern form after World War I, when it replaced the Parliamentary Committee with a General Council that could better represent the diverse industrial unions of the British labour movement. The council acquired powers to deal with interunion conflicts and to intervene in disputes with employers, and it helped mobilize unions during the nationwide General Strike of 1926. Under such leaders as Ernest Bevin and Walter Citrine, the TUC in the 1930s and '40s became the unchallenged spokesman for industrial labour in dealings with the government, and it participated closely in the management of Britain's industries during World War II.

The TUC retained its status in the postwar decades, and TUC members cooperated with government and business in formulating economic policy until 1979, when a Conservative government came to power under Margaret Thatcher. Excluded from government policy making thereafter, the TUC was unable to rally its members against the Thatcher government's legal restrictions on trade unions. As a result of these and other factors, the TUC's membership declined from about 12,000,000 in 1979 to about 8,000,000 in 1989.

The TUC's union affiliates are autonomous and act independently in the conduct of their relations with business. The TUC is not itself affiliated with any political party, but many of its affiliate unions support the Labour Party. The TUC is affiliated with the International Confederation of Free Trade Unions (ICFTU), which it helped to found in 1949.

**Tradescant, John** (b. Aug. 4, 1608, Meopham, Kent, Eng.—d. April 22, 1662, South Lambeth, near London), British naturalist and son of Charles I's naturalist and gardener, also John Tradescant, whom he succeeded in the same post.

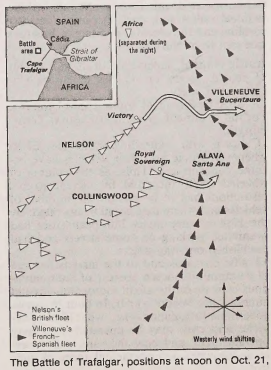
Tradescant added to his father's collection of natural history objects, ultimately forming a significant collection acquired principally from Algiers and Virginia. After the younger Tradescant's death, it was eventually given to an acquaintance, Elias Ashmole. He in turn gave it to the University of Oxford in 1683, founding thereby the Ashmolean Museum, the first scientific museum in England established on a substantial basis. The Tradescant collection was the first collection of natural history objects of such quantity and quality assembled in England.

**trading stamp,** any of the printed stamps of value given as a premium by retail dealers to customers and redeemable for cash or merchandise from a trading stamp company when accumulated in specified amounts. The retailer purchases the stamps from the trading stamp company at a cost usually amounting to about 2 to 3 percent of total sales.

Trading stamps existed in the United States and Great Britain in the late 19th century but did not become popular in the United States until the 1930s and in Great Britain until the 1960s. They also became well established in Japan during the '60s. In some companies stamps are redeemable for bank deposits rather than merchandise.

The introduction of a stamp plan by one merchant may enable him to draw customers away from his competitors; if they respond with comparable plans, however, the efforts are likely to cancel each other out. The cost of the stamps is a merchandising expense, passed on to consumers through higher prices.

**Trafalgar, Battle of** (Oct. 21, 1805), naval engagement of the Napoleonic Wars, which established British naval supremacy for more than 100 years; it was fought west of Cape Trafalgar, Spain, between Cádiz and the Strait of Gibraltar. A fleet of 33 ships (18 French and 15 Spanish) under Admiral Pierre de Villeneuve fought a British fleet of 27 ships under Admiral Horatio Nelson.




The Battle of Trafalgar, positions at noon on Oct. 21, 1805

From E.B. Potter (ed.), *Sea Power, A Naval History* © 1960: Prentice-Hall, Inc., Englewood Cliffs, N.J.

At the end of September 1805, Villeneuve had received orders to leave Cádiz and land troops at Naples to support the French campaign in southern Italy. On October 19–20 his fleet slipped out of Cádiz, hoping to get into the Mediterranean Sea without giving battle. Nelson caught him off Cape Trafalgar on October 21.

Villeneuve ordered his fleet to form a single line heading north, and Nelson ordered his fleet to form two squadrons and attack Villeneuve's line from the west, at right angles. By noon the larger squadron, led by Admiral Cuthbert Collingwood in the *Royal Sovereign,* had engaged the rear (south) 16 ships of the French-Spanish line. At 11:50 AM Nelson, in the *Victory,* signaled his famous message: "England expects that every man will do his duty." Then his squadron, with 12 ships, attacked the van and centre of Villeneuve's line, which included Villeneuve in the *Bucentaure.* The majority of Nelson's squadron broke through and shattered Villeneuve's lines in the pell-mell battle. Six of the leading French and Spanish ships, under Admiral Pierre Dumanoir, were ignored in the first attack and about 3:30 PM were able to turn about to aid those behind. But Dumanoir's weak counterattack failed and was driven off. Collingwood completed the destruction of the rear, and the battle ended about 5:00 PM. Villeneuve himself was captured, and his fleet lost 19 or 20 ships—which were surrendered to the British—and 14,000 men, of whom half were prisoners of war. Nelson was mortally wounded by a sniper, but when he died at 4:30 PM he was certain of his complete victory. About 1,500 British seamen were killed or wounded, but no British ships were lost. Trafalgar shattered forever Napoleon's plans to invade England.

**Trafalgar Square,** plaza in the City of Westminster, Greater London, named for Lord Nelson's naval victory (1805) in the Battle of Trafalgar. The square is dominated by Nelson's Column (1840–43), a 185-foot- (56-metre-) high monument to Lord Nelson that includes a 17-foot- (5-metre-) high statue of him by E.H. Baily. At the corners of the column's plinth are four lions sculptured by Sir Edwin Landseer. Trafalgar Square was constructed in between the 1820s and '40s, and it is the site of the National Gallery and the Church of St. Martin-in-the-Fields. Traditions associated with Trafalgar Square include political rallies and, each December, nightly caroling and the erection of a large Christmas tree sent from Norway.

**traffic control,** supervision of the movement of people, goods, or vehicles to ensure efficiency and safety.

A brief treatment of traffic control follows. For full treatment, *see* MACROPAEDIA: Transportation.

Concern with controlling traffic has arisen whenever people and their vehicles have become concentrated. Thus, as the volume of wheeled traffic increased in ancient Rome, restrictions had to be put on the number of vehicles and where they could be operated. By the 17th century many European cities had prohibited parking on some streets and had established one-way streets.

Traffic on roads and in the air has become of paramount concern because of the tremendous increase in the use of motor vehicles and aircraft since World War II. In both instances government regulation—*i.e.,* what kind of vehicles and craft may be operated, who may operate them, and how they are to be operated—provides a fundamental form of control.

In the early days of automobiles there was little concern for regulating traffic, as there were only a few vehicles and speeds were low. The number of vehicles increased dramatically in the early 20th century, however, and their speeds increased as more powerful engines were used and as better roads were built. A system of traffic-control devices was devised that included regulatory devices, such as traffic signals and prohibitory and mandatory signs; warning devices, to alert drivers of hazardous or unusual road conditions; and guidance devices, to give drivers route and other pertinent information.

Control of air traffic is considerably more difficult because it must be done for craft moving at much higher speeds within a three-dimensional framework. The most important objective is to ensure that safe distances are maintained between aircraft. The primary area of concern is in and around airports; the sky around them is called controlled airspace.

The first systematic attempt to regulate traffic on a large scale took place on railroad lines. As the use of trains became widespread, it became obvious that some method of control was needed to keep trains heading in opposite directions off of the same track and to maintain safe intervals between trains heading in the same direction.

The first attempts at interval control, by running trains on timed schedules, was only partially successful. The development of the block system, in which portions of track (blocks) were controlled by signalmen in communication with each other by telegraph, permitted train operators to learn of track conditions as the train advanced from block to block. Colour light signals activated automatically by electric relays in the track greatly reduced potential for human error and allowed traffic to run more smoothly. An important modern innovation is the moving-block system, in which a moving zone, based on speed, is maintained by electronic equipment that automatically adjusts the speed of the train when it enters the zone of another train.

Harbours and their approaches and inland canals and rivers are the areas of greatest concern in water-traffic control. The primary methods of control include marking hazardous areas on charts and with lights, sound signals, and buoys; creating shipping lanes in areas of heavy traffic; standardizing forms of communication and of collision avoidance; and establishing agencies to check and to certify vessels for seaworthiness.

**Trafford,** district (borough) in the southwest of the metropolitan area of Greater Manchester, England, bordering Cheshire. It covers 41 square miles (106 square km). The name Trafford is well known for the Trafford Park Industrial Estate and for Old Trafford, home of both the Lancashire County Cricket Club and the Manchester United Football Club.

The early industrial growth of the district was stimulated by the building in 1761 of the Bridgewater Canal, which runs north through Trafford Park and southwest through Stretford, Sale, and Altrincham. Development accelerated after 1894 with the completion of the Manchester Ship Canal, which forms the western boundary of the district. This made Manchester a port and provided the impetus for the development of the Trafford Park Industrial Estate, a centre for manufacturing, engineering, and storage and distribution. Office development is also expanding. Parts of the district near Cheshire have served as residential suburbs for Manchester businessmen since the 19th century. Pop. (1986 est.) 216,300.

**tragedy,** *see under* descriptive word (*e.g.,* domestic tragedy; revenge tragedy; Senecan tragedy), except as below.

**tragedy,** branch of drama that treats in a serious and dignified style the sorrowful or terrible events encountered or caused by a heroic individual. By extension the term may be applied to other literary works, such as the novel.

A brief treatment of tragedy follows. For full treatment, *see* MACROPAEDIA: Literature, The Art of.

The origins of the tragic form are Greek, as are those of the term itself, meaning "goat-song" and possibly referring originally to the sacrifice of a goat in the vegetation and fertility rituals associated with the god Dionysus, in whose honour tragedies were performed. The starkly universal themes of tragedy, the problems and conditions of life lived under the shadow of death and disaster, may be connected with the seasonal rhythms of life, decay, death, and rebirth. To begin with, it seems, these mysteries were celebrated in movement and song by a chorus. Later an individual emerged from the chorus to engage in dialogue with it. Aeschylus is credited with the innovation of isolating a second speaker so that dialogue between characters became possible. By the time of Sophocles and Euripides it had become customary for up to three characters to appear on stage at once.

The materials of Greek tragedy were drawn from familiar myths of gods and men found in the works of Homer and elsewhere, so that the dramatic interest was less in the story than in the presentation of the changing awareness and responses of those involved, including the chorus. Major events tended to happen offstage and to be reported and commented on rather than presented directly. The plot, as in Sophocles' *Oedipus the King,* often traces the stages by which the hero or heroine becomes involved in an intolerable yet ultimately inescapable situation, prompted by will or circumstance, fatal ignorance, or binding obligation, but confronted in the end by the workings of an inexorable fate that ensures an unhappy outcome. The experience of ordeal is not wholly negative, however, for it may disclose unsuspected dimensions of human grandeur and dignity in extreme circumstances.

Roman adaptations of Greek tragedy, particularly by Seneca, tended toward violent sensation and declamatory rhetoric, qualities that were taken up in Elizabethan tragic drama. For Chaucer and the European Middle Ages, tragedy came to mean simply the edifying account of how a great man's fortunes altered from initial prosperity to final wretchedness. But the new adventurous spirit of Elizabethan England, with its voyages of discovery and fascination with the rewards and perils of individual achievement, produced a frequently bombastic neo-Senecan "tragedy of blood," of which Thomas Kyd's *The Spanish Tragedie* (*c.* 1589) is an example. Christopher Marlowe's *Tamburlaine* (1587) and *Doctor Faustus* (*c.* 1588) introduced the overambitious hero, awe-inspiring in his ambition and magnificent even in his fall. Shakespearean tragedy incorporates elements of the drama of the time but goes further in presenting an imaginative vision of evil and of the resources with which man confronts it in his extremity. By taking a prominent but imperfect public figure as tragic hero—King Lear or Hamlet, Prince of Denmark—Shakespeare contrived to involve a whole social and political order in the deeds and misfortunes of the protagonist.

Seventeenth-century French classical tragedy, unlike Elizabethan tragedy, self-consciously returned both to the legendary subject matter and to the highly conventionalized unities of time, place, and action attributed to Greek tragedy by Aristotle and later critics. The gods of the Greek pantheon became literary and conventional in the theatre of Racine and Corneille, but the sense of tragic necessity remained so that individuals, often confronted with intolerable choices such as that between love and duty, were shown to have achieved the heights of human dignity even in keen personal anguish.

A new kind of tragedy emerged in northern Europe in the 19th century. Unlike earlier tragedies, the plays of Henrik Ibsen, August Strindberg, and Anton Chekhov were written in prose rather than formal verse and dealt with painful contemporary situations. Ibsen explored individual frustration, particularly when an unusually perceptive character falls victim to hereditary blight or the constrictions and corruptions of society against which he has sought to protest. Strindberg explored compulsive but destructive sexuality, while Chekhov examined the boredom and emptiness of privileged lives in a decaying social order.

Tragedy in its fullest dimensions was rarely conspicuous in 20th-century drama, though the American playwright Eugene O'Neill wrote many undeniably successful tragedies. Tragedy did assume prominence in another literary form, that of the novel. Such important novelists as Fyodor Dostoyevsky, Thomas Hardy, Joseph Conrad, and William Faulkner wrote books that unmistakably recall the values of the tragic tradition. But by the late 20th century, despite the unimaginable evils of World War II that might have inspired tragic drama and despite moving explorations of human loneliness and desolation in the postwar theatre, tragedy was thought by many to be a moribund literary form.

**tragic flaw** (drama): *see* hamartia.

**tragicomedy,** dramatic work incorporating both tragic and comic elements. When coined by the Roman dramatist Plautus in the 2nd century BC, the word denoted a play in which gods and men, masters and slaves reverse the roles traditionally assigned to them, gods and heroes acting in comic burlesque and slaves

adopting tragic dignity. This startling innovation may be seen in Plautus' *Amphitryon*.

In the Renaissance, tragicomedy became a genre of play that mixed tragic elements into drama that was mainly comic. The Italian writer Battista Guarini defined tragicomedy as having most of tragedy's elements—*e.g.*, a certain gravity of diction, the depiction of important public events, and the arousal of compassion—but never carrying the action to tragedy's conclusion, and judiciously including such comic elements as low-born characters, laughter, and jests. Central to this kind of tragicomedy were danger, reversal, and a happy ending. Despite its affront to the strict Neoclassicism of the day, which forbade the mixing of genres, tragicomedy flourished, especially in England, whose writers largely ignored the edicts of Neoclassicism. John Fletcher provides a good example of the genre in *The Faithful Shepherdess* (*c.* 1608), itself a reworking of Guarini's *Il pastor fido*, first published in 1590. Notable examples of tragicomedy by William Shakespeare are *The Merchant of Venice* (1596–97), *The Winter's Tale* (1610–11), and *The Tempest* (1611–12).

Nineteenth-century Romantic writers espoused Shakespeare's use of tragicomedy in the belief that his plays closely mirrored nature, and they used him as a model for their works. The dramas of Georg Büchner, Victor Hugo, and Christian Dietrich Grabbe reflect his influence. With the advent of realism later in the 19th century, tragicomedy underwent yet another revision. Still intermingling the two elements, comic interludes now highlighted the ironic counterpoints inherent in a play, making the tragedy seem even more devastating. Such works as Henrik Ibsen's *Ghosts* (1881) and *The Wild Duck* (1884) reflect this technique. George Bernard Shaw said of Ibsen's work that it established tragicomedy as a more meaningful and serious entertainment than tragedy. Anton Chekhov's tragicomedies include *Uncle Vanya* (1897) and *The Cherry Orchard* (1904).

Modern tragicomedy is sometimes used synonymously with Absurdist drama, which suggest that laughter is the only response left to man when he is faced with the tragic emptiness and meaninglessness of existence. Examples of this modern type of tragicomedy are Samuel Beckett's *Endgame* (1958) and Harold Pinter's *The Dumb-Waiter* (1960).

**Traherne, Thomas** (b. 1637, Hereford, Eng.—d. 1674, Teddington), last of the mystical poets of the Anglican clergy, which included most notably George Herbert and Henry Vaughan.

The son of a shoemaker, Traherne was educated at the University of Oxford, ordained in 1660, and presented in 1661 to the living of Credenhill, which he held until 1674. From 1669 to 1674 Traherne lived in London and Teddington, serving as chaplain to Sir Orlando Bridgeman, lord keeper from 1667 to 1672.

The only work by Traherne published during his lifetime was *Roman Forgeries* (1673). His *Christian Ethicks* appeared posthumously in 1675, and his *Thanksgivings* in rhythmical prose were published anonymously as *A Serious and Pathetical Contemplation of the Mercies of God* in 1699. The greater part of Traherne's poetry and his prose meditations remained unknown until their recovery in modern times. The chance discovery in 1896 in a London street bookstall of the manuscripts of Traherne's *Poetical Works* (published 1903) and his *Centuries of Meditations* (published 1908) created a literary sensation. The manuscript of *Poems of Felicity* was subsequently found in the British Museum and published in 1910; other manuscripts were discovered later.

As a poet Traherne possessed originality of thought and intensity of feeling, particularly in his mystical evocations of the joy and innocence of childhood, but he lacked discipline in his use of metre and rhyme. Indeed, his poetry is overshadowed by the prose work *Centuries of Meditations*, in which he instructs an acquaintance in his personal philosophy of "felicity"; the latter was based on Traherne's Christian training, his retention of vivid impressions of the wonder and joy of childhood, and his desire to regain that sense in a mature form.

**Trail,** city, southeastern British Columbia, Canada. It lies along the Columbia River at the mouth of Trail Creek, adjacent to Rossland, in the Selkirk Mountains, and just north of the U.S.-Canada border and the state of Washington.

The modern city's economy rests on the mining and smelting of metals (especially silver, zinc, and lead) and on the production of chemicals and fertilizers, with food processing and sawmilling important as secondary industries. Trail's mining operation eventually evolved into the Consolidated Mining and Smelting Company of Canada, Ltd. (Cominco). Inc. city, 1910. Pop. (1991) 7,919.

**Trail of Tears,** a forced migration undertaken by the Cherokee (*q.v.*) Indians of the eastern United States in 1838–39.

**trailing arbutus,** also called GROUND LAUREL, WINTER PINK, or MAYFLOWER (species *Epigaea repens*), trailing plant of the heath family (Ericaceae), native to sandy or boggy, acid woodlands of eastern North America. It has oblong, hairy evergreen leaves 2–6 cm (0.75–2.5 inches) long. The highly fragrant white, pink, or rosy flowers have a five-lobed corolla (the petals, collectively) and grow in dense clusters. Trailing arbutus grows in shady wildflower gardens.



Trailing arbutus (*Epigaea repens*)
Karl Maslowski

**Traill, Catherine Parr,** *née* STRICKLAND (b. Jan. 9, 1802, London, Eng.—d. Aug. 29, 1899, Lakefield, Ont., Can.), nature writer who, in richly detailed descriptions of frontier life, was one of the first to praise the beauties of the Canadian landscape.

Traill, a writer of children's books in England, emigrated to the wilderness of Upper Canada (now Ontario) in 1832 with her husband and her sister, the writer Susanna Strickland Moodie. *The Backwoods of Canada* (1836), which was based on a series of letters written to her mother in England, was the forerunner of the Canadian nature essay. This book was followed by *The Female Emigrant's Guide, and Hints on Canadian Housekeeping* (1854) and *The Canadian Settlers' Guide* (1860), entertaining and practical narratives of frontier life. Also a naturalist, Traill wrote *Canadian Wild Flowers* (1869), *Studies of Plant Life in Canada* (1885), and *Pearls and Pebbles* (1895), on birds and animals. She introduced the animal story for children into Canadian literature with the publication of *Afar in the Forest* (1869). Like her nature writings, these stories abound in lyrical descriptions of the fields and forests.

**Traill, Thomas Stewart** (b. Oct. 29, 1781, Kirkwall, Orkney, Scot.—d. July 30, 1862, Edinburgh), Scottish professor of medical jurisprudence at the University of Edinburgh from 1832, who was editor of the eighth edition of *Encyclopædia Britannica*.

Traill graduated from the University of Edinburgh (1802) and for 30 years practiced medicine in Liverpool, where he helped to found, and was secretary of, the Literary and Philosophical Society and also devoted time to establishing the Royal Institution and the Mechanics Institution. On his return to Edinburgh he was chosen by *Britannica* proprietor Adam Black to edit the eighth edition. The first volume appeared just before Traill became president (December 1852) of the Edinburgh Royal College of Physicians. Traill's articles for *Britannica* included, among other contributions, "Medical Jurisprudence" and "Light and Heat."

**Trailok,** also called BOROMMATRAILOKANAT (b.1431, Ayutthaya, Siam [now Phra Nakhon Si Ayutthaya, Thailand]—d. 1488, Phitsanulok), eighth king of Siam (Thailand; 1448–88), who established a centralized political and administrative system, the outlines of which lasted until the late 19th century.

Trailok's father, King Borommaracha II (1424–48), named him heir apparent in 1438, and even as a small boy he was named the king's deputy in the important northern city of Phitsanulok. Though only an adolescent when he came to the throne, he proved to be an energetic leader and administrator. Under the pressure of constant warfare against the Thai kingdom of Lan Na (later Chiang Mai) in the north, he greatly strengthened the central administration. He formalized the division of responsibilities among one military and five civilian departments: provincial administration, capital administration, finance, lands and agriculture, and justice and the royal household. He further stabilized the structure of Thai society by assigning all officials and all his subjects a numerical rank (*sakdi na*) notionally expressed in terms of units of land—from 4,000 acres for the highest minister down to 10 acres for the humblest freeman—thus making explicit the relative status of everyone in the kingdom. Similarly, he ranked the provinces in four classes and clarified hierarchical relations amongst them. In 1468 he issued a palatine law that defined the succession to the throne and the status and obligations of princes and officials.

Throughout his reign, warfare with Lan Na continued. After Lan Na captured the capital city of Sawankhalok in 1460, Trailok moved his base of operations to Phitsanulok (1463) in order to direct the war from a more forward position. He extended Siamese influence southward into the Malay Peninsula and, according to a disputed account in the chronicles, captured the Malay city of Melaka in 1455.

**train oil:** *see* whale oil.

**trainer,** in military aviation, an airplane that is designed and used to train pilots to operate advanced aircraft effectively. The complicated modern military airplane requires a high degree of skill on the part of pilots. Military training programs commonly make use of a single-engine aircraft for primary training phases, with twin-jet trainers for transition stages.

Primary training airplanes are generally of simplified construction, with a minimum of complicated equipment. The transition trainers are considerably more complicated. They are fast and highly maneuverable and can be fitted with a variety of complicated equipment found also in combat types.

Training in navigation is generally given on a class basis, in which groups of students are taken aloft in a "flying classroom," usually a twin-engined transport airplane containing a number of navigator's stations at which each student can make his own observations and computations while in the air.

Because the use of high-speed, high-performance military airplanes for training purposes is expensive, difficult, and dangerous, a great deal of pilot and crew training is done in flight simulators (*q.v.*).

**training, transfer of,** the effects of having learned one activity on an individual's execution of other activities.

A brief treatment of transfer of training follows. For full treatment, *see* MACROPAEDIA: Learning and Cognition, Human.

Three basic types of transfer of training are possible: positive, negative, and zero (neutral). Positive transfer occurs when a previously acquired skill enhances the performance or acquisition of a new one. An example of positive transfer of training is the ability to apply fluency in one Romance language to the acquisition of another. Conversely, a previously acquired skill may have detrimental effects on the attempt to master a new one, which is considered negative transfer. In the case of zero transfer, possessing one skill has a minimal effect on learning another.

Psychologists determine the transfer of training by comparing two groups of people, one of which previously has acquired a specific skill and one of which has not. A criterion of a certain level of performance is set for the acquisition of the new skill, and the amount of rehearsal required by each group to reach the criterion is compared.

One factor that appears to be important in transfer of training is whether some behaviour needed for the previously learned skill must be abolished to master the new one. This is illustrated by studies of paired-associate learning, in which people are required to respond to the presentation of one word, the stimulus, with another word, the response (*e.g.*, "hope-fortress"). People who have not previously been taught any other associations to the stimulus learn the response more quickly than people who have been taught a different association (*e.g.*, "hope-charity"). Thus, if a previously acquired response must be extinguished, negative transfer occurs.

Another important factor is the similarity between components of two abilities. If the components are similar and each of them must be utilized differently for the new and old skill, negative transfer results. Using paired-associate learning once again as an example, memorizing the pair "hope-fortress" will later impede producing, in response to "faith," a word dissimilar to "fortress," such as "river."

Negative transfer of training may be caused by a skill that has been obtained either before or after the capacity under investigation. If learning a new task interferes with the production of a skill acquired earlier, retroactive inhibition has taken place. Conversely, when a learned skill impairs the competence of another learned later, proactive inhibition has occurred. *See* inhibition.

**Trajan,** Latin in full CAESAR DIVI NERVAE FILIUS NERVA TRAIANUS OPTIMUS AUGUSTUS, also called (AD 97–98) CAESAR NERVA TRAIANUS GERMANICUS, original name MARCUS ULPIUS TRAIANUS (b. Sept. 15?, AD 53, Italica, Baetica [now in Spain]—d. Aug. 8/9, 117, Selinus, Cilicia [now in Turkey]), Roman emperor (AD 98–117), the first to be born outside Italy. He sought to extend the boundaries of the empire to the east (notably in Dacia, Arabia, Armenia, and Mesopotamia), undertook a vast building program, and enlarged social welfare.

*Origins and early career.* Marcus Ulpius Traianus was born in the Roman province of Baetica, southern Spain. Although his ancestors, whether or not original settlers, were undoubtedly Roman, or at least Italian, they may well have intermarried with natives. While his family was probably well-to-do and prominent in Baetica, his father was the first to have a career in the imperial service. He became a provincial governor and in 67–68 commander of a legion in the war the future emperor Vespasian was conducting against the Jews. In 70, Vespasian, by then emperor, rewarded him with a consulship and a few years later enrolled him among the patricians, Rome's most aristocratic group within the senatorial class. Finally, he became governor, successively, of Syria and Asia.

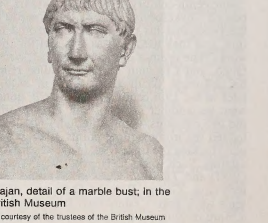
Although there is little documentation of Trajan's early life, presumably the future emperor grew up either in Rome or in various military headquarters with his father. He served 10 years as a legionary staff tribune. In this capacity he was in Syria while his father was governor, probably in 75. He then held the traditional magistracies through the praetorship, which qualified him for command of a legion in Spain in 89. Ordered to take his troops to the Rhine River to aid in quelling a revolt against the emperor Domitian by the governor of Upper Germany, Trajan probably arrived after the revolt had already been suppressed by the governor of Lower Germany. Trajan clearly enjoyed the favour of Domitian, who in 91 allowed him to hold one of the two consulships, which, even under the empire, remained most prestigious offices.

When Domitian had been assassinated by a palace conspiracy on Sept. 18, 96, the conspirators had put forward as emperor, and the Senate had welcomed, the elderly and innocuous Nerva. His selection represented a reaction against Domitian's autocracy and a return to the cooperation between emperor and Senate that had characterized the reign of Vespasian. Nevertheless, the imperial guard (the praetorian cohorts) forced the new emperor to execute the assassins who had secured the throne for him. There was also discontent among the frontier commanders.

Therefore, in October 97, Nerva adopted as his successor Trajan, whom he had made governor of Upper Germany and who seemed acceptable both to the army commanders and to the Senate. On Jan. 1, 98, Trajan entered upon his second consulship as Nerva's colleague. Soon thereafter, on January 27 or 28, Nerva died, and Trajan was accepted as emperor by both the armies and the Senate. Before his accession, Trajan had married Pompeia Plotina, to whom he remained devoted. As the marriage was childless, he took into his household his cousin Hadrian, who became a favourite of Plotina.

*Domestic policies as emperor.* Trajan defied Nerva and included his name in his imperial title. In 114 he placed before his title Augustus the adjective Optimus ("Best"). This was undoubtedly intended, by recalling the epithets Optimus Maximus, applied to Jupiter, to present Trajan as the god's representative on earth. Trajan was a much more active ruler than Nerva had been during his short reign. Instead of returning to Rome at once to accept from the Senate the imperial powers, he remained for nearly a year on the Rhine and Danube rivers, either to make preparations for a coming campaign into Dacia (modern Transylvania and Romania) or to ensure that discipline was restored and defenses strengthened. He sent orders to Rome for the execution of the praetorians who had forced Nerva to execute the conspirators who had brought him to the throne. He gave the soldiers only half the cash gifts customary on the accession of a new emperor, but in general, he dealt fairly, if strictly, with the armies.

When he returned to Rome in 99, he behaved with respect and affability toward the Senate. He was generous to the populace of Rome, to whom he distributed considerable cash gifts, and increased the number of poor citizens who received free grain from the state. For Italy and the provinces, he remitted the gold that cities had customarily sent to emperors on their accession. He also lessened taxes and was probably responsible for an innovation for which Nerva is given credit—the institution of public funds (*alimenta*) for the support of poor children in the Italian cities. Such endowments had previously been established in Italy by private individuals, notably by Trajan's close friend, the orator and statesman Pliny the Younger, for his native Comum (modern Como) in northern Italy.



Trajan, detail of a marble bust; in the British Museum

By courtesy of the trustees of the British Museum

For the administration of the provinces, Trajan tried to secure competent and honest officials. He sent out at least two special governors to provinces whose cities had suffered financial difficulties. One was Pliny the Younger, whom he dispatched to Bithynia-Pontus, a province on the northern coast of Asia Minor. The letters exchanged between Pliny and Trajan during the two years of Pliny's governorship are preserved as the 10th book of his correspondence. They constitute a most important source for Roman provincial administration.

In one exchange, Pliny asked Trajan how he should handle the rapidly spreading sect of Christians, who, refusing to conform to normal religious practices, suffered from great unpopularity but were, as far as Pliny could see, harmless. In his reply, a model of judiciousness, Trajan advised Pliny not to ferret out Christians nor to accept unsupported charges and to punish only those whose behaviour was ostentatiously recalcitrant. Clearly in Trajan's time the Roman government did not yet have (and, indeed, was not to have for another century) any policy of persecution of the Christians; official action was based on the need to maintain good order, not on religious hostility. The correspondence also illustrates the wasteful expenditure of cities on lavish buildings and competition for municipal honours, an indication that the finances of the empire were already beginning to show inflationary trends.

Trajan undertook or encouraged extensive public works in the provinces, Italy, and Rome: roads, bridges, aqueducts, the reclamation of wastelands, the construction of harbours and buildings. Impressive examples survive in Spain, in North Africa, in the Balkans, and in Italy. Rome, in particular, was enriched by Trajan's projects. A new aqueduct

brought water from the north. A splendid public bathing complex was erected on the Esquiline Hill, and a magnificent new forum was designed by the architect Apollodorus of Damascus. It comprised a porticoed square in the centre of which stood a colossal equestrian statue of the emperor. On either side, the Capitoline and Quirinal hills were cut back for the construction of two hemicycles in brick, which, each rising to several stories, provided streets of shops and warehouses.

Behind the new forum was a public hall, or basilica, and behind this a court flanked by libraries for Greek and Latin books and backed by a temple. In this court rose the still-standing Trajan's Column, an innovative work of art that commemorated his Dacian Wars. Its cubical base, decorated with reliefs of heaps of captured arms, later received Trajan's ashes. The column itself is encircled by a continuous spiral relief, portraying scenes from the two Dacian campaigns. These provide a commentary on the campaigns and also a repertory of Roman and Dacian arms, armour, military buildings, and scenes of fighting. The statue of Trajan on top of the column was removed during the Middle Ages and replaced in 1588 by the present one of St. Peter.

*Military campaigns.* Trajan's civil accomplishments were impressive but, except for the *alimenta*, not innovative. He is renowned chiefly for abandoning the policy, established by Augustus and generally adhered to by his successors, of not extending the Roman frontiers. Despite his title Germanicus, his first year on the Rhine-Danube frontier was not marked by any major conquest.

In 101, however, he resumed the invasion of Dacia that Domitian had been forced to abandon by Decebalus, the country's redoubtable king. In two campaigns (101–102 and 105–106), Trajan captured the Dacian capital of Sarmizegethusa (modern Varhély), which lay to the north of the Iron Gate in western Romania; Decebalus evaded capture by suicide. Trajan created a new province of Dacia north of the Danube within the curve of the Carpathian Mountains. This provided land for Roman settlers, opened for exploitation rich mines of gold and salt, and established a defensive zone to absorb movements of nomads from the steppes of southern Russia.

Trajan's second major war was against the Parthians, Rome's traditional enemy in the east. The chronology of his campaigns is uncertain. In preparation for them, in 105/106, one of his generals annexed the Nabataean kingdom, the part of Arabia extending east and south of Judaea. Next, about 110, the Parthians deposed the pro-Roman king of Armenia, whereupon, in 113/114, Trajan campaigned to reinstate him. In the following year (115) he annexed upper Mesopotamia and, in the same or next year, moved down the Tigris River to capture the Parthian capital of Ctesiphon. He reached the Persian Gulf, where he is said to have wept because he was too old to repeat Alexander the Great's achievements in India.

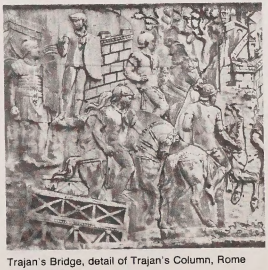
*Death and succession.* Late in 115, Trajan barely escaped death in an earthquake that devastated Antioch (modern Antakya, Turkey). In 116 revolts broke out both in the newly conquered territories and in Jewish communities in several of the eastern provinces. Trajan, discouraged and in ill health, left Antioch for Rome. He died, in his 64th year, at Selinus (modern Selindi) on the southern coast of Asia Minor. His ashes were returned to Rome for a state funeral and burial in the base of his column. Just before his death was made public, it was announced that he had adopted Hadrian, who in 100 had married Trajan's favourite niece.

Although Hadrian differed completely in temperament from Trajan and initially had not been advanced with any unusual speed, Trajan, a few years before his death, had made him governor of Syria, where he was responsible for the logistical support of the Parthian campaign. But Trajan did not then adopt him or give any indication of a choice of successor. Hence contemporary gossip stamped the announcement of Hadrian's last-minute adoption as a fiction put out by the empress Plotina, though it was probably a genuine deathbed decision.

Modern historians differ in their judgments of Trajan both as a ruler and as a conqueror. Some think that his Dacian campaigns brought the empire new revenues and strengthened the Danubian frontier. Others regard his success as having been prepared by Domitian and his Parthian war as having overstrained the resources of the empire because of his megalomanic desire for military glory. (M.Ha.)

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**Trajan's Bridge,** first bridge spanning the Danube River, built east of the Iron Gate Rapids at Turnu Severin by the Roman emperor Trajan (reigned AD 98–117) to guarantee the supply line of his legions in conquered



Trajan's Bridge, detail of Trajan's Column, Rome
Alinari—Art Resource

Dacia. The engineer, probably Trajan's lieutenant, Apollodorus of Damascus, used timber arches mounted on masonry piers to span the 0.5-mile- (800-metre-) wide river. A century and a half later the emperor Aurelian withdrew from Dacia and demolished the bridge, which is memorialized on Trajan's Column in Rome. Its 170-foot (52-metre) spans were the longest built for more than a thousand years.

**Trajan's Column,** monument erected AD 106–113 by the Roman emperor Trajan and surviving intact in the ruins of Trajan's Forum in Rome. A marble column of the Roman Doric order, it measures 125 feet (38 m) high together with the pedestal, or base, within which there is a chamber that served as Trajan's tomb. Originally the column stood in the middle of a courtyard surrounded by galleries from which one could view at various levels the spiral band (over 800 feet [240 m] long and about 4 feet [1.2 m] wide) covered with low-relief sculpture that forms a continuous narrative of the emperor's two campaigns in Dacia. A spiral staircase is contained within the shaft's interior, which measures 12 feet 2 inches (3.7 m) in diameter. At first a bronze eagle had been placed on top of the column and then after Trajan's death a bronze statue of the deceased emperor, which was replaced in 1588 by a statue of St. Peter.

**Trakl, Georg** (b. Feb. 3, 1887, Salzburg, Austria—d. Nov. 3, 1914, Cracow, Galicia, Austria-Hungary [now Kraków, Pol.]), Expressionist poet whose personal and wartime torments made him Austria's foremost elegist of decay and death. He influenced Germanic poets after both world wars.

Moody and withdrawn, Trakl trained as a pharmacist at the University of Vienna (1908–10)—partly, perhaps, to gain access to narcotics, for by 1913 he was a confirmed addict. Other compulsions were an abnormal affection for his younger sister, Grete, and restless wanderlust.

The patronage of a periodical publisher and of the philosopher Ludwig Wittgenstein, who secretly gave him part of a patrimony, enabled Trakl to devote himself to poetry; he brought out his first volume in 1913. The following year he became a lieutenant in the army medical corps and, in Galicia, was placed in charge of 90 serious casualties whose agonies he, as a mere dispensing chemist, could hardly relieve. One patient killed himself while Trakl watched helplessly; he also saw deserters being hanged. He either attempted or threatened to shoot himself in the aftermath of these horrors and was sent to a military hospital at Kraków for observation. There he died of an overdose of cocaine, perhaps taken inadvertently.

Throughout his intense lyrics, lamentation for the present is infused with longing for the golden spirit of a pastoral past and for rebirth, and in his haunted imagery he sings of "the heart against a lonely sky." A volume of selected poems, translated into English by Lucia Getsi, was published in 1973.

**Tralee,** urban district, county seat, and minor seaport at the head of Tralee Bay, County Kerry, southwestern Ireland. The earls of Desmond had their main castle at Tralee in the 14th and 15th centuries. There are remains of the castle wall and of a medieval Dominican abbey. The Roman Catholic church, completed in 1870, is a large Gothic structure. Tralee, a bacon-curing centre and market town with textiles and light manufacturing, is the gateway to the Dingle peninsula and a busy tourist centre. Pop. (1991 prelim.) 17,206.

**Trallwng, Y** (Wales): *see* Welshpool.

**tram:** *see* streetcar.

**tramp steamer,** one of the two principal types of merchant ships as classified by operating method (the other is the ocean liner). The tramp steamer, in contrast to the liner, operates without a schedule, going wherever required to deliver its cargoes. The tramp is a descendant of the early merchant ships whose masters (who were also their owners) loaded them with cargo at home to sell abroad, and vice versa. Tramps are used mainly for carrying bulk commodities or homogeneous cargoes in whole shiploads, with each voyage separately negotiated between the ship's owner and the shipper, usually through a broker.

**trampoline,** an elevated, resilient webbed bed or canvas sheet supported by springs in a metal frame and used as a springboard for tumbling. Trampolining, or rebound tumbling, is an individual sport of acrobatic movements performed after rebounding into the air from the trampoline.

Although rebound tumbling has existed for centuries, it did not achieve wide popularity until the 20th century, when it became a featured attraction performed by circus acrobats. The modern sport was born in 1936 with the development of the present-day trampoline by American gymnast George Nissen.

The first unofficial American trampolining competition took place in 1947, followed by the first official American championships in 1954. The sport was included in the Pan-American Games for the first time in 1955. In 1962 the first open international trampolining event took place in West Germany, after which the first world championship was held in England in 1964. Immediately after the 1964 competition, officials from participating countries met to form the International Tram-

poline Association, the sport's worldwide governing body.

A competition consists of one compulsory and one optional routine, with the winners of those events performing another optional rou-



Trampoline tumbling competition
*London Daily Express*—Pictorial Parade

tine. Each routine is limited to eight contacts with the trampoline, with competitors scored on difficulty, execution, and form.

**Tran** DYNASTY (1225–1400), rulers of a kingdom that successfully defended Vietnam from the Mongol armies and continued Vietnamese penetration southward down the Indochinese peninsula.

The Tran dynasty replaced the Later Ly dynasty (1009–1225), which started the process of Vietnamese expansion south from the Red River region at the expense of the Indianized kingdom of Champa. Shortly thereafter, Indochina was invaded by a Mongol army under the great conqueror Kublai Khan. The Tran dynastic capital at Hanoi was sacked in 1257, but the Tran rulers repulsed this first Mongol invasion; and a united Vietnam-Champa effort repelled second and third Mongol invasions in 1284 and 1287. After the elimination of the Mongol threat, the Tran resumed pressure on Champa; in 1312 the Tran monarch Tran Anh Ton invaded Champa, captured its king, and made the country into a subject state.

Champa temporarily regained its independence in 1326 and, under its great king Che Bong Nga (reigned 1360–90), even recovered its lost provinces. But, after Che's death, the Tran reconquered the country, moving their capital southward from Hanoi to Thanh Hoa in 1398 to reflect the shift in their territory. In 1400, however, a discontented general seized the Tran throne. Tran partisans called in aid from the Chinese, who occupied the country. Not until 1428 were the Chinese driven out and a new native dynasty restored.

**Tran Hung Dao,** original name TRAN QUOC TUAN, also called HUNG DAO VUONG (b. 1229?—d. 1300, Van Kiep, Vietnam), figure of almost legendary proportions in Vietnamese history, a brilliant military strategist who defeated two Mongol invasions and became a cultural hero among modern Vietnamese.

By the early 1280s the Vietnamese kingdom faced a growing threat from the Mongols under Kublai Khan, who had conquered China in the previous decade. When he was appointed commander-in-chief of the Vietnamese armed forces, Tran Hung Dao, in a rousing speech to his forces, called for national unity and persuaded his army to fight the invaders. When the Mongols invaded the Red River valley (in northern Vietnam) with a massive army in 1283/84, Tran gave way before the invaders and adopted a defensive strategy, using guerrilla warfare and scorched-earth tactics against them. He then launched a counteroffensive that liberated the Vietnamese capital and drove the Mongols back into China.

When the Mongols resumed their campaign against Vietnam in 1287, Tran and his forces again gave ground, avoiding a pitched battle until the Mongols had occupied the capital. After resuming the offensive, Tran engaged the Mongol fleet in battle at the mouth of the Bach Dang River in 1288. Kublai Khan's junks, lured by Hung Dao's men, were ripped apart by iron-tipped spears that had been implanted beneath the waters—a strategy borrowed from an earlier Vietnamese warrior, Ngo Quyen (939).

Tran Hung Dao was one of the first great Vietnamese military strategists. His use of guerrilla warfare to harass and eventually defeat a more powerful enemy provided a model for communist guerrilla warfare in the 20th century. His mobilization of the entire Vietnamese population in the cause of national resistance to foreign invasion similarly inspired the North Vietnamese during the Indochina Wars (1946–75). His proclamation calling for national unity, along with a textbook he wrote on military strategy, became classics of Vietnamese literature. Tran Hung Dao is still an object of worship in rural areas of Vietnam, with many temples dedicated to him.

**Trang,** town, southern Thailand, on the Malay Peninsula. Trang is an inland town on the Trang River and is a centre for rubber production. A spur links Trang and the nearby port of Kantang to the Bangkok-Singapore railway. Its airport has scheduled flights to other southern Thai towns. Pop. (1991 est.) 48,589.

**tranh** (musical instrument): *see* cheng.

**Trani,** ancient (Latin) TURENUM, town and archiepiscopal see, Bari *provincia,* Puglia (Apulia) *regione,* southeastern Italy. It lies along the Adriatic Sea, northwest of Bari city. Trani originated in Roman times and flourished under the Norman and Swabian (Hohenstaufen) kings of Sicily by means of its trade with the Middle East. Its Ordinamenta Maris (1063) is considered to be the first medieval maritime code of the Mediterranean Sea. The medieval part of the town is dominated by the castle, built (1233–49) by the Holy Roman emperor Frederick II; the 12th-century Ognissanti Church; the Palazzo Caccetta (1458); and the splendid Romanesque-Apulian Cathedral (begun 1094) dedicated to St. Peregrinus (Nicola Pellegrino), a young Greek pilgrim who died at Trani and was canonized by Pope Urban II. Inland from the medieval section is the modern town, and to the southeast, extending as far as the Colonna peninsula, is the garden city, a much-frequented summer vacation resort with an excellent beach.

Trani is noted for its wines (particularly moscato) and for its stone quarries. Marble is exported to Switzerland and Germany. There is also a furniture industry and some fishing. Pop. (1991 prelim.) mun., 498,337.

**Tranninh, Plateau du,** English TRAN NINH PLATEAU (Laos): *see* Xiangkhoang, Plateau de.

**tranquilizer,** also spelled TRANQUILLIZER, drug that is used to reduce anxiety, fear, tension, agitation, and related states of mental disturbance. Tranquilizers fall into two main classes, major and minor. Major tranquilizers, which are also known as antipsychotic agents, or neuroleptics, are so called because they are used to treat major states of mental disturbance in schizophrenics and other psychotic patients. By contrast, minor tranquilizers, which are also known as antianxiety agents, or anxiolytics, are used to treat milder states of anxiety and tension in healthy individuals or people with less serious mental disorders. The major and minor tranquilizers bear only a superficial resemblance to each other, and the trend has been to drop the use of the word tranquilizer altogether in reference to such drugs, though the term persists in popular usage.

Major tranquilizers are highly selective in alleviating the delusions, hallucinations, and disordered thinking of schizophrenics and other psychotic patients. The drugs return agitated, excited, and irrational patients to a state of rational calm, and they have enabled many seriously ill people who would otherwise be hospitalized to live at home and engage in productive work. Major tranquilizers do not cure schizophrenia but merely suppress its symptoms, and they are usually prescribed on a long-term basis. The basic types are the phenothiazines, thioxanthines, butyrophenones, clozapine, and rauwolfia alkaloids. The phenothiazines are the most widely used of these and include the drug chlorpromazine (*q.v.*). They are thought to work by blocking the neurotransmitter dopamine in the brain. This leads to a reduction of psychotic symptoms but can also result in such unwanted side effects as tremors of the limbs, rigidity, restlessness, and involuntary spasms of the facial muscles, tongue, and lips. (*See also* phenothiazine.) The thioxanthines and the butyrophenones, chief among which is haloperidol (Haldol), are similar to the phenothiazines. Another drug, clozapine, whose exact mode of action remains unclear relieves schizophrenic symptoms in some patients who are not helped by phenothiazines. Clozapine lacks the side effects of the phenothiazines but tends to induce an infectious disease known as agranulocytosis. The rauwolfia alkaloids, such as reserpine, are no longer in common use.

The principal minor tranquilizers are the benzodiazepines, among which are diazepam (Valium), chlordiazepoxide (Librium), and alprazolam (Xanax). These drugs have a calming effect and eliminate both the physical and psychological effects of anxiety or fear. Besides the treatment of anxiety disorders, they are widely used to relieve the strain and worry arising from stressful circumstances in daily life. Because of this, benzodiazepines are among the most widely prescribed drugs in the world. Benzodiazepines work by enhancing the action of the neurotransmitter gamma-aminobutyric acid (GABA), which inhibits anxiety by reducing certain nerve-impulse transmissions within the brain. Benzodiazepines resemble barbiturates in their side effects: sleepiness, drowsiness, reduced alertness, and unsteadiness of gait. Though less dangerous than barbiturates, they can produce physical dependency even in moderate dosages, and the body develops a tolerance to them, necessitating the use of progressively larger doses. The drugs are thus intended for short- and medium-term use. Other, less commonly used minor tranquilizers include meprobamate (Equanil, Miltown) and buspirone (BuSpar).

**Trans-Alay Range,** Russian ZAALAYSKY KHREBET, mountain range on the frontier between Kyrgyzstan and Tajikistan. It is the most northerly range of the Pamirs and extends for 150 miles (240 km) east-west in an unbroken chain of snow-covered peaks between the lush summer pastures of the broad Alay valley to the north and the Muksu and Markansu valleys to the south. Its highest point is Lenin Peak, at 23,406 feet (7,134 m). The total area of glaciation is 461 square miles (1,194 square km). The vegetation on the lower slopes is

steppe and alpine pasture. The Osh-Khorog road, or Pamirs Highway, crosses the Kyzylart Pass, which lies at 14,042 feet (4,280 m) in the eastern part of the range.

**Trans-Canada Highway,** world's longest national road, extending east-west across the breadth of Canada for 4,860 miles (7,821 km), between Victoria (Vancouver Island, British



Trans-Canada Highway in Rogers Pass, Glacier National Park, British Columbia
Tourism Canada

Columbia) and St. John's (Newfoundland), linked by car ferries between Prince Edward Island, Nova Scotia, and Newfoundland. The highway passes through all 10 Canadian provinces, links many leading Canadian cities, and provides access to national and provincial parks. Authorized by the Trans-Canada Highway Act (1949), it was dedicated Sept. 3, 1962, at a ceremony in Rogers Pass in Glacier National Park, British Columbia. Not until 1965, however, when a 200-mile (320-km) stretch was completed in Newfoundland, were motorists able to drive the fully paved route between the Pacific and Atlantic coasts.

**Trans-Himalayas,** eastward continuation of the most northerly Himalayan ranges in the southern part of the Tibet Autonomous Region, China. It consists of an ill-defined mountain area about 600 miles (1,000 km) long and 140 miles (225 km) wide in the centre, narrowing to a 20-mile (32-km) width at the east and west ends. The Trans-Himalayas, mainly composed of granites and volcanic rocks in the Tertiary Period, are bounded by the Kailas (southwest), Nganglong Kangri (north), and Nien-ch'ing-t'ang-ku-la (southeast) mountain ranges and by the Brahmaputra (Ya-lu-tsang-pu) River (south). Unlike the main Himalayas, the mountains are not divided by deep river gorges and lack a definite alignment. Passes average 17,500 feet (5,330 m) in height; the highest is Chargoding Pass (19,308 feet [5,885 m]). The first recorded European sighting of the mountains was by Sven Hedin, a Swedish explorer, in 1906.

**Trans-Siberian Railroad,** Russian TRANSSIBIRSKAYA ZHELEZNODOROZHNAYA MAGISTRAL ("Trans-Siberian Main Railroad"), the longest single rail system in Russia, stretching from Moscow 5,778 miles (9,198 km) east to Vladivostok or (beyond Vladivostok) 5,867 miles (9,441 km) to the port station of Nakhodka. It had great importance in the economic, military, and imperial history of the Russian Empire and the Soviet Union.

Conceived by Tsar Alexander III, the construction of the railroad began in 1891 and proceeded simultaneously from the west (Moscow), from the east (Vladivostok), and across intermediate reaches by way of the Mid-Siberian Railway, the Transbaikal Railway, and other lines. Originally, the Russians secured Chinese permission to build a line directly across Manchuria (the Chinese Eastern Railway) from the Transbaikal region to Vladivostok; this trans-Manchurian line was completed in 1901. After the Russo-Japanese War of 1904–05, however, Russia feared Japan's possible takeover of Manchuria and proceeded to build an alternative route, the Amur Railway, through to Vladivostok; this line was completed in 1916. The Trans-Siberian Railroad thus had two completion dates: in 1904 all the sections from Moscow to Vladivostok were linked and completed running through Manchuria; in 1916 there was finally a Trans-Siberian Railroad wholly within Russian territory. The completion of the railroad opened vast areas of Siberia to exploitation, settlement, and industrialization.

The trans-Manchurian line came under full Chinese control only after World War II; it was renamed the Chinese Ch'ang-ch'un Railway. In the Soviet Union, over the years, a number of spur lines were built radiating from the main trans-Siberian line. From 1974 to 1989 construction was completed on a large alternative route, the Baikal-Amur Mainline;




Trans-Siberian Railroad with its associated rail systems

its route across expanses of taiga, permafrost, and swamps, however, has made upkeep difficult.

The full rail trip on the passenger train Rossiya from Moscow to Nakhodka (including a compulsory overnight stay in Khabarovsk) now takes about eight days.

**Trans World Airlines, Inc.** (TWA), former American airline with extensive routes in the United States and to Europe, the Caribbean, and the Middle East. Until 1950, TWA was known as Transcontinental & Western Air, Inc.

TWA was formed on July 16, 1930, in the amalgamation of divisions of Western Air Express (founded 1925) and Transcontinental Air Transport (founded 1928). Western Air Express had flown both mail and passengers in its first year of service between Los Angeles and Salt Lake City, Utah (1926), and in 1930 TWA inaugurated coast-to-coast service—Newark, N.J., to Los Angeles in 36 hours with a stopover in Kansas City. In 1934 Western Air Express again became independent (later to be called Western Air Lines), but TWA continued as a transcontinental airline.

In 1946 TWA inaugurated international flights between New York City and Paris, quickly expanding by the 1950s to routes through Europe, the Middle East, Africa, and Asia. From 1969 to 1975 it operated transpacific services and was a round-the-world carrier, but in 1975 it suspended such services in a route-exchange with Pan American World Airways.

The financier and aviation pioneer Howard Hughes was the principal stockholder and guiding genius of TWA from 1939 until 1960–61, when he lost control of the airline to a group of Wall Street banks and financial institutions that had financed the purchase of jet aircraft for the airline. An antitrust suit was mixed in with the complex civil litigation, and the multiple litigation involved repeated court hearings, before which the reclusive Hughes refused to appear. In 1966 he sold his TWA shares for more than $500,000,000.

TWA reorganized itself under the ownership of a holding company called Transworld Corp. in 1979, but Transworld sold TWA to the public in 1984 in the course of defending itself against a hostile takeover. By then TWA was experiencing financial troubles, and in late 1985 the American investor Carl C. Icahn acquired the airline. In 1986 TWA bought Ozark Air Lines, Inc., a carrier with routes centred on the south-central United States. Although it continued to operate as usual, the company filed for bankruptcy in 1992. It emerged from bankruptcy the following year but continued to operate at a loss. In 2001 American Airlines (*q.v.*) acquired TWA's assets, and the company ceased to exist that year.

**Transalpine Gaul,** Latin GALLIA TRANSALPINA, in Roman antiquity, the land bounded by the Alps, the Mediterranean, the Pyrenees, the Atlantic, and the Rhine. It embraced what is now France and Belgium, along with parts of Germany, The Netherlands, and Switzerland.

The Romans first ventured into Transalpine Gaul in 121 BC to subdue the Celtic tribes along the Mediterranean coast. All of Transalpine Gaul was annexed by Julius Caesar after the Gallic Wars (58–50 BC). Augustus later divided Transalpine Gaul into four provinces. Narbonensis, situated along the Mediterranean, became a senatorial province with stronger cultural and political ties to Italy than the rest of Gaul. The remaining territory was called Gallia Comata; Augustus divided it into three imperial provinces—Belgica, Lugdunensis, and Aquitania.

**Transamazonian highway,** Portuguese RODOVIA TRANSAMAZÔNICA, system of paved and unpaved roads in Brazil that is designed to facilitate settlement and exploitation of the vast underpopulated Amazon River Basin. The system consists of several major parts. A 3,400-mile (5,100-kilometre) east-west segment extends from Recife, on the Atlantic coast, through Marabá, Itaituba, Humaitá, and Rio Branco to Cruzeiro do Sul, on the Peru-

vian border. The two major north-south links are Rio de Janeiro–Brasília–Porto Franco–Belém and São Paulo–Cuiabá–Santarém, further west. An additional road links Cuiabá northwestward with the Transamazonian highway at Humaitá and continues northward to Manaus and beyond to the partially completed Northern Perimeter Highway.

The rapid pace of construction of this road system has raised serious questions about the preservation of the Amazon Rain Forest's fragile ecology and of the region's aboriginal Indian population in the face of the growing numbers of Brazilian farmers, loggers, and miners who now have access to the Amazon Basin. None of these fears, however, was expected to alter Brazil's determination to provide an outlet for its burgeoning population and a means of exploiting the enormous, so far almost untapped, mineral wealth of the basin, which includes bauxite, copper, iron, manganese, petroleum, and tin.

**Transamerica Corporation,** former American insurance and financial services corporation that was acquired in 1999 by Dutch insurance company Aegon N.V. for nearly $10 billion. The company's headquarters moved from the landmark Transamerica Pyramid building in San Francisco to Charlotte, N.C. in 1992.

The company, incorporated in 1928 by Peter Amadeo Giannini (*q.v.*), originated as the parent of Bank of America, and for many years banking was its principal activity. In 1958, following government antitrust action, Transamerica was reorganized to separate its banking and nonbanking activities. (Bank of America had been divested earlier.) The company then began a program of expansion into insurance and other services and began disposing of some of its nonfinance-oriented businesses.

Construction on the Transamerica Pyramid was begun in 1969 and completed in 1972. (It, too, was acquired by Aegon in 1999.) In 1979 Transamerica entered the field of transportation-equipment leasing by acquiring Interway Corporation, which it renamed Transamerica Interway.

In the mid-1980s Transamerica began selling off the travel and manufacturing subsidiaries it had earlier acquired in order to concentrate on expanding its core of financial service operations. In 1986 it sold Budget Rent-A-Car Corporation, a major car rental service, and also sold Transamerica Delaval Inc., which manufactured turbines, compressors, and other precision-engineered products.

From 1963 to 1981 Transamerica was a major producer and distributor of motion pictures, records, and tapes through its subsidiary United Artists Corporation. It sold United Artists to Metro Goldwyn Mayer in 1981, following some losses on large-budget films.

By the time Transamerica was acquired by Aegon, its business strengths included commercial lending, real estate and related services, reinsurance, and life insurance (including annuities). Soon after the Aegon purchase, Transamerica planned to expand its global insurance businesses in Latin America and China.

**transaminase,** also called AMINOTRANSFERASE, any of a group of enzymes that catalyze the transfer of the amino group ($—NH_2$) of an amino acid to a carbonyl compound, commonly an $\alpha$-keto acid (an acid with the general formula RCOCOOH). The liver, for example, contains specific transaminases for the transfer of an amino group from glutamic acid to $\alpha$-keto acids that correspond to most of the other amino acids. Other transaminases catalyze reactions in which an amino group is transferred from glutamic acid to other compounds—*e.g.*, to aldehydes to form amines. Transamination is one of the principal mechanisms for the formation of necessary amino acids in the metabolism of proteins. Vitamin $B_6$ is commonly involved in the action of the transaminases.

**Transantarctic Mountains,** mountain system subdividing the Antarctic continent into an eastern and a western region. The Transantarctic Mountains stretch for more than 2,000 miles (3,200 km) from Victoria Land to the shores of the Weddell Sea. Rising to 15,000 feet (4,500 m) in the Queen Maud Mountains, they traverse a region that is almost entirely covered by an ice sheet. Other major subdivisions of the system include the Shackleton, Pensacola, Horlick, Queen Alexandra, Britannia, Prince Albert, and Admiralty ranges. Extensive coal deposits, estimated as one of the world's largest reserves, and fossilized remains of primitive freshwater amphibia and reptiles have been found there. Research stations along the base of the mountains have been operated by the United States, the United Kingdom, and New Zealand.

**Transcaucasia,** Russian ZAKAVKAZYE, region immediately south of the crest of the Caucasus Mountains, and consisting of Georgia, Azerbaijan, and Armenia. It is bounded on the north by the Great Caucasus Range (separating it from Russia), on the south by Turkey and Iran, on the west by the Black Sea, and on the east by the Caspian Sea. All three nations of the region were formerly republics of the Soviet Union. Area 71,850 square miles (186,100 square km). Pop. (2001 est.) 16,145,000.

A brief treatment of Transcaucasia follows. For full treatment, *see* MACROPAEDIA: Transcaucasia.

*Physical and human geography.* The Caucasus Mountains trend generally northwest-southeast and consist of two ranges—the Great Caucasus in the north and the Lesser, or Little, Caucasus in the south. The glaciated, volcanic peaks of the Great Caucasus rise to more than 16,500 feet (5,000 m). Toward the south the Great Caucasus dips steeply beneath the great synclinal valley of Transcaucasia, beyond which the peaks of the Little Caucasus rise to more than 12,000 feet (3,700 m). The valley between the Great and Little Caucasus is divided by the Likhsky Mountains into the Kolkhida lowland on the west (bordering the Black Sea) and the Kura-Araks lowland on the east (bordering the Caspian Sea). The mild subtropical climate of the western lowland allows the growing of such crops as tea and citrus fruits, whereas the eastern one lies in a rain shadow, making irrigation essential. The Kura-Araks lowland, however, has the oil-bearing strata of Baku and the Apsheron Peninsula. Draining the lowlands, the Kura and Kuma rivers flow east into the Caspian Sea, and the Rioni and Inguri rivers flow west into the Black Sea. The mountains of the Little Caucasus merge with the Armenian Highland to the south, a stream-dissected region occasionally surmounted by volcanic cones. Because the Great Caucasus impedes the movement of cold-air masses from the north, the lowlands of Transcaucasia experience mild winters as well as warm summers.

More than 50 different peoples inhabit Transcaucasia, but the main ethnic groups are the Azeris, Armenians, and Georgians. The Azeris are Shī'ite Muslims who speak a Turkic language, while the Armenians are Orthodox or Catholic Christians whose language forms a separate branch of the western group of Indo-European languages.The Georgians are mostly Orthodox Christians who speak a language belonging to the South Caucasian group of the Caucasian family of languages.

Transcaucasia underwent considerable industrial development during the Soviet period, with heavy industry—hydroelectric power, oil and natural gas, metallurgy, chemicals, and the manufacture of heavy machinery and equipment—predominating. Textile, food-processing, and other light industries have also grown. Agriculture is concentrated in the humid subtropical lowland areas. The chief crops include tea, grapes, tobacco, and sugar beets in Georgia; cereal grains, cotton, and grapes in Azerbaijan; and grapes and fruit in Armenia. In higher elevations, sheep and cattle are raised.

*History.* Transcaucasia has often played the role of a buffer zone between rival empires: Roman and Parthian, Byzantine and Arab or Ottoman, and Persian and Russian. The two most important of the region's many semi-independent kingdoms down through the centuries were those of eastern Georgia (10th–13th century AD) in the north and Armenia (1st century BC) in the south; both were converted to Christianity in the 4th century AD and remained Christian despite later subjection to Islāmic rule by Ottomans and Persians. The population of Azerbaijan was Islāmized after Arab incursions in the 7th century and was largely under Persian suzerainty until the 18th century.

Russia gained possession of the northern portions of Transcaucasia in the late 18th century and controlled almost the entire region by 1830. Under tsarist rule the region received some Western education and benefited from the relative prosperity and peace of the Russian Empire. Russia developed the rich oilfields of eastern Azerbaijan from the late 19th century. After the Russian Revolution of 1917, Armenia, Azerbaijan, and Georgia enjoyed a brief period of independence before being forcibly incorporated into the Soviet Union by the Red Army in the early 1920s. Under the Soviets, Transcaucasia was administered as a single unit, the Transcaucasian Soviet Federated Socialist Republic, until 1936, when it was divided into the three union republics of Armenia, Azerbaijan, and Georgia. During 70 years of Soviet rule, Transcaucasia was transformed from a largely agricultural area into an industrial and urban region. With the breakup of the Soviet Union in late 1991, Armenia, Azerbaijan, and Georgia each gained full independence.

**transcendental ego,** the self that is necessary in order for there to be a unified empirical self-consciousness. For Immanuel Kant, it synthesizes sensations according to the categories of the understanding. Nothing can be known of this self, because it is a condition, not an object, of knowledge. For Edmund Husserl, pure consciousness, for which everything that exists is an object, is the ground for the foundation and constitution of all meaning. For Giovanni Gentile, it is the self that comes to consciousness when one expresses one's thoughts in language, the self whose being is pure act.

**transcendental idealism,** also called FORMALISTIC IDEALISM, term applied to the epistemology of the 18th-century German philosopher Immanuel Kant, who held that the human self, or transcendental ego, constructs knowledge out of sense impressions and from universal concepts called categories that it imposes upon them. Kant's transcendentalism is set in contrast to those of two of his predecessors—the problematic idealism of René Descartes, who claimed that the existence of matter can be doubted, and the dogmatic idealism of George Berkeley, who flatly denied the existence of matter. Kant believed that ideas, the raw matter of knowledge, must somehow be due to realities existing independently of human minds; but he held that such things-in-themselves must remain forever unknown. Human knowledge cannot reach to them because knowledge can only arise in the course of synthesizing the ideas of sense.

Transcendental idealism has remained a significant strand in later philosophy, being per-

petuated in various forms of Kantian and Neo-Kantian movements of thought.

**Transcendental Meditation** (TM), movement that was founded by the Maharishi Mahesh Yogi and became popular in the West during the 1960s. The movement is based more on the practice of specific techniques of meditation than on a set of religious or philosophical beliefs. As a monk in India in the 1940s and '50s the Maharishi developed a form of meditation that could be easily practiced by people in the modern world. In 1958 he began teaching it in India, and in 1959 he made his first tour of the West.

Transcendental Meditation uses one of a variety of Sanskrit mantras, each of which is a short word or phrase that, repeated in the mind, helps the user still the activity of thought and find a deeper level of consciousness. Through this process it is claimed that the practitioner finds deep relaxation, which leads to enhanced inner joy, vitality, and creativity. The perspective behind TM, based on Vedānta philosophy, is called the Science of Creative Intelligence.

To practice TM, a person must be initiated by a teacher. This involves sessions of formal instruction, followed by a ceremony in which the applicant makes monetary and other offerings and receives his mantra, selected by the teacher on the basis of the meditator's temperament and occupation. There are three subsequent "checking" sessions in which the person meditates under the teacher's observation. The person then begins meditating independently twice a day for periods of 20 minutes each and continues to do so indefinitely. Further levels of training are available. Many physiologists and psychologists have recognized Transcendental Meditation's relaxing and vitalizing effects on the body and mind.

**Transcendentalism,** 19th-century movement of writers and philosophers in New England who were loosely bound together by adherence to an idealistic system of thought based on a belief in the essential unity of all creation, the innate goodness of man, and the supremacy of insight over logic and experience for the revelation of the deepest truths. German transcendentalism (especially as it was refracted by Samuel Taylor Coleridge and Thomas Carlyle), Platonism and Neoplatonism, the Indian and Chinese scriptures, and the writings of such mystics as Emanuel Swedenborg and Jakob Böhme were sources to which the New England Transcendentalists turned in their search for a liberating philosophy. Eclectic and cosmopolitan in its sources and part of the Romantic movement, New England Transcendentalism originated in the area around Concord, Mass., and from 1830 to 1855 represented a battle between the younger and older generations and the emergence of a new national culture based on native materials. It attracted such diverse and highly individualistic figures as Ralph Waldo Emerson, Henry David Thoreau, Margaret Fuller, Orestes Brownson, Elizabeth Palmer Peabody, and James Freeman Clarke, as well as George Ripley, Bronson Alcott, the younger W.E. Channing, and W.H. Channing. In 1840 Emerson and Margaret Fuller founded *The Dial* (1840–44), the prototypal "little magazine" wherein some of the best writings by minor Transcendentalists appeared. The writings of the Transcendentalists and those of contemporaries such as Walt Whitman, Herman Melville, and Nathaniel Hawthorne, for whom they prepared the ground, represent the first flowering of the American artistic genius and introduced the American Renaissance in literature.

In their religious quest, the Transcendentalists rejected the conventions of 18th-century thought; and what began in a dissatisfaction with Unitarianism developed into a repudiation of the whole established order. They were leaders in such contemporary reform movements as anarchistic, socialistic, and communistic schemes for living (Thoreau; Alcott at Fruitlands; Ripley at Brook Farm, *q.v.*); suffrage for women; better conditions for workers; temperance for all; modifications of dress and diet; the rise of free religion; educational innovation; and other humanitarian causes.

Heavily indebted to the Transcendentalists' organic philosophy, aesthetics, and democratic aspirations have been the pragmatism of William James and John Dewey, the environmental planning of Benton MacKaye and Lewis Mumford, the architecture (and writings) of Louis Sullivan and Frank Lloyd Wright, and the American "modernism" in the arts promoted by Alfred Stieglitz.

**Transcontinental Treaty** (1819), also called ADAMS-ONÍS TREATY, or PURCHASE OF FLORIDA, accord between the United States and Spain that divided their North American claims along a line from the southeastern corner of what is now Louisiana, north and west to what is now Wyoming, thence west along the latitude 42° N to the Pacific. Thus Spain ceded Florida and renounced the Oregon Country in exchange for recognition of Spanish sovereignty over Texas.

**transcription,** in music, an arrangement of a composition for an instrument or voice other than that of the original. *See* arrangement.

**Transdanubia,** Hungarian DUNÁNTÚL, region, that part of Hungary lying west of the Danube River, which flows north-south across the middle of the country. Both the English and the Hungarian versions of the name mean "land beyond the Danube." Transdanubia is not uniform as a region, and it consists essentially of a mixture of hills and highlands, with intermontane basins. The hill country and the highlands of Transdanubia include the Bakony and Mecsek ranges; of the flatlands, the Mezőföld, a low loess tableland, a subdivision of the Great Alfold (plain), and the Little Alfold (*qq.v.*) are the largest. Large parts of Transdanubia are forested, but there are fertile agricultural areas and dispersed mining operations.

**transducer,** device that converts input energy into output energy, the latter usually differing in kind but bearing a known relation to input. Originally, the term referred to a device that converted mechanical stimuli into electrical output, but it has been broadened to include devices that sense all forms of stimuli—such as heat, radiation, sound, strain, vibration, pressure, acceleration, and so on—and that can produce output signals other than electrical—such as pneumatic or hydraulic. Many measuring and sensing devices, as well as loudspeakers, thermocouples, microphones, and phonograph pickups, may be termed transducers.

There are hundreds of kinds of transducers, many of which are designated by the energy change they accomplish. For example, piezoelectric transducers contain a piezoelectric element that produces motion when subjected to an electrical voltage or produces electrical signals when subjected to strain. The latter effect may be applied in an accelerometer, a piezoelectric vibration pickup, or a strain gauge. An electroacoustic transducer may convert electrical signals to acoustic signals or vice versa. An example is the hydrophone, which responds to waterborne sound waves and is useful in underwater sound detection. A photoelectric transducer reacts to visible light to produce electrical energy. Electromagnetic transducers form a large group, the major categories of which are differential transformers, Hall-effect magnetic transducers, inductance transducers, induction transducers, and saturable reactors. These operate on electromagnetic principles.

Electrical transducers may be classified as active or passive. The active transducers generate electric current or voltage directly in response to stimulation. An example is the thermocouple; here, the fact that a current will flow in a continuous circuit of two metals, if the two junctions are at different temperatures, is used to generate electricity. The passive transducer produces a change in some passive electrical quantity, such as capacitance, resistance, or inductance, as a result of stimulation. Passive transducers usually require additional electrical energy. A simple example of a passive transducer is a device containing a length of wire and a moving contact touching the wire. The position of the contact determines the effective length of the wire and, thus, the resistance offered to electric current flowing through it. This is the simplest version of what is called a linear-displacement transducer, or linear potentiometer. For practical use, such transducers employ wire-wound, thin-film, or printed circuits to allow for a long resistor within a relatively small device. The longer the resistor, the greater the drop in voltage passing through the device; thus, changes in position are converted to electrical signals.

Transducers also may produce pneumatic or hydraulic output. Pneumatic systems communicate by means of compressed air. An example is a device in which motion is applied via a system of pivots to a baffle that can be moved closer to or farther away from a nozzle that emits a stream of air. The amount of resistance created by the baffle affects the amount of back pressure behind the nozzle, creating a pneumatic signal. Hydraulic systems tend to be designed similarly to pneumatic systems, except that hydraulic systems use hydraulic (liquid) pressure rather than air pressure. Fluidic principles, which apply to the interaction between two fluid streams, have also been used to create transducers.

**transduction,** a process of genetic recombination in bacteria in which genes from a host cell (a bacterium) are incorporated into the genome of a bacterial virus (bacteriophage) and then carried to another host cell when the bacteriophage initiates another cycle of infection. In general transduction, any of the genes of the host cell may be involved in the process; in special transduction, however, only a few specific genes are transduced. It has been exploited as a remarkable molecular biological technique for altering the genetic construction of bacteria, for locating bacterial genes, and for many other genetic experiments.

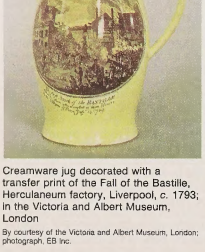
**transept,** the area of a cruciform church lying at right angles to the principal axis. The bay at which the transept intersects the main body of the church is called the crossing. The transept itself is sometimes simply called the cross. The nave of a church with a cruciform plan usually extends toward the west from the crossing, the choir and sanctuary toward the east. The arms of the transept are then designated by direction, as north transept and south transept. They may have aisles or not and are generally about the same width as the nave.

There is disagreement over the origin of the transept. It may have developed from the bema, or platform, of Christian basilican churches, such as the original St. Peter's, Rome. Or it may have developed from the cruciform plan of tombs in the time of the Roman emperor Constantine. Actual transepts first appear in Romanesque churches. Those of the Cluniac order had double transepts, a feature carried over into some English Gothic cathedrals such as those at Lincoln and Salisbury, the latter having main north and south transepts, and smaller northeast and southeast ones. The far more common plan of a Latin cross may be seen in San Michele, Pavia, Italy (*c.* 1155).

**transfer of training** (psychology): *see* training, transfer of.

**transfer orbit:** *see* Hohmann orbit.

**transfer printing,** method of decorating pottery by using an inked, engraved copperplate to make a print on paper that, while still wet, is pressed against a glazed pottery surface, leaving behind an impression, or transfer, of



Creamware jug decorated with a transfer print of the Fall of the Bastille, Herculaneum factory, Liverpool, *c.* 1793; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London; photograph, EB Inc.

the engraving. Sometimes these monochrome transfer prints were subsequently filled in with colour by hand.

Much about the authorship of the invention is conjectural, but it is known that it originated in England some time in the 1750s and was imitated on the Continent (in Sweden *c.* 1766, in Germany *c.* 1770, in Switzerland *c.* 1775, and in France *c.* 1790). In England transfer printing developed at Battersea, London, as an adjunct to the enamel painting on copper done there. Robert Hancock, who may have learned the process at Battersea, was using it around 1757 at Worcester (and possibly earlier at Bow). At Liverpool, John Sadler and Guy Green, who claimed in 1756 to have invented transfer printing, used the technique to decorate pottery made by several factories, particularly Josiah Wedgwood's creamware. The technique played a material part in the revolution wrought by Wedgwood's development of a factory system for the production of pottery, for it enabled less skilled workers to decorate pottery.

Transfer-printed earthenware in blue became popular after 1790 and was produced in enormous quantities; for example, by Spode. Polychrome transfer printing, essayed tentatively at Liverpool during the 1760s, was mastered by the early 19th century, as was transfer printing in gold. Lithographic transfers followed around 1851.

**transferase,** any one of a class of more than 450 enzymes that catalyze the transfer of various chemical groups (other than hydrogen) from one compound to another. Transaminases, for example, catalyze the transfer of an amino group ($-NH_2$) from an amino acid to an *a*-keto acid. Phosphate, methyl ($-CH_3$), and sulfur-containing groups are among the other groups transferred by the action of these enzymes. For the large and important group of enzymes that catalyze the transfer of hydrogen, *see* oxidoreductase.

**transferrin,** also called SIDEROPHILIN, protein (beta$_1$ globulin) in blood plasma that transports iron from the tissues and bloodstream to the bone marrow, where it is reused in the formation of hemoglobin. Found fixed to the surface of developing red blood cells, transferrin frees iron directly into the cell. Human beings have 14 different types of transferrin, but all are believed to be determined at a single genetic locus. They are named by letters of the alphabet; the commonest is called C.

**Transfiguration, Feast of the,** Christian commemoration of the occasion upon which Jesus Christ took three of his disciples, Peter, James, and John, up on a mountain, where Moses and Elijah appeared and Jesus was transfigured, his face and clothes becoming white and shining as light (Mark 9:2–13; Matthew 17:1–13; Luke 9:28–36). The festival celebrates the revelation of the eternal glory of the Second Person of the Trinity, which was normally veiled during Christ's life on earth. According to tradition, the event took place on Mt. Tabor.

It is not known when the festival was first celebrated, but it was kept in Jerusalem as early as the 7th century and in most parts of the Byzantine Empire by the 9th century. It was gradually introduced into the Western Church, and its observance was fixed as August 6 by Pope Callistus III in 1457, as a thank offering for the victory over the Turks at Belgrade on Aug. 6, 1456.

In the Orthodox Church it has always been a major festival. In some churches it is celebrated on other dates. The Syrians and Armenians keep it on the seventh Sunday after Pentecost and some Lutherans on the last Sunday after Epiphany.

**transfinite number,** denotation of the size of an infinite collection of objects. Comparison of certain infinite collections suggests that they have different sizes even though they are all infinite. For example, the sets of integers, rational numbers, and real numbers are all infinite; but each is a subset of the next. Ordering the size of sets according to the subset relation results in too many classifications and gives no way of comparing the size of sets involving different elements. Sets of different elements can be compared by pairing them off and seeing which set has leftover elements. If the fractions are listed in a special way, they can be paired off with the integers with no numbers left over from either set. Any infinite set that can be thus paired off with the integers is called countably, or denumerably, infinite. It has been demonstrated that the real numbers cannot be paired off in this way; and so they are called uncountable or nondenumerable and are considered as larger sets. There are still larger sets, such as the set of all functions involving real numbers. The size of infinite sets is indicated by the cardinal numbers symbolized by the Hebrew letter aleph (alef) with subscript. Aleph-null symbolizes the cardinality of any set that can be matched with the integers; aleph-one and aleph-two indicate sets that correspond to the real numbers and functions, respectively. The set of all subsets of a given set has a larger cardinal number than the set itself, resulting in an infinite succession of cardinal numbers of increasing size.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**transformation,** in biology, one of several processes by which genetic material in the form of "naked" deoxyribonucleic acid (DNA) is transferred between microbial cells. Its discovery and elucidation constitutes one of the significant cornerstones of molecular genetics. The term also refers to the change in an animal cell invaded by a tumour-inducing virus.

The study of transformation dates to the late 1920s, when an English physician, F. Griffith, discovered that pneumococcal cells (*Streptococcus pneumoniae*) could convert from a harmless form to a disease-causing type. He noticed that pneumococci may or may not have a capsular covering. Those cells with a capsule (forming smooth colonies) caused disease in mice; those lacking a capsule (and forming rough-surfaced colonies) were harmless. A mixture of living, nonencapsulated cells and heat-killed, capsulated cells, when inoculated into mice, caused disease. Living, encapsulated cells (pathogenic) were created by a "transforming principle" liberated from the dead cells to the living cells. The transformation was heritable. In 1943 a group of investigators at the Rockefeller Institute, New York City, identified that "transforming principle" as DNA.

**transformational grammar,** also called TRANSFORMATIONAL-GENERATIVE GRAMMAR, a system of language analysis that recognizes the relationship among the various elements of a sentence and among the possible sentences of a language and uses processes or rules (some of which are called transformations) to express these relationships. For example, transformational grammar relates the active sentence "John read the book" with its corresponding passive, "The book was read by John." The statement "George saw Mary" is related to the corresponding questions, "Whom [or who] did George see?" and "Who saw Mary?" Although sets such as these active and passive sentences appear to be very different on the surface (*i.e.,* in such things as word order), a transformational grammar tries to show that in the "underlying structure" (*i.e.,* in their deeper relations to one another), the sentences are very similar. Transformational grammar assigns a "deep structure" and a "surface structure" to show the relationship of such sentences. Thus, "I know a man who flies planes" can be considered the surface form of a deep structure approximately like "I know a man. The man flies airplanes." The notion of deep structure can be especially helpful in explaining ambiguous utterances; *e.g.,* "Flying airplanes can be dangerous" may have a deep structure, or meaning, like "Airplanes can be dangerous when they fly" or "To fly airplanes can be dangerous."

The most widely discussed theory of transformational grammar was proposed by U.S. linguist Noam Chomsky in 1957. His work contradicted earlier tenets of structuralism by rejecting the notion that every language is unique. The use of transformational grammar in language analysis assumes a certain number of formal and substantive universals.

**transformer,** device that transfers electric energy from one alternating-current circuit to one or more other circuits, either increasing (stepping up) or reducing (stepping down) the voltage. Transformers are employed for widely varying purposes; *e.g.,* to reduce the voltage of conventional power circuits to operate low-voltage devices, such as doorbells and toy electric trains, and to raise the voltage from electric generators so that electric power can be transmitted over long distances.

Transformers change voltage through electromagnetic induction; *i.e.,* as the magnetic lines of force (flux lines) build up and collapse with the changes in current passing through the primary coil, current is induced in another coil, called the secondary. The secondary voltage is calculated by multiplying the primary voltage by the ratio of the number of turns in the secondary coil to the number of turns in the primary coil, a quantity called the turns ratio.

Air-core transformers are designed to transfer radio-frequency currents—*i.e.,* the currents used for radio transmission; they consist of two or more coils wound around a solid insulating substance or on an insulating coil form. Iron-core transformers serve analogous functions in the audio-frequency range.

Impedance-matching transformers are used

to match the impedance of a source and that of its load, for most efficient transfer of energy. Isolation transformers are usually employed for reasons of safety to isolate a piece of equipment from the source of power.

**transhumance,** form of pastoralism or nomadism organized around the migration of livestock between mountain pastures in warm seasons and lower altitudes the rest of the year. The seasonal migration may also occur between lower and upper latitudes (as in the movement of Siberian reindeer between the subarctic taiga and the Arctic tundra). Most peoples who practice transhumance also engage in some form of crop cultivation, and there is usually some kind of permanent settlement.

Transhumance is practiced in those parts of the world where there are mountains, highlands, or other areas that are too cold to be inhabited and utilized for grazing except in summer. An extreme form of transhumance is that of the Kohistanis of the Swāt area of Pakistan, who range between altitudes of 2,000 and 14,000 feet (600 and 4,300 m). Most Kohistani families possess houses in four or five different settlements, and at any one time of the year nearly the whole population is concentrated in the altitude belt appropriate to the season. Their economy is based on a combination of the cultivation of grain on terraced fields—mostly irrigated and plowed with bullocks—and the breeding of oxen, buffalo, sheep, goats, and donkeys.

**transistor,** solid-state device for amplifying, controlling, and generating electrical signals. Transistors are used in a wide array of electronic equipment, ranging from pocket calculators and radios to industrial robots and communications satellites.

A brief treatment of transistors follows. For full treatment, *see* MACROPAEDIA: Electronics: *Transistor*.

The transistor was invented in 1947 by three American physicists at the Bell Telephone Laboratories, John Bardeen, Walter H. Brattain, and William B. Shockley. By the late 1950s transistors had supplanted vacuum tubes in most applications. Transistors played a pivotal role in the advancement of electronics, their small size, low heat generation, high reliability, and relatively small power requirements making possible the miniaturization of complex circuitry such as required by computers. During the late 1960s and '70s individual transistors were superseded by integrated circuits in which a multitude of transistors and other components (*e.g.,* diodes and resistors) are formed on a single tiny wafer of semiconducting material. *See also* integrated circuit.

Transistors are made up of layers of different semiconductors produced by the addition of certain impurities (*e.g.,* arsenic or boron) to silicon. These impurities affect the way electric current moves through the silicon. In semiconductors known as *n*-type, the primary electric charge carriers are free electrons; in those called *p*-type, the principal charge carriers are positively charged "holes." (That is to say, vacancies in an atom's electron shell, or holes, can also conduct current.) Holes in semiconductors move about as readily as electrons do, but their motion is in a direction opposite to that of electrons since they are positively charged.

There are two general types of transistors: (1) the bipolar junction transistor (BJT), and (2) the field-effect transistor (FET). The BJT, composed of two closely coupled *p-n* junctions, is bipolar in that both electrons and holes are involved in the conduction process. It is readily able to deliver a change in output voltage in response to a change in input current. This type of transistor is widely used as an amplifier and is also a key component in oscillators, high-speed integrated circuits, and switching circuits.

In contrast to the BJT, the FET is a unipolar device—*i.e.,* its conducting process primarily involves only one kind of charge carrier. It can be built either as a metal-oxide-semiconductor field-effect transistor (MOSFET) or as a junction field-effect transistor (JFET).

Since the mid-1980s the MOSFET has surpassed the BJT in importance and become the predominant component of very-large-scale integrated (VLSI) circuits. Not only does it consume much less power than the BJT, but it can be scaled down to smaller dimensions than the latter with greater ease. Other commercially important types of FETs are the metal-semiconductor field-effect transistor (MESFET) and the closely related JFET. The MESFET can be employed in both analog and digital circuits and is particularly useful for microwave amplification.

**Transit,** any of the first series of U.S. navigation satellites. Launched by the U.S. Navy in 1960–61, the Transit satellites were developed to provide an accurate, all-weather navigational aid for seagoing vessels (including submarines) and aircraft. The system was so designed that any such craft could pinpoint its position by using a computer specially programmed to translate coded radio signals beamed from the satellites into latitude and longitude.

Transit 1-B, the first in the series, was placed in a north-south polar orbit on April 13, 1960. It had only a 40-month life-span, however. Three advanced Transit models equipped with nuclear-power generators were launched from June 22, 1960, to Nov. 15, 1961.

**transition,** alteration of a physical system from one state, or condition, to another. In atomic and particle physics, transitions are often described as being allowed or forbidden (*see* selection rule). Allowed transitions are those that have high probability of occurring, as in the case of short-lived radioactive decay of atomic nuclei. In three-millionths of a second, for instance, half of any sample of unstable polonium-212 becomes stable lead-208 by ejecting alpha particles (helium-4 nuclei) from individual atomic nuclei. Forbidden transitions, on the other hand, are those that have a high probability of not occurring. A strictly forbidden transition is one that cannot occur at all.

A transition may be forbidden by some basic conservation law such as the conservation of angular momentum, which inhibits light and other electromagnetic energy from being emitted in certain transitions within excited atoms and nuclei, or the conservation of electric charge, which strictly forbids electrons from decaying into even more elementary particles.

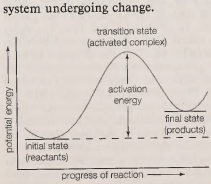
**transition element,** any of various chemical elements that have valence electrons in two shells instead of only one. The elements from scandium to copper (atomic number 21–29), yttrium to silver (39–47), and lanthanum to gold (57–79) are frequently designated as the three main transition series.

A brief treatment of the transition elements follows. For full treatment, *see* MACROPAEDIA: Chemical Elements. *See also* MICROPAEDIA for entries on each member of the transition series.

All of the transition elements are metals. Many of them, such as iron, copper, gold, nickel, silver, titanium, and manganese, are of major economic or technological importance. Most of the transition metals have high melting points, low vapour pressures, and high densities. A large number combine with each other and with other metallic elements to form useful alloys. The majority of the transition elements dissolve in mineral acids, but a few, notably gold, silver, and platinum, are unaffected by nonoxidizing (simple) acids.

The atoms of the transition elements use not only the electrons in their outermost shells for bonding but also those of the underlying *d* orbitals as well. Furthermore, as they are able to accept electrons in unoccupied *d* orbitals, transition metals and their stable compounds often manifest catalytic properties; *i.e.,* they are able to effect chemical changes without themselves undergoing modification. For most transition metals, the compounds formed in at least one oxidation state are coloured and are paramagnetic (capable of being weakly magnetic).

**transition-state theory,** also called ACTIVATED-COMPLEX THEORY, or THEORY OF ABSOLUTE REACTION RATES, a conception of chemical reactions or other processes that involve rearrangement of matter as proceeding through a continuous change in the relative positions and potential energies of the constituent atoms and molecules. Between the initial and final arrangements of atoms or molecules there exists an intermediate configuration for which the energy arising from interatomic and intermolecular forces (potential energy) reaches a maximum; this configuration corresponds to the transition state. The difference between the energies of the transition and the initial states is called the activation energy; it represents the minimum energy that a reacting or flowing system must acquire for the transformation to take place. The variation of energy during a typical transformation from an initial to a final state is shown in the Figure. The horizontal coordinate represents the extent of the transformation from the initial state to the final state rather than distances between atoms or molecules in the system undergoing change.




Potential energy curve

From S. Glasstone *et al., Theory of Rate Processes* (© 1941). Used with permission of McGraw-Hill Book Co.

The activated complex is a hypothetical, transient molecule considered to be in a state of equilibrium with the atoms or molecules in the initial state and therefore amenable (to some extent) to specification of thermodynamic properties. The rate by which the final state is attained is determined by the number of activated complexes formed and the frequency with which they go over to the final state. These quantities may be calculated for simple systems using statistical-mechanical principles. In this way the rate constant $k$ of a chemical reaction or a transport process may be expressed in terms of measurable properties, such as atomic or molecular dimensions, atomic masses, and interatomic or intermolecular forces and differences in thermodynamic properties between the initial and transition states—*e.g.,* free energy, entropy, and enthalpy.

**transitive law,** in mathematics and logic, statement that if $A$ bears some relation to $B$ and $B$ bears the same relation to $C$, then $A$ bears it to $C$. In arithmetic, the property of equality is transitive, for if $A = B$ and $B = C$, then $A = C$. Likewise is the property inequality if the two inequalities have the same sense: that is, if $A$ is greater than $B$ (*i.e.,* $A > B$) and $B > C$, then $A > C$; and if $A$ is less than $B$ (*i.e.,* $A < B$) and $B < C$, then $A < C$. An

example of an intransitive relation is: if *B* is the daughter of *A*, and *C* is the daughter of *B*, then *C* is not the daughter of *A*; and of a nontransitive relation: if *A* loves *B*, and *B* loves *C*, then *A may* or *may not* love *C*.

**Transjordan,** former name of the present Kingdom of Jordan, as an emirate (1921–46) and as a kingdom (1946–49). *See* Jordan.

**Transkei,** former republic (though never internationally recognized as such) in southern Africa. It lay along the Indian Ocean and was surrounded mainly by the Republic of South Africa, though to the north it also touched Lesotho. Transkei consisted of three separate land units, two much smaller than the third. The capital was at Umtata.

Transkei was administratively created by the South African government in 1959 as a non-independent black state designated (together with Ciskei) for the Xhosa-speaking peoples. Transkei was made nominally independent in 1976 in order to serve as a legal homeland for millions of Xhosa-speaking blacks who had lost their South African citizenship under the apartheid system of racial separation.

By the early 2nd millennium AD, the area to the east of the Great Kei River was occupied by the ancestors of the present-day Cape Nguni. When Europeans (Boers) moved into the territory from the west, they clashed with the resident Africans, and in 1778 the Great Fish River was fixed as a boundary between the Xhosa (the southernmost Cape Nguni) and the Cape Colony. The Europeans attached the name "Ciskei" to the Xhosa lands between the Great Fish and Great Kei rivers; those lands lying east of the Great Kei they called "Transkei." A series of Cape Frontier Wars (*q.v.;* also called Kaffir Wars) ensued between 1779 and 1879. In 1847 the British annexed Kaffraria (*q.v.*), an area directly west of the Great Kei that was attached to the Cape Colony in 1866. Between 1879 and 1894 the other Transkeian geographic regions—Griqualand East, Pondoland, and Tembuland—were incorporated within the Cape Colony. In 1894 territorial councils were established, replacing the Cape Nguni's traditional political system, and by the 20th century these were grouped under a single General Council for the Transkeian Territories. In 1910, when the Union of South Africa was formed, these territories were incorporated into it as part of the Cape of Good Hope province.

Under the Promotion of Bantu Self-Government Act of 1959, Transkei became the first of the Bantu Homelands (*see* black state), and in 1963 a Legislative Assembly was introduced, all of whose actions, however, had to be approved by South Africa. Upon the creation of a (nominally) independent Transkei in 1976, all black Africans with language ties to Transkei (whether or not they lived there) lost their South African citizenship and became citizens of the new country. The Organization of African Unity urged the world to shun Transkei on the grounds that recognition would constitute acceptance of apartheid, and the United Nations supported its view. Under the new South African constitution, which abolished the apartheid system, Transkei in 1994 was reincorporated into South Africa. Its territory became part of Eastern Cape and KwaZulu/Natal provinces.

**translocation,** in plants, movement of water and dissolved substances within the vascular system. Soil minerals and substances synthesized by root tissues move in very dilute solution in water through the xylem (fluid-conducting tissues) from the roots to the leaves but, exceptionally, also in the opposite direction. The speed of upward transport varies up to 50 m (150 feet) or more per hour. Foods and other substances synthesized by or applied to the leaves move in all directions in the phloem (vascular tissues of the inner bark). Speeds of phloem transport normally range from about 20 to 100 cm (8 to 40 inches) per hour. Certain growth-regulating substances move only in a polar manner—*i.e.,* away from the shoot tip.

Mechanisms suggested to account for transport of substances in the phloem include simple diffusion, spreading along interfaces, cytoplasmic streaming, active transport, and the one most generally accepted, the pressure flow hypothesis. (*See* mass flow.)

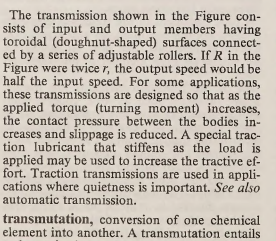
**transmigration** (of the soul): *see* reincarnation.

**transmission:** *see under* descriptive word (*e.g.,* automatic transmission; facsimile transmission; hydraulic transmission), except as below.

**transmission,** in mechanical engineering, a device interposed between a source of power and a specific application for the purpose of adapting one to the other. Most mechanical transmissions function as rotary speed changers; the ratio of the output speed to the input speed may be constant (as in a gearbox) or variable. On variable-speed transmissions the speeds may be variable in discrete steps (as on an automobile or some machine-tool drives) or they may be continuously variable within a range. Step-variable transmissions, with some slip, usually employ either gears or chains and provide fixed speed ratios with no slip; stepless transmissions use either belts, chains, or rolling-contact bodies.

A widely used and inexpensive stepless drive consists of a V-belt running on variable-diameter pulleys. The sides of the pulleys are conical on the inside to match the taper of the V-belt, and moving them closer together causes the V-belt to move outward from the centre of the pulley and operate on a larger effective circle; this movement changes the speed ratio. Such drives depend on friction and are subject to slip.

Stepless transmissions employing rolling-contact bodies are known as traction drives. In these transmissions, power is transmitted in a variety of ways that depend on the rolling friction of bodies in the form of cylinders, cones, balls, rollers, and disks.



Traction transmission

The transmission shown in the Figure consists of input and output members having toroidal (doughnut-shaped) surfaces connected by a series of adjustable rollers. If *R* in the Figure were twice *r,* the output speed would be half the input speed. For some applications, these transmissions are designed so that as the applied torque (turning moment) increases, the contact pressure between the bodies increases and slippage is reduced. A special traction lubricant that stiffens as the load is applied may be used to increase the tractive effort. Traction transmissions are used in applications where quietness is important. *See also* automatic transmission.

**transmutation,** conversion of one chemical element into another. A transmutation entails a change in the structure of atomic nuclei and hence may be induced by a nuclear reaction (*q.v.*), such as neutron capture, or occur spontaneously by radioactive decay, such as alpha decay and beta decay (*qq.v.*). Transmutation of base metals (such as mercury, tin, copper, lead) into precious metals (gold, silver) was long attempted by alchemists, who had no concept of the atomic nature of matter. Their experimentation led to discoveries of many important chemical reactions, but chemical reactions are not capable of effecting the nuclear changes required for transmutation.

**Transnistria,** also known as TRANSDNIESTER, semiautonomous enclave in Moldova, located on the east bank of the Dniester River. Loosely occupying some 1,350 square miles (3,500 square km), the self-proclaimed (1990) Trans-Dniester Moldavian Republic is not recognized by any state; it has a national bank, national currency, and customs house.

Historically, Transnistria was at various times controlled by the Ottoman Empire, the Russian Empire, and the Soviet Union, particularly its Ukrainian and Moldavian republics. The main city is Tiraspol. A substantial Russian military presence in Transnistria strained Moldovan relations with Russia in the early 21st century.

**Transoxania,** also spelled TRANSOXIANA, Arabic MĀ WARĀʾ AN-NAHR ("That Which Lies Beyond the River"), historical region of Turkistan in Central Asia east of the Amu Darya (Oxus River) and west of the Syrdarya (Jaxartes River), roughly corresponding to present-day Uzbekistan and parts of Turkmenistan and Kazakhstan. A great centre of Muslim civilization during the Middle Ages, Transoxania was the centre of the Timurid empire in the 15th century, and its cities (*e.g.,* Bukhara and Samarkand) were known worldwide. The region came under Russian occupation in the 19th century.

**Transpacific Race,** also called HONOLULU RACE, one of the oldest major ocean races for sailing yachts, a 2,225-mile (3,580-km) event run from various California harbours to Honolulu, Hawaii. It was first held in 1906 and made a biennial event in 1939 to alternate with the Bermuda Race. Since 1941 the race has been from San Pedro, Calif. (Los Angeles' harbour), to Diamond Head Buoy, off Honolulu. Since the course is mostly downwind and there is no limit on overall length of vessels, the race is notable for the speeds attained. *See* Sporting Record: *Yachting.*

**transpiration,** in botany, a plant's loss of water, mainly through the stomates of leaves. Stomates consist of two guard cells that form a small pore on the surfaces of leaves. The guard cells control the opening and closing of the stomates in response to various environmental stimuli. Darkness, internal water deficit, and extremes of temperature tend to close stomates and decrease transpiration; illumination, ample water supply, and optimum temperature open stomates and increase transpiration. The exact significance of transpiration is disputed; its roles in providing the energy to transport water in the plant and in aiding in dissipation in direct sunlight (by cooling through evaporation of water) have been challenged. Stomatal openings are necessary to admit carbon dioxide to the leaf interior and to allow oxygen to escape during photosynthesis, hence transpiration has been considered by some authorities to be merely an unavoidable phenomenon that accompanies the real functions of the stomates.

**transplant,** also called GRAFT, in medicine, a portion of the body or a complete organ that is artificially removed from its natural site and transferred to a separate site on the same or a different individual.

A brief treatment of transplants follows. For full treatment, *see* MACROPAEDIA: Transplants, Organ and Tissue.

Transplants in humans and other animals are classified as autografts, allografts (or homografts), or xenografts (or heterografts), according to whether the tissue or organ is obtained from the recipient himself, from another member of the same species, or from a member of another species, respectively.

The fate of a living autograft depends on whether its nutritional requirements are adequately met and thus, as with most tissues, depends on the early reestablishment of a blood supply. Pieces of skin (either whole thickness or partial thickness) or small pieces of other tissues may be transplanted freely to suitable sites and soon become permeated by new vessels. Autografts of skin and subcutaneous tissue may be left connected by a pedicle containing blood vessels, at least until they acquire a new blood supply, and transplants of organs may be handled similarly or by vascular anastomosis—*i.e.*, by connecting the artery and vein to suitable vessels in the new site.

Allografts, as a rule, evoke an immune reaction in the recipient and, in consequence, are destroyed after a few days or weeks. Exceptionally, allografts may survive for a long time or even permanently, notably (1) when the donor and recipient are unusually compatible, (2) when the tissue, such as cornea and cartilage, is devoid of blood vessels, (3) when the recipient has been treated with immunosuppressive agents such as alkylating agents, antimetabolites, corticosteroids, cyclosporine, or other drugs, and (4) when the recipient has been made specifically tolerant of donor tissue. Complete or nearly complete compatibility occurs when the donor and recipient are identical twins or, in the case of animals, members of the same sex of a closely inbred strain, and in this event immunosuppressive agents may not be required. In other cases, the degree of immunosuppression necessary to prevent rejection is related inversely to the degree of compatibility.

Xenografts, as a rule, are destroyed even more quickly than allografts, and it is more difficult to prevent their rejection.

In surgery, free (*i.e.*, unattached) autografts of skin, bone, and cartilage are used extensively. Skin transplants are of special importance in the treatment of deep burns. They often consist of only part of the thickness of the skin, and in this event the donor site normally will heal spontaneously (*see* skin graft). Free nerve transplants also are used, sometimes in the form of multistrand or cable grafts made from small sensory nerves that can conveniently be sacrificed.

Successful replacement of severed limbs (hands and arms or legs and feet), called replantation, is increasing. Guillotine-type injuries have a better prognosis than do infected or avulsed injuries. Upper extremities are more successfully reattached than are lower extremities. Prompt cooling of the severed limb and transporting it in sterile gauze and plastic also improve the prognosis. Pedicled autografts of stomach or bowel are used in reconstruction of the gastrointestinal tract after resection for cancer and other disorders, and similar transplants of bowel are used also in reconstruction of the urinary tract.

Allografts of cornea are used to restore sight in patients with corneal opacities and keratoconus (conical cornea). They may be of partial or full thickness and will remain clear provided that blood vessels do not enter them. Skin allografts survive for only a few weeks but may be lifesaving in patients with extensive burns. They are replaced by autografts when the patient's general condition is satisfactory. Allografts of bone are used in orthopedic surgery; the living cells of the donor bone are usually rejected, but the remaining noncellular bone matrix provides a structural lattice upon which the recipient's body forms new bone.

Allografts of other tissues and of organs usually require close matching of the donor and recipient and the subsequent use of immunosuppressive agents to prevent rejection. As in blood transfusions, the donor and recipient must be of compatible ABO red-blood-cell groups. This, however, is not sufficient; the donor and recipient must also be matched in terms of histocompatibility antigens. The primary human histocompatibility antigens are those of the HLA (human leukocyte group A) system; lymphocytes (a class of white blood cells) from the donor and recipient are tested to determine HLA compatibility.

Allografts of bone marrow are used to treat patients with aplastic anemia, congenital immunodeficiency syndromes, and certain forms of leukemia. Because the grafted marrow may contain immunologically active donor cells, there is a risk of the transplant attacking the recipient's tissues. This often fatal "graft-versus-host" reaction is one of the major complications of bone-marrow transplants.

Kidneys for transplantation have been obtained from living donors or cadavers; other organs can be obtained only from cadavers. Organs from cadavers must be obtained very soon after death; they may, however, be preserved for some hours by cooling and other procedures. *See* kidney transplant.

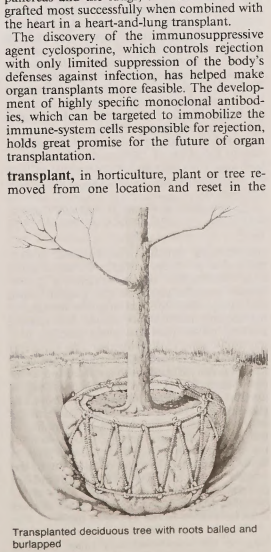
Liver transplantation is technically very difficult, and the transplant must begin to function at once if the patient is to survive, because there is no satisfactory "artificial liver"; on the other hand, rejection is more easily prevented than in the case of the kidney.

Heart transplantation resembles liver transplantation in that the patient's life depends on the transplant being able to function at once; it is technically easier than liver transplantation, but rejection is hard to recognize early and appears to be more difficult to prevent. *See* heart transplant.

Other human organs that have been transplanted with at least some success include the pancreas and the lungs; the latter have been grafted most successfully when combined with the heart in a heart-and-lung transplant.

The discovery of the immunosuppressive agent cyclosporine, which controls rejection with only limited suppression of the body's defenses against infection, has helped make organ transplants more feasible. The development of highly specific monoclonal antibodies, which can be targeted to immobilize the immune-system cells responsible for rejection, holds great promise for the future of organ transplantation.

**transplant,** in horticulture, plant or tree removed from one location and reset in the ground at another. Most small deciduous trees may be moved with no soil attached to their roots. Trees of more than 7.5 cm (3 inches) in trunk diameter, however, are best moved balled and burlapped, that is, with a ball of earth enclosing the roots held in place with burlap.



Transplanted deciduous tree with roots balled and burlapped

The tree is usually set out at approximately the depth it stood before moving, and planting is done as quickly as possible after digging, protecting the roots from sun and wind and keeping them moist. Holes must be wide and deep enough to permit the roots to spread naturally or, in the case of balled and burlapped stock, to receive the ball. The hole is filled around the transplanted tree with fertile soil of good texture, worked around the roots and tamped to eliminate air pockets. A shallow, saucerlike depression is formed around the tree to retain water. Trees that are transplanted in the fall should be mulched with 10–12.5 cm of straw, moist leaves, or hay. Broken or damaged branches should be pruned. In preparing a native tree for transplantation, both top growth and roots should be pruned back. The trunk is wrapped with tree wrap paper to prevent damage from borers, animals, sunscald, or windburn.

Vegetables and flowers that have been started indoors may be transplanted when all danger of frost has passed. Plants must be handled carefully to avoid shock. Seedlings are hardened up for a day or two outside before transplanting. A day that is cloudy or rainy, windless, and cool is ideal for transplanting garden plants. The roots must be kept moist and intact. Newly transplanted small plants require a few days of protection from direct sunlight.

**transport,** in plant physiology, the movement of water and nutrients across a cell membrane.

The fundamental type of distribution of water and nutrients is found in the unicellular algae; the exchange of substances with the water in which they live occurs through their cell membranes. In nonvascular plants, fluid containing nutrients is passed from the apoplast (space where water can flow freely, between and within cell walls) into the cell by enzyme activity, and from cell to cell through cytoplasmic joints called plasmodesmata. In most vascular land plants, water is transported from the soil from the roots up to the leaves via a system called the xylem (in trees, the xylem is the wood). The products of photosynthesis are carried to other parts of the plant via the phloem (in trees, the inner bark is the phloem).

*Xylem.* The essential activity of plants is photosynthesis, which mostly takes place in the leaves. In the course of photosynthesis in vascular plants, the water content of the leaves is evaporated by transpiration, creating within each of the cells from which it is evaporated a low-pressure area that draws more sap into it from the more highly pressurized adjacent cells. Pressure in the adjacent cells is thereby lowered, the result being a pressure gradient extending from the leaves through the xylem system to the roots. This difference in pressure gradients draws water up from the roots to the leaves. In wet weather, transpiration may abate so that sap ceases flowing altogether because there is no pressure difference to force water upward.

The cells that constitute the xylem of conifers originate in a layer of tissues between the inner bark and wood called the vascular cambium and are called tracheids. Tracheids become functional for fluid transport when they die; once the cell has achieved full growth, its protoplasm breaks up and its wooden outer membrane becomes the wall of a passage through which fluids may pass unobstructed.

Tracheids run more or less parallel to the axis of the plant stem and are connected end to end by plasmodesmata through which fluids may pass but not air (a limitation that prevents the spread of damage from an injured section through the xylem to the rest of the tree).

The hard cell walls of the tracheids provide conifers with the structural strength they need to grow and stand against gravity. In more highly developed plants, tracheids have evolved so as to separate the transport function (which takes place in the vessels) from the structural function (which is performed by the fibres). The degree of elaboration of a plant's xylem is related to the humidity of the plant's habitat and its degree of evolutionary development. Some plants that have readapted to living in water after having lived on land have reduced xylem systems; buoyed and surrounded by the water, they have no more need for the transport and structural features the xylem provided.

Soil contents are filtered in the roots by a cell layer called the Casparian strip and converted to the chemical compounds of the sap before being passed into the plant xylem.

*Phloem.* In the leaf, transpiration, the evaporation of water and taking in of carbon dioxide for photosynthesis, is effected through pores called stomata, which are regulated by valve cells called guard cells. Sugars and other products of photosynthesis enter the phloem system in the leaves, whence they are conveyed to all other parts of the plant for storage and tissue growth. Phloem cells, called sieve cells, originate in the same vascular cambium as xylem cells, but on the outside rather than the inside. The rate of flow of solution through the phloem cannot be measured absolutely, since some molecules seem to move faster than others; the fastest molecular movement, under conditions of the most intense transpiration, may be between 40 and 120 inches per hour. Today, phloem transport is investigated by introducing radioactive traces into the system and monitoring them as they pass through the plant body.

The exact workings of phloem transport are not known. Some researchers believe that all substances in the phloem solution are borne along uniformly with solvent water, along a pressure gradient created at the top by the flow of solution into the sieve cells and at the storage cells by the removal of sugars. Understanding of the phloem system has yielded a rationale for the once-common practice of flogging fruit trees to increase yield. Damaging the phloem cells in the bark inhibits the flow of sugars down from the upper reaches of the tree so the sugars remain in the fruit.

**Transport and General Workers' Union** (TGWU), labour union that was the largest in Great Britain throughout much of the 20th century. Its origins extend back to 1889, when the Dockers' Union was formed. That union took the lead in the 1922 merger of 14 unions having a combined membership of more than 300,000. A dominant influence in the TGWU's formation and growth was Ernest Bevin, the union's first general secretary (1922–40).

As a general union prepared to enroll workers who had been excluded by the rigid requirements of the craft unions, the TGWU enjoyed a remarkable growth, reaching a membership of more than 2,000,000 by the 1970s. Its membership included all categories of workers engaged in transport (except the railroads) as well as workers in the automotive, construction, chemical, textile, and other industries. By organizing the semiskilled and unskilled workers employed in smaller manufacturing industries, the general workers' unions such as the TGWU served workers that neither the craft unions nor the mass-production industrial unions had reached.

The TGWU has been characterized by an unusual degree of internal democracy, stability, and influence on general trade union policy in Britain. It long exerted a powerful influence within both the Trades Union Congress and the Labour Party. The TGWU, along with other British trade unions, experienced a significant decline in its membership and influence beginning in the 1970s, however.

**transport phenomenon,** in physics, any of the phenomena involving the movement of various entities, such as mass, momentum, or energy, through a medium, fluid or solid, by virtue of nonuniform conditions existing within the medium. Variations of concentration in a medium, for example, lead to the relative motion of the various chemical species present, and this mass transport is generally referred to as diffusion. Variations of velocity within a fluid result in the transport of momentum, which is normally referred to as viscous flow. Variations in temperature result in the transport of energy, a process usually called heat conduction. There are many similarities in the mathematical descriptions of these three phenomena; and the three often occur together physically, as in combustion, where a flowing, viscous, fluid mixture is undergoing chemical reactions that produce heat, which is conducted away, and that produce various chemical species that interdiffuse with one another.

**transportation,** the movement of goods and persons from place to place and the various means by which such movement is accomplished. The growth of the ability—and need—to transport large quantities of goods or numbers of people over long distances at high speeds in comfort and safety has been an index of civilization and in particular of technological progress.

Transportation is treated in a number of articles in the MACROPAEDIA. For the history and principal treatment of the subject, *see* Transportation. For the major types of propulsion used in modern forms of transportation, *see* Energy Conversion. For forms of transportation for military applications, *see* War, The Technology of. For the engineering infrastructure on which transportation systems depend, *see* Public Works. For the place of transportation in law, *see* Transportation Law.

For a description of the place of transportation in the circle of learning and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Seven, Division III.

For international statistical data about transportation, *see* BRITANNICA BOOK OF THE YEAR.

**transposing musical instrument,** instrument that produces a higher or lower pitch than indicated in music written for it. Examples include clarinets, the English horn, and saxophones. Musical notation written for transposing instruments shows the relative pitches, rather than the exact pitches, produced. Writing in this manner is a historical convention that often allows players to switch from a given instrument to a related one without relearning fingerings and other techniques (as from E♭ clarinet to B♭ clarinet or from English horn to oboe). The instrument name, as in the case of the B♭ clarinet, often indicates the pitch resulting when the player sounds the note written as C. If the actual pitch is lower (or higher) than the notated pitch, the written music must be adjusted upward (or downward) by the same amount. Thus, in the key of C major the music for the B♭ clarinet must be written in the key of D major.

Although most transposing instruments belong to the woodwind and brass families, transposing keyboard instruments have also been built. The piccolo, contrabassoon, and other instruments whose parts are written an octave above or below the actual pitch (as c' above c) are not considered transposing instruments.

**transsexualism,** disturbance of gender identity in which the affected person believes that he or she should belong to the opposite sex. The transsexual male, for example, is born with normal male genitalia and other secondary characteristics of the masculine sex; very early in life, however, he identifies with women and behaves in a manner appropriate to the female sex. His sexual orientation is generally one of attraction to other males. Unlike the male homosexual, however, the transsexual male desires to relate to other men and be treated by them as if he were a normal female.

With the development of successful surgical techniques and hormone therapy, several thousand transsexuals, male and female, have undergone a permanent sex change. Although both male and female transsexuals exist, the male-to-female operation is more common because the genital reconstruction is more satisfactory. The male transsexual's penis and testes are removed and an artificial vagina is created; breast implants may be inserted, although some breast development usually is promoted with the use of feminizing hormones. Female transsexuals may undergo mastectomy and hormone treatments to produce the male secondary sexual characteristics, but attempts to create an artificial penis have not been particularly satisfactory.

**Tranströmer, Tomas** (b. April 15, 1931, Stockholm, Sweden), Swedish lyrical poet noted for his resonant and strangely suggestive imagery.

Tranströmer earned a degree in psychology at the University of Stockholm in 1956 and served from 1960 to 1965 as a psychologist at Roxtuna, a prison for young offenders. From the mid-1960s he divided his time between his writing and his work as a psychologist.

In his first published collection, *17 dikter* (1954; "Seventeen Poems"), Tranströmer displayed a bold, Surrealistic use of metaphor while also experimenting with free and blank verse and Sapphic stanzas. The poetry in *Hemligheter på vägen* (1958; "Secrets on the Way") and *Klanger och spår* (1966; *Echoes and Traces*) is composed in a more personal style, with plainer diction and exceptionally strong rhythmic qualities evident in free verse. Tranströmer's precise poetic observations of nature combine richness of meaning with the utmost simplicity of style. His celebrations of the Baltic coast around Stockholm in such works as *Östersjöar* (1974; *Baltics*) rely on a deceptively plain imagery, which through daring leaps of association opens strange and uncanny perspectives. Tranströmer's famous metaphor "Sweden is a hauled-up, unrigged ship," in reference to what he viewed as the stagnant state of Swedish society, is a good example of his strangely resonant imagery. His later works include *Sanningsbarriären* (1978; *The Truth Barrier*) and *Collected Poems* (1988), an English translation.

Tranströmer's direct language and powerful images made him the most widely translated Scandinavian poet in the English-speaking world in the later 20th century.

**transubstantiation,** in Christianity, the change by which the substance (though not the appearance) of the bread and wine in the Eucharist becomes Christ's Real Presence—that is, His body and blood. In Roman Catholicism and some other Christian churches the doctrine, which was first called transubstantiation in the 12th century, aims at safeguarding the literal truth of Christ's Presence while emphasizing the fact that there is no change

in the empirical appearances of the bread and wine.

The doctrine of transubstantiation, elaborated by scholastic theologians from the 13th to the 15th century, was incorporated into the documents of the Council of Trent (1545–63). The faith in the Real Presence as brought about by a mysterious change antedates the scholastic formulation of the doctrine, as is shown by the use of equivalent terms in the patristic writers. In the mid-20th century some Roman Catholic theologians were restating the doctrine of Christ's eucharistic presence. Shifting the emphasis from a change of substance to a change of meaning, they coined the terms transsignification and transfinalization to be used in preference to transubstantiation. But, in his encyclical *Mysterium fidei* in 1965, Pope Paul VI called for a retention of the dogma of transubstantiation together with the terminology in which it has been expressed.

**transuranium element,** any of the chemical elements that lie beyond uranium in the periodic table—*i.e.,* those with atomic numbers greater than 92.

A brief treatment of the transuranium elements follows. For full treatment, *see* MACROPAEDIA: Chemical Elements.

All the transuranium elements are radioactive. They have half-lives ranging from tens of millions of years to fractions of a millisecond. Of the known transuranium elements, only neptunium and plutonium have been found in nature. Both occur only in minute amounts, however. The other elements have been synthesized through various nuclear reactions. These reactions involve transmuting the atoms of one element into those of another by bombarding the former with neutrons or fast-moving charged particles. This changes the number of protons in their nuclei (*i.e.,* atomic number) to that of the new element.

The transuranium elements are neptunium (93), plutonium (94), americium (95), curium (96), berkelium (97), californium (98), einsteinium (99), fermium (100), mendelevium (101), nobelium (102), lawrencium (103), unnilquadium (rutherfordium; 104), unnilpentium (hahnium, or dubnium; 105), unnilhexium (seaborgium; 106), unnilseptium (bohrium, or nielsbohrium; 107), unniloctium (hassium; 108), unnilennium (meitnerium; 109), ununnilium (110), unununium (111), and ununbium (112). The transuranium elements from neptunium (93) through lawrencium (103) are chemically similar to the rare-earth elements (*see* rare-earth metal). Elements with atomic numbers above 103 are often called transactinides. Those with atomic numbers 104 and 105 seem to be chemically analogous to the elements immediately above them in the periodic table—hafnium and tantalum, respectively. The chemical properties of the other transactinides are uncertain.

**Transvaal,** former province of South Africa. It occupied the northeastern part of the country. The Limpopo River marked its border with Botswana and Zimbabwe to the north, while the Vaal River marked its boundary with Orange Free State province to the south. It was bounded by Mozambique and Swaziland on the east and by Cape Province on the west. The Transvaal's name, which means "across the Vaal," originated with the Afrikaners who in the 1830s migrated to the region after crossing the Vaal River.

The land between the Limpopo and Vaal rivers was originally inhabited by the Sotho, Venda, and other Bantu-speaking peoples. In the 1820s and '30s they were unsettled by invasions of the Ndebele and other Bantu tribes fleeing from the warring Zulu. Another migration was that of seminomadic pastoral Afrikaner farmers called Voortrekkers, or Boers, who in the mid-1830s began to probe northward beyond the borders of the Cape Colony with the aim of organizing an exodus from British-controlled territory. Some 12,000 of these Boer emigrants moving northward from the Cape crossed the Vaal River and entered the area, where they settled in isolated farms. After driving the Ndebele north of the Limpopo River in November 1837, the Voortrekker leader Hendrik Potgieter was able to claim all of the land between it and the Vaal River. More Boers moved to the Transvaal when Great Britain annexed the nascent Boer republic of Natal (1843) and established the Orange River Sovereignty (1848). Rivalries between Potgieter and his fellow leaders Andries Pretorius and W.F. Joubert prevented the Boers from forming a strong government in the Transvaal. But because the area lay out of reach of the administration in the Cape Colony, the British in 1852 recognized the independence of the Afrikaners north of the Vaal River under the terms of the Sand River Convention.

The Boers drafted a constitution in 1855, and the communities centred at Pretoria, Potchefstroom, and Rustenburg joined in 1857 to form a Transvaal state called the South African Republic. It was governed by a Volksraad of 24 elected members and had Marthinus W. Pretorius, the son of Andries, as its first president. The new republic's authority was limited to the southwestern Transvaal, though it claimed sovereignty over the entire area between the two rivers. The government tried to expand its territory, but more important to the Transvaal's future were discoveries of diamonds and gold deposits (1868–74) along the Vaal River and other sites, which heightened British interest in gaining control of the region but did little to help the Boers' stagnant agricultural-pastoral economy. In 1877 Sir Theophilus Shepstone annexed the financially bankrupt republic to Britain over the half-hearted protest of its then-president, Thomas F. Burgers. The British failed to fulfill their promises of internal self-government to the Boers, however, and late in 1880 the Afrikaners revolted against the British and declared a new Transvaal republic. They regained their independence—subject to certain provisos—in 1881 after overwhelming British forces at the Battle of Majuba Hill. Paul Kruger became the new republic's first president.

The discovery of large gold deposits in the Witwatersrand area in 1886 resulted in a tremendous influx of miners and fortune seekers, primarily English and Germans, who were called Uitlanders. These foreigners eventually came to outnumber the Afrikaners two to one in the Transvaal, but Kruger refused to grant them voting and other rights. The British immigrants speeded the building of rail links between the Transvaal and the Cape Colony, and their growing urban populations stimulated the Boers' commercial agriculture. The Transvaal government, however, refused to undertake political reforms and was unable to mediate between the rural, agricultural, staunchly Calvinist Afrikaners and the new British financial, mining, and commercial classes. Tensions with Britain increased greatly after an English adventurer, Leander Starr Jameson, led an abortive raid (December 1895) into the Transvaal in an attempt to provoke the Uitlanders to an internal uprising against Kruger's rule. The Transvaal government subsequently began to arm itself and also strengthened a defensive alliance with its sister Boer republic, the Orange Free State.

War between the two Boer republics and Great Britain broke out two days after the Transvaal gave the British an ultimatum (Oct. 9, 1899) demanding the withdrawal of British troop reinforcements that had been sent to the Cape. The British were able to occupy the capital, Pretoria, in June 1900, and in September they formally annexed the Transvaal. Fighting between the Boers and British continued, however, until the resources of both Boer republics had been broken by unceasing strain against superior forces. The Peace of Vereeniging (May 31, 1902) ended the independence of the Transvaal, which became a British crown colony under the administration of Sir Alfred Milner.

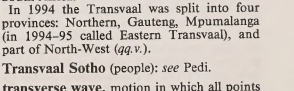
The British restored internal self-government to the Transvaal in 1906. In elections held (1907) under the colony's new constitution, the former commander of the Transvaal's forces in the war, General Louis Botha, led his Het Volk party to a majority and became prime minister with the support of Jan Christian Smuts. Their government promoted unity between the Afrikaners and the British, and in 1910 the Transvaal became a province of the Union of South Africa, a status that was maintained when the Union became the Republic of South Africa in 1961.

The Transvaal's history in the rest of the 20th century was primarily economic. The province was extremely rich in mineral resources, especially gold and uranium. The gold deposits were concentrated in the southern Transvaal, in a highland area known as the Witwatersrand, where Johannesburg is located. The province also contained enormous reserves of platinum, chromite, tin, and nickel, and other areas made it a major producer of diamonds and coal. The complex of mining, industrial, commercial, and financial activities arising from this vast mineral wealth made the southern Transvaal the economic heartland of South Africa.

In 1994 the Transvaal was split into four provinces: Northern, Gauteng, Mpumalanga (in 1994–95 called Eastern Transvaal), and part of North-West (*qq.v.*).

**Transvaal Sotho** (people): *see* Pedi.

**transverse wave,** motion in which all points on a wave oscillate along paths at right angles to the direction of the wave's advance. Surface ripples on water, seismic *S* (secondary) waves, and electromagnetic (*e.g.,* radio and light) waves are examples of transverse waves.



Transverse wave

A simple transverse wave can be represented by a sine or cosine curve, so called because the amplitude of any point on the curve—*i.e.,* its distance from the axis—is proportional to the sine (or cosine) of an angle. In the Figure, sine curves of various amplitudes are shown. These curves represent how a standing transverse wave might look at consecutive (1, 2, 3, 4, and 5) intervals of time. The time required for a point on the wave to make a complete oscillation through the axis is called the period of the wave motion, and the number of oscillations executed per second is called the frequency. Wavelength is considered to be the distance between corresponding points on the wave—*i.e.,* the distance between two adjacent peaks or troughs of the wave. Transverse waves may also be complex, in which the curves representing them are composed of two or more sine or cosine curves.

**transvestism,** practice of wearing the clothes of the opposite sex (cross-dressing), generally to derive some kind of sexual pleasure. It is often mistakenly associated with homosexuality; in fact, however, transvestites may be either heterosexual or homosexual, and the practice of cross-dressing is sometimes even ridiculed among homosexuals. The transvestite must also be distinguished from the transsexual, who desires to become a functioning member of the opposite sex; most transvestites

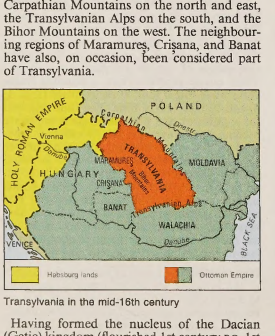
are men who comfortably fill male roles in society and are satisfied with their biological sex. Transsexuals, both male and female, are uncomfortable with their sex and are usually required to cross-dress for an extended period before they undergo surgery. That most transvestites are men is at least in part a result of the role of fashion in Western culture; in the mid-to-late 20th century Western women wearing trousers and other clothes once considered to be exclusively men's clothes are not seen as deviant.

Transvestites may quite early in life express interest in the clothes and manners of the opposite sex and, around the time of puberty, may develop erotic fantasies associated with cross-dressing. One type of transvestite whose cross-dressing remains a form of fetishism (*q.v.*) concentrates on a single favourite garment, such as shoes or underwear. Most transvestites keep the practice a secret because of negative societal connotations.

A small segment of the homosexual male population does engage in transvestism; these men are referred to as "drag queens" by other homosexuals, and the practice of cross-dressing is called being "in drag." Unlike the male transsexual who wants to pass in society as a normal woman, the "drag queen" often wears flamboyant outfits in a conscious caricature of femininity.

Some male cross-dressers are professional female impersonators, entertainers who usually impersonate female celebrities. Entertainers who cross-dress (usually quite unconvincingly) to comic effect are quite popular in some cultures, particularly in England. In general, however, transvestism may be distinguished from other types of cross-dressing by the elements of emotional or sexual gratification it affords the transvestite, rather than for its entertainment value.

**Transylvania,** Romanian TRANSILVANIA, German SIEBENBÜRGEN, historic eastern European region. After forming part of Hungary (11th–16th century), it was an autonomous principality within the Ottoman Empire (16th–17th century) and then once again became part of Hungary at the end of the 17th century; later it was incorporated into Romania (1918–20). The region, whose name first appeared in written documents in the 12th century, covered a territory bounded by the Carpathian Mountains on the north and east, the Transylvanian Alps on the south, and the Bihor Mountains on the west. The neighbouring regions of Maramureş, Crişana, and Banat have also, on occasion, been considered part of Transylvania.




Transylvania in the mid-16th century

Having formed the nucleus of the Dacian (Getic) kingdom (flourished 1st century BC–1st century AD) and the Roman province of Dacia (after AD 106), Transylvania was overrun by a succession of barbarian tribes after the Roman legions withdrew about AD 270. Thereafter the Romanized Dacian inhabitants either moved into the mountains and preserved their culture or migrated southward. The area then was repopulated by peoples from the Romanized lands south of the Danube River or from the Balkans. The Magyars (Hungarians) conquered the area at the end of the 9th century and firmly established their control over it in 1003 when their king Stephen I, according to legend, defeated the native prince Gyula. Administration was consolidated by the settlement, probably as frontier guards, of the Székely (Szeklers, a people akin to the Magyars) and the Saxons (Germans). The Magyars encouraged the political and economic development of the region. Despite the interruption caused by the Mongol invasion of 1241, Transylvania (while remaining part of the Hungarian kingdom) evolved during the following centuries into a distinctive autonomous unit, with its special voivode (or governor), its united, although heterogenous, leadership (descended from Szekler, Saxon, and Magyar colonists), and its own constitution.

When the Turks decisively defeated Hungary at the Battle of Mohács (1526), Transylvania effectively became independent. Its voivode John (János Zápolya), who was elected king of Hungary (November 1526), engaged Transylvania in a 12-year war against Ferdinand I, the Habsburg claimant to the Hungarian throne. Afterward Hungary was divided between the Habsburgs and the Turks, and Transylvania was transformed into an autonomous principality that was subject to Turkish suzerainty (1566).

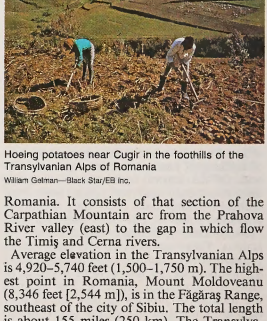
During the next century Transylvania—ruled by the Báthory dynasty (1570–1613, with interruptions), István Bocskay (reigned 1605–06), Gábor Bethlen (reigned 1613–29), and György Rákóczi I (reigned 1630–48)—played off the Turkish sultan against the Habsburg emperor to retain its independent status. It emerged from a series of internal religious struggles, accentuated by Habsburg intervention, as a power of international importance, a defender of Hungarian liberties against Habsburg encroachments, and a bulwark of Protestantism in eastern Europe.

During the reign (1648–60) of György Rákóczi II, the Turks, trying to curb Transylvania's growing power, stripped it of its vital western territory and made the obedient Mihály Apafi its prince (1662). Shortly afterward, the Turks were defeated before Vienna (1683). The Transylvanians, their land overrun by the troops of the Habsburg emperor, then recognized the suzerainty of the emperor Leopold I (1687); Transylvania was officially attached to Habsburg-controlled Hungary and subjected to the direct rule of the emperor's governors. In 1699 the Turks conceded their loss of Transylvania (Treaty of Carlowitz); the anti-Habsburg elements within the principality submitted to the emperor in 1711 (Peace of Szatmár).

During the succeeding century the pressure of Roman Catholic and bureaucratic rule gradually undermined the distinctive character of Transylvania. A strong Magyar movement, overshadowing the declining influence of the Szekler and Saxon nobles, urged the abandonment of the principality's separate administration and integration with Hungary. Consequently, during the Hungarian Revolution of 1848, the Magyars of Transylvania identified with the insurgents. The Romanian peasantry, which had been developing its own national consciousness and agitating for more extensive political and religious liberties, took a stand against the Magyars and swore allegiance to the Habsburgs. When the Habsburgs reasserted their control over Hungary, Transylvania was separated from Hungary and transformed into a Habsburg crown land, subject to strict, absolutist rule. Subsequently, it was reabsorbed into Hungary (1867) and dominated by the Magyar population.

When Austria-Hungary was defeated in World War I, the Romanians of Transylvania in late 1918 proclaimed the land united with Romania. In 1920 the Allies confirmed the union in the Treaty of Trianon. Hungary regained about two-fifths of Transylvania during World War II (Vienna Award; August 1940), but the entire region was ceded to Romania in 1947.

**Transylvanian Alps,** also called SOUTHERN CARPATHIANS, Romanian CARPAŢII MERIDIONALI, mountainous region of south-central



Hoeing potatoes near Cugir in the foothills of the Transylvanian Alps of Romania
William Gelman—Black Star/EB inc.

Romania. It consists of that section of the Carpathian Mountain arc from the Prahova River valley (east) to the gap in which flow the Timiş and Cerna rivers.

Average elevation in the Transylvanian Alps is 4,920–5,740 feet (1,500–1,750 m). The highest point in Romania, Mount Moldoveanu (8,346 feet [2,544 m]), is in the Făgăraş Range, southeast of the city of Sibiu. The total length is about 155 miles (250 km). The Transylvanian Alps include three groups of ranges. They are a higher, more continuous, and more impassable section of the Carpathians than the eastern and western segments and are broken only by four passes. There is one major intermontane depression, the Petroşani. The Carpathian ranges, formed in Tertiary times, are part of the Alpine–Himalayan system and of the eastern arm of the European Alpine fold chain.

**Transylvanian rug,** also called SIEBENBÜRGER RUG, any of the large numbers of floor coverings found in the churches of Transylvania (part of Romania), to which they had



Transylvanian rug, 17th century; in the Mr. and Mrs. Joseph V. McMullan Collection
Collection of Joseph V. McMullan; photograph, Otto E. Nelson—EB inc.

been donated by pious families. Some of these rugs are of Turkish manufacture, survivals of a massive importation centuries ago. Turkey is generally assumed to be the source of all Transylvanian carpets, but certain similarities of technique, weight, and dye range suggest that most have been made in the same neighbourhood, possibly in Transylvania itself or in the European Turkey of the 17th and 18th centuries. The question remains unsettled.

Prevalent designs include bird rugs, Lotto carpets, carpets with arches at both ends of the field, columnn Ládik, and varied prayer-rug forms commonly ascribed to Ghiordes, Melas, or Konya carpets. All of these kinds of Transylvanian rugs have been counterfeited in large numbers.

**tranylcypromine,** synthetic drug of the monoamine-oxidase inhibitor type, used to treat severe mental depression. Like other monoamine-oxidase inhibitor drugs, tranylcypromine prevents the enzymatic breakdown of norepinephrine, the brain-neurotransmitter substance concerned with emotional stimulation. It does so by inhibiting the enzyme monoamine oxidase (MAO), which normally breaks down norepinephrine at nerve endings. Tranylcypromine is administered orally. The onset of action is delayed, the effects of the drug developing slowly over the first two weeks of therapy. As with other monoamine-oxidase inhibitor drugs, liver damage is a possible side effect.

**trap,** in theatre, a concealed opening, usually in the stage floor, through which actors, props, and scenery can be brought on and off stage. Traps are used, often with elaborate and ingenious machinery, to create a great variety of stage effects, particularly the sudden appearance, disappearance, or apparent transformation of characters or objects on the stage.

Certain types of traps have become more or less standard items of stage equipment. The corner trap, for example, is a small, square opening, usually located at the side of the stage, fitted with a trapdoor or flaps that can be lowered out of sight. Through it, standing figures or objects can be lifted onto the stage. When a sudden, mysterious appearance is required, a star trap is used. The star trap is a circular opening with a lid composed of wedge-shaped sections, individually hinged to the circumference. An actor, standing below on a heavily counterweighted platform, can be projected through the opening with great speed. The sections of the lid are pushed up as he passes and immediately fall back into place, thus concealing his point of entrance. Another common trap with a long history is the grave trap, a large, rectangular opening in the centre of the stage floor. It is named for its most famous use, as an open grave in the graveyard scene from *Hamlet*. Most traps and their mechanisms are designed so that they can be taken apart and moved to any point in the stage floor where they are required or can be stored when not in use.

**trap,** in physics, any location within a solid (generally a semiconductor or an insulator) that restricts the movement of electrons and holes—*i.e.,* quasi-positive electrical charges. A trap consists of either a chemical impurity or an imperfection in the regular spacing of the atoms that make up the solid. Traps play a significant role in photoconduction, luminescence, and the operation of various electronic devices because the ability of a solid to carry an electrical current depends on the flow of electrons and holes through the solid.

A trap can capture and immobilize an electron or hole and prevent its recombination with the carrier of opposite charge as an electron-hole pair. Electrons and holes may break free from traps quickly, or they may remain there for an extended period of time (*e.g.,* several months or longer). Charge carriers can be released from traps by irradiating the solid with infrared rays or by heating it.

**trap cut** (gemstones): *see* step cut.

**trap-door spider,** any member of the spider family Ctenizidae and certain members of the families Antrodiaetidae, Actinopodidae, and Migidae (order Araneida). Trap-door spiders construct burrows in the ground; at the entrance they build a silken-hinged door. The spider feeds by quickly opening the trap door and grabbing an insect that is passing close by.



Trap-door spider (*Bothriocyrtum californicum*) at covered entrance of tunnel
Ruth Gardner from Root Resources—EB Inc.

The ctenizids, the best-known trap-door spiders, have a special row of teeth adapted for digging. The body, 2.5 cm (one inch) or more in length, is usually dull brown in colour. The legs are relatively short. Ctenizids are common in the southwestern United States and in tropical and subtropical regions.

The tunnel of a ctenizid, sometimes 15 cm (almost 6 inches) long, may consist of a single tube or may be branched. The door, often camouflaged, usually exceeds 2.5 cm (1 inch) in width. Tunnels off the main tube may also have doors. The spiders remain in the tube except when hunting. They are timid and quickly retreat into the tube if frightened.

Antrodiaetids occur in Japan and North America. Actinopodids are found in Argentina, Africa, and Australia. Migids occur in temperate regions of the Southern Hemisphere.

**Trapani,** Latin DREPANUM, city, capital of Trapani province, northwestern Sicily, Italy. It is situated on a promontory overlooked by the town of Erice (Monte San Giuliano), west of Palermo. The ancient Drepana, it was the port for the Elymian settlement of Eryx until it was captured and made a naval base by the Carthaginians in 260 BC. It passed to the Romans in 241 BC and flourished in the Middle Ages under the successive rulers of Sicily. It was heavily bombed by the Allies in World War II. Notable buildings of the old part of the city include the 14th-century church of San Agostino, the magnificent Santuario dell'Annunziata (1315–32, rebuilt 1760), the cathedral (1635), the 15th- and 16th-century church of Santa Maria di Gesù, and the Baroque Palazzo della Giudecca (Casa Ciambra). Trapani is an episcopal see, and its museum houses notable collections of paintings and sculpture.

Trapani is an active port exporting salt and wine, and its industrial activities include tunny fishing and canning, marble working, and food processing. Pop. (1984 est.) mun., 71,708.

**trapezius muscle,** large, superficial muscle at the back of the neck and the upper part of the thorax, or chest. The right and left trapezius together form a trapezium, an irregular four-sided figure. It originates at the occipital bone at the base of the skull, the ligaments on either side of the seven cervical (neck) vertebrae (ligamentum nuchae), and the seventh cervical and all thoracic vertebrae. It is inserted on the posterior of the clavicle (collarbone) and on the spine of the scapula (shoulder blade). Its chief action is support of the shoulders and limbs and rotation of the scapula necessary to raise the arms above shoulder level.

**Trapezus** (Turkey): *see* Trabzon.

**Trapp** FAMILY, Austrian singers whose story was made into a popular Rodgers and Hammerstein Broadway musical, *The Sound of Music* (1959), that proved one of the most successful in theatre history. Their story was also the basis for a film starring Julie Andrews (1965) that had a comparable success.

Maria Augusta Kutschera (b. Jan. 26, 1905, Vienna—d. March 28, 1987, Morrisville, Vt., U.S.), the best-known member of the family, wrote *The Story of the Trapp Family Singers* (1949). She recounted her experience as an orphan and novitiate in a Benedictine convent in Salzburg. As a governess, she won the hearts of the seven children of a widower, Freiherr (Baron) Georg von Trapp, a World War I submarine commander, and of the baron himself. She was married to Trapp in 1927, and they had three children. In the mid-1930s the family began singing German and liturgical music under the tutelage of the Reverend Franz Wasner, who continued as their director. In 1937 they made their first European tour as professional singers—the Trapp Family Choir. With Father Wasner, the family fled in 1938 from Nazi-dominated Austria to Italy (Switzerland in the play) and emigrated to the United States. As the Trapp Family Singers they developed a program of folk and other music that appealed to audiences worldwide. They toured in many countries from 1940 until 1955, when the group disbanded. Georg von Trapp died in 1947.



The Trapp family, 1939
*The New York Times*

Maria Augusta, who with other family members became a naturalized U.S. citizen in 1948, helped manage a family lodge in Stowe, Vt., from the 1940s on. She also conducted a summer music camp there until 1956. The Trapp Family Austrian Relief, Inc., was established in 1947.

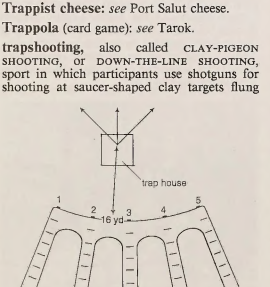
**Trappist,** member of ORDER OF THE REFORMED CISTERCIANS OF THE STRICT OBSERVANCE (O.C.S.O.), a branch of the Roman Catholic Cistercians, founded by the converted courtier Armand de Rancé (1626–1700), who had governed the Cistercian abbey of La Trappe in France, which he transformed (1662) into a community practicing extreme austerity of diet, penitential exercises, and absolute silence. He became its regular abbot in 1664 and, for more than 30 years, kept the abbey under his forceful sway.

In 1792 the monks were ejected from La Trappe, and a number of them, led by Dom Augustine de Lestrange, settled at Val-Sainte in Fribourg, Switz., where they adopted an even more rigid life and made several foundations before their expulsion in 1798. Long years of wandering in Russia and Germany were followed in 1814 by a return to La Trappe; they were the first religious order to revive after the French Revolution and, at the death of Lestrange in 1827, numbered 700. Their increase has never ceased, and by the late 20th century there were abbeys worldwide, including several in England, Scotland, Canada, the United States, Australia, and South Africa. The three existing congregations of Trappists were united by Pope Leo XIII as the independent Reformed Cistercians of the Strict Observance; they follow the primitive custom of Cîteaux with an emphasis on silence and austerity but without the rigid regulations of the early Trappists. After World War II their growth was particularly notable in France and the United States.

**Trappist cheese:** *see* Port Salut cheese.

**Trappola** (card game): *see* Tarok.

**trapshooting,** also called CLAY-PIGEON SHOOTING, or DOWN-THE-LINE SHOOTING, sport in which participants use shotguns for shooting at saucer-shaped clay targets flung



Layout of a trapshooting field

into the air from a spring device called a trap. A later variant, skeet shooting (*q.v.*), is also included in trapshooting.

Trapshooting originated in England in the late 18th century when marksmen, to improve their hunting skills, shot at live pigeons released from cages or box traps. The practice was outlawed or died out in the late 19th century when various inanimate objects were substituted as targets, culminating with the invention of the modern disk. Trapshooting has since developed an appeal of its own apart from training for hunting and is chiefly pursued among marksmen who seldom or never hunt. It has been included in Olympic Games competition, with few exceptions, since 1900.

Modern birds, or clay pigeons, are $4^{5}/_{16}$ inches (11 cm) in diameter and $1^{1}/_{8}$ inch (3 cm) in thickness and are made of pitch and clay or limestone, weighing $3^{1}/_{2}$–4 ounces (99–113 g). They are so brittle that even one pellet from a shot will usually shatter them for a score.

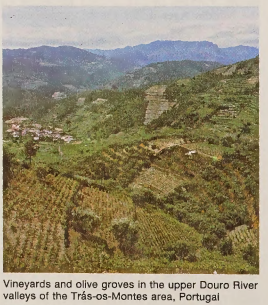
A trapshooting field consists of a single trap house located 16 yards (15 m) in front of five shooting stations. Targets are thrown into the air away from the shooter and at varying angles unknown to him. A regulation round is made up of 25 targets, with each shooter firing at five targets from each of the five stations. In doubles competition, two targets are released at the same time, and the shooter must fire one shot at each. The gun used is usually a double-barreled 12-gauge (bore) shotgun.

World championship and Olympic trapshooting events are supervised by the International Shooting Union. In the Olympics each competitor fires four 25-target rounds on each of two days, and total targets hit out of the 200 attempted determine the winner.

*See* Olympic Games.

**Traralgon,** city, Victoria, Australia. It lies in the La Trobe River valley, West Gippsland, southeast of Melbourne. First settled in the 1840s, its name is Aboriginal for "crane feeding on frogs." It serves a dairying, sheep-raising, and fruit-farming district that has become increasingly industrialized since the end of World War I, with the availability of inexpensive electric power from Yallourn (114 miles [184 km] west). Limestone is quarried, and cement, paper, and clothing are manufactured. Nearby Maryvale is the site of vast pulp and paper mills. A rail junction and situated on the Prince's Highway, Traralgon is also a tourist centre for part of the Eastern Highlands. It became a borough in 1961 and a city in 1964. Pop. (1989 est.) 20,720.

**Trás-os-Montes** (Portuguese: "Beyond the Mountain"), historical province of northeastern Portugal, bounded north and east by Spain, south by the gorges of the Douro River, and west by the mountains of Gerez, Cabreira, and Marão. Geologically a part of the Meseta Central (*q.v.*), the terrain may be divided physically into two regions. Terra Fria in the north is a monotonous sequence of rolling hills and dry plateaus where grains (especially rye) are extensively cultivated and livestock are raised. Terra Quente, in the south, consists of the valleys of the upper Douro River and its tributaries. In this region, stomping is the traditional method for making port wine. The Alto Rabagão hydroelectric project on the Cávado River in Trás-os-Montes was opened in 1978. Of archaeological interest are the Iron Age granite effigies of boars found in the province, most notably at Murça. Bragança (capital of the historical province), Chaves, and Vila Real, home of the 15th-century explorer Diogo Cão (Cam), are the chief towns.


Vineyards and olive groves in the upper Douro River valleys of the Trás-os-Montes area, Portugal
Eric Carle—Shostal

**Trasimeno, Lake,** also called LAKE OF PERUGIA, Italian LAGO TRASIMENO, Latin TRASIMENUS LACUS, largest lake of the Italian peninsula in Umbria region, central Italy, 10 miles (16 km) west of Perugia. It has an area of 49 square miles (128 square km) and is shallow, its maximum depth being 20 feet (6 m). The lake it is fed by small streams and has an artificial subterranean outlet (opened 1898) to the Tiber River. Surrounded by hills on three sides, with an open lowland to the west, Trasimeno is often subject to heavy storms created by violent winds, especially from the north and west. There are three islets in the lake: Maggiore, Minore, and Polvese. The lake's shores, formerly marshy and malarial, are sparsely inhabited, with only two villages, both popular bathing resorts, Castiglione del Lago and Passignano sul Trasimeno.

The lake is known in Roman history as the scene in 217 BC of the bloody defeat by Hannibal of a Roman army under the consul Gaius Flaminius. At a site on the north shore the precise location of which is still controversial, Hannibal's African, Iberian, and Celtic troops ambushed the Roman army in a narrow defile in the hills close to the lake, killing about 15,000 of the Romans, including the consul, and capturing about 6,000.

**Trastámara, Enrique, conde de** (count of): *see* Henry II *under* Henry (Spain: Castile).

**Trau** (Croatia): *see* Trogir.

**Traube, Isidor** (b. March 31, 1860, Hildesheim, Hanover—d. Oct. 27, 1943, Edinburgh), German physical chemist who founded capillary chemistry and whose research on liquids advanced knowledge of critical temperature, osmosis, colloids, and surface tension.

In 1882 Traube joined the faculty of the Technische Hochschule, Berlin, and there became professor of chemistry in 1900. He left Germany in 1939 and accepted a position at the University of Edinburgh.

Traube's practical interests included physical chemical studies of gastric juice, urine, blood, and milk. He designed a viscometer and capillarimeter to measure viscosity and capillary action. He advocated the use of physical therapy to supplement the traditional treatment of illness by drugs. Traube's rule relates the surface tension of capillary active organic compounds to the number of the hydrocarbon $CH_2$ groups present in their molecules.

**Traun,** town, *Bundesland* Oberösterreich (federal province of Upper Austria), north-central Austria. It lies along the Traun River, just south of Linz. First mentioned in 612, it became the seat of the countship of Traun, which became Abensperg-Traun in the late 16th century. Traditionally an agricultural community with fishing, milling, and brewing enterprises, Traun now manufactures textiles, paper, glasses, metalware, and machinery. Pop. (1990) 22,268.

**Traun, Otto Ferdinand, Graf von Abensperg und** (count of Abensberg and) (b. Aug. 27, 1677, Ödenburg, Hung.—d. Feb. 18, 1748, Hermannstadt, Transylvania), Austrian field marshal who was one of the ablest military commanders in the wars of the Polish (1733–38) and Austrian Successions (1740–48).

Traun was a member of a Protestant noble family, but he converted to Catholicism and entered the Austrian Army in 1697. He distinguished himself during the War of the Spanish Succession (1701–14) and later was active primarily in Italy. During the War of the Polish Succession he successfully resisted superior Spanish forces, became commander in chief for Lombardy (1735), and ruled Milan as acting governor from 1736 to 1743. Promoted field marshal in 1741, he reached the apex of his career during the War of the Austrian Succession. He defeated the Spaniards in



Traun, detail of a portrait by an unknown artist

By courtesy of the Heeresgeschichtliches Museum, Vienna

Italy (1742–43), engineered Austria's victories on the Rhine, forced Prussia's Frederick II the Great out of Bohemia in 1744, and, finally, expelled the French from southern Germany (1745). His achievements secured the election of Maria Theresa's husband, Francis I, as Holy Roman emperor.

**trautonium,** electronic musical instrument whose tone is generated by oscillating radio tubes that produce an electronic pulse that is converted into sound by a loudspeaker. A neon light generates weaker frequencies that, controlled by a set of push buttons, affect the upper harmonics (component tones of the sound), making available many timbres, or tone colours. Pitch was originally controlled by moving the hand away from and toward an antenna, altering the frequency produced. Later, a steel wire was strung over a steel bar that indicated tempered scale intervals (*i.e.,* those of the piano). Touching the wire varied the frequency. The instrument was invented by Friedrich Trautwein in Germany in 1930. The German composer Paul Hindemith, who played the trautonium, wrote a *Concertino for Trautonium and Strings* (1931).

**Trauttmansdorff, Maximilian, Graf (Count) von** (b. May 23, 1584, Graz, Austria—d. June 8, 1650, Vienna), Austrian statesman, confidant of the emperors Ferdinand II and Ferdinand III, chief imperial plenipotentiary during the negotiations of the Peace of Westphalia, and one of the foremost political figures of early 17th-century Europe.

After participating in the Austrian war against the Turks (1593–1606) and in Spanish counterinsurgency activity in the Netherlands, he was named to the Council of War (Hofkriegsrat) by the Habsburg emperor Matthias (reigned 1612–19). Later, he proved instrumental in securing the crowns of Bohemia and Hungary (1617–18) and ultimately the imperial title (1619) for Archduke Ferdinand of Styria, thereafter Emperor Ferdinand II. During the Thirty Years' War (1618–48) he worked for a quick conclusion of the peace with Lutheran Germany, his efforts finally issuing in the Peace of Prague (1635).

Trauttmansdorff became chief minister of Ferdinand II in 1634 and exercised paramount influence over the policies of Ferdinand III (reigned 1637–57). Through the five years of negotiations of the Peace of Westphalia, which in 1648 ended the Thirty Years' War, he consistently guarded the Austrian dynastic interests and, at the same time, was probably the most influential diplomat in contributing to the peace settlement.

**Travancore,** former princely state in southwestern India, now part of Kerala state. Travancore was in the kingdom of Kerala, or Cēra, in the early centuries AD and traded with distant parts of the world. In the 11th century the region fell under the Coḷa empire; the Hindu kings of the Vijayanagar empire held it briefly in the 16th century, after which it came under Muslim rule. In the mid-18th century the region was unified and became the independent state of Travancore, allied with the British in their wars in southern India. A treaty brought it under British protection in 1795. Travancore was known for its relatively high literacy rate and its progressive government. After Indian independence, Travancore and Cochin merged to form the state of Travancore-Cochin; boundaries were redrawn, and it was renamed Kerala in 1956.

**Travelers Group,** former insurance and financial services corporation that merged with Citicorp in 1998 to form Citigroup (*q.v.*). The diversified company grew out of a packaging firm that was formed at the beginning of the 20th century.

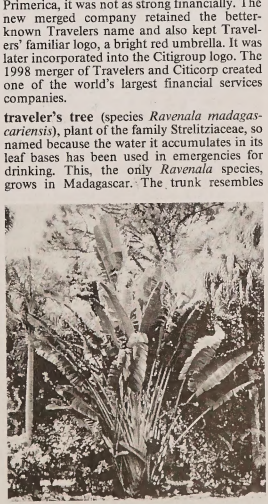
The American Can Company was founded in 1901 through the consolidation of several producers of metal cans for the food-canning industry. That year American Can monopolized 90 percent of the nation's can-making capacity; by 1913 the percentage had dropped to about 30 percent, and an antitrust suit brought by the U.S. government to dismember the firm failed in the courts (1916). Another antitrust decision in 1950 did restrict the company's selling procedures.

American Can was notable for its pioneering research in tin-plating, container sterilization, and the use of aluminum in cans. In the 1970s the company began to diversify, adding specialty retailing operations, and in 1981 the company began to move out of manufacturing and transformed itself into a financial services conglomerate. The former American Can Company assumed the name Primerica Corporation in 1987. Primerica acquired brokerage firm Smith Barney the same year.

In 1987 Primerica was acquired by Commercial Credit. Under the leadership of chief executive Sanford I. Weill, the growing firm retained the Primerica name.

In 1993 Primerica acquired the Travelers Corporation, a major insurance company and an innovative industry leader since its foundation in 1863 in Hartford, Conn. Although Travelers' assets were greater than those of Primerica, it was not as strong financially. The new merged company retained the better-known Travelers name and also kept Travelers' familiar logo, a bright red umbrella. It was later incorporated into the Citigroup logo. The 1998 merger of Travelers and Citicorp created one of the world's largest financial services companies.

**traveler's tree** (species *Ravenala madagascariensis*), plant of the family Strelitziaceae, so named because the water it accumulates in its leaf bases has been used in emergencies for drinking. This, the only *Ravenala* species, grows in Madagascar. The trunk resembles



Traveler's tree (*Ravenala madagascariensis*)

By courtesy of McKee Jungle Gardens, Vero Beach, Florida

that of a palm tree and attains a height of more than 27 m (90 feet). At the top of the tree are banana-like leaves, with pale midribs that give a fanlike appearance. The leaves are 4 to 5 m long, and each leaf base, shaped like a huge cup, holds about 1 litre (about a quart) of rainwater. The large flower clusters contain white blossoms and light blue seeds.

**traveling library:** *see* bookmobile.

**traveling salesman problem,** an optimization problem in graph theory, in which the nodes (cities) of a graph are connected by directed edges (routes), where the weight of an edge is the distance between two cities. The problem is to find a path that visits each city once, returns to the starting city, and minimizes the distance traveled. The only known solution that guarantees the shortest path requires a solution time that grows exponentially with the problem size (*i.e.,* number of cities). This is an example of an NP-complete problem (*q.v.*), for which no known efficient (*i.e.,* polynomial time) algorithm exists.

**Traven, B.,** also called BERICK TRAVEN TORSVAN, or RET MARUT (b. March 5, 1890?, Chicago?, Ill., U.S.—d. March 27, 1969, Mexico City, Mex.), novelist noted as a writer of adventure stories and as a chronicler of rural life in Mexico. A recluse, Traven refused personal data to publishers; hence many theories have arisen as to his parentage, his nationality, and his general identity. Most of his books were originally written in German and were first published in Germany.

In 1987 Karl S. Guthke published *B. Traven: The Life Behind the Legends* (originally in German), based in part on Traven's personal papers and conversations with his widow, Rosa Elena Luján. Luján revealed that Traven had been the Bavarian revolutionary Ret Marut; Marut itself, however, was an assumed name. Guthke's conclusion was that Traven himself did not know who his parents were. Other scholars have argued that Traven was Otto Feige (b. 1882, East Prussia); still others believed he was the illegitimate son of Kaiser Wilhelm II.

Several years after Traven settled in Mexico in the 1920s, his first book came out in Berlin. *Das Totenschiff* (1926; *The Death Ship*) tells of a sailor who, having lost his papers, boards a ship that is destined to be sunk for insurance money. Another work, *Der Schatz der Sierra Madre* (1927; *The Treasure of the Sierra Madre*), about a search for gold in Mexico, was made into a motion picture in 1948. Traven's most important work is a series of novels that trace the exploitation, political awakening, and rebellion of a group of impoverished Indians in southern Mexico just before the start of the Mexican Revolution. Among the books in this series are *Der Karren* (1931; *The Carreta*), *Die Rebellion der Gehenkten* (1936; *The Rebellion of the Hanged*), and *Ein General kommt aus dem Dschungel* (1940; *General from the Jungle*).

Traven's works are harsh, filled with descriptions of danger, cruelty, and physical and emotional suffering, but his lean, direct prose has a hypnotic immediacy.

**Travers, P.L.,** in full PAMELA LYNDON TRAVERS, original name HELEN LYNDON GOFF (b. Aug. 9, 1899, Maryborough, Queen., Australia—d. April 23, 1996, London, Eng.), Australian-born English writer known for her *Mary Poppins* books, which have been translated into more than 20 languages and were the basis for the successful motion picture *Mary Poppins* (1964).

Travers went to England in 1924 and became a dancer and actress, appearing mostly in plays of William Shakespeare.

She also worked as a journalist and became friendly with the poets William Butler Yeats and AE (George William Russell), with whom she shared an interest in myth. AE published some of her poems in *The Irish Statesman.* Her first book, *Mary Poppins* (1934), about a magical, good-hearted, and exceedingly efficient nanny, was an immediate success. Two years later, after she began writing sequels, Travers decided to write full-time. She traveled throughout Europe and the United States lecturing and gaining new material for her stories. From 1965 to 1971 she served as writer-in-residence at such colleges as Radcliffe, Smith, and Scripps. Later works include several travel books and a collection of essays, *What the Bee Knows: Reflections on Myth, Symbol and Story* (1989).

**Traverse City,** seat (1851) of Grand Traverse county, northwestern Michigan, U.S., on Grand Traverse Bay (Lake Michigan). Settled in 1847 and named for the bay (French Lac Travers: "lake lying crosswise"), it developed from a timber town into one of the nation's chief cherry-processing markets and the hub of a vast year-round resort area. Light manufacturing augments its economy. The tip (marked by a lighthouse) of the 20-mile- (32-kilometre-) long Old Mission Peninsula, jutting into Grand Traverse Bay from the city, is exactly midway between the Equator and the North Pole. Summer events include the National Cherry Festival and the Northwestern Michigan Fair. Northwestern Michigan College (1951) is located in the city. The National Music Camp for summer students and the Interlochen Arts Academy are at Interlochen, 14 miles (23 km) southwest. Inc. village, 1881; city, 1895. Pop. (2003 est.) 14,466.

**traverse jury:** *see* petit jury.

**travertine,** dense, banded rock composed of calcite (calcium carbonate, $CaCO_3$). Formed by the evaporation of river and spring waters, it is a variety of limestone that has a light colour and takes a good polish; it is often used for walls and interior decorations in public buildings. Travertine deposits along the Aniene River, near Rome, are several metres thick. In the United States the Mammoth Hot Springs in Yellowstone National Park, Wyoming, are actively depositing travertine. It also occurs in limestone caves in the form of stalactites and stalagmites, as, for example, in Carlsbad Caverns, New Mexico.

**travesty,** in literature, the treatment of a noble and dignified subject in an inappropriately trivial manner. Travesty is a crude form of burlesque in which the original subject matter is changed little but is transformed into something ridiculous through incongruous language and style. An early example of travesty is the humorous treatment of the Pyramus and Thisbe legend in Shakespeare's *A Midsummer Night's Dream* (1595/96). After 1660, travesty became a popular literary device in England as seen in John Phillips' *Don Quixote* (1687), a vulgar mockery of the original work, and Charles Cotton's travesty of Virgil, *Scarronides: or, Virgile Travestie. Being the First Book of Virgil's Aeneis in English, Burlesque* (1664), an imitation of the French *Virgile travesty* (1648–53) by Paul Scarron. Later the French developed the *féeries folies,* a musical burlesque that travestied fairy tales.

**trawler,** fishing vessel that uses a trawl, a conical net that snares fish by being dragged through the water or along the bottom. Trawlers vary according to the method of towing the net. On side trawlers, the trawl is set and hauled over the side with power winches or manually by a large crew. Outrigger trawlers (a type that includes shrimp boats) drag one or two nets from long booms extending from each side. Stern trawlers are powerful vessels that are often built with ramps for hauling heavy catches up the stern onto the working deck. Powered by engines of up to 5,000 horsepower, modern trawlers drag huge nets that must be hauled by rope winches and large net drums or reels. Large trawlers can be floating factories, cleaning and freezing the fish for processing ashore.

**Treacher-Collins syndrome** (congenital disorder): *see* mandibulofacial dysostosis.

**treacle:** *see* molasses.

**treason,** the crime of betraying a nation or a sovereign by acts considered dangerous to security. In English law, treason includes the levying of war against the government and the giving of aid and comfort to the monarch's enemies. It is also treason to violate the monarch's consort, eldest unmarried daughter, or heir's wife.

In the United States, treason was defined restrictively by the framers of the Constitution. History had taught them that men in power might falsely or loosely charge treason against their opponents; therefore, they denied Congress the authority to enlarge or reshape the offense. Treason against the United States "shall consist only in levying War against them, or in adhering to their Enemies, giving them aid and comfort."

The Japanese law of treason places special emphasis on acts designed to frustrate the country's alliances with other powers. This is mainly a consequence of Japan's renunciation of war after World War II. A Japanese citizen may thus be punished for advocating war against another nation. *See also* sedition.

**treasure trove,** in law, coin, bullion, gold, or silver articles, found hidden in the earth, for which no owner can be discovered.

In most of feudal Europe, where the prince was looked on as the ultimate owner of all lands, his claim to the treasure trove became, according to the founder of international law, Hugo Grotius, a common and universal right. In England and similarly in Scotland, the right to treasure trove is in the crown, which may grant it as a franchise. Such articles are presumed to have once had an owner; and, in his absence, they belong not to the finder but to the crown. Their concealment is an indictable offense in England but not a crime in Scotland unless accompanied by intent to appropriate. In England the finder—and indeed anyone who acquires knowledge—should report the matter to the coroner, who must hold an inquest to find whether the discovery be treasure trove or not. In the United States the common law, following the English, would seem to give treasure trove to the public treasury, but in practice the finder has been allowed to keep it. Modern French, German, Italian, and Spanish law is the same.

The counterpart of treasure trove under Roman law was *thesaurus inventus.* Its exact nature and the extent of its resemblance to the Anglo-American concept are in doubt, as the definition in the Code of Justinian has been discredited by some authorities and appears to conflict with the general Roman law of succession. A constitution of Hadrian apparently divided *thesaurus inventus* equally between the finder and the landowner.

**treasury bill,** short-term U.S. government security with maturity ranging from one month to one year. Treasury bills are usually sold at auction on a discount basis with a yield equal to the difference between the purchase price and the maturity value. In contrast to longer-term government securities, such as treasury notes (with maturity ranging between 1 and 10 years), treasury bills are much more "liquid" investments (*i.e.,* cash for alternative investments is tied up for shorter periods of time). Because of this high liquidity, the yield rate on treasury bills is normally lower than on longer-term securities. Prices of treasury bills do not usually fluctuate as much as those of other government securities but may be influenced by the purchase or sale of large quantities of bills by the central bank. From 1970 to 1998 the minimum order for treasury bills was $10,000, after which it was reduced to $1,000. In 2001 the U.S. Treasury stopped offering treasury bills with maturities of 52 weeks.

First used extensively during World War I and initially regarded as an emergency source of revenue, bills and other short-term debt instruments have become a permanent element in the public debt of several countries because of their relatively low-interest cost and greater flexibility. Treasury bills are ordinarily held as secondary reserves by commercial banks and by other investors as a means of temporarily employing excess funds.

**Treasury Relief Art Project** (TRAP), smallest of the federal visual arts projects conceived under the New Deal to help Depression-stricken American artists in the 1930s. It was directed by the painter Olin Dows and designed to embellish existing federal buildings that lacked construction appropriations to finance such works. It was operated under the procedures of the U.S. Department of the Treasury Section and funded by the Works Progress (later Projects) Administration (WPA).

**Treasury Section of Painting and Sculpture,** most important of the U.S. Department of the Treasury's three visual arts programs conceived during the Great Depression of the 1930s by the Franklin D. Roosevelt administration and designed to embellish new federal buildings with murals and sculpture. It was established within the Procurement Division of the Department of the Treasury's Public Works Branch in October 1934 and was funded by one percent of each construction appropriation. Under the direction of the financier and painter Edward Bruce, who was assisted by Edward Rowan and the critic Forbes Watson, the section commissioned works of art by contract after selecting the artists by means of competitions.

The section's chief objective was to procure art and not, like the other cultural projects, to provide work relief for needy artists; it tended, however, to frown on any image that was politically controversial or particularly abstract. The section also circulated exhibitions of mural studies and sculpture models, sponsored murals at the New York World's Fair of 1939–40, and supervised the art program of the Civilian Conservation Corps (CCC). In 1938 its name was changed to Section of Fine Arts, and in 1939 it was removed from the Department of the Treasury and placed under the Public Buildings Administration of the Federal Works Agency. Although Edward Bruce fought to make the section a permanent government program, it ended in 1943 along with the other remaining cultural projects.

**treated gem,** also called TREATED STONE, genuine gem material whose colour has been artificially enhanced or produced to increase the value of the stone; staining, heat treatment, and irradiation are among the treatments used.

Relatively porous material may be stained or dyed to change its colour. Agate may be stained a variety of colours by soaking it in different solutions and, in some cases, by subsequent heat treatment: reds are produced by heat or ferrous nitrate and heat; lemon yellow, by hydrochloric acid and heat; greens, by chromium or nickel salts; blue, by ferric ferrocyanide followed with ferrous sulfate or by Prussian blue; and brown, by sugar followed with sulfuric acid. Jasper, stained blue, has been used to simulate lapis lazuli,

and turquoise, opal, and alabaster are often coloured to enhance their beauty.

Heat treatment of gems to improve or change colour has been practiced for centuries. When heated, smoky quartz resembles citrine or topaz, some brownish or reddish zircon becomes bright blue or colourless, yellow topaz becomes pink, slightly coloured chalcedony becomes carnelian red, and some rubies or amethysts are more evenly coloured. The colour change often depends on the temperature to which the stone is heated, the atmospheric conditions in the vicinity, and the duration of heating or cooling.

Irradiation of certain gemstones also causes colour changes. Some colourless diamonds become green, rose quartz becomes brown, and decolourized amethyst regains its purple hue. These colour changes are not always permanent, and the stone may become radioactive.

**Treatise on the Power and Primacy of the Pope,** also called APPENDIX ON THE PAPACY, one of the confessional writings of Lutheranism, prepared in 1537 by Philipp Melanchthon, the German Reformer. The Protestant political leaders who were members of the Schmalkaldic League and several Protestant theologians had assembled at Schmalkalden to consider a response to a bull issued in June 1536 by Pope Paul III in which he called for a general council of the Catholic Church to deal with the Reformation movement. Although the assembly decided not to officially endorse the confession written by Martin Luther for the occasion, the Schmalkaldic Articles, it was decided that a work discussing the primacy of the pope should be prepared since this subject had not been covered in the Augsburg Confession in 1530.

Melanchthon was chosen as author, and on Feb. 17, 1537, he read his completed Latin manuscript to the other theologians. Subsequently 33 of them signed the treatise as a confession of faith. It was first published in Latin anonymously in 1540 in Strasbourg, and the next year a German translation was published. It came to be regarded as an appendix to Luther's Schmalkaldic Articles, although later research established that it is more properly considered an extension of the Augsburg Confession. In 1580 it was published in the *Book of Concord,* the collected doctrinal standards of Lutheranism.

The first section of the treatise considers the papal claim of supremacy within the church and over secular kingdoms and the necessity for Christians to believe this claim in order to be saved. Melanchthon declared the papal claim to be false and without basis in Scripture or history. In the second section, the proper role and power of bishops were considered. Melanchthon discussed what he considered abuses of the papal office and recommended that the office be eliminated.

**treaty,** a contract or other written instrument binding two or more states under international law. According to modern diplomatic usage the term treaty is confined to the more important international agreements, whereas those agreements of lesser or subordinate importance have been called conventions, agreements, arrangements, protocols, and acts.

A treaty is normally negotiated between plenipotentiaries provided by their respective governments with "full power" to conclude the treaty within the scope of their instructions. Signature, however, is today presumed to be subject to ratification by the government unless explicitly waived. Apart from such express provision, the instrument does not become formally binding until ratifications have been exchanged. A multilateral treaty—such as the Treaty of Versailles of 1919 or the Charter of the United Nations of 1945—is usually negotiated at a diplomatic conference ending with signature of the treaty.

In making a treaty, the authors need not employ any special form. A treaty often takes the form of a contract, but it may take the form of a joint declaration or of an exchange of notes (as in the case of the Rush–Bagot Agreement between the United States and Great Britain in 1817 for mutual disarmament on the Great Lakes). It is, however, customary to draw up all important treaties on a fixed plan. First comes the preamble, giving the names and styles of the high contracting parties, a statement of the general objectives which they have in view, the names and official designations of the plenipotentiaries charged with the negotiation, and a statement that their full powers have been verified. Then follow the articles containing the stipulations agreed upon. If the treaty is concluded for a definite period, this is next stated; or, if it be in form perpetual, there may be a provision inserted that either party may "denounce" (*i.e.,* give notice to terminate) the treaty. Next follows an article providing for ratification and for the time and place for the exchange of ratifications. At the end is a clause stating that "in witness whereof the respective plenipotentiaries have affixed their names and seals." The signatures follow, with the place and date. "Additional articles" are often appended and signed by the plenipotentiaries, with the declaration that they have the same force and value as if they had been included in the body of the treaty or convention.

International jurists have classified treaties on a variety of principles. Aside from the distinction between general (multilateral) and bilateral treaties, the distinction has been drawn between those that represent a definite transaction, such as a cession of territory (*Rechtsgeschäft*), and those which seek to establish a general rule of conduct, such as the "renunciation of war" (*Rechtssatz*). They may be classified in a more practical way according to their object, as follows: (1) political treaties, such as treaties of peace, of alliance, of cession of territory, of pacific settlement, and of disarmament; (2) commercial treaties, including tariff, consular, fishery, and navigation agreements; (3) constitutional and administrative treaties, such as the conventions establishing and regulating international unions, organizations, and specialized agencies; (4) treaties relating to criminal justice, such as treaties defining international crimes and providing for extradition; (5) treaties relating to civil justice, such as conventions for the protection of human rights, trademarks and copyright, and the execution of the judgments of foreign courts; (6) treaties codifying international law, such as procedures for the peaceful settlement of international disputes, rules for the conduct of war, and definitions of the rights and duties of states. In practice it is often difficult to assign a particular treaty to any one of these classes.

A treaty may lapse naturally by the destruction of one of the states party to it, by the object of the agreement ceasing to exist, by the conclusion of a new agreement among the parties abrogating or superseding it, or by denunciation by one of the parties under powers reserved in the treaty itself. Treaties are also in most cases suspended if not terminated by war between the contracting parties and are therefore usually revived in express terms of the treaty of peace.

**Treaty of ——:** *see under* substantive word (*e.g.,* Aix-la-Chapelle, Treaty of).

**treaty port,** any of the ports that Asian countries, especially China and Japan, opened to foreign trade and residence in the mid-19th century because of pressure from powers such as Britain, France, Germany, the United States, and, in the case of China, Japan. In China the initial ports were opened to British traders in 1842 following China's defeat in the Chinese–British trade conflict known as the first Opium War (1839–42); the treaty port system began in Japan in 1854 after Commo. Matthew C. Perry of the United States sailed a fleet of gunships into Edo (now Tokyo) Bay and forced the Japanese to allow U.S. merchants into their country. Other Western nations rapidly followed the British and U.S. examples and gained treaty port privileges for their own citizens not only in China and Japan but also in Vietnam, Korea, and Siam. Toward the end of the 19th century, as the Western countries demanded more and more concessions from China, the number of Chinese treaty ports grew from five in 1842 to more than 50 by 1911. The Japanese, having less trade appeal and a stronger military force than the Chinese, were better able to withstand pressure, and in that country only six ports were opened to foreign trade and residence. No more than two or three ports were ever opened in the smaller countries.

Within the treaty ports, Western subjects had the right of extraterritoriality—*i.e.,* they were under the control of their own consuls and were not subject to the laws of the country in which they resided. Eventually an independent legal, judicial, police, and taxation system developed in each of the ports, although the cities themselves were still nominally considered a part of the country in which they were located. Along with Western municipal institutions came Western ways of life, and many Asians were first acquainted with Western thought and techniques in the treaty ports. Throughout the 19th and 20th centuries, treaty port cities such as Shanghai and Canton constituted the major areas of industrialization in China.

The treaty ports were abolished in Japan in 1899 as a result of that country's rapid industrialization and burgeoning military power. Most of the imperialist powers, however, refused to relinquish their treaty port rights in China and other Asian countries until the end of World War II.

**Trebbia River,** Italian FIUME TREBBIA, Latin TREBIA, river, Emilia-Romagna region, northern Italy, rising in the Ligurian Apennines at an altitude of 4,613 ft (1,406 m), northeast of Genoa, and flowing 71 mi (115 km) north-northeast across the northern Apennines and the Po lowland to enter the Po River just west of Piacenza (ancient Placentia). Throughout its course, except for the first 2 mi, the river is followed by the Genoa–Piacenza Highway.

The river is known in Roman history for the victory gained on its bank in 218 BC by Hannibal whose troops defeated the combined armies of the consuls Scipio Africanus and Tiberius Sempronius Longus; some of the Roman troops, mainly cavalry, escaped to nearby Placentia, but most of them were driven into the river to their death. The plain of the Trebbia was also the scene in 1799 of a defeat of the French under Jacques-Étienne Macdonald (later duc de Tarente) by a Russo-Austrian army commanded by Gen. A.V. Suvorov.

**Trebizond** (Turkey): *see* Trabzon.

**trebizond date** (tree): *see* oleaster.

**Treblinka,** major German Nazi concentration camp and extermination camp, located near the railway village of Treblinka, between the Polish towns of Siedlce and Malkinia, 62 miles (100 kilometres) northeast of Warsaw. There were two camps: the first Treblinka, 2.5 mi from the station, was opened in December 1941 as a small forced-labour camp; the second, larger, and ultrasecret camp, called "T.II" (*i.e.,* Treblinka II) in official dispatches, was located one mile from the first and opened in July 1942 as an extermination camp for Jews marked for the Final Solution.

After being unloaded from arriving railway

freight cars, the victims at Treblinka II were separated by sex, stripped of their clothing and other possessions, marched into buildings containing "bathhouses," and gassed with carbon monoxide from ceiling pipes issuing from diesel engines. (The camp may later have also used the poison gas Zyklon-B.) A few hundred Ukrainians and about 1,000 to 1,500 Jewish male prisoners were employed in performing the executions, removing gold teeth, dentures, and other valuables from the corpses, and transporting the remains to mass graves. The total number killed at Treblinka has been estimated to be between 700,000 and 900,000.

On Aug. 2, 1943, a group of Jewish prisoner-workers rose in a planned revolt, killing some Ukrainian guards and one SS officer but generally failing in a confusion of mistiming and ill luck. Most of the 200 or more who did escape were eventually killed or recaptured.

The facilities at Treblinka II were closed in October 1943; those at Treblinka I in July 1944. Fewer than 100 survivors could be found after World War II. *See also* Holocaust.

**Třeboň,** German WITTINGAU, town, Jihočeský *kraj* (region), Czech Republic, on the main road to Vienna. It lies in the basin of the Lužnice River, which is floored with heavy impermeable clays upon which a good deal of peat has formed. The area has many artificial lakes, and, since the Middle Ages, a freshwater fishing economy has been developed, chiefly with carp. The largest fishpond, laid out (1584–90) by Jakub Krčín, was named after the Rožmberk family, who founded Třeboň's Augustinian monastery and promoted fish breeding. The town and its environs passed to the Schwarzenbergs, a powerful Austrian noble family, in 1660. A remarkable work of medieval pond husbandry is the Zlatá stoka (Golden Canal), which supplies the system with water from the Lužnice. The Svět fishpond (540 acres [220 hectares]) is used for training in water sports.

Wide stretches of water, rimmed with forest and successions of small fish pens, surround the old town, which is noted for its Gothic Church of St. Giles (1367) and Schwarzenberg Castle, which contains valuable archives. Třeboň also has a spa and a small textile industry. Pop. (1990 est.) 9,676.

**Trebonius, Gaius** (d. 43 BC), Roman general and politician who had been one of Caesar's most trusted lieutenants before becoming a member of the conspiracy that resulted in Caesar's death.

During his term as quaestor (financial magistrate) about 60 BC, Trebonius opposed Publius Clodius. Five years later he backed Caesar's party; he was the author of an act that granted Spain to Pompey and Syria to Marcus Licinius Crassus for an additional five years and allowed these two consuls to recruit soldiers both in Italy and in the provinces. After Trebonius' participation in the conquest of Gaul and the Roman Civil War, Caesar in 48 rewarded him with a praetorship and in 49 with the governorship of Further Spain. Trebonius soon abandoned Spain, however, following a mutiny of his troops. In 45 Caesar made him consul and promised him the governorship of Asia, but Trebonius joined the conspiracy against Caesar and participated in his assassination. He was appointed proconsul in Asia in 44. He was murdered the next year by the governor of Syria.

**Trece Martires,** city, southern Luzon, Philippines. Located in a fertile and densely populated plain about halfway between Cavite City on Manila Bay (north) and Taal Lake (south), it is named after the 13 Filipino patriots martyred by the Spanish in 1896 at Cavite. Trece Martires is a trading centre; rice, fruits, coffee, sugarcane, and bananas are grown in the region. Inc. city, 1954. Pop. (1990) 15,686.

**Trediakovsky, Vasily Kirillovich** (b. Feb. 22 (March 5, New Style), 1703, Astrakhan, Russia—d. Aug. 6 [Aug. 17], 1768, St. Petersburg), Russian literary theoretician and poet whose writings contributed to the classical foundations of Russian literature.

The son of a poor priest, Trediakovsky became the first Russian not of the nobility to receive a humanistic education abroad, at the Sorbonne in Paris (1727–30). Soon after his return to Russia he became acting secretary of the Academy of Sciences and de facto court poet. In 1735 Trediakovsky published *Novy i kratky sposob k slozheniyu rossiyskikh stikhov* ("A New and Concise Method for the Composition of Russian Verses"), which discussed for the first time in Russian literature such poetic genres as the sonnet, the rondeau, the madrigal, and the ode. In 1748 appeared his *Razgovor ob ortografii* ("A Conversation on Orthography"), the first study of the phonetic structure of the Russian language. He continued his advocacy of poetic reform in *O drevnem, srednem i novom stikhotvorenii rossiyskom* (1752; "On Ancient, Middle, and New Russian Poetry"). Trediakovsky was also a prolific translator of classical authors, medieval philosophers, and French literature. His translations frequently aroused the ire of the censors, and he fell into disfavour with his Academy superiors and conservative court circles. In 1759 he was dismissed from the Academy. His last major work was a translation of Fénelon's *Les aventures de Télémaque* (1766; *Tilemakhida*), which he rendered in Russian hexameters.

**tree,** woody plant that renews its growth every year (called a perennial); most plants classified as trees have a single self-supporting trunk containing woody tissues, and in most species the trunk produces secondary limbs, called branches.

A brief treatment of trees follows. For full treatment, *see* MACROPAEDIA: Trees.

In modern plant-classification systems based on evolutionary and genetic relationships, trees do not constitute a group separate from shrubs, vines, and herbaceous plants. Instead, trees are among the plants in the botanical divisions and subdivisions of pteridophytes (which include tree ferns), gymnosperms (which include cycads, the ginkgo, and conifers), and angiosperms (which include all flowering plants). Gymnosperms and angiosperms bear seeds, whereas pteridophytes reproduce by means of spores. In angiosperms the seeds are enclosed within fruits. Most of the Earth's trees are angiosperms, of which there are two classes: monocotyledons, including palms, aloes, and yuccas; and the more numerous dicotyledons, including oaks, poplars, apples, and birches.

Trees provide many valuable products, especially wood, which remains one of the world's chief building materials and fuels, and wood pulp, which is used in papermaking. Trees are also an important source of edible fruits and nuts. In addition, they help to clean the air by taking in carbon dioxide and releasing oxygen during photosynthesis (the process by which plants use the energy of sunlight to convert water and carbon dioxide into food). The root systems of trees help to conserve water and deter floods and soil erosion. Trees provide homes and food for a wide variety of animals, and they beautify both natural and man-made landscapes.

The tallest trees in the world are the Pacific coast redwoods (*Sequoia sempervirens*), specimens of which are found in Redwood Creek Valley, Calif. They reach heights of more than 105 m (350 feet). "El Gigante," a Mexican swamp cypress (*Taxodium mucronatum*) in Tule, Oaxaca, holds the record for circumference: its base measures 46 m (150 feet). The oldest known living tree is a bristlecone pine (*Pinus aristata*) in Nevada; it is believed to be between 4,600 and 4,900 years old.

Trees are part of the natural vegetation of regions that have an adequate growing season and receive at least 76 cm (30 inches) of rainfall a year. A few species have become adapted to desert and semidesert climates.

Features such as branching, bark, leaves, flowers, fruit, and thorns, as well as colour, texture, and shape, vary among species.

The reproductive organs of a mature tree are the flowers in angiosperms, the strobili (cones and related structures) in gymnosperms, and the spore-producing sporangia in pteridophytes. A tree develops when a male reproductive cell (sperm) fertilizes a female reproductive cell (egg). Among gymnosperms and angiosperms fertilization is preceded by pollination, in which sperm-bearing pollen grains are transferred to egg-bearing ovules by wind, insects, or other agents.

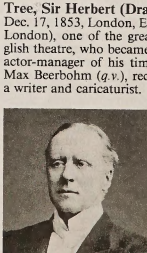
Roots and stems (both of which remain for the life of a tree) and leaves make up the tree's nonreproductive organs. Roots anchor the tree and take in water and nutrients. Stems, which include trunks, branches, and branchlets, expose the reproductive parts to pollinating and dispersing agents and the leaves to light for photosynthesis. Stems also move water and nutrients from the roots to the sites of photosynthesis, and, once the food is manufactured, carry it back to storage and growth tissues.

Tree growth occurs when new cells are formed or old ones are increased in size. The ends of stems and roots contain meristematic tissue, in which cell division produces new cells and thereby causes a tree to increase in height and length. Growth in diameter is caused by secondary meristems, or cambium layers, which lie between the wood and bark in conifers and dicotyledons, and are scantier in monocotyledons and cycads. A cross section of a conifer or dicotyledon reveals concentric rings that signify each year's growth.

Treelike plants first appeared during the Devonian Period (from 408 to 360 million years ago). Early trees reproduced by spores, as do ferns today, and had no flowers or seeds. At the end of the Devonian, gymnosperms (plants whose seeds are not enclosed by a ripened ovary or fruit) appeared; these were the first seed plants. The warm, moist Carboniferous Period (from 360 to 286 million years ago) produced enormous trees and dense, lush forests. The decaying remains of these forests were transformed over time into vast coal deposits. Most of the plants of the Carboniferous forests died out during the colder, drier Permian Period (from 286 to 245 million years ago). Angiosperms appeared during the Early Cretaceous Period (144 to 97.5 million years ago).

**Tree, Ellen:** *see* Kean, Ellen.

**Tree, Sir Herbert (Draper) Beerbohm** (b. Dec. 17, 1853, London, Eng.—d. July 2, 1917, London), one of the great figures of the English theatre, who became the most successful actor-manager of his time. His half brother, Max Beerbohm (*q.v.*), received recognition as a writer and caricaturist.



Sir Herbert Beerbohm Tree

By courtesy of the Victoria and Albert Museum, London

Herbert was educated in England and Germany. Taking the stage name of Herbert Beerbohm Tree, he made his amateur debut in London in 1876 and turned professional two years later. In 1882 he married Helen Maud Holt (1863–1937), who frequently appeared on the stage with him. He was a striking success in 1884 in the role of a curate, and in 1887 he became lessee and manager of the Haymarket Theatre, which he ran with great success for 10 years.

His range of plays and parts was very wide. His Shakespearean productions carried on the traditions of Henry Irving in stressing lavish visual displays. He proved a fine Falstaff and Malvolio, but his Hamlet was not so successful. His Svengali in *Trilby* was acclaimed as the best performance of the role ever seen.

In 1897 Tree moved to Her Majesty's Theatre, which he recently had built, and there produced a repertoire ranging from poetic drama by Stephen Phillips to children's plays. His Shakespearean productions drew audiences from all over the world. Among the most remarkable were *Richard II*, *King John*, *Henry VIII*, and *A Midsummer Night's Dream*. His stage versions of Dickens' works and his characterization of Fagin in *Oliver Twist* were considered outstanding. He was above all a romantic actor with a genius for character parts and comedy. In 1904 he founded what became the Royal Academy of Dramatic Art, and he was knighted in 1909. *Herbert Beerbohm Tree* (1920) was written by Max Beerbohm.

**tree bear** (primate): *see* potto.

**tree cotton** (plant): *see* bombax cotton.

**tree duck:** *see* whistling duck.

**tree ear,** Chinese MU ERH, also called WOOD EAR, or BLACK FUNGUS, any of several edible mushrooms of the genus *Auricularia* that are popular in Chinese cuisine, especially that of Sichuan (Szechwan) province. Tree ears grow wild on and are cultivated on the bark of trees. They are gathered for use in a fresh state and are dried for storage. Dried tree ears resemble gray-black flakes of ash; when reconstituted the mushrooms expand into dark brown, ruffled petals that bear a fanciful resemblance to an animal's ear. Tree ears have only a very subtle, earthy taste. Rather, they are prized for their unique gelatinous-crunchy texture, which supplies contrast in soups and other mixed dishes. Cloud ears are a related species, and the term is often used interchangeably with tree ear.

**tree frog,** also called TREE TOAD, any typical arboreal frog of the family Hylidae. Hylid tree frogs are usually small, slender and long-legged, with sucker-like adhesive disks, which aid in climbing, on the tips of the fingers and toes. Some hylids do not climb well and live in the water, on land, or in burrows. Most species deposit their eggs in water. Some, such as the smith frog (*Hyla faber*), build mud nests at the water's edge; others lay their eggs in the water that collects between the leaves of plants. In the marsupial frogs (*Gastrotheca*) of South America, the young develop in a brood pouch that forms on the back of the female.

There are more than 550 species of hylids. They are found primarily in the New World but are present on all continents. The genus *Hyla* includes several hundred species. Better known species include the barking tree frog (*H. gratiosa*), the European green tree frog (*H. arborea*), the gray tree frog (*H. versicolor*), the green frog (*H. cinerea*), and the Pacific tree frog (*H. regilla*).



European green tree frogs (*Hyla arborea*)
Jane Burton—Bruce Coleman Ltd.

**tree lungwort,** also called LUNGWORT (*Lobaria pulmonaria*), a lichen that, because of its physical resemblance to the lungs, was once used to treat tuberculosis, pneumonia, and other lung diseases. Its elongated, forked thallus (12 to 18 centimetres), loosely attached at one end, is dark green when wet and greenish brown and papery when dry. The forked lobes have square ends.



Tree lungwort (*Lobaria pulmonaria*)
Vernon Ahmadjian

**tree mallow** (*Lavatera arborea*), biennial, herbaceous plant, of the mallow family (Malvaceae), native to Europe. It grows 1.2–3 metres (4–10 feet) tall and bears downy, lobed leaves 10–25 centimetres (4–10 inches) long. Purplish-red flowers about 5 cm wide are borne in profuse, leafy clusters. The cultivated variety *L. arborea variegata* has white-mottled leaves.



Tree mallow (*Lavatera arborea*)
G.R. Roberts

*To make the best use of the Britannica, consult the* INDEX *first*

**tree marriage,** symbolic marital union of a person with a tree that is said to be infused with supernatural life. Tree marriage may also be a form of proxy marriage. In one such practice, between a bachelor and a tree, the tree was afterward felled, thereby endowing the man with the widower status required to marry a widow. Tree marriage was once widespread in India. The term can also refer to a nuptial ceremony that takes place in, on, or around a tree or that is sanctified with some part of the tree, such as the bark or sap. The latter practice is more usually part of a religious system or cult organized around beliefs that trees contain hidden or sacred power to cure or to enhance fertility or that they contain the souls of ancestors or of the unborn.

**tree moss,** any of the plants of the genus *Climacium* (order Bryales), which resemble small evergreen trees and are found in damp, shady places throughout the Northern Hemisphere. The most common species are the European tree moss (*C. dendroides*), which is also found in North America, and the American tree moss (*C. americanum*). Both are about 5 to 10 centimetres (2 to 4 inches) high, with the branches clustered at the top of the shoot. The reddish-brown capsules (spore cases), borne on the female plant, have lids with long beaks and mature in the fall. The American tree moss has longer, narrower capsules with longer beaks and a leaf different from that of the European tree moss. Both species produce new shoots vegetatively each year from horizontal stems growing on the soil surface. A less common North American species, *C. kindbergii*, can be found growing in very wet, swampy places. It is very dark green, almost black, in colour, and its tendency to form dense tufts or cushions obscures the treelike appearance of the small individual plants.



Tree moss (*Climacium dendroides*)
F.K. Anderson—EB Inc.

**tree of heaven,** also called COPAL TREE, or VARNISH TREE (*Ailanthus altissima*), rapid-growing tree, in the family Simaroubaceae, native to China but widely naturalized elsewhere. It has been planted as a yard and street tree in urban centres, because of its resistance to pollution, freedom from insects and disease, and ability to grow in almost any soil.

The tree of heaven grows to 18 metres (60 feet) or more, producing long, many-parted leaves, which emit a rank odour when bruised. Male trees bear unpleasantly scented flowers. Female trees produce winged fruits, tannish orange when ripe. Several varieties are known, among them *A. altissima sutchuenensis*, with

purplish leaf stalks and whitish underleaf, and *A. altissima erythrocarpa,* with brilliant red seed clusters.

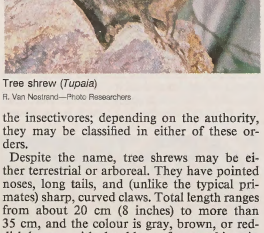
**tree of knowledge** (mythic motif): *see* world tree.

**tree of life:** *see* arborvitae.

**tree poppy:** *see* bush poppy.

**tree-ring dating** (method of age determination): *see* dendrochronology.

**tree shrew,** any of the small, squirrellike mammals constituting the family Tupaiidae, found in forests of Southeast Asia. Tree shrews show resemblances to both the primates and



Tree shrew (*Tupaia*)
R. Van Nostrand—Photo Researchers

the insectivores; depending on the authority, they may be classified in either of these orders.

Despite the name, tree shrews may be either terrestrial or arboreal. They have pointed noses, long tails, and (unlike the typical primates) sharp, curved claws. Total length ranges from about 20 cm (8 inches) to more than 35 cm, and the colour is gray, brown, or reddish brown, with shoulder or face markings in some species. Tree shrews are diurnal. They feed on insects, fruit, and some small animals, and they nest in tree hollows or holes in the ground. They usually bear one or two young; gestation periods, for those in which they are known, are about 47 to 56 days.

There are five genera and about 15 species of tree shrews. Among these are the common tree shrews (*Tupaia*) and the feather- or pentailed tree shrews (*Ptilocercus*), in which the tail is naked and ends in a single, featherlike tuft.

**tree snake,** any of a number of arboreal serpents, primarily of the family Colubridae.



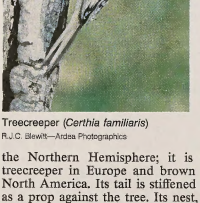
Blunt-headed tree snake (*Imantodes cenchoa*)
Dede W. Thornton—The National Audubon Society Collection/Photo Researchers

They prey on birds and on arboreal lizards and frogs. A well-known genus is *Dendrophis,* found from Southeast Asia to Australia. The most common of Australia's few colubrid snakes is the green tree snake (*Dendrelaphis punctulatus*) of northern and eastern regions. It has a tiny head and thin foreparts and may reach a length of 1.8 m (5.9 feet). The green tree snakes of northern South America are the slender, broad-headed members of the genus *Thalerophis.* Another tropical American genus is *Imantodes,* made up of exceptionally slender rear-fanged tree snakes that stiffen the body in the shape of an I-beam to cross from branch to branch. Flying snakes, mangrove snakes, and whip snakes are sometimes called tree snakes.

**tree swift** (bird): *see* crested swift.

**treecreeper,** also spelled TREE CREEPER, also called CREEPER, any of a dozen species of small slender birds, with downcurved bills, that spiral up tree trunks in search of insects. They are variously classified in the families Certhiidae and Climacteridae.

The six species of the genus *Certhia* constitute the family Certhiidae (order Passeriformes). The best known is *C. familiaris,* a 13-centimetre- (5-inch-) long streaky brown-and-white bird found in woodlands across



Treecreeper (*Certhia familiaris*)
R.J.C. Blewitt—Ardea Photographics

the Northern Hemisphere; it is known as treecreeper in Europe and brown creeper in North America. Its tail is stiffened and serves as a prop against the tree. Its nest, a soft cup within a mass of rootlets, is usually placed behind a slab of bark and contains three to nine eggs.

The six species of *Climacteris,* known as Australian treecreepers, constitute the family Climacteridae, which is sometimes considered a subfamily of the Sittidae (nuthatches) or the Meliphagidae (honeyeaters); formerly, these creepers were included in the family Certhiidae. The Australian treecreepers have brush-tipped tongues and behave rather like honeyeaters, although they resemble certhiids in their drab streaky plumage. As in nuthatches, the tail is not stiffened. The nest, made in a tree hollow, contains one to four eggs. Climacterids are virtually confined to Australia; one species ranges to New Guinea.

*Rhabdornis* species (*see* creeper) are also sometimes placed in the Climacteridae.

**treehopper,** any member of the approximately 2,600 species of insects of the family Membracidae (order Homoptera), sometimes called insect brownies because of their elflike appearance. They are easily recognized by their vertical face and grotesquely enlarged thorax, which extends anteriorly over the head to form a spine and expands posteriorly over the body to form a hoodlike covering. They range in colour from green and blue to bronze and are often marked with spots or stripes.



Treehopper
Alexander B. Klots

Many treehoppers secrete honeydew, a sweet by-product of digestion. These sap-sucking insects, best represented in the tropics, may injure trees and shrubs when the female deposits her yellow, elongated eggs into a double row of curved slits cut into the bark. Fungi and other diseases may enter through these slits. In the spring, pale-green nymphs emerge and feed on the sap of nearby weeds and grasses. They mature and return to the trees in the middle of the summer to lay eggs.

The buffalo treehopper, *Stictocephala* (or *Ceresa*) *bubalus,* 6 to 8 mm (0.2 to 0.3 inch) long, is harmful to young orchard trees, especially apple trees. The oak treehoppers (*Platycotis vittata* and *P. quadrivittata*) feed on deciduous and evergreen oaks. Treehoppers can be controlled by spraying before eggs are laid and by cutting down surrounding weeds.

**treerunner** (bird): *see* sitella.

**trefa** (Judaism): *see* terefah.

**Treich-Laplène, Marcel** (b. June 24, 1860, Ussel, France—d. March 9, 1890, Grand-Bassam, Côte d'Ivoire), French explorer whose difficult voyage into the interior of western Africa established the eastern boundary of the Côte d'Ivoire (Ivory Coast).

Treich traveled to Africa in 1883 and from the start complained of the encroachments of British traders on French territory. The desire to forestall British control of the western African interior led to his voyages of exploration. In 1887 he concluded treaties with the rulers of the Anyi and the Brong peoples. His longest journey began in September 1888, in relief of another French explorer, L.-G. Binger. He traveled inland to Bondoukou and Kong (in the Côte d'Ivoire), establishing French protectorates over the peoples he encountered, and returned to the coast in April 1889.

**Treinta y Tres,** city, east-central Uruguay, near the Olimar Grande River. It is the commercial and manufacturing centre for an agricultural and pastoral hinterland. Cattle and sheep are raised widely; wheat, corn (maize), oats, and linseed are the chief crops. Treinta y Tres lies on the Pan-American Highway and on the main railroad linking Montevideo to Río Branco, and it has an airport. The name (meaning "thirty-three") refers to 33 independence fighters of the 19th century. Pop. (1985) 28,117.

**Treitschke, Heinrich von** (b. Sept. 15, 1834, Dresden, Saxony [Germany]—d. April 28, 1896, Berlin, Ger.), German historian and political writer whose advocacy of power politics was influential at home and contributed to distrust of Germany abroad.

The son of a Saxon general, Treitschke studied at Bonn and Leipzig. He taught history and politics at the University of Leipzig (1859) and went on to teach at Freiburg (1863), Kiel (1866), Heidelberg (1867), and Berlin (1874). From 1866 to 1889 he edited the *Preussische Jahrbücher* ("Prussian Yearbooks"), a journal influential in his field. From 1871 to 1884

he was a member of the Reichstag, first as a National Liberal and then as a moderate conservative, but as a public figure he was handicapped by almost total deafness.

Treitschke was a proponent of authoritarian power politics and a vociferous herald of the unity of Germany through Prussian might. Treitschke believed that the state should be the centre of the lives of its citizens and that it should be headed by authoritarian rulers without the check of a parliament. He held that Germany was the true heir of the Holy Roman Empire; thus he pressed for its rise to the status of a great imperialist power. He disparaged western European liberalism and took an equally skeptical view of democracy in North America.

As a historian, Treitschke won great influence in Germany owing to his rhetorical gifts, his masterful literary style, and his colourful descriptions of political and cultural life. His writings contain many vehement and inaccurate political judgments, however, and his lack of objectivity stands in sharp contrast to the dispassionate learning of his great German contemporary, the historian Leopold von Ranke. After von Ranke's death in 1886, Treitschke was named official historiographer of Prussia. In 1895 he became editor of the *Historische Zeitschrift* ("Historical Journal").

Treitschke's admiration for the early Hohenzollerns and his hatred of Prince von Metternich and the English are evident in his magnum opus, *Deutsche Geschichte im 19. Jahrhundert,* 5 vol. (1879–94; *Treitschke's History of Germany in the Nineteenth Century*), which covers the period from 1800 to 1848. Treitschke did not live to finish writing this work. His most important other works are the essays collected in *Historische und politische Aufsätze,* 4 vol. (1865–97; "Historical and Political Essays"), and his lectures on politics, collected in *Politik,* 2 vol. (1897–98).

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**Trelawny, Edward John** (b. Nov. 13, 1792, London, Eng.—d. Aug. 13, 1881, Sompting, Sussex), English author and adventurer, the friend of Percy Bysshe Shelley and Lord Byron, whom he portrayed brilliantly in his books.

Trelawny was a handsome, dashing, and quixotic personality from an old and famous Cornish family. He was brought up in London and went to a school in Bristol, from which he ran away. At the age of 13 he entered the Royal Navy, and he was discharged in 1812. He wrote of his experiences as a midshipman in *Adventures of a Younger Son* (1831).

In 1822 Trelawny met Shelley and Byron in Pisa, and, after Shelley drowned at Livorno on July 8 of that year, Trelawny never recovered from the blow of his death. He supervised the recovery and cremation of Shelley's body, and he raised the money for Mary Shelley's return to England.

In 1823 Trelawny accompanied Byron to Greece to aid in the struggle for Greek independence. Later Trelawny would vividly recount his friendships with the two great poets in his *Recollections of the Last Days of Shelley and Byron* (1858; revised edition, *Records of Shelley, Byron and the Author,* 1878). From 1833 to 1835 Trelawny traveled in the United States, where, among other adventures, he swam the Niagara River between the rapids and the falls and demonstrated his sympathy for the Abolitionists by buying the freedom of a slave.

A man of many gifts, Trelawny was unable to focus any one of them, and he never fulfilled his promise either as a writer or a man of action. Nevertheless, his great charm made him a favourite in London society. Besides the Shelley circle, his friendships included Caroline Norton, the Rossettis, Walter Savage Landor, Algernon Swinburne, and John Millais. Trelawny's ashes were buried next to Shelley's in the Protestant Cemetery in Rome—a grave he had reserved almost 60 years before his death.

BIBLIOGRAPHY. William St. Clair, *Trelawny: The Incurable Romancer* (1977), puts the author's life in historical perspective.

**Trelleborg,** town and port, Malmöhus *län* (county) southern Sweden, on the Baltic. During the Middle Ages it was an important herring-fishing and commercial centre, but it declined after the herring left the area in the 15th century. After being plundered during war (1563–70) between Denmark and Sweden and devastated by fire in 1617, it lost its charter in 1619 and did not regain its former status as a town until 1867. With the beginning of steamer service to Sassnitz (Germany) in 1897, followed by ferry service in 1909, the town grew in importance. Because of its ferry service, Trelleborg was a focal point for the transportation of sick and wounded and the exchange of prisoners during World Wars I and II. As Sweden's southernmost town, Trelleborg is a major crossing point to continental Europe and maintains a busy coastal trade as well. The modern, well-equipped harbour has been conducive to industrialization, notably sugar refining and the manufacture of rubber goods. Pop. (1994 est.) mun., 37,141.

**Tremadoc Series,** also called TREMADOCIAN SERIES, all those rocks deposited worldwide during the Tremadocian Age (505 to 488 million years ago). The Tremadoc is the lowest of the six divisions comprising the Ordovician System, and its base defines the boundary between the Ordovician and the underlying Cambrian System. The series' name is derived from the village of Tremadoc, near Caernarvon in northern Wales. No global stratotype section and point (GSSP) has yet been defined for its base by the International Commission on Stratigraphy.

The unratified defining point for the base of the series is proposed as the first appearance of the conodont *Cordylodus lindstromi,* which occurs below but close to the first influx of nematophorous graptolites. Graptolites and condonts are most commonly used for biostratigraphic correlation of the series. The Tremadoc Series is defined by a sequence of four graptolite biozones that extend from the base of the *Dictyonema flabelliforme* zone to the top of the *Apatokephalus serratus* zone.

**trematode:** *see* fluke.

**Trembley, Abraham** (b. Sept. 3, 1710, Geneva, Switz.—d. May 12, 1784, Geneva), Swiss naturalist, best known for his studies of the freshwater hydra, mainly *Chlorohydra viridissima.* His extensive systematic experiments foreshadowed modern research on tissue regeneration and grafting.

Trembley's experiments demonstrated the hydra's ability, when cut in two, to regenerate complete individuals from each part and also its ability, when two individuals are grafted together, to form from them a single individual. His demonstration that the hydra is an animal proved the existence of reproduction by budding in the animal kingdom and also proved that the process of budding is asexual. He reported his investigations on the hydra in the monograph on freshwater polyps for which he is best known, *Mémoires pour servir à l'histoire d'un genre de polypes d'eau douce, à bras en forme de cornes* (1744; "Memoirs for History of a Genus of Freshwater, Horn-shaped Polyps"). He was the first to witness multiplication of protozoans by division and cell division in algae. Trembley did his most important biological work while serving as a private tutor to distinguished families.

**Trémoille, Georges de La:** *see* La Trémoille, Georges de.

**trench, oceanic:** *see* oceanic trench.

**trench fever,** infectious disease characterized by sudden onset with fever; headache; sore muscles, bones, and joints; and outbreaks of skin lesions on the chest and back. It is transmitted from one person to another by a body louse harbouring the causative organism, the rickettsial bacterium *Rochalimaea* (formerly *Rickettsia*) *quintana.* There may be one period of fever, or the fever may recur several times at intervals of four to five days. Most persons recover within about two months; there may be relapses, however, and the disease becomes chronic in about 5 percent of the cases. Treatment with chlortetracycline brings permanent relief of the symptoms, but the patient continues to carry rickettsiae and remains infectious for lice. First recognized in 1915, trench fever was a major medical problem during World War I. It reappeared in epidemic form among German troops on the Eastern front during World War II. The control of body lice is the chief means of prevention.

**trench mouth:** *see* Vincent's gingivitis.

**trench warfare,** warfare in which opposing armed forces attack, counterattack, and defend from relatively permanent systems of trenches dug into the ground. The opposing systems of trenches are usually close to one another. Trench warfare is resorted to when the superior firepower of the defense compels the opposing forces to "dig in" so extensively as to sacrifice their mobility in order to gain protection.

A trench system may begin simply as a collection of foxholes hastily dug by troops using their entrenching tools. These holes may



French troops, wearing gas masks, await attack in a trench on the Western Front during World War I

© Roger-Viollet

subsequently be deepened so that a soldier can safely stand up in one of them, and the individual foxholes may be connected by shallow crawl trenches. From this beginning a system of more permanent trenches may be constructed. In making a trench, soil from the excavation is used to create raised parapets running both in front of and behind the trench. Within the trench are firing positions along a raised forward step called a fire step, and duckboards are placed on the often muddy bottom of the trench to provide secure footing.

The tactical ancestor of modern trench warfare was the system of progressively extended trenches developed by the French military

engineer Sébastien Le Prestre de Vauban for the attack of fortresses in the 17th century. Trenches remained merely a part of siegecraft until the increasing firepower of small arms and cannon compelled both sides to make use of trenches in the American Civil War (1861–65). The trench lines of the Petersburg–Richmond theatre of operations in the final months of that war were the foremost example of trench warfare in the 19th century.

Trench warfare reached its highest development on the Western Front during World War I (1914–18), when armies of millions of men faced each other in a line of trenches extending from the Belgian coast through northeastern France to Switzerland. These trenches arose within the first few months of the war's outbreak, after the great offensives launched by Germany and France had shattered against the deadly, withering fire of the machine gun and the rapid-firing artillery piece. The sheer quantity of bullets and shells flying through the air in the battle conditions of that war compelled soldiers to burrow into the soil to obtain shelter and survive.

The typical trench system in World War I consisted of a series of two, three, four, or more trench lines running parallel to each other and being at least 1 mile (1.6 km) in depth. Each trench was dug in a type of zigzag so that no enemy, standing at one end, could fire for more than a few yards down its length. Each of the main lines of trenches was connected to each other and to the rear by a series of communications trenches that were dug roughly perpendicular to them. Food, ammunition, fresh troops, mail, and orders were delivered through these trenches. The intricate network of trenches contained command posts, forward supply dumps, first-aid stations, kitchens, and latrines. Most importantly, it had machine-gun emplacements to defend against an assault, and it had dugouts deep enough to shelter large numbers of defending troops during an enemy bombardment.

The first, or front, line of trenches was known as the outpost line and was thinly held by scattered machine gunners distributed behind dense entanglements of barbed wire. The main line of resistance was a parallel series of two, three, or four lines of trenches containing the bulk of the defending troops. The defenders' artillery was posted to the rear of the main line of trenches. Each main line of trenches was fronted by fields of barbed wire intended to slow down and entangle attacking infantry. As World War I progressed, both sides, but particularly the Germans, developed trench systems of progressively greater depth and strength in order to ensure that the enemy could not achieve a breakthrough at any particular point. The Germans evolved an extremely elaborate defense system using pillboxes, *i.e.,* concrete shelters for machine guns. Behind the pillboxes were more lines of barbed wire and more trenches and dugouts reinforced with concrete to withstand artillery bombardment. Behind these defenses were still more lines of trenches that were effectively out of range of the enemy's artillery fire. By 1918 the Germans had constructed some trench systems that had a depth of 14 miles (22 km).

Throughout most of World War I, the opposing armies on the Western Front tried to break through the enemy's trench system by mounting infantry assaults preceded by intense artillery bombardments of the defending trenches. These attacks usually failed, partly because the preliminary bombardment alerted the defenders to the imminence of an attack, thus allowing them time to bring up reserves for a counterattack, and because the bombardments themselves turned the "no-man's-land" between the opposing sides into rough, shell-pocked terrain that slowed down the attacking infantry. The crucial elements in attacking a trench system, surprise and overwhelming numbers of infantry, were thus almost impossible to attain. The Allies' increased use of the tank in 1918 marked the beginning of the end of trench warfare, however, since the tank was invulnerable to the machine gun and rifle fire that were the trenches' ultimate defense.

Relatively little use was made of trenches in the mobile warfare of World War II, though the Japanese in the Pacific theatre, faced with overwhelming American artillery and air power, did fortify many of their islands with chains of deeply dug caves and bunkers. Similar tactics were used by the North Korean and Chinese forces in the Korean War when confronted with American air power. Classic trench warfare did, however, reappear in the Iran–Iraq War (1980–88), a basically static war in which such mobile weapons as tanks and aircraft were in short supply.

**Trenchard (of Wolfeton), Hugh Montague Trenchard, 1st Viscount,** BARON TRENCHARD OF WOLFETON (b. Feb. 3, 1873, Taunton, Somerset, Eng.—d. Feb. 10, 1956, London), British officer and air marshal who helped lay the foundations of the Royal Air Force (RAF).

Trenchard entered the army in 1893 and served in the South African War and later in Nigeria. After being invalided home in 1912, he learned to fly and in 1913 became assistant commandant of the Central Flying School, Upavon, Wiltshire. In 1915, during World War I, he assumed command in France of the Royal Flying Corps, which was then a branch of the British army. His policy of launching persistent attacks in order to establish dominance of the air became the standard doctrine of Britain's air force. In January 1918 he became Britain's first chief of air staff, though he resigned the post in April of that year. Subsequently that year, he organized the Inter-Allied Independent Bomber Force, a force of RAF heavy bombers to raid targets in Germany.

In 1919 Trenchard was appointed by War Minister Winston Churchill to be the chief of staff of the RAF. In this capacity he strengthened the RAF by founding colleges for air officer cadets and staff officers and by introducing a system of short-service commissions, thereby building a reserve of trained officers. He held the post of chief of air staff until he became the first marshal of the RAF in 1927, and he retired from the service in 1929. He was commissioner of the London metropolitan police from 1931 to 1935. From 1936 to 1953 he was chairman of the United Africa Company.

Trenchard was created a baronet in 1919, a baron in 1930, and a viscount in 1936. He was made Knight Commander of the Bath in 1918.

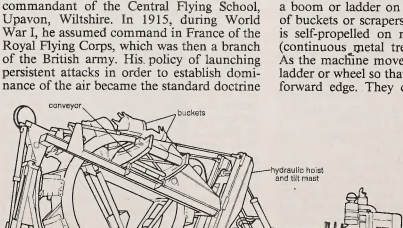
**trencher,** originally a thick slice of bread, used as a primitive form of plate for eating and for slicing meat (hence its derivation from "trancher"—to cut, or carve), but by the 14th century a square or circular wooden plate of rough workmanship. There was usually a small cavity for salt in the rim of the wooden plate, and sometimes the main section was so formed that it could be turned over and the other side used for a second course.



Beechwood trencher, English, 16th century, with pewter and wood spoons; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

By the beginning of the 17th century trenchers were being replaced, first by pewter ware, then by earthenware and porcelain, though the word was still used occasionally to refer to cheap plates not made of wood. It still survives in phrases such as "trencherman," describing a hearty eater.

**trenching machine,** also called DITCHER, or DIGGING WHEEL, excavation machine employing a wheel fitted with rim buckets, or with a boom or ladder on which an endless chain of buckets or scrapers revolves. The machine is self-propelled on rubber tires or crawlers (continuous metal treads driven by wheels). As the machine moves forward, it rotates the ladder or wheel so that the buckets dig at their forward edge. They dump onto a conveyor belt or a chute that piles the cuttings on either side. Trenching machines can be equipped to cut hard ground and even soft rock, but they encounter difficulty with boulders.




Trenching machine
By courtesy of Koehring Company

**Trendelenburg, Friedrich Adolf** (b. Nov. 30, 1802, Eutin, Oldenburg [Germany]—d. Jan. 24, 1872, Berlin), German philologist, educator, prolific writer, and controversial philosopher who is remembered for his criticisms based on the thought of Aristotle and aimed against adherents of Immanuel Kant and G.W.F. Hegel.

Attracted to the study of Plato and Aristotle as a student, Trendelenburg attempted to arrive at a more accurate knowledge of Plato through Aristotle's commentaries. At the end of seven years spent as a tutor to a private family, he wrote in 1833 his critical edition of Aristotle's *De anima* (*On the Soul*). The same year, he was appointed *extraordentlicher Professor* at Berlin and four years later was advanced to *ordentlicher Professor.* In 1865 he began a controversial exchange with the German historian Kuno Fischer centring on Kant's philosophical doctrine of space. Trendelenburg's attack in *Kuno Fischer und sein Kant* (1869; "Kuno Fischer and His Kant")



Trendelenburg, engraving
By courtesy of Bildarchiv Preussischer Kulturbesitz BPK, West Berlin

was met the next year by the response *Anti-Trendelenburg*.

Preferring to attend to problems of the real world, Trendelenburg viewed ethics in the context of politics and history rather than in the framework of purely philosophical formulations. Law, the state, and the actualization of human potential in the real world were central to Trendelenburg's system, epitomized by his *Naturrecht auf dem Grunde der Ethik* (1860; "Natural Law on the Basis of Ethics"). Among his other works are *Elementa Logices Aristotelicae* (1836; *Outline of Logic*), *Logische Untersuchungen* (1840; "Logical Investigations"), and *Die logische Frage in Hegels System* (1843; "The Logical Question in Hegel's System").

**Trent** (Italy): *see* Trento.

**Trent, Council of,** 19th ecumenical council of the Roman Catholic church (1545–63), highly important for its sweeping decrees on self-reform and for its dogmatic definitions that clarified virtually every doctrine contested by the Protestants. Despite internal strife, external dangers, and two lengthy interruptions, the council played a vital role in revitalizing the Roman Catholic church in many parts of Europe.

Though Germany demanded a general council following the excommunication of the German Reformation leader Martin Luther, Pope Clement VII held back for fear of renewed attacks on his supremacy. France, too, preferred inaction, afraid of increasing German power. Clement's successor, Paul III, however, was convinced that Christian unity and effective church reform could come only through a council. After his first attempts were frustrated, he convoked a council at Trent (northern Italy), which opened on Dec. 13, 1545.

Period I (1545–47): When an emotional crisis developed as the council opened (some urging immediate reform and others urging clarification of Catholic doctrines), a compromise was reached whereby both topics were to be treated simultaneously. The council then laid the groundwork for future declarations: the Niceno-Constantinopolitan Creed was accepted as the basis of Catholic faith; the canon of Old and New Testament books was definitely fixed; tradition was accepted as a source of faith; the Latin Vulgate was declared adequate for doctrinal proofs; the number of sacraments was fixed at seven; and the nature and consequences of original sin were defined. After months of intense debate, the council ruled against Luther's doctrine of justification by faith alone: man, the council said, was inwardly justified by cooperating with divine grace that God bestows gratuitously. By enjoining on bishops an obligation to reside in their respective sees, the church effectively abolished plurality of bishoprics. Political problems forced the council's transfer to Bologna and finally interrupted its unfinished work altogether.

Period II (1551–52): Before military events forced a second adjournment of the council, the delegates finished an important decree on the Eucharist that defined the Real Presence of Christ in opposition to the interpretation of Huldrych Zwingli, the Swiss Reformation leader, and the doctrine of transubstantiation (*q.v.*) as opposed to that of Luther. The sacrament of penance was extensively defined, extreme unction (later, the anointing of the sick) explained, and decrees issued on episcopal jurisdiction and clerical discipline. German Protestants, meanwhile, were demanding a reconsideration of all the council's previous doctrinal decrees and wanted a statement asserting that a council's authority is superior to that of the pope.

Period III (1562–63): Pope Paul IV (1555–59) was opposed to the council, but it was reinstated by Pius IV (1559–65). The arrival of French bishops reopened the explosive question regarding the divine basis for the obligations of bishops to reside in their sees. When peace was restored, the council defined that Christ is entirely present in both the consecrated bread and the consecrated wine in the Eucharist but left to the pope the practical decision of whether or not the chalice should be granted to the laity. It defined the mass as a true sacrifice; issued doctrinal statements on holy orders, matrimony, purgatory, indulgences, and the veneration of saints, images, and relics; and enacted reform decrees on clerical morals and the establishment of seminaries.

Pius IV confirmed the council's decrees in 1564 and published a summary of its doctrinal statements; observance of disciplinary decrees was imposed under sanctions. In short order the catechism of Trent appeared, the missal and breviary were revised, and eventually a revised version of the Bible was published. By the end of the century, many of the abuses that had motivated the Protestant Reformation had disappeared, and the Roman Catholic church had reclaimed many of its followers in Europe. The council, however, failed to heal the schism that had sundered the Western Christian church.

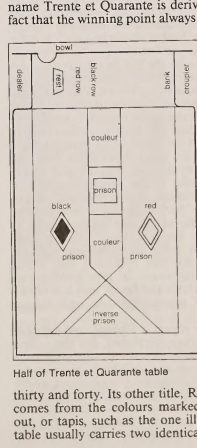
**Trent, River,** river in the English Midlands. It rises in the county of Staffordshire and, after flowing southeastward, northeastward, and then northward for 168 miles (270 km), enters the Humber estuary 40 miles (65 km) from the North Sea. Its drainage basin covers more than 4,000 square miles (10,000 square km). At Alrewas the high ground of its upper valley recedes, and the Trent flows in a broad floodplain. Its fall below Newark is very slight. The upper Trent itself is a comparatively small stream and provides much less water than its powerful tributaries (the Churnet, Dove, and Derwent) from the Peak District. The Trent is tidal for 50 miles (80 km) up to Cromwell Lock, 3 miles (5 km) below Newark, and at spring tide a bore known as the eagre develops, with a wave front of 3 to 4 feet (about 1 m). Considerable quantities of bulk oil are still transported upstream on the Trent from Hull. Of the canals leading from the Trent, only the Sheffield and South Yorkshire Navigation and the Foss Dyke to Lincoln are of much importance today, and the once-famous Trent and Mersey Canal is little used.

**Trent Affair** (1861), incident during the American Civil War involving the doctrine of freedom of the seas, which nearly precipitated war between Great Britain and the United States. On Nov. 8, 1861, Captain Charles Wilkes, commanding the Union frigate *San Jacinto,* seized from the neutral British ship *Trent* two Confederate commissioners, James Murray Mason and John Slidell, who were seeking the support of England and France for the cause of the Confederacy.

Despite initial rejoicing by the Northern populace and Congress, this unauthorized seizure aroused a storm of indignant protest and demands for war throughout Britain. The British government sent an ultimatum demanding an American apology and the release of Mason and Slidell. To avert armed conflict, Secretary of State William Seward, on December 26, replied that Wilkes had erred in failing to bring the *Trent* into port for adjudication, thus violating America's policy of freedom of the seas. The Confederate commissioners were released shortly thereafter.

**Trent Canal,** also called TRENT–SEVERN WATERWAY, canal, southeastern Ontario, Canada, linking Georgian Bay of Lake Huron with Lake Ontario. It extends from the southeastern shore of Georgian Bay near Port Severn, up the Severn River to Lake Simcoe, eastward, connecting several lakes of the Kawartha Lake region to Rice Lake, and down the Trent River to the Bay of Quinte (at Trenton) and Lake Ontario; the small Murray Canal, 8 miles (12 km) long, connects Trenton more directly with Lake Ontario. Trent Canal's 242-mile (387-kilometre) main course consists of 33 miles (53 km) of man-made channels (6 to 8 feet [1.8 to 2.4 m] deep), marine railways at Big Chute on the Severn River, and 42 locks. Among the latter are two hydraulic-lift locks, the one at Peterborough being one of the world's highest (65 feet [20 m]). The Trent Canal also has branches of 10 and 35 miles (16 and 56 km; the latter with one lock). Started in 1833, the waterway once served a flourishing lumber trade. Because of improved road and rail networks, however, its significance as a commercial water route declined rapidly after 1930. The waterway is now a popular tourist attraction providing access to recreational areas, and it is used for municipal water supplies, flood control, and hydroelectricity. Orillia, Barrie, Lindsay, Peterborough, and Trenton are the largest communities along the waterway.

**Trente et Quarante** (French: "Thirty and Forty"), also called ROUGE ET NOIR ("Red and Black"), French card game played at Monte-Carlo and French and Italian gambling casinos. It is not popular in North America. The name Trente et Quarante is derived from the fact that the winning point always lies between




Half of Trente et Quarante table

thirty and forty. Its other title, Rouge et Noir, comes from the colours marked on the layout, or tapis, such as the one illustrated. The table usually carries two identical layouts. All

betting is done against the house, or bank, at even money. Before the deal begins, a player may place his bet on *rouge, noir, couleur,* or *inverse.* Six 52-card packs are shuffled together by the dealer and cut by any player against the house. The dealer then deals out the first card face upward, the suit being noted. He then continues to deal alternately to either side of the card already placed, announcing the cumulative total with each card dealt. Aces count 1 each, face (court) cards count 10 each, and every other card counts its numerical, or pip, value. Dealing stops with the card that causes the total to reach or exceed 31. This first row is called *noir,* the second row, *rouge,* is dealt below the first and in the same manner. The row with the total nearer to 31 is the winning row. For example, a bet on *noir* wins if the count of the first, or *noir,* row is 34 while the *rouge* row totals 36. A bet on *couleur* wins if the very first card dealt is the same colour as that designating the winning row. If this card is of the opposite colour, a bet on *inverse* wins.

As bets are settled, the cards dealt for that coup are brushed into the bowl. When there are insufficient cards for the next coup, all the cards are reshuffled.

**Trentino-Alto Adige,** autonomous frontier *regione,* northern Italy, comprising the *provincie* of Bolzano-Bozen (north) and Trento (south). Historically, the region includes the area of the medieval ecclesiastical principalities of Trento (Trent) and Bressanone (Brixen), which were later contested between the counts of Tirol and Venice. Passing to Italy after World War I, the area was known as Venetia Tridentina until 1947 and was established as an autonomous region by the constitution of 1948. The population of Bolzano is largely German-speaking; that of Trento, Italian-speaking. Members of the provincial parliaments also sit in the regional parliament, which meets for two years alternately in each provincial capital and with alternate Italian-speaking and German-speaking chairmen.

Most of the region is mountainous terrain above 3,000 feet (900 m), including the Ötztal, Brenner, Zillertal (Aurine), and Pusteria Alps to the north, the Ortles and Adamello groups in the west, the Dolomites in the east, and the high plateaus of the interior. Some peaks of the border Alps are among the highest in Europe, notably Palla Bianca (Weisskugel; 12,264 feet [3,738 m]) in the Ötztal Alps. Passes breaching these Alps are the Stelvio into Switzerland, the Resia and the Brenner into Austrian Tirol, and the Dobbiaco or Pusteria Valley (Pustertal) into Austrian Kärnten (Carinthia). The chief rivers draining the mountain masses are the upper Adige (Etsch), the Isarco (Eisack), the Noce, and the Avisio. All are tributaries of the Adige River, which flows south down the principal valley through Bolzano and Trento cities to Verona in the Lombardy Plain. A large part of Bolzano-Bozen province consists of a roughly rectangular area between the Adige, Passiria, and Isarco valleys; much of it is a plateau averaging from 4,300 to 5,600 feet (1,300 to 1,700 m). The valleys of the larger rivers are well populated and fertile, especially in the south. In 1966 great storms brought landslides and floods with loss of life, disruption of communications, and damage to property.

Much of the region is forested, and a timber industry has been developed; but the valleys are quite densely populated and intensively cultivated. Vines and fruit trees are grown extensively on the hillsides. Corn (maize), wheat, oats, and barley are grown in the south, while rye is more common north of Bolzano city. Cattle raising and dairy farming are found on the lower hills and slopes in the valleys. Deposits of zinc, lead, copper, and iron, along with hydroelectric power stations on the Adige and Noce rivers, have encouraged the development of mining and manufacturing in the *regione.* Tourism in both summer and winter is also of prime importance. From the Lombardy Plain several roads converge on Trento. Road and railway then follow the main Adige River valley to Bolzano city and from there connect with Switzerland, the Brenner Pass, and Carinthia. Area 5,258 square miles (13,618 square km). Pop. (1991) 934,731.

**Trento,** Latin TRIDENTUM, German TRIENT, English TRENT, city, capital of Trento *provincia,* Trentino-Alto Adige *regione,* northern Italy. It lies along the Adige River near the mouth of the Brenta River, south of Bolzano. Trento was founded, according to the classical savant Pliny the Elder and the geographer Strabo of Amaseia, by the Raetians, and became a Roman colony and military base on the road north to the Brenner Pass. Its first bishop, St. Vigilius, converted Trentino and the southern Tirol to Christianity in the late 4th to the early 5th century. The seat of a Lombard duchy and later of a Frankish march (borderland), it became a dominion of its prince-bishops in 1027 under Holy Roman imperial patronage and later became famous as the site of the ecumenical Council of Trent (1545–63). Under French control during the Napoleonic Wars, it passed to Austria in 1814. Trento's population has long been an Italian-speaking one, and after the creation of a unified Italy in the 1860s, the city became a centre of irredentist agitation that was ruthlessly suppressed by the Austrian authorities. Trento became part of Italy in 1918. The city was badly flooded in 1966.

Important monuments of the Roman period include the remains of a theatre and of town walls. The city's austere cathedral (consecrated 1145) and the churches of Sant' Apollinare and San Lorenzo are in the Romanesque style. Notable Renaissance buildings include numerous mansions, the Church of Santa Maria Maggiore (1520), and the Castello del Buon Consiglio. The latter, dating from the 13th century, served as the seat of the prince-bishops from the 15th century; in 1528–36 a palace and splendid Renaissance courtyard were added to the castle, which is now a national museum.

Trento now has light mechanical, textile, printing, tanning, and furniture industries; garden vegetables and fruit are cultivated locally. Pop. (1991 prelim.) mun., 101,430.

**Trenton,** city, Hastings county, southeastern Ontario, Canada. It is a port of entry on the Bay of Quinte, on the northern shore of Lake Ontario, and lies at the mouth of the Trent River and at the southern end of the Trent Canal system. First settled by Loyalists in 1792 as Trent Port, it was renamed Trent Town and later Trenton. Its economy, once dominated by lumber and transportation, now includes diversified manufacturing. A Royal Canadian Air Force transport base is east of the town. Inc. village, 1853; town, 1880; city, 1980. Pop. (1991) 16,908.

**Trenton,** city, southwestern suburb of Detroit, Wayne county, southeastern Michigan, U.S. It lies along the Detroit River, opposite Grosse Ile. The site of the Battle of Monguagon during the War of 1812, it was settled by Major Abram Caleb Truax in 1816. It was laid out as Truaxton in 1834 and was called Truago from 1837 until renamed in 1847 for the Trenton Limestone Series that underlies the district. The town's early development was based on the steamboat trade, shipbuilding (the *American Champion* was launched there), and fishing. Economic factors now include planned industrial development (automotive, electric power, steel, and plastics). Inc. village, 1855; city, 1957. Pop. (1992 est.) 20,898.

**Trenton,** city and capital of New Jersey, U.S., seat (1837) of Mercer county, and industrial metropolis at the head of navigation on the Delaware River. It lies 30 miles (48 km) northeast of Philadelphia and 55 miles (89 km) southwest of New York City.

The original settlement (1679) by Mahlon Stacy and other Quakers was known as The Falls. In 1714 William Trent, a Philadelphia merchant, bought 800 acres (324 hectares) from Stacy's son and laid out the town, which was named in his honour in 1721. On Christmas night, 1776, the Revolutionary general George Washington led his army across the ice-choked Delaware River at McKonkey's Ferry, now commemorated by Washington Crossing State Park, and the next morning attacked the Hessian troops of Colonel Johann Rall quartered at Trenton. The surprise attack resulted in a victory for the Americans. On Jan. 2, 1777, the British general Lord Cornwallis arrived in Trenton, but Washington withdrew to Princeton, where he defeated a detachment under Colonel Charles Mawhood. Trenton served as the temporary capital of the United States in 1784 and again in 1799 and became the capital of New Jersey in 1790.

The completion of the Delaware and Raritan Canal and the Camden and Amboy Railroad in the 1830s spurred Trenton's industrial development. The iron industry had been established there since 1734. Peter Cooper opened a rolling mill (1845), and in 1868 his partner, Abram Hewitt, introduced into America the open-hearth process for making steel. In 1848 John Roebling moved his wire mill to Trenton, where he manufactured cables for suspension bridges, including the Brooklyn Bridge. Potteries have operated there since 1723, and late in the 19th century Walter Scott Lenox developed an international reputation with the fine china his firm made there. The railroads, trucking, and rubber, plastics, metalworking, electrical, drug, and textile industries are now among the city's foremost enterprises.

Trenton State College was founded in 1855; other colleges include Rider (1865) in nearby Lawrenceville and Mercer County Community (1966). The Revolutionary battle is commemorated by a 155-foot (47-metre) monument topped by a statue of Washington. The restored William Trent House (1719) is the city's oldest landmark. The gilt-domed State House (1792) is adjacent to the New Jersey State Cultural Center, which contains a museum, auditorium, planetarium, and state library. The Old Barracks (erected [1758–59] as winter quarters for British troops during the French and Indian War), the Old Masonic Lodge (1793), and the Douglass House, where Washington held a council of war (Jan. 2, 1777), are in Stacy Park. The War Memorial Building (1931–32) is used for the inauguration of New Jersey governors. Inc. borough and town, 1745; city, 1792. Pop. (1992 est.) city, 89,349; Trenton PMSA, 328,290.

**Trenton and Princeton, battles of** (1776–77), in the American War of Independence, battles notable as the first successes won by the Revolutionary general George Washington in the open field. After the capture of Fort Washington on Manhattan Island in November 1776, the British general Sir William Howe forced the Americans to retreat through New Jersey and across the Delaware River into Pennsylvania. Howe then went into winter quarters, leaving the Hessian colonel Johann Rall at Trenton with about 1,400 men.

Although Washington's Continental Army was discouraged by the year's disasters, its morale was not crushed, and it now numbered 6,000 effectives. Ascertaining that the Hessians were virtually unsupported, Washington determined to attempt their capture. Despite the ice floes in the Delaware, Washington crossed the river on December 25 and surprised the enemy, the next day capturing more than 900

men. Four days later he occupied Trenton. Hearing of Washington's move, Lord Cornwallis confronted the Continentals east of the city with about 7,000 troops on Jan. 2, 1777, driving them back. Unable to find boats for an escape, Washington called a council of war that confirmed his bold plan to break camp quietly that night and take a byroad to Princeton. The manoeuvre succeeded, and three British regiments that met him there on January 3 were all driven back or retreated. As a result, Washington continued his march to Morristown, N.J., where he flanked British communications with New York. Cornwallis retired to New Brunswick. Besides succeeding in breaking through Howe's lines, Washington had placed himself in an advantageous position for recruiting his army and maintaining a strong defensive in the next campaign.

The effect of these early American victories in the battles of Trenton and Princeton was marked. Following close upon a series of defeats, they put new life into the American cause and renewed confidence in Washington as commander of the Revolutionary Army.

**Trentonian Stage,** division of Middle Ordovician time in North America (the Ordovician Period began about 500,000,000 years ago and lasted about 70,000,000 years); the Trentonian Stage is the uppermost stage of the Champlainian Series of rocks. Trentonian rocks consist largely of limestones and calcareous shales, although a notable black, graptolite-rich shale unit extends from New York to Alabama. The black shale interfingers with limestones to the east, and correlations must be made across the boundaries of these facies.

**trepang** (marine delicacy): *see* bêche-de-mer.

**Trepospira,** extinct genus of gastropods (snails) found as fossils in rocks of Devonian to Pennsylvanian age (between 395,000,000 and 280,000,000 years old). Its shell has a low spire, and the length of the coiling axis is short relative to the shell's width. The shell is smooth but is ornamented by nodules next to the sutures between the whorls.

**Trepostomata,** extinct order of bryozoans (moss animals) found as fossils in marine rocks of Ordovician to Permian age (225,000,000 to 500,000,000 years old). The trepostomes are characterized by colonies in long, curved calcareous tubes, the interiors of which are intersected by partitions. The order includes several common and well-known genera, including the Ordovician forms *Prasopora* and *Dekayella.*

**Tres de Febrero,** *partido* (political subdivision), Gran (Greater) Buenos Aires, Argentina, immediately west of the city of Buenos Aires, in Buenos Aires province. The *partido* is named for the Battle of Caseros on Feb. 3, 1852, in which the Argentine military ruler Juan Manuel de Rosas was defeated. Early settlement of Tres de Febrero focussed on two sites, those of present-day Santos Lugares and of the battle. In 1799 Bernardo Casero built the Palomar de Caseros, his home, which was the site of the 1852 battle and later of the town of Caseros. The settlement around Santos Lugares centred on an 18th-century mission and chapel dedicated to Jesús Amoroso. The area of present-day Tres de Febrero was part of Morón *partido* until 1864, then was included in the *partido* of San Martín (later General San Martín) until 1959, when the *partido* of Tres de Febrero was created out of General San Martín.

Tres de Febrero covers 18 sq mi (46 sq km) and is bordered by the national capital (southeast); the *partidos* of General San Martín (northeast), La Matanza and Morón (southwest), and General Sarmiento (northwest); and also by the Río (river) de la Reconquista (northwest). Besides the *cabecera* (principal built-up area) of Caseros, the major localities in the *partido* are Santos Lugares, Lourdes, and Billinghurst.

The industries of Tres de Febrero produce metal goods, glass, paper, textiles, pharmaceuticals, perfume, and bricks. The National Military College is located in Caseros, as is a museum dedicated to the Battle of Caseros.

With the growth of the national capital, the *partido* has been absorbed into the western suburbs of Gran Buenos Aires, and it lies entirely within the Gran Buenos Aires urban area. Its population density is the third highest among the Gran Buenos Aires *partidos.* It is served by two major railway lines, running west-northwest from Buenos Aires, and by the national highway system. Pop. (1991) 349,376.

**Tres Galliae** (ancient Gaul): *see* Gallia Comata.

**Três Lagoas,** city, east central Mato Grosso do Sul state, south central Brazil, at the confluence of the Sucuriú and Paraná rivers, at 1,030 ft (313 m) above sea level. A cattle-shipping and meat-packing centre, Três Lagoas is on the São Paulo–Corumbá Railroad and is linked by road to Paranaíba and other towns in Mato Grosso do Sul. In 1982 operations began to produce ferromanganese and silicomanganese from Urucum deposits. Pop. (1996) 69,000.

**Trésaguet, Pierre-Marie-Jérôme** (b. 1716, France—d. 1796, France), French engineer known for his introduction of modern road-building ideas.

Youngest son of a family of engineers, Trésaguet served many years in the Corps des Ponts et Chaussées (Bridges and Highways Corps), first in Paris as a subinspector and later in Limoges as chief engineer. Appointed inspector general in 1775, he prepared a memoir describing in detail a method of building a hard-surfaced roadway by successive courses of broken stone. Trésaguet's base, consisting of flat stones set on edge and hammered in, was laid parallel to the curving road surface, providing good strength and drainage. His basic design, first employed in a highway from Paris to the Spanish border via Toulouse, spread to Central Europe and Sweden and was adopted by the Scottish road builder Thomas Telford.

**Tresor de la langue française** (French: "Treasury of the French Language"), in full TRESOR DE LA LANGUE FRANÇAISE; DICTIONNAIRE DE LA LANGUE DE XIX$^{E}$ ET DU XX$^{E}$ SIÈCLE (1789–1960), etymological and historical dictionary of the French language, a comprehensive, large-scale work still in progress; its first six volumes were published in Paris in 1974–78. Volume 3 is evidence of the editorial decision, made following publication of the first two, to reduce the scope dramatically and to complete the work in 15 volumes rather than the 60 originally planned.

Each entry supplies pronunciation in the International Phonetic Alphabet, definition, orthography, etymology with sources, and history. The first two volumes contain extremely numerous quotations citing usage; this feature was reduced in the third and subsequent volumes. Definitions in the later volumes are still treated comprehensively with illustrative quotations, but not to the extent first envisioned by the Centre de Recherche pour un Tresor de la Langue Française, in Nancy, through whose offices the project is being administered.

**trespass,** in law, the unauthorized entry upon land. Initially, trespass was wrongful conduct directly causing injury or loss and thus was the origin of the law of torts in common-law countries. Trespass now, however, is generally confined to issues involving real property.

Neither malice nor knowledgeability is essential to trespass. Thus, mistaken belief as to ownership of land is no defense to a trespass charge. Moreover, possession—not ownership—is the issue in trespass to land. A trespass suit can be brought by anyone in possession of land—even wrongful possession.

Formerly, every unauthorized entry was trespass, even if no loss resulted. The courts have softened this policy, but vestiges of it remain. Once a trespass is proved, the trespasser is usually held liable for any damages resulting—regardless of whether he was negligent or whether the damage was foreseeable. Similarly, if a man fells a tree on his land even with complete caution, if the tree falls onto his neighbour's land, he is held strictly liable for damage.

Trespass to land is also unauthorized subsurface entry (*e.g.,* horizontal drilling) and in the air (*e.g.,* stringing telephone wires), although air rights are still very much in controversy. If there is a continuing presence (*e.g.,* dumping trash on land), the trespass continues until removed.

Trespass can also be against personal property, but in such cases the object must be carried away and actual damage must be shown—in contrast to technical trespasses against land.

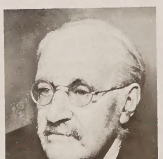
Trespass in criminal law is a trespass accomplished through the intentional demonstration of force calculated to intimidate or alarm the owner or accomplished in such a way as to tend toward a breach of the peace. No trespass is criminal unless it tends to a breach of the peace, even though the act be committed forcefully and maliciously.

**tresviri** (civil officials): *see* triumvirate.

**Tretyakov Gallery,** in full STATE TRETYAKOV GALLERY, Russian GOSUDARSTVENNAYA TRETYAKOVSKAYA GALEREYA, Moscow art museum founded by Pavel M. Tretyakov in 1856. It contains the world's finest collection of 17th- and 18th-century Russian icons, having more than 40,000 of them.

There are also 18th-century portraits, 19th-century historical paintings, and works of the Soviet period. The museum is organized into Early Russian Art, Art of the 18th Century, Art of the First Half of the 19th Century, Art of the Second Half of the 19th Century, Art of the Early 20th Century, and Soviet Art.

**Trevelyan, G(eorge) M(acaulay)** (b. Feb. 16, 1876, Welcombe, Warwickshire, Eng.—d. July 21, 1962, Cambridge, Cambridgeshire), English historian whose work, written for the general reader as much as for the history student, shows an appreciation of the Whig tra-



G.M. Trevelyan
Camera Press

dition in English thought and reflects a keen interest in the Anglo-Saxon element in the English constitution.

The third son of Sir George Otto Trevelyan, he was educated at Harrow and at Trinity College, Cambridge. He became Regius Professor of modern history at Cambridge in 1927 and master of Trinity College in 1940, retiring in 1951.

Essentially liberal by training and temperament, Trevelyan showed as a historian a love

of England that was also indicated by his association with the National Trust (*Must England's Beauty Perish?,* 1929) and with youth hostels. His regard for the Whigs is evidenced in his *Lord Grey of the Reform Bill* (1920) and *Grey of Fallodon* (1937). The romantic aspect of Trevelyan's liberalism led to three books on Giuseppe Garibaldi (1907, 1909, and 1911).

Other works include *England in the Age of Wycliffe* (1899), *British History in the Nineteenth Century (1782–1901)* (1922), *History of England* (1926), *An Autobiography and Other Essays* (1949), and *The Seven Years of William IV* (1952).

**Trevelyan, Sir George Otto,** 2ND BARONET (b. July 20, 1838, Rothley Temple, Leicestershire, Eng.—d. Aug. 17, 1928, Wallington, Northumberland), English historian and statesman remembered for his biography of his uncle Lord Macaulay and for his part in the political events surrounding Prime Minister William Gladstone's introduction of Irish Home Rule (1886), which Trevelyan first opposed and then reluctantly supported.

Trevelyan was a Liberal member of Parliament from 1865 and served in various governmental capacities until 1897, when he retired from politics. His *Life and Letters of Lord Macaulay,* 2 vol. (1876), regarded as one of the best biographies in English, presents its subject in the round and, though sympathetic, is never partisan. His historical works include the *Early History of Charles James Fox* (1880) and six volumes on the U.S. War of Independence. Trevelyan succeeded his father in the baronetcy in 1886.

**Trèves** (Germany): *see* Trier.

**Trevino, Lee (Buck)** (b. Dec. 1, 1939, near Dallas, Texas, U.S.), American professional golfer who became an immediate success when he joined the Professional Golfers' Association of America (PGA) tour in 1967 and soon was recognized as one of the finest players in the world.

Of Mexican-American descent, Trevino received a grade-school education, served in the U.S. Marine Corps, and worked as an odd-job man and assistant professional at golf courses in his native Texas. In 1967 he unexpectedly came in fifth in the U.S. Open. He won that tournament in 1968 and 1971 and the British Open in 1971 and 1972. In 1970 Trevino led all other golfers in prize earnings, and in 1971 he became the first player to win the U.S., British, and Canadian Opens in a single year.

After winning the U.S. PGA tournament in 1974, Trevino was struck by lightning and suffered minor injuries to his arm and back. Later he underwent surgery to remove a damaged spinal disc. Trevino underwent surgery again in 1982, and his chronic back problems significantly restricted his play. He competed in only a few tournaments a year and regularly served as a television sports commentator.

In 1984, however, Trevino rallied to win the PGA tournament, and in 1985 he won the British Masters. He was elected to the American Golf Hall of Fame and the World Golf Hall of Fame.

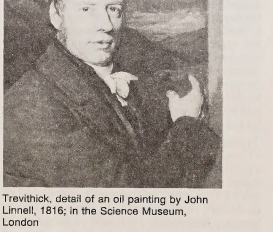
**Trévise, Édouard-Adolphe-Casimir-Joseph Mortier, duc de** (duke of): *see* Mortier, Édouard-Adolphe-Casimir-Joseph.

**Treviso,** ancient (Latin) TARVISIUM, city, capital of Treviso *provincia,* Veneto *regione,* northeastern Italy, situated north of Venice in a fertile plain at the confluence of the Sile and Botteniga rivers and intersected by canals. Originating as the Celtic Tarvisium, it was a Roman municipality and had an important mint at the time of Charlemagne. As capital of the march of Trevigiana, it reached its cultural peak in the 13th century under the da Camino family. Loyal to the republic of Venice from 1339 until it fell to the French in the Napoleonic era, Treviso was subject to Austria from 1815 until it was incorporated in united Italy in 1866. Treviso suffered from aerial bombing in World Wars I and II.

Most of its important buildings have been restored, including the cathedral, founded in the 12th century, which houses treasures by such artists as Titian, Pordenone, and Paris Bordone, a native of Treviso. The Romanesque-Gothic Church of San Nicolò contains a group of saints by Tommaso da Modena, and the Church of San Francesco (where Dante's son Pietro and Petrarch's daughter Francesca are buried) has frescoes by the same artist. Characteristic of the city are the frescoes on house facades, notably those by Pordenone and Bordone. The Luigi Bailo Civic Museum contains prehistoric and Roman relics, as well as early Christian and Byzantine sculpture and a rich picture gallery.

An important agricultural market centre, Treviso has rice and paper mills and food, textile, chemical, and ceramics manufactures. Pop. (1989 est.) mun., 84,478.

**Trevithick, Richard** (b. April 13, 1771, Illogan, Cornwall, Eng.—d. April 22, 1833, Dartford, Kent), English mechanical engineer and inventor who successfully harnessed high-pressure steam and constructed the world's first steam railway locomotive (1803). In 1805 he adapted his high-pressure engine to driving an iron-rolling mill and to propelling a barge with the aid of paddle wheels.



Trevithick, detail of an oil painting by John Linnell, 1816; in the Science Museum, London

By courtesy of the Science Museum, London, the Woodcroft Bequest

Trevithick spent his youth at Illogan in the tin-mining district of Cornwall and attended the village school. The schoolmaster described him as "disobedient, slow and obstinate." His father, a mine manager, considered him a loafer, and throughout his career Trevithick remained scarcely literate. Early in life, however, he displayed an extraordinary talent in engineering. Because of his intuitive ability to solve problems that perplexed educated engineers, he obtained his first job as engineer to several Cornish ore mines in 1790 at the age of 19. In 1797 he married Jane Harvey of a prominent engineering family. She bore him six children, one of whom, Francis, became locomotive superintendent of the London & North Western Railway and later wrote a biography of his father.

Because Cornwall has no coalfields, high import costs obliged the ore-mine operators to exercise rigid economy in the consumption of fuel for pumping and hoisting. Cornish engineers, therefore, found it imperative to improve the efficiency of the steam engine. The massive engine then in use was the low-pressure type invented by James Watt. Inventive but cautious, Watt thought that "strong steam" was too dangerous to harness; Trevithick thought differently. He soon realized that, by using high-pressure steam and allowing it to expand within the cylinder, a much smaller and lighter engine could be built without any less power than in the low-pressure type.

In 1797 Trevithick constructed high-pressure working models of both stationary and locomotive engines that were so successful that he built a full-scale, high-pressure engine for hoisting ore. In all, he built 30 such engines; they were so compact that they could be transported in an ordinary farm wagon to the Cornish mines, where they were known as "puffer whims" because they vented their steam into the atmosphere.

Trevithick built his first steam carriage, which he drove up a hill in Camborne, Cornwall, on Christmas Eve 1801. The following March, with his cousin Andrew Vivian, he took out his historic patent for high-pressure engines for stationary and locomotive use. In 1803 he built a second carriage, which he drove through the streets of London, and constructed the world's first steam railway locomotive at Samuel Homfray's Penydaren Ironworks in South Wales. On Feb. 21, 1804, that engine won a wager for Homfray by hauling a load of 10 tons of iron and 70 men along 10 miles of tramway. A second, similar locomotive was built at Gateshead in 1805, and in 1808 Trevithick demonstrated a third, the *Catch-me-who-can,* on a circular track laid near Euston Road in London. He then abandoned these projects, because the cast-iron rails proved too brittle for the weight of his engines.

In 1805 Trevithick adapted his high-pressure engine to driving an iron-rolling mill and propelling a barge with the aid of paddle wheels. His engine also powered the world's first steam dredgers (1806) and drove a threshing machine on a farm (1812). Such engines could not have succeeded without the improvements Trevithick made in the design and construction of boilers. For his small engines, he built a boiler and engine as a single unit, but he also designed a large wrought-iron boiler with a single internal flue, which became known throughout the world as the Cornish type. It was used in conjunction with the equally famous Cornish pumping engine, which Trevithick perfected with the aid of local engineers. The latter was twice as economic as the Watt type, which it rapidly replaced.

Trevithick, a quick-tempered and impulsive man, was entirely lacking in business sense. An untrustworthy partner caused the failure of a London business he started in 1808 for the manufacture of a type of iron tank Trevithick had patented; bankruptcy followed in 1811. Three years later, nine of Trevithick's engines were ordered for the Peruvian silver mines, and, dreaming of unlimited mineral wealth in the Andes Mountains, he sailed to South America in 1816. After many adventures, he returned to England in 1827, penniless, to find that in his absence other engineers, notably George Stephenson, had profited from his inventions. He died in poverty and was buried in an unmarked grave.

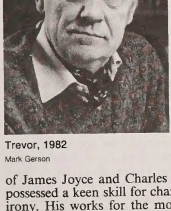
(L.T.C.R.)

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**Trevor, William,** original name WILLIAM TREVOR COX (b. May 24, 1928, Mitchelstown, County Cork, Ire.), Irish writer who is noted for his wry and often macabre short stories and novels, especially for the novel *The Old Boys* (1964), the story of an "old boys" com-

mittee, whose rapidly aging members plot and plan against each other, driven by searing memories of the insults and rivalries of their school days.

Trevor was educated at Trinity College, Dublin, and began his career as a teacher and sculptor. He taught both history and art at various schools in Northern Ireland and England, and then in 1960 he moved to London and worked as an advertising copywriter. It was at this time (1960–65) that Trevor began to publish his novels and short stories. Eventually he decided to move to Devon, England, and write full time. His novels after *The Old Boys* include *The Boarding-House* (1965), *Mrs. Eckdorf in O'Neill's Hotel* (1969), *Elizabeth Alone* (1973), *The Children of Dynmouth* (1976), *Other People's Worlds* (1980), *Fools of Fortune* (1983), and *The Silence in the Garden* (1988). He also wrote several highly acclaimed collections of short stories. The comprehensive collection *Stories of William Trevor* appeared in 1983. Influenced by the writings



Trevor, 1982
Mark Gerson

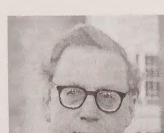
of James Joyce and Charles Dickens, Trevor possessed a keen skill for characterization and irony. His works for the most part focus on the psychology of eccentrics and outcasts.

**Trevor-Roper, H(ugh) R(edwald),** Baron Dacre of Glanton (b. Jan. 15, 1914, Glanton, Northumberland, Eng.), British historian and scholar noted for his works on aspects of World War II and on Elizabethan history.

Trevor-Roper graduated from Christ Church College, Oxford, in 1936, and in 1939, as a research fellow at Merton College, he qualified for the M.A. degree. His first book was *Archbishop Laud, 1573–1645* (1940), a biography of the archbishop of Canterbury and adviser to King Charles I. During World War II, Trevor-Roper was an intelligence officer and helped investigate Adolf Hitler's death. In 1947 his book *The Last Days of Hitler* was published. From 1946 to 1957 he taught history at Christ Church College. During this period he wrote several articles about Hitler, stirring controversy by contending that Hitler was not only a systematic thinker but a genius as well. In 1957 he was appointed regius professor of modern history and fellow of Oriel College, Oxford. He remained at this post until 1980, when he was appointed Master of Peterhouse College, Cambridge, where he stayed until 1987. He was created a life peer in 1979.

His interest in modern history is evident in his works about World War II. He wrote *The Philby Affair: Espionage, Treason, and Secret Service* (1968) and edited *Hitler's Table Talk, 1941–1944* (1953), *Hitler's War Directives, 1939–1945* (1964), and *The Goebbels Diaries* (1978). He gained international attention in 1983 when he certified as genuine some 60 volumes of diaries purported to be Hitler's; they later proved to be forgeries.

He wrote a number of noncontroversial books, including *The Gentry, 1540–1640*



Trevor-Roper
Jerry Bauer

(1953), *Historical Essays* (1957), *Religion, the Reformation and Social Change, and Other Essays* (1967), *Princes and Artists: Patronage and Ideology at Four Habsburg Courts, 1517–1633* (1976), and *Catholics, Anglicans and Puritans* (1987). He also wrote a biography revealing the amazing deceptions of Sir Edmund Backhouse, an internationally known Sinologist.

**trevorite,** the mineral nickel iron oxide, a member of the magnetite (*q.v.*) series of spinels.

**triad,** in chemistry, any of several sets of three chemically similar elements, the atomic weight of one of which is approximately equal to the mean of the atomic weights of the other two. Such triads—including chlorine-bromine-iodine, calcium-strontium-barium, and sulfur-selenium-tellurium—were noted by the German chemist J.W. Döbereiner between 1817 and 1829. The triad was the earliest atomic-weight classification of the elements.

**triad,** in music, a chord of three tones, consisting of a root with its third and fifth and constituting the harmonic basis of tonal music. *See* chord.

**trial jury:** *see* petit jury.

**triaminotriazine** (chemistry): *see* melamine.

**triangle,** percussion instrument consisting of a steel rod bent into a triangle with one corner left open. It is suspended by a gut or nylon loop and struck with a steel rod. It is theoretically an instrument of indefinite pitch, for its fundamental pitch is obscured by its inharmonic partials (component tones). Some players, however, perceive a suggestion of pitch and often possess more than one instrument. A single stroke on the triangle clearly penetrates the full force of an orchestra, and it is perhaps most effective when used sparingly.

The triangle was known by the 14th century and was sometimes trapezoidal in form; until about 1800 it often had jingling rings. With cymbals and bass drums, triangles were basic to the Turkish Janissary music in vogue in 18th-century Europe, entering the orchestra at that time as a device for local colour. In the 19th century it began to be used purely for its sound, as in Franz Liszt's *Piano Concerto No. 1 in E-flat Major* (*Triangle Concerto*).

**Triangle Shirtwaist Company fire,** conflagration that occurred on March 25, 1911, in a New York City sweatshop and resulted in the deaths of 146 individuals, mostly young immigrant women. The event touched off a national movement in the United States for safer working conditions.

The fire started on the eighth floor of the Asch Building just east of Washington Square Park and quickly spread upward to the two top floors of the building. Some workers, having no way of opening the doors that had been locked to prevent theft, leapt from windows to their deaths. Fire truck ladders, then able to reach only six stories, were of little help, and the building's overloaded fire escape collapsed. The disaster led to the creation of health and safety legislation, including factory fire codes and child-labour laws, and helped shape future labour laws.

**triangulation,** in navigation, surveying, and civil engineering, a technique for precise determination of distances and angles for location of a ship's or aircraft's position, and in such endeavours as road building, tunnel alignment, and other construction. It is based on the laws of plane trigonometry, that if one side and two angles of a triangle are known, the other two sides and angle can be readily calculated. One side of the selected triangle is measured; this is the baseline. The two adjacent angles



A chain of triangles

are measured by means of a surveying device known as a theodolite, and the entire triangle is established. By constructing a series of such triangles, each adjacent to at least one other, values can be obtained for distances and angles not otherwise measurable. Triangulation was used by the ancient Egyptians, Greeks, and other peoples at a very early date, with crude sighting devices that were improved into the diopter, or dioptra (an early theodolite), in the 1st century AD by Hero of Alexandria.

**Trianon, Treaty of** (1920), treaty concluding World War I and signed by representatives of Hungary on one side and the Allied Powers on the other. It was signed on June 4, 1920, at the Trianon Palace at Versailles, Fr.

The Allies' presentation of their terms for peace with Hungary was delayed first by their reluctance to treat with Béla Kun's communist regime in that country and subsequently by the obvious instability of the more moderate Hungarian governments that assumed office during the Romanian occupation of Budapest (from August to mid-November 1919). At last, however, the Allies recognized a new government, and on Jan. 16, 1920, at Neuilly, near Paris, a Hungarian delegation received the draft of a treaty.

By the terms of the treaty, Hungary was shorn of at least two-thirds of its former territory and two-thirds of its inhabitants. Czechoslovakia was given Slovakia, sub-Carpathian Ruthenia, the region of Pressburg (Bratislava), and other minor sites. Austria received western Hungary (most of Burgenland). The Kingdom of Serbs, Croats, and Slovenes (Yugoslavia) took Croatia-Slavonia and part of the Banat. Romania received most of Banat and all of Transylvania. Italy received Fiume. Except for plebiscites in two small regions, all the transfers were effected without any plebiscites.

The Covenant of the League of Nations was integrally included in the treaty. Hungary's armed forces were to be restricted to 35,000 men, lightly armed and employed only to maintain internal order and to secure the frontiers. The amount of reparations to be imposed was to be determined later.

**Triassic Period,** interval of geologic time from about 245 to 208 million years ago. It marks the beginning of the Mesozoic Era of Earth history. It is divided into the Early Triassic Epoch (245 to 240 million years ago), the Middle Triassic Epoch (240 to 230 million years ago), and the Late Triassic Epoch (230 to 208 million years ago). The rocks that originated during the Triassic Period make up the Triassic System.

A brief treatment of the Triassic Period follows. For full treatment, *see* MACROPAEDIA: Geochronology.

The name Triassic is derived from the term Trias, which was first applied (1834) by the paleontologist Friedrich August von Alberti to a sequence of rock strata in central Germany. The term refers to a threefold division of the strata into a lower unit of nonmarine red-coloured sediments (Bunter, or Buntsandstein), a middle unit of marine limestone, sandstone, and shale (Muschelkalk), and an upper unit of nonmarine rocks (Keuper) that are similar to those of the lower division. This sequence, which is typical of the Triassic strata of northern Europe, France, Spain, and north Africa, is commonly known as the Germanic facies.

During the Permian Period (from 286 to 245 million years ago), which preceded the Triassic, Laurasia (consisting of present-day North America and Eurasia) united with Gondwana (consisting of South America, Africa, India, Australia, and Antarctica) into a single supercontinent. Known as Pangaea, this enormous landmass extended from pole to pole within a narrow belt of about 60° longitude. Near the end of the Triassic, continental rifting occurred along the Tethys seaway, which extended westward partway between Laurasia and Gondwana. Spreading centres also developed between the various constituent continents of Gondwana. This tectonic activity set the stage for Pangaea's fragmentation during the subsequent periods of the Mesozoic.

The Appalachian mountain chain in eastern and southern North America and the Ural Mountains underwent their final orogenic (mountain-building) episodes in the Early Triassic Epoch (245 to 240 million years ago); a minor orogeny occurred in late Middle Triassic times in southwestern Japan (the Middle Triassic occurred from 240 to 230 million years ago); and parts of China underwent orogeny in the Late Triassic (230 to 208 million years ago).

The Triassic is represented by a wide array of sedimentary rocks and by a few of the igneous variety. Sedimentary rocks of Triassic age in the western interior of North America include red beds of sandstone and shale interbedded with limestone "tongues" from marine transgressions. Late Triassic fluvial sequences contain conifer logs petrified by silica from volcanic-ash deposits. The rifting of Pangaea created fault-block basins near the lines of separation. These basins filled with fluvial and lacustrine beds, as well as with basaltic intrusions and pillow lavas, between the Late Triassic and Early Jurassic (the latter extends from roughly 208 to 187 million years ago). Rocks of Triassic age also are widely distributed in former geosynclinal belts (major depositional troughs in the Earth's crust). In the geosynclines of the Circum-Pacific region, for example, graywacke, sandstone, shale, and volcanic rock predominate. In the northern Tethyan geosyncline, many limestones with deep-sea sediments (*e.g.*, radiolarian cherts) occur. These deposits outcrop today in such areas as the Alps, Turkey, Pakistan, and the Himalayas.

The Triassic Period heralded the major changes that were to occur in both terrestrial and marine biota during the Mesozoic. Its fossil record contrasts markedly with that of earlier periods and sets the stage for the remainder of Mesozoic time.

The evolution of life during Earth history is punctuated by episodes of large-scale extinctions. The extinction event that occurred toward the end of the Permian Period was one of the most severe, especially among marine invertebrates. During the Middle and Late Triassic, some of the forms that survived, as, for example, the pelagic cephalopod mollusks known as ammonoids, recovered, undergoing explosive adaptive radiation. Other groups, such as the bivalves (notably the genera *Claraia, Halobia,* and *Monotis*), also recovered and began to flourish in the later Triassic. Scleractinian corals dominated reef complexes for the first time in the Late Triassic, and the coccolithophores, a major group of extant pelagic algae, evolved at this time.

Many new vertebrate forms emerged during the Triassic. The seas became inhabited by large marine reptiles, such as the turtlelike placodonts, long-necked nothosaurs, and dolphin-shaped ichthyosaurs. On land, labyrinthodont amphibians survived from Permian times and were joined by the ancestral forms of various modern animals, including proanurans (precursors of the frogs), marine turtles, and crocodilians. By the Late Triassic, reptiles of the subclass Archosauria were becoming more and more dominant. The archosaurs include the thecodonts from which the dinosaurs of the later Mesozoic descended. The first true mammals, small shrewlike omnivores, evolved by the end of the Triassic, while the therapsids, a group of mammallike reptiles, became extinct.

The pteridosperm genus *Dicroidium* dominated the Triassic flora of the southern Gondwanan region. Gymnosperms of the conifer, cycad, and ginkgo varieties were common throughout much of Pangaea.

**Triballi,** a Thracian people whose earliest-known home was the "Triballian plain" (probably the Plain of Kosovo), near the junction of the Axius and Brongus rivers (the western and southern Morava) in the north-central Balkans. Sometime after 424 BC they were overcome by the Autariatae, an Illyrian tribe. In 339 BC the Triballi refused to allow Philip II of Macedon to pass through the Haemus (Balkan) Range unless they received a share of his booty. Philip forced a passage but was wounded in the hostilities. After Philip's death, Alexander the Great in 335 crossed the Haemus and defeated the Triballi. They later retained enough strength to cause trouble to the Roman governors of Macedonia.

**tribe,** in cultural anthropology, theoretical type of human social organization based on small groups defined by traditions of common descent and having temporary or permanent political integration above the family level and a shared language, culture, and ideology. In the ideal model of a tribe, members typically share a tribal name and a contiguous territory; they work together in such joint endeavours as trade, agriculture, house construction, warfare, and ceremonial activities. Tribes are usually composed of a number of smaller local communities (*e.g.*, bands, villages, or neighborhoods) and may be aggregated into higher-order clusters, called nations.

As an ideal type, the tribe is regarded by cultural evolutionists as the form of social organization that developed into a stratified society and, eventually, into the type of social organization known as the primitive state. As an ideal type, the tribe derives its unity not from a territorial identity but from a sense of extended kinship.

Few ethnographically known tribes possess all the characteristics of the ideal, or model, tribe. The Amba of Uganda are considered to be one tribe although they speak two mutually unintelligible languages; the Zuni "tribe" consists of only one community; the Dorobo of Kenya live scattered among the Nandi and Masai, for whom they hunt and perform ritual services.

As an anthropological term, the word tribe fell out of favour in the latter part of the 20th century. Some anthropologists rejected the term itself, on the grounds that it could not be precisely defined. Others objected to the negative connotations the word acquired in the colonial context. African scholars, in particular, felt that the term was pejorative as well as inaccurate. Thus, many modern anthropologists replaced it with the designation ethnic group, usually defined as a group of people with a common ancestry and language, a shared cultural and historical tradition, and an identifiable territory. The use of the term ethnic group is particularly appropriate in the discussion of modernizing countries, where a person's extended kinship ties may be less important than his village or region of origin in establishing his identity and claim to landownership.

**tribe,** Latin TRIBUS, plural TRIBI, in Roman history, a unit of the Roman state. The first Roman tribes were probably ethnic in origin and consisted of the Titienses (Tities), Ramnenses (Ramnes), and Luceres. They were superseded by the creation of new local tribes (date uncertain) consisting of 4 urban tribes and 16 rural, or rustic, tribes. The latter were probably named after *pagi* (country districts) that were, in turn, known by the principal *gentes* (clans) settled on that territory. The number of rural tribes was increased until by 241 BC they totaled 35. The additional tribes were instituted in new Roman territory on the Italian peninsula where Romans settled; moreover, original inhabitants who had been granted Roman citizenship were also enrolled in those added rural tribes. In later times there was no geographic significance involved with the enrollment of citizens in tribes. The lower classes and freed slaves, however, seem to have been enrolled mostly in the less-numerous urban tribes.

Provincial communities (*civitates*) as well as individuals who were granted Roman citizenship under the empire (from 27 BC) were all enrolled in a particular tribe. The tribes served as units for purposes of taxation, military conscription, and census taking.

**Triberg,** in full TRIBERG IM SCHWARZWALD, city, Baden-Württemberg *Land* (state), southwestern Germany. It lies along the Gutach River, northeast of Freiburg im Breisgau. Situated in a gorgelike valley among tall pinewoods near Triberg Falls, the highest (535 feet [163 m]) waterfall in Germany, Triberg is one of the oldest Black Forest resorts and is noted for its beneficial climate and its winter-sports facilities. The pilgrimage church of Maria in der Tanne (1702) has a fine Baroque altar. Metalworking, wood carving, and clock-making are carried on in the city, and the local museum has a collection of Black Forest clocks. Pop. (1990 est.) 6,037.

**tribology,** the study of the interaction of sliding surfaces. It includes three subjects: friction, wear, and lubrication (*qq.v.*). There is a difficulty in that friction is generally characterized as a branch of physics or mechanical engineering, wear is part of the material science of metallurgy, while lubrication is a branch of chemistry. Tribology is thus a complex interdisciplinary subject.

The phenomena considered in tribology are among the most fundamental and most common of those encountered by humans in interaction with their largely solid environment. Many manifestations of tribology are beneficial and, indeed, make modern life possible. Many other effects of tribology, however, constitute serious nuisances, and careful design is necessary to overcome the inconvenience arising from excessive friction or wear. On an overall basis, friction uses up, or wastes, a substantial amount of the energy generated by mankind, while a large amount of productive capacity is devoted to replacing objects made useless by wear.

Friction is the resistance to sliding of a solid when the resistance is produced by a contacting body. It is therefore a vital factor in the operation of most mechanisms. High friction is needed for the satisfactory functioning of nuts and bolts, paper clips, and tongs, as well as in the familiar processes of walking, grip-

ping objects manually, and building piles of sand or of apples. Low friction, however, is desired in objects that are designed to move continuously, like engines, skis, and the internal mechanism of watches. Constant friction is required in brakes and clutches, as otherwise unpleasant jerky movement would be produced.

Friction has been studied as a branch of mechanics for many hundreds of years and its laws, as well as satisfactory methods of estimating the magnitude of friction, have been known for nearly two centuries. The mechanism of friction, namely, the exact process by which energy is lost as two surfaces slip past each other, is understood only in an incomplete way.

Wear is the removal of material from a solid surface as a result of the mechanical action exerted by another solid. It is such a universal phenomenon that rarely do two solid bodies slide over each other or even touch each other without measurable material transfer or material loss. Thus, coins become worn as a result of continued contact with human fingers; pencils become worn after sliding over paper; and rails become worn as a result of the continued rolling of train wheels over them. Only living things (*e.g.*, bone joints) are in general immune to the permanent damage caused by wear because only they have the property of healing through regrowth. And even a few living things do not heal themselves (*e.g.*, teeth in humans).

The systematic study of wear has been severely hampered by two factors: first, the existence of a number of separate wear processes, which has led to much confusion, especially in terminology; second, the difficulties caused by the small amounts of material involved in wear processes. These difficulties were greatly alleviated when radioactive isotopes of the common engineering metals (iron, copper, chromium, etc.) became available in the 1940s; tracer techniques using these radioisotopes permit measurements of wear, even in small amounts, while it is occurring. This has made it possible to identify types of wear and discover the laws of wear.

The use of lubricants, namely, substances introduced into the interface between sliding surfaces to diminish friction, is an ancient practice, and Egyptian pictures dating back 4,000 years show the application of lubricants to reduce the friction involved in dragging heavy monuments. In modern lubrication practice, the main concern is to reduce the wear that accompanies sliding and, at the same time, to design lubrication systems that will operate for long periods without inspection or maintenance.

A large number of different lubricants are in use at any one time, (a single major oil company may market many hundreds of different varieties), and no aspect of tribology receives as much attention as the development and testing of improved lubricants.

**Tribonian,** Latin TRIBONIANUS (b. Pamphylia?—d. 545), legal authority and public official in the Byzantine (Eastern Roman) Empire, who was the chief compiler and perhaps the initiator of the comprehensive Roman law codification sponsored by and named for the emperor Justinian I.

From 530 to 532, and from 534 until his death, Tribonian served as Justinian's *quaestor sacri palatii,* a minister comparable to the late medieval English chancellor. Perhaps untruthfully, he was accused of venality in office and of religious unorthodoxy (a charge possibly based on his interest in secular philosophy and in astronomy).

A member of the imperial commission that produced the first Codex Constitutionum of imperial legislation (529), Tribonian then was president of commissions that prepared the Digest (Digesta, also called Pandects, or Pandectae: 533) and a second Codex (534). In addition, he supervised the writing of the Institutes (Institutiones; 533) by the law teachers Dorotheus and Theophilus. As Justinian's legal adviser, he was doubtless responsible for the earlier Novels (Novellae Constitutiones post Codicum; 534–565), containing enactments from 534 until Justinian's death in 565.

**tribune,** Latin TRIBUNUS, any of various military and civil officials in ancient Rome.

Military tribunes (*tribuni militum*) were originally infantry commanders. Under the early republic there were six to a legion; some were appointed by the consuls (chief executives) or military commanders, and others were elected by the people. Under the empire (after 27 BC) the military tribunate was a preliminary part of a senatorial or an equestrian career and subject to the emperor's nomination. Tribunes commanded bodyguard units and auxiliary cohorts.

The *tribuni plebis* (tribunes of the plebs, or lower classes) were in existence by the 5th century BC; their office developed into one of the most powerful in Rome. The exact date of its institution, the original mode of election, and the original extent of its powers are uncertain. From 471 BC the tribunes of the plebs were elected in the plebeian assembly (*concilium plebis*), over which they presided, and thus could express, and agitate for, plebeian demands. Their power was exercised through the veto (*intercessio*), which could invalidate the acts of consuls and lower magistrates and of their own colleagues. Their persons were legally inviolable. By 450 they were 10 in number. It was their duty to protect persons against the acts of magistrates, but they could also initiate prosecutions of offenders against the state. From 300 BC most legislation was introduced by tribunes because the legislative process in the plebeian assembly was less cumbersome than in the centuriate assembly (*see* comitia). After 287 BC, when the people they represented began to rise in the social scale, some tribunes began to use their powers to thwart more sweeping popular proposals. Others, like Gaius and Tiberius Gracchus in the 2nd century BC, continued to champion them, even in the area of land reform and debtor relief. Their powers were curtailed by Sulla, then restored by Pompey in the 1st century BC. Under the empire (after 27 BC) the tribunes themselves were without authority, but the "tribunician power" (*tribunicia potestas*) was held by the emperor, and was a major element in his authority. By virtue of it, he had personal inviolability, could veto measures freely, summon the organs of government, and propose decrees and legislation. He numbered the years of his power by it, thus exploiting to the full the old democratic tradition of the champion of the plebs.

Treasury tribunes (*tribuni aerarii*) were probably originally the officials who collected the tribute and distributed the soldiers' pay in the tribes. After 168 BC they remained a distinct order ranking below the equites.

**tribus** (ancient Rome): *see* tribe.

**tributyl phosphate,** an organic liquid solvent used in the extraction of uranium and plutonium salts from reactor effluents, as a solvent for nitrocellulose and cellulose acetate, and as a heat-exchange medium. A phosphorus-containing compound with molecular formula $(C_4H_9)_3PO_4$, it is prepared by reaction of phosphorus oxychloride with butyl alcohol. Tributyl phosphate is corrosive to the skin and irritating to the mucous membranes.

**tricarboxylic acid cycle** (TCA CYCLE), also called KREBS CYCLE and CITRIC ACID CYCLE, the terminal stage of the chemical processes by which living cells oxidize foodstuffs and obtain energy from them. The reactions of the cycle, first completely formulated in 1937 by Sir Hans Adolf Krebs, have been established in numerous types of cells including those of animals, plants, microorganisms, and fungi. The cycle is thus one of the features of the chemistry of cells that is shared by all types of life.

Each step of the cycle is catalyzed by a specific enzyme. Except in microorganisms, these enzymes, as well as those concerned with the proper utilization of the energy liberated, are located in highly organized intracellular structures, the mitochondria in animals and the chloroplasts in plants. The enzymes are so arranged that the reaction sequence occurs smoothly and rapidly, and the energy can be utilized efficiently. In microorganisms the enzymes occur as components of the cell membrane.

The TCA cycle is initiated when one of the most important compounds in metabolism, acetyl coenzyme A—of which the two-carbon acetyl group is the most common product of the incomplete oxidation of sugars, fatty acids, and glycerol—reacts with the compound oxaloacetate to form citrate. In a succession of enzyme-catalyzed reactions, the following 10 intermediate compounds are formed: *cis*-aconitate; isocitrate; oxalosuccinate; α-oxoglutarate and carbon dioxide; succinate, carbon dioxide, and one molecule of the energy-rich compound adenosine triphosphate (ATP); fumarate; and malate. Many of these intermediates are utilized to supply carbon for compounds synthesized by the cell when needed. The cycle ends with the conversion of malate to oxaloacetate. One complete turn of the cycle thus results in the reformation of oxaloacetate and the formation of two molecules of carbon dioxide and one molecule of ATP. The hydrogen atoms and electrons that are removed from intermediate compounds formed during the cycle are channelled via a system of carrier molecules ultimately to oxygen in animal cells, or to carbon dioxide in plant cells.

The oxidation by oxygen of hydrogen atoms is accompanied by the conservation (as ATP) of much of the energy of the food ingested by aerobic organisms (*i.e.*, those that live in the presence of oxygen). These events, known as terminal respiration and oxidative phosphorylation, are quantitatively the most important means by which the cell generates ATP, the form in which energy is utilized by organisms.

**Tricart, Jean-Léon-François** (b. Sept. 16, 1920, Montmorency, Fr.), French geographer and geomorphologist known for his extensive regional studies in South America and Africa.

Tricart was a faculty member of the University of Paris from 1945 until 1948, when he moved to the University of Strasbourg. He founded and was director of the Centre of Applied Geography at Strasbourg from 1957. In 1971 he became professor at the Université Louis Pasteur (Université de Strasbourg I). He did research on the development and utilization of natural resources. Tricart was co-author of *Traité de géomorphologie,* 6 vol. (1981; "Treatise on Geomorphology") and author of *Principes et méthodes de la géomorphologie* (1965; "Principles and Methods of Geomorphology") and *Géomorphologie des régions froides* (1963; *Géomorphology of Cold Environments,* 1970).

**tricellular theory,** obsolescent model of the Earth's wind systems that represents them as three parallel wind cells or belts in each hemisphere. First advanced by T. Bergeron (1928) and further developed by C.-G. Rossby, it replaced the Hadley-cell model (proposed by George Hadley in 1735): a single cell in each hemisphere with westward and Equatorward flow at low levels and eastward and poleward flow at higher altitudes. The tricellular theory postulates two such Hadley cells in each

hemisphere, one near the Equator and one near the pole. Between these is a Ferrel cell, in which air flows eastward and poleward at the surface and westward and equatorward at higher levels.

The tricellular theory explains the observed wind systems at the Earth's surface fairly well: the easterly (from the east) trade winds of the tropics, the mid-latitude westerly winds, and the polar easterlies. It is inconsistent, however, with the facts that the mid-latitude westerlies do not reverse their direction at high altitudes but instead become stronger, that the upper-level tropical winds are often weak or nonexistent, and that the meridional circulation does not transport as much energy poleward as the atmosphere receives in the tropical regions from solar radiation.

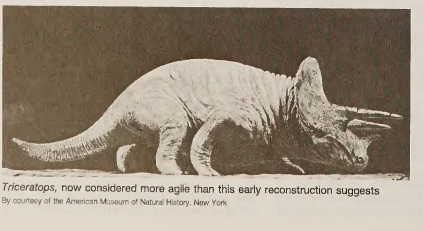
The tricellular theory, moreover, does not explain the transfer of angular momentum in the atmosphere. The tropical and polar easterly winds, because they flow against the Earth's rotation, are slowed (relative to the surface) by surface friction and are continually gaining angular momentum from the Earth; because their speed remains constant, the angular momentum gained must simultaneously be transferred to the mid-latitude westerlies. These winds, which blow eastward faster than the Earth turns, are slowed by surface friction and lose this angular momentum to the Earth; thus, they continue to blow at relatively constant speeds also. This momentum transfer is accomplished by means that are not evident from the tricellular theory. It is now believed that the mid-latitude high- and low-pressure centres, or disturbances, and large standing waves accomplish this momentum transfer.

**triceps muscle,** any muscle with three heads, or points of origin, particularly the large extensor along the back of the upper arm in humans. It originates just below the socket of the scapula (shoulder blade) and at two distinct areas of the humerus, the bone of the upper arm. It extends downward and inserts on (attaches to) the upper part of the ulna, in the forearm. Its major action is extension of the forearm upon the elbow joint, in opposition to the biceps brachii.

The gastrocnemius muscle and soleus muscle (*q.v.*) are sometimes considered the triceps of the lower leg (triceps surae).

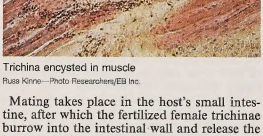
**Triceratops,** genus of large plant-eating dinosaurs characterized by a great bony head frill and three horns. Its fossils date to only the last 5 million years of the Cretaceous Period (97.5 million to 66.4 million years ago), making *Triceratops* one of the last of the dinosaurs to have evolved.

The massive body measured nearly 9 m (30 feet) long and must have weighed four to five tons, and the skull alone was sometimes more than 2 m (6 feet) long. Each of the two horns above the eyes was longer than a metre, and they were covered by a horny sheath or soft tissue. The frill, unlike that of other ceratopsians (*q.v.*), was made completely of solid bone, without the large openings typically seen in ceratopsian frills. The front of the mouth was beaklike and probably effective for nipping off vegetation. The cheek teeth were arranged in powerful groups that could effectively grind plant matter. The hind limbs were larger than the forelimbs, but both sets were very stout. The feet ended in stubby toes probably covered by small hooves. *Triceratops* was an upland, browsing animal that may have traveled in groups or small herds.



*Triceratops*, now considered more agile than this early reconstruction suggests
By courtesy of the American Museum of Natural History, New York

**trichina,** plural TRICHINAE, or TRICHINAS (species *Trichinella spiralis*), parasitic worm of the class Nematoda (phylum Aschelminthes) that causes trichinosis (*q.v.*), a serious disease in humans and other mammals—*e.g.,* pigs, cats, dogs, bears, foxes, and rats. The worm, which occurs all over the world, ranges in length from 1.5 to 4 mm (0.06 to 0.2 inch).



Trichina encysted in muscle
Russ Kinne—Photo Researchers/EB Inc.

Mating takes place in the host's small intestine, after which the fertilized female trichinae burrow into the intestinal wall and release the larvae. The larvae, in turn, are transported by the bloodstream to all parts of the body. The worm grows within muscle tissue, requiring approximately 16 days to mature. A cyst develops around the larva's body. Further development occurs if the muscle tissue containing the encysted larva is eaten by an appropriate host; the worm matures and reproduces in the host's intestine.

**Trichinopoly** (India): *see* Tiruchchirāppalli.

**trichinosis,** also called TRICHINIASIS, a disorder resulting from infestation with the small roundworm *Trichinella spiralis,* commonly acquired by humans by the eating of undercooked pork containing encapsulated larvae of the parasite. In the stomach and small intestine, the capsular coating is digested, and the liberated larvae invade the mucosal lining of the small intestine, becoming adults within a week. After fertilization the female worm deposits larvae into the mucosa and, sometimes, directly into the lymphatics, from which the larvae reach the blood and are carried to all parts of the body, notably the burrows of skeletal muscles, where they reach the encapsulating stage. The muscles most often invaded are those of the diaphragm, eyes, neck, throat, larynx, and tongue. In the muscles, the larval capsules, or cysts, may remain alive for years, eventually becoming calcified. Trichinosis is more common in Europe and the United States than in other parts of the world. In the United States the incidence of infection (as detected by finding calcified cysts at autopsy) may be as high as 15 to 20 percent. Only a small percentage of infected persons, however, have sufficient parasites to produce recognizable clinical symptoms, which include diarrhea, nausea, vomiting, and fever in the early stage, followed later by pain, stiffness, and swelling of various muscular structures, and often edema (swelling) of the face. Treatment consists of the use of anti-inflammatory drugs for symptomatic relief; thiabendazole has been reported to be highly effective in destroying the parasites in the digestive tract. There is no practical method for the large-scale detection of trichinous pork, and the surest safeguard remains the thorough cooking of pork.

**trichloroacetaldehyde monohydrate:** *see* chloral hydrate.

**trichloroethane,** either of two isomeric colourless, nonflammable liquids belonging to the family of organic halogen compounds.

One isomer, 1,1,1-trichloroethane, is used as a replacement for carbon tetrachloride as a cold-cleaning solvent for machinery; it is not used in vapour degreasing processes because no stabilizer is available that will prevent its decomposition at high temperatures. It is produced by the reaction of 1,1-dichloroethylene and hydrogen chloride; its toxicity is very low.

The other isomer, 1,1,2-trichloroethane, by contrast, is a dangerous poison that is made from acetylene, hydrogen chloride, and chlorine, or from ethylene and chlorine. Its principal use is in the manufacture of 1,1-dichloroethylene.

**trichloroethylene,** a colourless, somewhat toxic, volatile liquid belonging to the family of organic halogen compounds, nonflammable under ordinary conditions and used as a solvent in dry cleaning, in degreasing of metal objects, and in extraction processes, such as removal of caffeine from coffee or of fats and waxes from cotton and wool.

Trichloroethylene was first prepared in 1864; its commercial manufacture, begun in Europe in 1908, is based on the reaction of 1,1,2,2-tetrachloroethane with dilute caustic alkali. The compound is denser than water, in which it is practically insoluble.

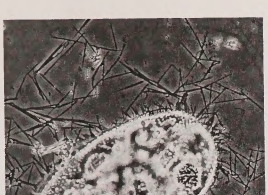
Trichloroethylene has been used as a cement for polystyrene plastics, especially in model-building kits. Inhalation of the vapours (glue-sniffing) induces euphoria; the practice can be addictive.

Industrially, an important use for trichloroethylene is in the manufacture of tetrachloroethylene: trichloroethylene is treated with chlorine to form pentachloroethane, which is converted to tetrachloroethylene by reaction with caustic alkali or by heating in the presence of a catalyst.

**trichloromethane:** *see* chloroform.

**trichloronitromethane:** *see* chloropicrin.

**trichocyst,** a structure in the cortex of certain ciliate and flagellate protozoans consisting of a cavity and long, thin threads that can be ejected in response to certain stimuli. Trichocysts may be widely distributed over an organism or restricted to certain areas (*e.g.,* tentacles, papillae, around the mouth). There are several types. Mucoid trichocysts are elongated inclusions that may be ejected as visible bodies after artificial stimulation. Filamentous trichocysts in *Paramecium* and other ciliates are discharged as filaments composed of a cross-striated shaft and a tip. Toxicysts (in *Dileptus* and certain other carnivorous protozoans) tend to be localized around the mouth. When discharged, a toxicyst expels a long, nonstriated filament with a rodlike tip, which paralyzes or kills other microorganisms; this



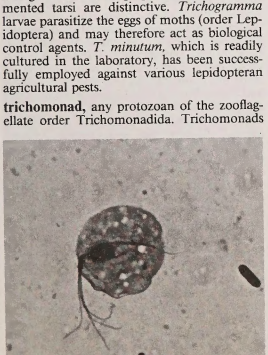
Discharged trichocysts of *Paramecium* (highly magnified)
Walter Dawn

filament is used to capture food and, presumably, in defense.

The functional significance of other trichocysts is uncertain, although those of *Paramecium* apparently can be extruded for anchorage during feeding.

**trichogrammatid,** any of the tiny parasitic chalcid insects of the family Trichogrammatidae (order Hymenoptera), particularly those of the genus *Trichogramma*. Adults of *Trichogramma* species are less than one millimetre long, with pear-shaped wings having a single vein and fringing hairs; the three-segmented tarsi are distinctive. *Trichogramma* larvae parasitize the eggs of moths (order Lepidoptera) and may therefore act as biological control agents. *T. minutum*, which is readily cultured in the laboratory, has been successfully employed against various lepidopteran agricultural pests.

**trichomonad,** any protozoan of the zooflagellate order Trichomonadida. Trichomonads



*Trichomonas vaginalis*
A.L. Leu

have three to six flagella, and one commonly trails or borders an undulating membrane. Most trichomonads inhabit the digestive systems of animals. They may be uninucleate or multinucleate. Reproduction is by division.

The genus *Trichomonas* is a common parasite in the digestive system of many animals. *Trichomonas* cells are pear-shaped and may have four flagella anteriorly and a fifth bordering the undulating membrane. A mouth and a basal rod (costa) are found along the membrane; an axostyle, a stiff rod of cytoplasm used for support, often protrudes posteriorly. Three species occur in humans: *T. hominis* in the intestine, *T. vaginalis* in the vagina, and *T. buccalis* in the mouth. *Tritrichomonas foetus* is a pathogenic form in cattle. *See* trichomoniasis.

**trichomoniasis,** infection by the flagellate protozoan parasite *Trichomonas*. Infection is most often intestinal, but it may occur in other cavities or organs such as the liver. The species *T. vaginalis* may be common in women, causing irritation of the vaginal mucosa; more than 50 percent of women with abnormal vaginal discharge may harbour the organism.

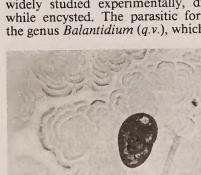
The pear-shaped species *T. gallinarum* causes avian trichomoniasis in the intestine of fowl, especially chickens and turkeys. Symptoms are diarrhea, appetite and weight loss, ruffled feathers, and intestinal lesions. The method of transmission is not known. Also in birds, particularly pigeons, *T. gallinae* causes an often fatal infection in the upper intestine.

*T. foetus*, in the sheath of bulls and the vagina and uterus of cows, produces bovine or venereal trichomoniasis. Transmitted through contamination or coitus, the parasites cause temporary infertility or abortion and may invade the unborn calf. Some immunity can be developed; certain bulls seem to be naturally resistant.

**Trichomycetes,** class of fungi (division Mycota) with a vegetative body (thallus) consisting of single or branched filaments (hyphae). The class was earlier subsumed under the group Phycomycetes (*q.v.*). Trichomycetes occur in the gut or on the cuticle (outer covering) of crabs, beach fleas, boring gribble, and other arthropods. Asexual reproduction occurs by the formation of saclike fruiting bodies (sporangia), the entire cytoplasmic contents of which divide into spores (sporagiospores). Sexual reproduction has not been confirmed.

**Trichophyton,** a genus of fungi (division Mycota) that infects the skin, hair, and nails of man and other animals. It is one of several causes of athlete's foot, jockstrap itch, and other ringworm (*q.v.*) infections in man. *T. verrucosum* causes ringworm in cattle. Although worldwide in distribution, some species apparently are more abundant in some areas than in others. *T. schoenleini*, for example, is the cause of a human skin infection in the Mediterranean, and *T. rubrum* causes a similar disease in the tropics.

**trichostome,** any ciliate protozoan of the holotrichous order Trichostomatida. Free-living forms are found in freshwater (*e.g., Tillina*), salt water (*e.g., Woodruffia*), and decaying vegetation; parasitic forms also occur. Trichostomes usually have a heavily ciliated vestibule (outer cavity) that leads to the ventrally located mouth. Body ciliation is uniform, although it may be reduced in parasitic species. Reproduction by fission or budding may occur during either the active or the encysted state. The freshwater genus *Colpoda*, widely studied experimentally, divides only while encysted. The parasitic forms include the genus *Balantidium* (*q.v.*), which infests the



Trichostome (*Tillina magna*)
J.M. Langham

intestines of many animals and, in rare cases, may cause a severe type of human dysentery; another genus (*Isotricha*) lives in the stomachs of cattle and sheep.

**Trichūr,** town, administrative headquarters of Trichūr district, central Kerala state, southwestern India. The town is located 12 mi (19 km) inland on an extensive lagoon system. A commercial and cultural centre, it is considered to be the oldest town on the west coast of India; its name means "small sacred place." Trichūr is built around a hillock topped by the Vaṭakkunātha temple, the focus of an annual festival. Its industries include cotton weaving, rice and oilseed milling, soap manufacturing, and sawmilling. Trichūr has 13 colleges affiliated with the University of Calicut, a museum, and zoological gardens. The town has good road and rail connections with the rest of Kerala and with the interior.

Trichūr district, 1,167 sq mi (3,032 sq km) in area, was formed from parts of the former princely state of Cochin. It lies largely on the coastal plain, except in the southeast, where it overlaps the hills of the Western Ghāts. Although agriculture is important (rice and coconuts are the main crops), the district also has some industry. Pop. (1981) town, 77,923; metropolitan area, 170,122; district, 2,439,543.

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**trickster tale,** in oral traditions worldwide, an anecdote of deceit, magic, and violence perpetrated by an animal-human with special or magical powers. Usually grouped in cycles, these tales feature a trickster-hero who within a single society may be regarded as both creator god and innocent fool, evil destroyer and childlike prankster. In psychological terms, the trickster may be said to serve as a sort of scapegoat figure onto which are projected simultaneously the fears, failures, and unattained ideals of the source culture.

Trickster stories may be told in a variety of situations ranging from those purely for amusement and entertainment to serious, sacred occasions. Either a single tale is told or the narrative may be a complex series of interrelated incidents. The characteristic trickster tale is in the form of a picaresque adventure: the trickster was "going along"; he encountered a situation to which he responded by knavery or stupidity; he met a violent or ludicrous end; and then the next incident is told. Frequently, he is accompanied by an animal companion, who either serves as a stooge or tricks the trickster.

Until recently, collection, examination, and comparison of trickster tales and trickster figures have been concentrated upon those of North American Indian groups. Coyote, the trickster of tales from California, the Southwest, and the plateau region, is perhaps the most widely known. In the Pacific Northwest, the trickster is the Raven, Mink, or Blue Jay, each of which is also viewed as a transformer figure, responsible for bringing the ordered world out of chaos, and a culture hero, credited with transmitting the skills of survival, such as fire making, from gods to men. Wisakedjak, anglicized to Whiskey Jack, is a cultural hero trickster of the Eastern Woodlands. Another is Nanabozho (the Hare), who in the Southeast is called Rabbit and who became identified with the African hare trickster as Brer Rabbit. Among numerous Plains peoples, the trickster is an anthropomorphic figure frequently called "Old Man." Common North American motifs include the false bridegroom who boasts of supernatural powers but is exposed as an impostor and is deserted by his wives; the eye juggler, an animal who plays ball with his eyes and finally loses them; and a contest between the beaver and the porcupine, in which the beaver invites the porcupine to swim and the porcupine invites the beaver to climb.

South American tricksters include Fox of the Chaco people, who is always bested, and the Twins of the Amazon region, one of whom plays tricks that end badly and are then repaired by the other, a culture hero.

In East, Central, and southern Africa and in the western Sudan, the trickster is the hare. In West Africa, the spider (Ghana, Liberia, Sierra Leone) or the tortoise (the Igbo and Yoruba people of Nigeria) is the trickster. Many African tribes also have tales about human tricksters (*e.g.*, the stories of Yo in Benin).

In most African cycles the trickster is an underdog figure, smaller in stature and strength than his opponents (thus gaining the audience's sympathy) but much cleverer and always well in control of the situation. He is ruthless, greedy, and a glutton and often outwits his opponent through a calculating suaveness combined with sheer lack of scruples. Each cycle centres upon a particular prey, such as the hyena, lion, or elephant. The trickster's victim is usually earnest, hardworking, and slow-witted and soon yields to the smooth arguments and attractive promises of his opponent. Although in an occasional cycle the trickster is an admirable figure, in most, any good that results from his actions is inadvertent.

In other African tales, particularly those of the spider Anansi, the trickster often appears as a mythological figure, rival of the sky god, who steals the Sun or tricks him in one way or another. In this function he shows some similarity with the Yoruba trickster god Eshu, who constantly opposes the other gods and thwarts their intentions.

African slaves brought trickster tales with them to the New World. In the United States the trickster hare became Brer Rabbit, whose adventures were first given literary form in the late 19th century by Joel Chandler Harris in a series of tales supposedly told by a wise, old black character called Uncle Remus.

In Japan, Kitsune is a trickster fox renowned for his mischievous metamorphic abilities. He is regarded in Shintō lore as the messenger who ensures that farmers pay their offerings to the rice god. Buddhist stories, however, cast the fox as an evil agent of possession.

Numerous Oceanian tales recount the creative exploits of the trickster Maui, or Mauitiki-tiki, such as his fishing out the land from the sea. *See also* Coyote; Raven cycle.

**triclinic system,** one of the structural categories to which crystalline solids can be assigned. Crystals in this system are referred to three axes of unequal lengths that are inclined at angles less than 90° to one another. If the atoms or atom groups in the solid are represented by points and the points are connected, the resulting lattice will consist of an orderly stacking of blocks, or unit cells. The triclinic unit cell has the least-symmetrical shape of all unit cells. Potassium dichromate, albite, anorthite, kyanite, and microcline crystallize in the triclinic system.

**Triclinius, Demetrius** (Latin), Italian DEMETRIO TRICLINIO (fl. 14th century AD, Byzantium), Byzantine scholar of the Palaeologan era, who edited the works of the ancient Greek poets, mainly the tragedians, with metrical and exegetical scholia (annotations).

Triclinius' editions incorporated notes by other scholars as well as scholia from earlier traditions. He was the first Byzantine scholar to examine closely the metrical structure of the lyrics of Attic plays; but, striving to apply the rules of Hephaestion and misled by his own unsatisfactory views of Greek prosody, he often tampered with the text. His text of Aeschylus survives, probably in his own handwriting, as does his transcript of Hesiod; his text of Sophocles was not superseded until the 18th century. Triclinius also annotated works by Euripides, Pindar, Aristophanes, and Theocritus.

**Triconodon,** genus of extinct primitive mammals found in Europe as fossil deposits of the Late Jurassic (163 to 144 million years ago). *Triconodon* is representative of the triconodonts, known throughout the world in regions as widely separated as North America, Europe, and China. *Triconodon,* a relatively large animal for its time (most early mammals were very small), was about the size of



Skull of *Triconodon*

Reprinted from *Vertebrate Paleontology* by A.S. Romer, by permission of the University of Chicago, copyright 1933, 1945, 1966; all rights reserved

a domestic cat. The canine teeth were large and strongly developed, and it is probable that *Triconodon* was an active predator. The premolars were simple, but the molars had three distinctive cone-shaped cusps, hence the name. The brain was small and not much advanced beyond the brain of the mammallike reptiles. The relationships of *Triconodon* to later, more advanced mammals are uncertain. It is possible that the triconodonts had an independent reptilian origin and are best grouped or classified alone.

**Trident missile,** American-made submarine-launched ballistic missile (SLBM) that succeeded the Poseidon and Polaris missiles in the 1980s and '90s. Under development from the late 1960s, the Trident developed into two models. The Trident I, or C-4, is 34 feet (10.4 m) long and 6 feet (1.8 m) in diameter. It can deliver eight independently targetable 100-kiloton nuclear warheads to a range of 4,600 miles (7,400 km). The Trident II, or D-5, is about 46 feet (14 m) long and carries an average of 10 475-kiloton warheads. It has a maximum range of 7,000 miles (11,300 km).

The Trident warheads are launched by three solid-fueled booster stages and are dispersed toward their targets by a liquid-fueled "bus" in the missile's front end. With inertial guidance refined by stellar or satellite navigation, Tridents are more accurate than most land-based ballistic missiles. Their accuracy gave them the ability, unprecedented among SLBMs, to threaten hardened missile silos and command bunkers in the Soviet Union, and their extended range allowed their submarines to patrol almost anywhere in the Atlantic and Pacific oceans, making detection extremely difficult.

Beginning in 1979, Trident I missiles were fitted aboard older Poseidon-carrying submarines and newer Ohio-class vessels, which were built with larger missile tubes designed to accommodate the Trident II in the 1990s. In 1986 the United Kingdom began to build new Vanguard submarines to carry the Trident II, which was to have warheads of British design.

**tridymite,** silica mineral, the stable form of silica (silicon dioxide, $SiO_2$) at temperatures between 870° and 1,470° C (1,598° and 2,678° F); at lower temperatures it transforms to high-quartz, at higher to cristobalite. It has three modifications: high-tridymite, middle-tridymite, and low-tridymite. Tridymite forms thin hexagonal plates that are generally twinned, often in groups of three; its name alludes to this habit. It commonly occurs in igneous rocks, more abundantly than cristobalite, as in the trachytes of Rhineland-Palatinate, Germany; northern Italy; and in the Massif Central, France. Tridymite, also found in meteorites, has the same chemical composition as coesite, cristobalite, keatite, lechatelierite, and quartz but has a different crystal structure. For detailed physical properties, *see* silica mineral (Table 2).

**Trier,** *Regierungsbezirk* (administrative district), western Rhineland-Palatinate *Land* (state), southwestern Germany. Trier is bordered by Luxembourg and Belgium to the west, North Rhine–Westphalia *Land* to the north, the *Regierungsbezirk* of Koblenz to the east, and Saarland *Land* to the south. The district forms a southern portion of the larger historical region of the Rhineland (*q.v.*). The *Regierungsbezirk* takes its name from that of the largest city and administrative seat of the district.

Trier lies in the western Middle Rhine Highlands and is crossed from southwest to northeast by the meandering course of the Mosel (Moselle) River. The principal city of the Mosel valley is Trier, located near the western border. It is an important road, rail, and water transportation centre and a leader in Mosel wine production and trade. Downriver the narrowness of the valley has prevented the growth of large cities and industrial areas. The scenery is dominated by old-world wine villages, castle ruins, and vineyards lining the sunny south-facing valley slopes. The Hunsrück highlands rise south of the Mosel, reaching their highest point, the Erbeskopf (2,677 feet [816 m]), at the southeastern border with Koblenz. The Hunsrück-Höhenstrasse (Hunsrück Ridgeway) runs the length of the range through extensive deciduous forests and many small settlements. North of the Mosel is the wooded Eifel region, comprising the northwestern Middle Rhine Highlands and an eastern extension of the Ardennes Mountains of Belgium and Luxembourg. The region is traversed by the Eifel upland, a rolling plateau of lower elevation situated between the Schneifel and Hohe Eifel ranges. Dairy farming is the chief source of income. The fertile Bitburg land is a southern continuation of the Eifel upland. Together the two provide a transportation route between the Trier basin and the city of Cologne. Nearly three-fourths of the Bitburg between the Prüm and Kyll rivers is devoted to arable crops, most importantly potatoes, cereals, and sugar beets. In eastern Trier the Eifel upland is characterized by funnel-shaped volcanic craters filled by small scenic lakes called *Maare.* The Eifel upland has traditionally been one of Germany's poorest and most remote regions. More recently a greatly improved road network has increased tourism and made commuting from the fringes to more industrialized regions possible.

The majority of the district's population are of Frankish descent and speak the Moselle Franconian dialect. More than four-fifths of the people are Roman Catholics. The predominant rural settlement pattern is one of irregular, compact villages with some isolated farmsteads in the Schneifel and Hohe Eifel highlands. Area 1,902 square miles (4,926 square km). Pop. (1989 est.) 472,908.

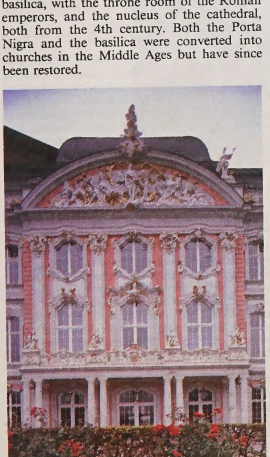
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**Trier,** French TRÈVES, Latin AUGUSTA TREVERORUM, city, Rhineland-Palatinate *Land* (state), southwestern Germany, on the right bank of the Mosel (Moselle) River, surrounded by the foothills of the Eifel, Hunsrück, and Mosel mountains, just east of the Grand Duchy of Luxembourg frontier. A shrine of the Treveri, a Germanic tribe, existed at the site (*c.* 400 BC). The Roman town was founded by the emperor Augustus about 15 BC. The city's strategic position at a crossroads contributed to its rapid rise as a commercial and administrative centre; it was the capital

of the Belgic division of Roman Gaul in the 2nd century AD, an imperial seat in the 3rd century, and later, as Treveris, it became the seat of the emperor responsible for Gaul and Britain. After it became a bishopric in the 4th century, the town was a centre of Christianity north of the Alps, a status it maintained after its capture by the Franks in the 5th century. Trier was designated an archbishopric in 815, its archbishops becoming temporal princes with power over extensive territory; they were made electors of the Holy Roman Empire in the late 12th century.

Trier flourished as a commercial and cultural centre with a university (1473–1797) until French encroachments led to its decline in the 17th century. It was occupied by the French in 1797 and was formally ceded to them in 1801, when the electorate was dissolved. Trier passed to Prussia in 1815, and the bishopric was reconstituted in 1821. The city grew rapidly in the 19th century but suffered French occupation again after World War I and was considerably damaged in World War II. It revived as a commercial and cultural centre after 1946 and has been rebuilt.

Trier has preserved more Roman monuments than any other German city. They include the 4th-century Porta Nigra, a fortified town gate; ruins of 4th-century Roman baths and substructures of baths from the 2nd century; the amphitheatre (*c.* AD 100); and the basilica, with the throne room of the Roman emperors, and the nucleus of the cathedral, both from the 4th century. Both the Porta Nigra and the basilica were converted into churches in the Middle Ages but have since been restored.



The Electoral Palace, Trier, Ger.

© Ronald Sheridan—The Ancient Art & Architecture Collection

The cathedral, largely Romanesque, was rebuilt in about 550 and extended in the 11th, 12th, and 13th centuries. Other notable churches include the Church of Our Lady (1235–70); the Church of St. Gangolf (13th to 15th century); the Abbey Church of St. Matthias (1127–60), with the tomb of the saint; and the Baroque Church of St. Paulin (1734–57), designed by Balthasar Neumann. Civic monuments include the Market Cross from 958 and the Petersbrunnen (Peter's Fountain; 1595), both in the market square; nearby are the Kesselstatt Palace (1740–45) and the Electoral Palace (1614). The Catholic theological faculty, part of the university founded in 1473, was refounded in 1950. The University of Trier (founded 1970 as part of the Trier-Kaiserslautern University) became autonomous in 1975.

Trier serves as an important centre for road, rail, and water traffic on the western border of Germany. It is the trade centre for the surrounding region, especially for wines. Diversified industries include the manufacture of beer, tobacco products, textiles, leather goods, and machinery. St. Ambrose, who converted and baptized St. Augustine, was born (*c.* AD 339) in Trier as was Karl Marx (1818), the German political philosopher and socialist. Pop. (1989 est.) 95,692.

**Trieste,** ancient (Latin) TERGESTE, Slovene and Serbo-Croatian TRST, German TRIEST, city and capital of Friuli-Venezia Giulia *regione* and of Trieste *provincia,* northeastern Italy, located on the Gulf of Trieste at the northeastern corner of the Adriatic Sea, 90



Miramare Castle, near Trieste, Italy

Marzari—SCALA from Art Resource/EB Inc

miles (145 km) east of Venice. It was under Roman control by about 177 BC; Julius Caesar made it a colony and recorded its name as Tergeste in his *Commentarii de bello Gallico* (*The Gallic War*), written in 52–51 BC. Augustus ordered the construction of a harbour and city walls in about 33 BC. After the breakup of the Roman Empire, Trieste shared the general fortunes of Istria and was granted independence under its count-bishops in 948 by Lothair II, king of Italy. Captured by the Venetians in 1202, it constantly agitated for autonomy, placing itself in 1382 under the protection of Leopold III of Habsburg, whose overlordship gradually developed into Austrian possession.

Trieste was a town of 5,700 inhabitants when it was proclaimed an imperial free port by Charles VI in 1719, and its population had reached 156,000 when it was deprived of the privilege in 1891. It became the prosperous main port of the Austro-Hungarian Empire and served as the headquarters of the Austrian Lloyd Steam Navigation Company and of other shipping lines, with a seaborne trade in 1913 of 6,200,000 metric tons. In the Austrian census of 1910, nearly two-thirds of the city's population of 229,510 was composed of Italians (Austrian and Italian subjects), the rest being Slovenes and Croats, other Austrian subjects (including Germans), and foreigners. The Italian preponderance was the ground on which, in the secret treaty of London of April 26, 1915, Great Britain, France, and Russia agreed to give the city to Italy at the conclusion of World War I as part of a group of territorial concessions rewarding Italian alliance with the Triple Entente. The arrangement fulfilled a long-stated goal of Italian irredentism, the movement to include all Italian-speaking territories as part of Italy. Trieste was occupied by Italian troops in 1918 and later lost most of its maritime trade because it was cut off by a political frontier from its natural hinterland. The volume of merchandise handled fell to 2,200,000 tons in 1930–34, but Italy maintained and developed, with government subsidies, the shipbuilding industries, steel mills, oil refineries, and insurance business. A university was founded there in 1938.

Trieste was seized in 1943 by the Germans, who intended to maintain it as a southern outlet to the sea for the Third Reich. It was occupied by Marshal Tito's troops in 1945, however, and was claimed for Yugoslavia. The peace treaty with Italy signed in Paris in 1947 created the Free Territory of Trieste, to be guaranteed by the United Nations Security Council. It was divided temporarily into northern and southern zones: Zone A, which included the city and its northern hinterland, was put under U.S.–British military administration, and Zone B, to the south of the city, was put under Yugoslav administration.

The Free Territory status was unworkable, however, and deadlock immediately followed the ratification of the treaty. After the failure of British and U.S. proposals to include the Free Territory in Italy (1948) or to divide it between Italy and Yugoslavia on the existing zonal basis (1953), negotiations in 1954 resulted in an agreement granting Zone B and part of Zone A to Yugoslavia (202 square miles [523 square km]) and the city of Trieste and the remainder of Zone A (91 square miles [236 square km]) to Italy. Italy agreed to maintain Trieste as a free port, and the Italian and Yugoslav governments agreed to a special statute regulating the rights of national minorities on both sides of the demarcation line. By an October 1975 treaty, Italy relinquished all claims to Zone B, settling finally the status of the region.

In 1963 Trieste was designated the capital of the newly formed autonomous *regione* of Friuli-Venezia Giulia. Trieste *provincia,* with an area of 82 square miles (212 square km), has an economy based chiefly on the activities of its port.

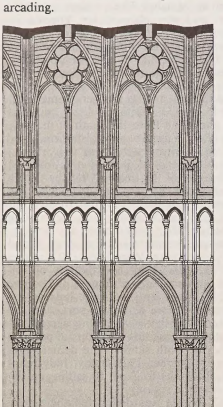
Roman ruins in the city of Trieste include a theatre and an archway. The campanile of the Cathedral of San Giusto incorporates part of a Roman temple. The old German (Austrian) town, called Triest, was built around Monte Giusto, a hill that is dominated by the Castello (1470–1680), now housing a medieval museum, and by the Cathedral of San Giusto, formed in the 14th century by the union of two earlier churches. The modern city, begun in 1719 on the flatland adjoining the bay, is characterized by broad streets and typical 18th-century Baroque and 19th-century Neoclassical architecture. During the 1850s Miramare Castle was built nearby for Archduke Maximilian (later Emperor Maximilian of Mexico). Pop. (1988 est.) mun., 237,191.

**Trieste,** bathyscaphe (*q.v.*) launched by Auguste Piccard in 1953.

**Trifid Nebula** (catalog numbers NGC 6514 and M 20), bright, diffuse nebula in the constellation Sagittarius, lying several thousand light-years from the Earth. It was discovered by the French astronomer Legentil de La Galaisière before 1750 and named by the English astronomer Sir John Herschel for the three dark rifts that seem to divide the nebula and join at its centre. Of about the ninth magnitude optically, the Trifid is also a radio source.

**triforium,** in architecture, space in a church above the nave arcade, below the clerestory, and extending over the vaults, or ceilings, of the side aisles. The term is sometimes applied to any second-floor gallery opening onto a higher nave by means of arcades or colonnades, like the galleries in many ancient Roman basilicas or Byzantine churches. The triforium became an integral part of church design during the Romanesque period, serving to light and ventilate the roof space. With the development of the Gothic vaulting system in France, the triforium diminished in size

and importance. The cathedrals at Reims (begun 1211) and Amiens (1220–47) both have triforia of little relative height but with rich arcading.

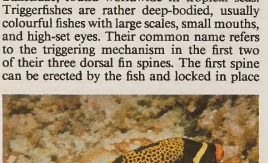


Elevation drawing of nave wall showing the triforium, Reims Cathedral, begun 1211

From Nikolaus Pevsner: *An Outline of European Architecture*, Copyright © Nikolaus Pevsner, 1943; Penguin Books Ltd

The more horizontal English Gothic style shows an important development of the triforium as a decorative element (Angel Choir, Lincoln Cathedral, completed 1282), but the gallery is relatively much higher than in France, often almost equaling the pier arcades. By the end of the 13th century the triforium was usually replaced by greatly heightened clerestory windows.

**triggerfish,** any of about 30 species of shallow-water marine fishes of the family Balistidae, found worldwide in tropical seas. Triggerfishes are rather deep-bodied, usually colourful fishes with large scales, small mouths, and high-set eyes. Their common name refers to the triggering mechanism in the first two of their three dorsal fin spines. The first spine can be erected by the fish and locked in place



Triggerfish (*Balistes conspicillius*)
Douglas Faulkner

by the second, the trigger, which must be withdrawn before the first spine is released. The first spine is large and strong and, when locked upright, can hold the fish tightly in protective crevices.

Triggerfishes are found among reefs and marine plants. Although generally considered edible, some cause food poisoning. The largest triggerfishes grow about 60 cm (2 feet) long. Common species include the queen triggerfish (*Balistes vetula*), a tropical Atlantic fish brightly striped with blue, and *Rhinecanthus aculeatus,* a grayish, Indo-Pacific fish patterned with bands of blue, black, orange, and white.

**Triglav,** Italian TRICORNO, mountain peak, the highest (9,396 feet [2,864 m]) of Slovenia and of the Julian Alps, situated 40 miles (64 km) northwest of the city of Ljubljana. The north wall of the peak forms an enormous limestone face nearly 2 miles (3 km) wide. From the time of its first ascent in 1778, the summit has rewarded climbers with an excellent view that extends north into Austria and south to the Adriatic Sea. Until the Treaty of



Triglav peak in the Julian Alps, Slovenia
Harrison Forman

Paris in 1947, the peak was located on the Yugoslavian-Italian border. The Triglav National Park comprises an area of glacial lakes and Alpine plant life.

**triglyceride,** any one of an important group of naturally occurring lipids (fat-soluble components of living cells). Triglycerides are esters in which three molecules of one or more different fatty acids are linked to the alcohol glycerol; they are named according to the fatty acid components; *e.g.,* tristearin contains three molecules of stearic acid, and oleodistearin, one of oleic acid and two of stearic acid. The types of triglycerides in animals vary with the species and the composition of fats in the food.

Triglycerides in animals and probably in plant seeds function as depots of energy. In mammals they are stored in adipose tissue until needed, at which time they are broken down to a molecule of glycerol and three molecules of fatty acid. The latter combine with albumin, a protein in blood plasma, and are carried in the bloodstream to sites of utilization. Triglycerides also serve as insulation and padding for organs in animals.

Many vegetable triglycerides (oils) are liquid at room temperature, unlike those of animals; in addition, they contain a greater variety of fatty acids. Vegetable oils can be hardened by treatment with hydrogen under pressure.

In alkali, triglycerides are broken down (saponified) to form glycerol and three molecules of soap (salts of the fatty acids).

**Trignan,** SAINT: *see* Ninian, Saint.

**trigonal system,** also called RHOMBOHEDRAL SYSTEM, one of the structural categories to which crystalline solids can be assigned. The trigonal system is sometimes considered to be a subdivision of the hexagonal system.

Components of crystals in the trigonal system, like those of the hexagonal system, are located by reference to four axes—three of equal length with 120° intersections and one perpendicular to the plane of the other three. The trigonal unit cell is distinguished by the presence of a single line called an axis of three-fold symmetry about which the cell can be rotated by 120° to produce a face indistinguishable from the face presented in the starting position.

**Trigonia,** genus of mollusks that first appeared during the Jurassic period, which began about 208 million years ago. The still-extant *Trigonia* has a triangular shell with distinctive concentric ridges on its surface as well as nodular outgrowths. A different ornamental pattern is present in the posterior parts of the shell.

**trigonometry,** mathematical subject dealing with the numerical relationships among the sides and the angles of a triangle. In plane trigonometry the triangle to be studied is formed by selecting three points in a two-dimensional plane (so that all three points do not lie on the same straight line) and connecting each pair of points with a straight line segment. In spherical trigonometry the triangle to be studied is formed by selecting three points on the two-dimensional surface of a three-dimensional sphere (so that all three points do not lie on the same great circle) and connecting each pair of points with an arc of the great circle that they determine on the sphere.

A brief treatment of trigonometry follows. For full treatment, *see* MACROPAEDIA: Trigonometry.

Spherical trigonometry arose in the early Greek period in response to a practical need for accurate information in astronomy and for efficient and systematic methods of obtaining this information. Plane trigonometry was implicitly contained in the study and methods of spherical trigonometry, but it was not until the demands of surveying, trade, and navigation of 15th-century Europe that it came to be studied and applied in its own right, quite independently of its connection with spherical trigonometry. Although spherical trigonometry was developed before plane trigonometry, it is easier to understand and appreciate spherical trigonometry if one is aware of the essentials of plane trigonometry. Plane trigonometry is ordinarily approached through the use of right triangles, although

the subject actually deals with any type of triangle. In this approach, given an angle $A$ that is between 0° and 90°, a right triangle is constructed having $A$ as one of its angles. (Since the sum of the three angles of a plane triangle is always 180°, the third angle must be $90 - A°$.) The side opposite the right angle is labeled the hypotenuse, the side opposite angle $A$ the opposite, and the side next to angle $A$ the adjacent. There are six possible ratios of side lengths that can be formed, and these are used to define the six trigonometric functions of angle $A$:

$$\text{sine } A = \frac{\text{opposite}}{\text{hypotenuse}}, \quad \text{cosine } A = \frac{\text{adjacent}}{\text{hypotenuse}},$$

$$\text{tangent } A = \frac{\text{opposite}}{\text{adjacent}}, \quad \text{secant } A = \frac{\text{hypotenuse}}{\text{adjacent}},$$

$$\text{cosecant } A = \frac{\text{hypotenuse}}{\text{opposite}}, \quad \text{cotangent } A = \frac{\text{adjacent}}{\text{opposite}}$$

Values of the trigonometric functions of different angles have been tabulated, and the tables allow the theory of plane trigonometry to be applied to problems in such pursuits as surveying and engineering. To illustrate this, consider a building of unknown height that must be measured. If the building is perpendicular to the ground on which it stands, then a right triangle can be formed having as its vertices the base of the building, a point a measured distance away along the ground, and the top of the building. The relationship

$$\text{tangent } A = \frac{\text{opposite}}{\text{adjacent}} = \frac{\text{height of building}}{\text{distance from base}}$$

now holds in this triangle, where $A$ is the angle of elevation from the measuring point to the top of the building. Since the distance from base is known, the angle $A$ can be measured using ordinary surveying instruments, and tangent $A$ can be looked up in a table of trigonometric functions, the height of the building can be found from this trigonometric relationship.

Given any (not necessarily right) triangle with an angle $A$, one of the areas of study in plane trigonometry is to establish relationships among the trigonometric functions of angle $A$, and these relationships are called trigonometric identities. The most basic trigonometric identity is $\sin^2 A + \cos^2 A = 1$. That is, the square of the sine of an angle plus the square of the cosine of the same angle is always equal to 1. Another area of study is the calculation of the trigonometric functions of certain angles from those of other angles. An example of this is the double-angle formula for the sine: $\sin 2A = 2(\sin A)(\cos A)$. Using this formula, the sine of the angle $2A$ can be obtained directly from the known values for the sine and cosine of angle $A$. Similar double-angle formulas have been developed for the other trigonometric functions as well.

The beginnings of spherical trigonometry can be traced to the work of the astronomer Hipparchus of Nicaea (180–125 BC), who has come to be known as "the father of trigonometry." One of the uses of astronomy in Greek and pre-Greek times was to tell the time of day or period of the year by the positions of various stars. Astronomers compiled charts of the angular measure between various stars. Hipparchus systematically studied the relationship between an arc of a great circle on the celestial sphere and its corresponding chord (*i.e.*, the distance between two points as measured along the surface of the sphere, and the distance as measured along a straight line, respectively).

The Alexandrian astronomer Ptolemy, who worked in the 2nd century AD, continued Hipparchus' work in the computation of arcs and chords of great circles. Greek trigonometry reached its height with Ptolemy, whose major work in the subject has come to be called the *Almagest* ("The Greatest"). In it, Ptolemy obtained relationships among the angles and sides of spherical triangles that are the equivalent of many basic relationships and identities of trigonometry today.

**triiodomethane** (chemistry): *see* iodoform.

**Tríkala,** also spelled TRÍKKALA, agricultural and grazing centre of Thessaly (Thessalia), Greece, and capital of the *nomós* (department) of Tríkala. It commands the Métsovon Pass leading westward across the Pindus Mountains and on the southwest the "Gates of Tríkala" leading to Árta. The Byzantine fortified acropolis may be the site of ancient Tricca, legendary abode of the healer god Asclepius; the sanctuary was believed to be the oldest in ancient Greece. Captured by the Normans in 1081, Tríkala was mentioned a century later as a trading centre, and for centuries more it was the most important town of Thessaly. Under the Turks it was the seat of the pasha of Thessaly. In 1881 Turkey ceded it to Greece. It is the seat of the bishop of Tríkki and Stagoi. The town deals in corn (maize), wheat, rice, and tobacco. Its population is swollen in winter by the annual migration of Vlach herdsmen from the hills. Pop. (1981) city, 40,857; *nomós*, 134,207.

**trikaya** (Sanskrit: "three bodies"), in Mahāyāna Buddhism, the concept of the three bodies, or modes of being, of the Buddha: the dharmakaya (body of essence), the unmanifested mode, and the supreme state of absolute knowledge; the sambhogakaya (body of enjoyment), the heavenly mode; and the nirmanakaya (body of transformation), the earthly mode, the Buddha as he appeared on earth or manifested himself in an earthly bodhisattva, an earthly king, a painting, or a natural object, such as a lotus.

The concept of trikaya applies not only to the historical Buddha, Gautama, but to all other buddhas as well.

**Trikoúpis, Kharílaos** (b. July 23, 1832, Návplion, Greece—d. April 11, 1896, Cannes, Fr.), statesman who sought with limited success to foster broad-scale national development in Greece during the last quarter of the 19th century. Together with a rival, Theódoros Dhiliyiánnis (*q.v.*), he dominated Greek politics during this period.

Trikoúpis studied literature and law in Athens and Paris before entering the Greek diplomatic service. In 1862 he represented the Greek community of London at the Constituent Assembly in Athens; elected to the Chamber of Deputies in 1865, he was appointed foreign minister the next year.

Trikoúpis sought to develop resources and an industrial base for Greece and to create a strong army and navy. He was prime minister for short periods in 1875, 1878, and 1880, but his periods in office were too short to implement his ideas. He became prime minister for the fourth time in March 1882 and immediately strove to strengthen Greek finances.

His party was defeated in the general election of April 1885, and Dhiliyiánnis replaced him. In May 1886 Trikoúpis was once again appointed prime minister. His development projects were generally successful, but his skill at financial management was not enough, and Greece could not pay the large debts left by the Dhiliyiánnis government. Despite these problems, Trikoúpis retained the confidence of the people and of King George. Even after his party suffered a defeat in the general election of 1890, the king reappointed him prime minister in 1892, following the dismissal of Dhiliyiánnis for alleged incompetence. Trikoúpis served from June 1892 to May 1893 and again from November 1893 to January 1895. In the 1890s he fostered a Balkan rapprochement. After defeat in the general election of 1895, he retired to private life.

**trilateration,** method of surveying in which the lengths of the sides of a triangle are measured, usually by electronic means, and, from this information, angles are computed. By constructing a series of triangles adjacent to one another, a surveyor can obtain other distances and angles that would not otherwise be measurable. Formerly, trilateration was little used in comparison to triangulation, a method for determining two sides and an angle of a triangle from the length of one side and two angles, because of the difficulty of the computations involved. But the development of electronic distance-measuring devices has made trilateration a common and preferred system. Except that only lines are measured, while all angles are computed, the field procedures for trilateration are like those for triangulation.

**Trilling, Lionel** (b. July 4, 1905, New York, N.Y., U.S.—d. Nov. 5, 1975, New York, N.Y.), American literary critic and teacher whose criticism was informed by psychological, sociological, and philosophical methods and insights.

Educated at Columbia University (M.A., 1926; Ph.D., 1938), Trilling taught briefly at the University of Wisconsin and at Hunter College in New York City and in 1931 joined the faculty of Columbia, where he remained for the rest of his life.

Trilling's critical writings include studies of Matthew Arnold (1939) and E.M. Forster (1943), as well as collections of literary essays: *The Liberal Imagination* (1950), *Beyond Culture: Essays on Literature and Learning* (1965), and *Sincerity and Authenticity* and *Mind in the Modern World* (both 1972). He also wrote *Freud and the Crisis of Our Culture* (1955) and *The Life and Work of Sigmund Freud* (1962). His single novel, *The Middle of the Journey* (1947), concerns the moral and political developments of the liberal mind in America in the 1930s and '40s.

Trilling was married to Diana Trilling, *née* Rubin, also a critic and writer.

**Trillium,** also called WAKEROBIN, or BIRTHROOT, genus of spring-flowering perennial herbs of the family Liliaceae, consisting of about 25 species, native to North America and Asia. They have oval leaves in whorls of three at the top of the stem. The flower parts and fruits also are in threes.

Each solitary white, greenish white, yellow, pink, or purple flower is borne on a short stalk

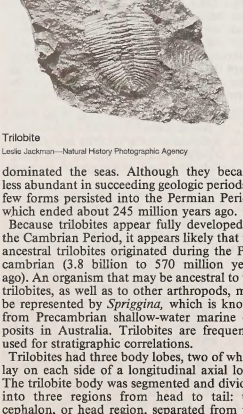


Purple trillium (*Trillium recurvatum*)
Louise K. Broman from The National Audubon Society Collection/Photo Researchers—EB Inc.

that arises from the whorl of leaves. Many species of *Trillium* are cultivated in wildflower gardens.

**trilobite,** any member of a group of extinct fossil arthropods easily recognized by their distinctive three-lobed, three-segmented form.

Trilobites, exclusively marine animals, first appeared at the beginning of the Cambrian Period, about 570 million years ago, when they



Trilobite
Leslie Jackman—Natural History Photographic Agency

dominated the seas. Although they became less abundant in succeeding geologic periods, a few forms persisted into the Permian Period, which ended about 245 million years ago.

Because trilobites appear fully developed in the Cambrian Period, it appears likely that the ancestral trilobites originated during the Precambrian (3.8 billion to 570 million years ago). An organism that may be ancestral to the trilobites, as well as to other arthropods, may be represented by *Spriggina,* which is known from Precambrian shallow-water marine deposits in Australia. Trilobites are frequently used for stratigraphic correlations.

Trilobites had three body lobes, two of which lay on each side of a longitudinal axial lobe. The trilobite body was segmented and divided into three regions from head to tail: the cephalon, or head region, separated from the thorax, which was followed in turn by the pygidium, or tail region. Trilobites, like other arthropods, had an external skeleton, called exoskeleton, composed of chitinous material. For the animal to grow, the exoskeleton had to be shed, and shed trilobite exoskeletons, or portions of them, are relatively common fossils.

Each trilobite body segment bore a pair of jointed appendages. The forwardmost appendages were modified into sense and feeding organs. Most trilobites had a pair of compound eyes; however, some were eyeless.

Some trilobites were active predators, whereas others were scavengers, and still others probably ate plankton. Some trilobites grew to large size; *Paradoxides harlani,* which has been found near Boston in rocks of the Middle Cambrian Epoch (540 to 523 million years ago), grew to be more than 45 cm (18 inches) in length and may have weighed as much as 4.5 kg (10 pounds). Others were small.

**Trim,** Irish BAILE ÁTHA TROIM ("Ford of the Elder Bushes"), market town and seat of County Meath, Ireland, on the River Boyne. It was important from ancient times and was the seat of a bishopric. St. Patrick is said to have founded a monastery there in 432; there are remnants of a 13th-century Augustinian abbey, two gates from the town walls, and extensive remains of Trim castle, which was founded in 1173 and was incorporated in the 13th century into the largest Anglo-Norman fortress in Ireland. St. Patrick's Church (1499) with its castellated tower became a Church of Ireland cathedral in 1955. Industries include textiles and the manufacture of addressing machines. Pop. (2002) 1,447.

**trimaran,** three-hulled variant of the catamaran (*q.v.*).

**Trimble, David,** in full WILLIAM DAVID TRIMBLE (b. Oct. 15, 1944, Belfast, N.Ire.), first minister of the Northern Ireland Assembly (elected 1998), leader of the Ulster Unionist Party (UUP), and member of the British Parliament. In 1998 he was corecipient of the Nobel Prize for Peace.

In 1975 Trimble was elected to the Northern Ireland Constitutional Convention for the Vanguard Unionist Progressive Party (VUPP), which opposed direct rule of Northern Ireland by the British government and favoured stringent measures against the Irish Republican Army (IRA). He joined the Official (now Ulster) Unionist Party in 1977 and was elected to the British Parliament in 1990. In 1995 he was elected leader of the UUP, and later that year he negotiated a compromise that permitted the Orange Order, a Protestant fraternal organization, to march through the Roman Catholic neighbourhood of Portadown.

He represented the UUP in multiparty peace talks beginning in September 1997. These talks, which included members of Sinn Féin, the political wing of the IRA, culminated in the Good Friday Agreement of April 1998, which aimed to restore self-government in Northern Ireland. Defying right-wing opposition, Trimble signed the agreement and successfully campaigned for it in referenda in Northern Ireland and Ireland. In elections to the new Northern Ireland Assembly in June, the UUP won the largest number of seats. Trimble was elected first minister, though conflict over IRA decommissioning (disarmament) blocked further implementation of the Good Friday Agreement until Trimble, buoyed by IRA concessions, convinced the UUP to allow him to share power with Sinn Féin in 1999 and again in 2000. In July 2001 Trimble briefly resigned as first minister, charging that the IRA had not fulfilled its decommissioning commitment. He continued to serve as first minister until October 2002, when the Northern Ireland Assembly was suspended. (Pa.A./K.C.)

**Trimble, Robert** (b. 1777, Augusta county, Va., U.S.—d. Aug. 25, 1828, Paris, Ky.), associate justice of the United States Supreme Court (1826–28).

In 1817 President James Madison appointed him federal district court judge for Kentucky, a post he held until his appointment to the U.S. Supreme Court in 1826. Despite opposition from his own congressional delegation because of his nationalist views, he was confirmed. Trimble usually sided with Chief Justice John Marshall in upholding the dominance of federal over state laws. However, he differed with Marshall in *Ogden* v. *Saunders* (1827), in which he wrote that a state insolvency law does not impair the obligations of future contracts between citizens of that state.

**Trimurti** (Sanskrit: "Three Forms"), in Hinduism, a triad of the three great gods, Brahmā, Vishnu, and Śiva. Scholars consider the Trimurti doctrine as an attempt to reconcile different monotheistic approaches with one another and with the philosophic doctrine of ultimate reality (Brahman). Although sometimes called the Hindu Trinity, Trimurti has little similarity to the Christian Trinity. The doctrine was given classical expression in Kālidāsa's poem *Kumārasambhava* (*c.* 4th–5th century).

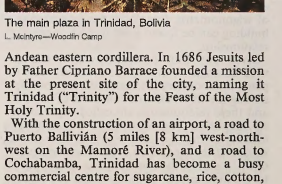
**Trincomalee,** ancient GOKAṆṆA, town and port, Sri Lanka (Ceylon), on the island's northeastern coast. It is situated on a peninsula in Trincomalee Bay (formerly known as Koddiyar [meaning "fort by the river"] Bay), one of the world's finest natural harbours.

Trincomalee was a major settlement of Indo-Aryan immigrants, who built the Temple of a Thousand Columns. The first Europeans to occupy the town were the Portuguese in the 17th century; they razed the temple, using its stone to construct a fort. The port's harbour changed hands repeatedly among the Dutch, French, and British until the British gained lasting possession of it in 1795. Trincomalee's importance as a major British base was heightened after the fall of Singapore in World War II; in 1942 the town was bombed by the Japanese. The British continued to hold the harbour after Sri Lanka's independence, relinquishing it only in 1957.

The port of Trincomalee is no longer important commercially, though in the 1960s congestion and labour problems at Colombo, Sri Lanka's commercial capital and chief port, caused some trade to be routed through it. The town is a rail terminus and has good road connections with the rest of Sri Lanka. Pop. (1994 est.) 76,000.

**Trinh** FAMILY, noble family that dominated northern Vietnam during much of the Later Le dynasty (1428–1788); it gained control of the position of regent to the Le rulers in the middle of the 16th century. Thereafter, the successive Le monarchs were rulers in name only. From about 1600 onward, Trinh control over southern sections of the Vietnamese state fell into the hands of the Nguyen dynasty (*q.v.*). Trinh power was swept away by the Tay Son brothers between 1771 and 1786.

**Trinidad,** city, northeastern Bolivia. It lies in the Moxos (Mojos) Plains, an ancient lake bed stretching eastward from the foothills of the



The main plaza in Trinidad, Bolivia
L. McIntyre—Woodfin Camp

Andean eastern cordillera. In 1686 Jesuits led by Father Cipriano Barrace founded a mission at the present site of the city, naming it Trinidad ("Trinity") for the Feast of the Most Holy Trinity.

With the construction of an airport, a road to Puerto Ballivián (5 miles [8 km] west-northwest on the Mamoré River), and a road to Cochabamba, Trinidad has become a busy commercial centre for sugarcane, rice, cotton, and beef. It also has a sugar refinery. The city is the seat of the "Mariscal Jose Ballivián" Bolivian University (1967). Pop. (2001) 75,540.

**Trinidad,** city, southwest Sancti Spíritus *provincia,* central Cuba. It lies on the southern slopes of the Sierra de Trinidad, north of its Caribbean port of Casilda. Founded in 1514 by Diego Velázquez, it prospered during the colonial era and for some time was Cuba's wealthiest city. To preserve the colonial atmosphere and to honour former residents—among whom were the Spanish explorer Hernán Cortés and the German naturalist Alexander von Humboldt—Trinidad has been declared a national monument. Pop. (1999 est.) 51,200.

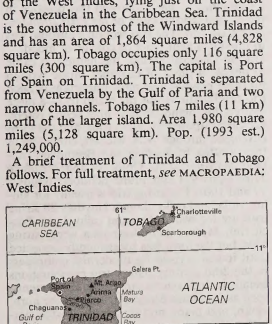
**Trinidad,** city, seat (1866) of Las Animas county, south-central Colorado, U.S., situated on the Purgatoire River in the foothills of the Sangre de Cristo Range at an elevation of 6,025 feet (1,836 m), south of Pueblo. Near the foot of Raton Pass (12 miles [19 km] south on the Colorado-New Mexico border), the site was a camping ground for traders, hunters, and cattlemen traversing the Santa Fe Trail. In 1870 the Santa Fe Railway built a line through the pass, and the settlement (named for Trinidad Baca, daughter of an early settler) developed as a coal-mining and shipping centre. Coal production, which decreased steadily after 1900, has been supplemented by cattle industries (dairying, meat-packing), wood processing, and the manufacture of bricks,

structural clay products, and plastics. Trinidad State Junior College was opened in 1925. Baca House (an adobe, built in 1869), Pioneer Museum, Bloom House (1882), and Kit Carson Museum are points of interest. Inc. town, 1876; city, 1879. Pop. (1990) 8,580.

**Trinidad,** also called PORONGOS, city, south-central Uruguay. It lies in the Cuchilla (hills) Porongos, a northern outlier of the Cuchilla Grande Inferior. The city is the area's principal trade and manufacturing centre. Wheat, corn (maize), linseed, oats, and fruit grown in the hinterland are processed in Trinidad. Dairying, viticulture, and cattle and sheep ranching are the main economic activities in the surrounding area. Situated on the Montevideo-Paysandú highway, Trinidad is also served by a railroad from Durazno and has an airport. Pop. (1985) 18,372.

**Trinidad and Tobago,** officially REPUBLIC OF TRINIDAD AND TOBAGO, island republic of the West Indies, lying just off the coast of Venezuela in the Caribbean Sea. Trinidad is the southernmost of the Windward Islands and has an area of 1,864 square miles (4,828 square km). Tobago occupies only 116 square miles (300 square km). The capital is Port of Spain on Trinidad. Trinidad is separated from Venezuela by the Gulf of Paria and two narrow channels. Tobago lies 7 miles (11 km) north of the larger island. Area 1,980 square miles (5,128 square km). Pop. (1993 est.) 1,249,000.

A brief treatment of Trinidad and Tobago follows. For full treatment, *see* MACROPAEDIA: West Indies.



Trinidad and Tobago

For current history and for statistics on society and economy, *see* BRITANNICA BOOK OF THE YEAR.

*The land.* Physiographically, Trinidad and Tobago represents an extension of the South American mainland. Trinidad is mostly flat or undulating except for three narrow belts of highland traversing the island. Trinidad's Northern Range runs generally from west to east and rises to 3,084 feet (940 m) at Aripo Mountain, the country's highest peak. The Central Range, rising to slightly more than 1,000 feet (300 m), crosses the island from southwest to northeast, while the Southern Range skirts the southern coast and reaches nearly 500 feet (150 m). Tobago's dominant feature, the Main Ridge, is an extension of Trinidad's Northern Range.

Trinidad's mountain ranges determine the drainage pattern of its rivers. Their courses are short, the longest being the Ortoire in the south (31 miles [50 km]) and the Caroni (25 miles [40 km]) in the north. Several swamps occupy the low-lying areas, among them the Caroni Swamp in the northwest.

The climate of Trinidad and Tobago is tropical with a high degree of humidity. A pronounced dry season from January to May corresponds roughly with the cool season. The average daily temperature maximum in January is about 86° F (30° C). The warmest month, April, has an average daily maximum of about 90° F (32° C). Trinidad and Tobago receives about 70 inches (1,800 mm) of rainfall annually.

Nearly one-fourth of the land area is arable, and most of that is under cultivation. More than two-fifths of the country is forested, with luxuriant rain-forest vegetation found mostly in the highlands. White flamingo, egret, and scarlet ibis frequent the Caroni Swamp, site of an important bird sanctuary.

Trinidad and Tobago's mineral resources include large reserves of petroleum and natural gas, limestone, and unexploited deposits of iron ore in the Northern Range. Pitch Lake at La Brea in southwestern Trinidad contains the world's largest supply of natural asphalt.

*The people.* African, East Indian, Spanish, French, English, and Chinese peoples have all contributed to the islands' ethnic composition. Blacks and East Indians each constitute about two-fifths of the population. Some one-third of the populace is Roman Catholic; about one-quarter is Hindu, and one-eighth is Anglican. Most others profess various Protestant faiths, Islām, or Rastafarianism. English is the official language. The population growth rate has declined sharply since the 1950s. The birth rate is about average for the Caribbean, but the country's comparatively low infant mortality rate and overall death rate contribute to a higher-than-average annual rate of population increase for the region.

*The economy.* Trinidad and Tobago has a partly developed, mainly free-enterprise economy with some government regulation and participation in certain industries. Petroleum production and processing dominate the economy and the service industries (including tourism) make up the other leading component. The gross national product (GNP) declined steadily during the 1980s because of falling petroleum prices. The GNP per capita remains, nonetheless, one of the highest in the Caribbean region owing to the revenues from oil exports.

Agriculture constitutes only a small share of the gross domestic product (GDP) and employs about one-tenth of the labour force. Major cash crops include sugarcane, citrus fruits, cacao, coffee, coconuts and copra, and bananas. Domestic crops include rice, peas, pigeon peas, corn (maize), cassava, sweet potatoes, dasheen (taro), and vegetables. Sugarcane is processed into raw sugar, molasses, and rum, and the residual bagasse is converted into Trinboard, a construction material. Pastures cover only about 2 percent of the land. The principal livestock includes cattle, goats, and pigs. Water buffalo, brought from India by Indian farmers, are used extensively for cultivation of rice paddies.

Trinidad's teak and Caribbean pine commercial forests are extensive. Three-fourths of the wood cut is used in industry and one-fourth for fuel and charcoal. Fishing remains mostly in the hands of small private fishermen, and the annual catch is not adequate for local demand. A shrimp fleet and a canning and processing plant were established in the 1970s.

Mining is dominated by the petroleum industry, which generates the largest share of the GDP but employs only a small portion of the labour force. Petroleum and natural-gas production is from both on- and offshore fields. Asphalt and pitch sand are extracted from Pitch Lake and other similar deposits. Other minerals quarried include diorite, limestone, argillite clay, and porcelainite.

The principal manufactured products include refined petroleum, petrochemicals, nitrogenous fertilizers, iron and steel, methanol, plastics, sugar, and various import-substitution products such as clothing, soap, and footwear. Industries for the local assembly of televisions and motor vehicles from imported parts have also been established.

Tourism is well developed and centres on winter vacations and natural scenery. More than half of all tourists come from the United States, Canada, and Europe.

Budgetary revenue roughly equals expenditure, and deficits generally occur only when the petroleum industry—from which most revenue originates—does poorly. High inflation and increasing unemployment after the oil glut of the early 1980s continued to plague the country into the 1990s.

Port of Spain, Pointe-à-Pierre, and Point Lisas (on Trinidad) and Scarborough (on Tobago) are the main ports. The international airport is at Piarco, near Port of Spain.

Trinidad and Tobago's principal exports include petroleum products and crude petroleum, fertilizers and ammonia, and iron and steel rods, exported mainly to the United States. Imports include machinery and transport equipment, crude petroleum, food, and basic manufactures, imported mainly from the United States, Venezuela, and the United Kingdom.

*Government and social conditions.* Under its 1976 Constitution, Trinidad and Tobago is a parliamentary republic with an elected president as chief of state and a prime minister as head of government. The legislature consists of a 36-member House of Representatives and a 31-member Senate. The country is a member of the Commonwealth, and its judiciary retains right of appeal to the Privy Council. It is a member of the Caribbean Community and Common Market. Legislation passed in 1980 gave Tobago considerable autonomy and established a separate Tobago House of Assembly of 15 members, and in 1987 Tobago was granted full internal self-government.

Health conditions have improved markedly since the 1950s. Substantial decreases in deaths from malaria, tuberculosis, typhoid, and syphilis have helped to raise the average life expectancy to more than 72 years. Rural-to-urban migration has created urban housing shortages. Education is free and compulsory between the ages of 5 and 11. Adult literacy is about 96 percent, one of the highest rates in the Caribbean region.

*History.* When Christopher Columbus visited Trinidad in 1498 during his third voyage, the island was inhabited by the Arawak Indians, and neighbouring Tobago was occupied by the warlike Carib. Trinidad remained a neglected Spanish possession for almost 300 years until it was surrendered to a British naval expedition in 1797. In the 17th and 18th centuries tobacco, and later cacao, were cultivated. African slaves were imported for labour to replace the original Indian population, which had been worked to death by the Spanish. The British first attempted to settle Tobago in 1721, but the French captured the island in 1781 and transformed it into a sugar-producing colony. In 1802 the British acquired Tobago, and in 1889 it was administratively combined with Trinidad.

The emancipation of slaves throughout the West Indies in 1834–38 resulted in a severe labour shortage on the sugar plantations, which was met by the subsidized immigration of labourers from India. Partial self-government was begun in 1925, when a constitutional reform added seven elected members to the colony's Legislative Council. Universal suffrage was instituted in 1945, and limited self-government was granted to the islands in 1956. The colony attained independence in 1962 and the status of a republic within the Commonwealth in 1976.

**Trinil faunal zone,** middle Pleistocene sequence of deposits characterized by distinctive animal forms (the Pleistocene epoch began about 1,600,000 years ago and ended about

10,000 years ago). The Trinil deposits, found in Southeast Asia, are named for a village near the town of Ngawi, on Java, Indonesia, and have been tentatively assigned an age of about 700,000 years. Trinil sediments consist of volcanic deposits, sands, and clays. Fossil mammals include elephants, rhinoceroses, tapirs, deer, and carnivores. Of great importance are Trinil's remains of early fossil man, the Java man. Formerly classified as *Pithecanthropus erectus,* but now as *Homo erectus,* this fossil assemblage provides a bridge between the australopithecines and more advanced human types.

The Trinil deposits are the second series of sediments formed in the Pleistocene of the region. They overlie deposits of the Djetis faunal zone, which are about 1,600,000 years old. Djetis deposits have also yielded the fossil remains of hominids that have been related to the australopithecines or to *Homo erectus* or *Homo habilis;* these remains have been assigned the classification *Meganthropus palaeojavanicus.* The Ngandong deposits overlie the Trinil and are late Pleistocene in age. More modern types of animals and humans occur in the Ngandong strata.

**Trinitarian,** member of ORDER OF THE MOST HOLY TRINITY FOR THE REDEMPTION OF CAPTIVES (O.SS.T.), a Roman Catholic order of men founded in France in 1198 by St. John of Matha to free Christian slaves from captivity under the Muslims in the Middle East, North Africa, and Spain. St. Felix of Valois has been traditionally considered as cofounder, but recent critics have questioned his existence. The order had its own rule, distinguished for its austerity, and devoted one-third of its possessions and revenues to the liberation of slaves. No accurate figure for the number of captives ransomed can be given, but it has been estimated that the total was as high as 140,000. Because slavery is no longer an international problem, the order now devotes itself to teaching, giving missions, and serving in parishes, hospitals, and prisons. The order is said to have numbered 5,000 members in 1240, but, by the end of the Middle Ages, a decline had set in, and various reforms were attempted during the 16th century. In 1597 a reform called the Barefooted (Discalced) Trinitarians was initiated in Spain by Juan Bautista of the Immaculate Conception; this became a distinct order and is the only surviving branch of the Trinitarians.

**trinitrotoluene** (TNT), a pale yellow, solid organic nitrogen compound used chiefly as an explosive, prepared by stepwise nitration of toluene. Because TNT melts at 82° C (178° F) and does not explode below 240° C (464° F), it can be melted in steam-heated vessels and poured into casings. It is relatively insensitive to shock and cannot be exploded without a detonator. For these reasons it is the most favoured chemical explosive, extensively used in munitions and for demolitions.

**Trinity,** in Christian doctrine, the unity of Father, Son, and Holy Spirit as three persons in one Godhead.

Neither the word Trinity nor the explicit doctrine appears in the New Testament, nor did Jesus and his followers intend to contradict the Shema in the Old Testament: "Hear, O Israel: The Lord our God is one Lord" (Deuteronomy 6:4). The earliest Christians, however, had to cope with the implications of the coming of Jesus Christ and of the presumed presence and power of God among them—*i.e.,* the Holy Spirit, whose coming was connected with the celebration of the Pentecost. The Father, Son, and Holy Spirit were associated in such New Testament passages as the Great Commission: "Go therefore and make disciples of all nations, baptizing them in the name of the Father and of the Son and of the Holy Spirit" (Matthew 28:19); and in the apostolic benediction: "The grace of the Lord Jesus Christ and the love of God and the fellowship of the Holy Spirit be with you all" (2 Corinthians 13:14). Thus, the New Testament established the basis for the doctrine of the Trinity.

The doctrine developed gradually over several centuries and through many controversies. Initially, both the requirements of monotheism inherited from the Old Testament and the implications of the need to interpret the biblical teaching to Greco-Roman religions seemed to demand that the divine in Christ as the Word, or Logos, be interpreted as subordinate to the Supreme Being. An alternative solution was to interpret Father, Son, and Holy Spirit as three modes of the self-disclosure of the one God but not as distinct within the being of God itself. The first tendency recognized the distinctness among the three, but at the cost of their equality and hence of their unity (subordinationism); the second came to terms with their unity, but at the cost of their distinctness as "persons" (modalism). It was not until the 4th century that the distinctness of the three and their unity were brought together in a single orthodox doctrine of one essence and three persons.

The Council of Nicaea in 325 stated the crucial formula for that doctrine in its confession that the Son is "of the same substance (*homoousios*] as the Father," even though it said very little about the Holy Spirit. Over the next half century, Athanasius defended and refined the Nicene formula, and, by the end of the 4th century, under the leadership of Basil of Caesarea, Gregory of Nyssa, and Gregory of Nazianzus (the Cappadocian Fathers), the doctrine of the Trinity took substantially the form it has maintained ever since.

**Trinity College:** *see* Dublin, University of.

**Trinity Sunday:** *see* Holy Trinity, Feast of the.

**Trinovantes,** also spelled TRINOBANTES, in ancient Britain, a powerful tribe living north and northeast of what is now London. When Julius Caesar invaded Britain in 54 BC, they joined him against their western rivals, the Catuvellauni. Conquered by the Romans in AD 43, the Trinovantes revolted unsuccessfully in 60–61 in alliance with Boudicca (Boadicea), queen of Iceni. Nothing more is known of them, but in medieval legends and romances, their name is connected with the legendary Trojans Brutus and Corineus, who were supposed to have given their names to Britain and Cornwall.

**Trintignant, Jean-Louis** (b. Dec. 11, 1930, Piolenc, Fr.), French motion-picture actor who achieved a wide range of characterizations with great economy.

Trintignant initially studied law but began acting on the stage in 1951. His first film appearance was in *Si tous les gars du monde* (1955; *If All the Guys in the World*), and he achieved critical recognition as Brigitte Bardot's deceived husband in *Et Dieu créa la femme* (1956; *And God Created Woman*). His sensitive performance as the widowed race-car driver in Claude Lelouch's *Un Homme et une femme* (1966; *A Man and a Woman*) brought him international fame.

With his taut acting style and cryptic countenance, Trintignant could subtly convey the psychic conflicts of repressed or introverted male characters. The best known of his many portrayals of innocent or insecure leading men was in Eric Rohmer's *Ma nuit chez Maud* (1969; *My Night at Maud's*), while his portrayals of neurotic or depraved characters culminated in Bernardo Bertolucci's *Il conformista* (1970; *The Conformist*). He appeared in several crime dramas and psychological thrillers as well as in films involving politics, the best known of which is Costa-Gavras' *Z* (1968). Among his other better-known films were *Les Biches* (1968; *The Does*), *L'Attentat* (1972; *The French Conspiracy*), and *Un Homme est morte* (1973; *The Outside Man*). He also appeared in several films directed by his second wife, Nadine Trintignant.

**trio,** musical composition for three instruments or voices, or a performing group of three voices or instruments.

The name trio originally referred to contrapuntal writing for three voices or parts, as in the trio sonata (*q.v.*) of Baroque music. The name trio soon came to denote the middle (B) section of a dance movement that occurs in ABA form, the trio being the section that occurs between the principal dance (whether a minuet, scherzo, or so on) and its repetition. This type of trio was so called because it was customary to score the middle (B) movement for three instruments, typically two oboes and a bassoon. J.S. Bach followed this practice in the second (trio) section of his *First Brandenburg Concerto.* The trio section's purpose was to provide a light relief or change of mood.

In the Classical period, the name trio came to denote a piece of chamber music written for three players. The most important of such trio combinations was the piano trio—a piece written for piano, violin, and cello. Joseph Haydn composed 31 piano trios, and the form developed through W.A. Mozart, climaxing in trios written by Ludwig van Beethoven (notably his *Ghost Trio,* Opus 70; and *Archduke Trio,* Opus 97) and Franz Schubert (Opuses 99 and 100). The string trio is usually for violin, viola, and cello, though Haydn's 20 string trios are for two violins and cello. Luigi Boccherini, Mozart, and Beethoven wrote string trios, but the form was subsequently neglected until it was revived by modernist composers in the 20th century. Other trio combinations usually include one or more wind instruments, such as Johannes Brahms's Opus 40 for horn, violin, and piano and his Opus 114 for clarinet, cello, and piano.

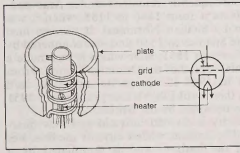
**trio sonata,** major chamber-music genre in the Baroque era (*c.* 1600–*c.* 1750), written in three parts: two top parts played by violins or other high melody instruments, and a basso continuo part played by a cello. The trio sonata was actually performed by four instruments, since the cello was supported by a harpsichord upon which a performer improvised harmonies implied by the written parts. In performance the instrumentation of a given piece may be varied, flutes or oboes replacing violins, for example, and bassoon or viola da gamba substituting for cello. Occasionally trio sonatas were performed orchestrally. The genre's texture of one low and two high melody instruments (hence the name trio sonata) plus a harmony instrument was highly favoured during the Baroque era, not only for the trio sonata but for other forms of orchestra and chamber music.

The trio sonata was the most common variety of Baroque sonata, which developed from the late Renaissance canzona (*q.v.*), an instrumental piece in several sections in contrapuntal style. In the late 17th and early 18th centuries, there were two types of trio sonata. The *sonata da camera,* or chamber sonata, intended for secular performance, consisted of several mostly dancelike movements, and the *sonata da chiesa,* or church sonata, was as a rule more contrapuntal. The number of movements varied, but the latter type usually consisted of four movements (slow-fast-slow-fast). Distinctions between the two types were by no means rigid; the church sonata might contain dance movements, not necessarily labeled as such, while the chamber sonata often adopted the fugal style (based on melodic imitation) typical of the church sonata's opening movement.

Notable composers of trio sonatas include Arcangelo Corelli, George Frideric Handel, François Couperin, and Antonio Vivaldi. The trio sonatas of Johann Sebastian Bach represent keyboard and pedal adaptations.

**triode,** electronic vacuum tube with three electrodes—cathode, anode (plate), and control grid—mounted in an evacuated metal or glass container. It has been used as an amplifier for both audio and radio signals, as an oscillator, and in electronic circuits.

The triode is the fundamental form of vacuum tube, other forms such as the tetrode or pentode being produced by the introduction of additional grids. In most vacuum tubes, the




*Triode*
(Left) Cutaway view, (right) symbolic representation

control grid is the most important and critical electrode, controlling a relatively large flow of current (thus of power) by the application of a small voltage and negligible power. The control grid is normally a wire mesh that intercepts little or no current, even though it may on occasion be actually positive relative to the cathode.

**triolet,** medieval French verse form that consists of eight short lines rhyming *A B a A a b A B* (the capital letters indicate the lines that are repeated). The name triolet is taken from the three repetitions of the first line. The great art of the triolet consists in using the refrain line with naturalness and ease and in each repetition slightly altering its meaning, or at least its relation to the rest of the poem. The triolet is preserved in many modern European literatures, especially for light and humorous verse.

Probably invented in the 13th century, the triolet was cultivated as a serious form by such medieval French poets as Adenet le Roi and Jean Froissart. Although its popularity declined in the 15th and 16th centuries, the triolet was revived in the 17th century by Jean de La Fontaine and in the 19th century by Alphonse Daudet and Théodore de Banville. Triolets are innumerable in French literature and are frequently used in newspapers to give a point and brightness to a brief stroke of satire.

The earliest triolets in English are those of a devotional nature composed in 1651 by Patrick Cary, a Benedictine monk at Douai, Fr. Reintroduced into English by Robert Bridges in 1873, the triolet has since been cultivated widely in that language, most successfully by Austin Dobson, whose "Rose Kissed Me Today," "I Intended an Ode," and "In the School of Coquettes" are masterpieces of ingenuity and easy grace.

In Germany anthologies of triolets were published at Halberstadt in 1795 and at Brunswick in 1796. Frederich Rassmann made collections in 1815 and 1817 in which he distinguished three species of triolet: the legitimate form; the loose triolet, which only approximately abides by the rules as to number of rhymes and lines; and single-strophe poems, which more or less accidentally approach the true triolet in character. The true form was employed particularly by German Romantic poets of the early 19th century.

**tripelennamine,** synthetic antihistamine introduced into medicine in 1946. It is administered orally in the form of tripelennamine citrate elixir or tripelennamine hydrochloride tablets. It is effective in controlling the symptoms of hay fever, acute skin reactions (such as hives), and contact dermatitis (such as from poison ivy). One side effect is drowsiness.

**triphane** (mineral): *see* spodumene.

**triphenylmethane dye,** any member of a group of extremely brilliant and intensely coloured synthetic organic dyes having molecular structures based upon that of the hydrocarbon triphenylmethane. They have poor resistance to light and to chemical bleaches and are used chiefly in copying papers, in hectograph and printing inks, and in textile applications for which lightfastness is not an important requirement.

The triphenylmethane derivatives are among the oldest man-made dyes, a practical process for the manufacture of fuchsine having been developed in 1859. Several other members of the class were discovered before their chemical constitutions were fully understood. Crystal violet, the most important of the group, was introduced in 1883.

The range of colours is not complete but includes reds, violets, blues, and greens. They are applied by various techniques, but most belong to the basic class, which are adsorbed from solution by silk or wool, but have little affinity for cotton unless it has been treated with a mordant such as tannin.

**triphylite,** common phosphate mineral, lithium iron phosphate ($LiFePO_4$), usually forming bluish or grayish, glassy masses in lithium- and phosphate-rich granite pegmatites. It forms a solid-solution series with the similar, but more brightly coloured (brown, yellow, or salmon), lithiophilite in which manganese replaces iron in the molecular structure; that is, a complete chemical variation exists in nature between the pure iron-bearing compound and the pure manganese-bearing compound. Triphylite and lithiophilite are readily weathered. When wetted, as by atmospheric moisture, the lithium ions are leached from the structure, and the iron and then manganese are oxidized to compensate for the valence (combining power) change. When subjected to hydrothermal solutions, triphylite and lithiophilite are altered to siderite, rhodochrosite, and hydrated normal phosphate minerals. For detailed physical properties, *see* phosphate mineral (table).

**Tripiṭaka** (Buddhist scriptures): *see* Tipiṭaka.

**Triple Alliance,** secret agreement between Germany, Austria-Hungary, and Italy formed in May 1882 and renewed periodically until World War I. Germany and Austria-Hungary had been closely allied since 1879 and sought additional security against France by establishing a tie with Italy. The treaty provided that Germany and Austria-Hungary were to assist Italy if it was attacked by France; Italy would assist Germany if Germany was attacked by France. In the event of a war between Austria-Hungary and Russia, Italy promised to remain neutral. This abstention would have the effect of freeing Austrian troops that would otherwise have been needed to guard the Austrian-Italian border.

When the treaty was renewed in February 1887, Italy gained an empty promise of German support of Italian colonial ambitions in North Africa in return for Italy's continued friendship. Austria-Hungary had to be pressured by German chancellor Otto von Bismarck into accepting the principles of consultation and mutual agreement with Italy on any territorial changes initiated in the Balkans or on the coasts and islands of the Adriatic and Aegean seas. Italy and Austria-Hungary did not overcome their basic conflict of interest in this region, the treaty notwithstanding. On Nov. 1, 1902, five months after the Triple Alliance was renewed, Italy reached an understanding with France that each would remain neutral in the event of an attack on the other. This entente nullified Italy's pledges to the other members of the Triple Alliance. Although the alliance was again renewed in 1907 and 1912, Italy entered World War I in May 1915, in opposition to Germany and Austria-Hungary.

**Triple Alliance, War of the:** *see* Paraguayan War.

**triple bond,** in chemistry, a covalent linkage in which two atoms share three pairs of electrons, as in the nitrogen molecule, $N_2$. One of the electron pairs is present in a sigma bond, concentrated in the region along the line joining the two nuclei; the other two pairs are present in pi bonds, each of which occupies two parallel regions of space on opposite sides of the line determined by the two atoms.

**Triple Crown,** in British horseracing, an unofficial championship attributed to a colt or filly that in a single season wins the races known as the Derby, the Saint Leger, and the Two Thousand Guineas (*qq.v.*). For winners, *see* Sporting Record: *Horse racing.*

In Britain the term Triple Crown is also applied—though far less commonly—to a filly that in a single season wins the Derby, the Saint Leger, and the One Thousand Guineas (*q.v.*), the first two races being for both colts and fillies and the last for fillies only.

**Triple Crown,** in U.S. horseracing, an unofficial championship attributed to a horse that in a single season wins the Kentucky Derby, the Preakness Stakes, and the Belmont Stakes (*qq.v.*). For winners, *see* Sporting Record: *Horse racing.*

**Triple Entente,** association between Great Britain, France, and Russia, the nucleus of the Allied Powers in World War I. It developed from the Franco-Russian alliance that gradually developed and was formalized in 1893, the Anglo-French Entente Cordiale (*q.v.*) of 1904, and an Anglo-Russian agreement of 1907, which brought the Triple Entente into existence.

**triple jump,** also called HOP, STEP, AND JUMP, track-and-field sport, a horizontal jump




Viktor Saneyev of the Soviet Union triple jumping at the 1968 Olympic Games in Mexico City
AP/Wide World Photos

for distance incorporating three distinct, continuous movements—a hop, in which the athlete takes off and lands on the same foot; a step, in which he lands on the other foot; and a jump, in which he lands in any manner, usually with both feet together. If a jumper touches ground with a wrong leg, his jump is disallowed. Other rules are similar to those of the long jump.

The origins of the triple jump are obscure, but it may be related to the ancient children's game hopscotch. It has been a modern Olympic event since the first Games in 1896 (two hops) and with one hop thereafter. The standing triple jump was contested only in the 1900 and 1904 Olympics.

Equipment needed for the triple jump includes a runway and a takeoff board identical to those used in the long jump, except that the board is at least 13 m (42 feet) from the landing area. *See* Sporting Record: *Athletics. See also* Olympic Games.

**tripletail,** any of four species of fishes constituting the family Lobotidae (order Perciformes). The family contains two genera (*Lobotes* and *Datnioides*), with members of the first genus found in tropical or warm temperate marine waters and those of the second found in brackish or freshwater environments. The name tripletail refers specifically to *Lobotes surinamensis*, the largest species in the family, which reaches a length of 1 m (3 feet) and is found worldwide.

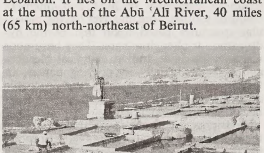
Tripletails are so called because they appear to have three tails, a consequence of enlarged lobes on the posterior fins. A peculiar adaptation, which may be a means of protective camouflage, is the propensity of young tripletails to turn sideways in the water and float listlessly, mimicking floating leaves.

**triplite,** phosphate mineral, consisting of manganese, iron, magnesium, and calcium phosphate $[(Mn, Fe, Mg, Ca)_3PO_4(F,OH)]$. It occurs as brightly coloured (brown, salmon, flesh-red) masses in granite pegmatites, notably in Bavaria, Ger.; Kimito, Fin.; Karibib, Namibia; and Maine, Connecticut, and Colorado in the United States. Its surfaces are usually altered, often to vivianite or wad. For detailed physical properties, *see* phosphate mineral (table).

**tripod,** any piece of furniture with three legs. The word can apply to a wide range of objects, including stools, tables, light stands, and pedestals. The tripod was very popular in ancient and classical times, largely because it was associated with religious or symbolic rites in the form of an altar, a sacrificial basin, or the most celebrated tripod of all, the seat at Delphi upon which the Pythian priestess sat to deliver the oracles of the god Apollo. Underlying the tripod's association with such rites was perhaps a mystical significance attached to the number three. The idea of three being united in one could very well have influenced the widespread use of the tripod in Christian liturgical furniture such as candlesticks.

The most obvious functional advantage of the tripod is its property of remaining steady on an uneven surface, as seen at its most basic level in the stool. In the 17th century it became apparent that, for seating purposes, the most useful type of table was a circular one supported on a single column, and for this a tripod base was essential. The tripod remained the most common support of circular tables throughout the 18th and 19th centuries, and it is only recently that it has been supplanted either by a metal cross lying flat on the floor and supporting a slender column or by a molded plastic column with a circular base. The use of the tripod for more decorative forms of furniture (freestanding candelabra, for example) was stimulated in the late 18th century by the growth of interest in classical and ancient furniture and in the 19th by the production of cast-iron furniture, such as garden tables and similar mass-produced units.

**Tripoli,** Latin TRIPOLIS, Arabic ṬARĀBULUS, in full ṬARĀBULUS ASH-SHĀM ("The Eastern Tripoli"), city and port, northwestern Lebanon. It lies on the Mediterranean coast at the mouth of the Abū ʿAlī River, 40 miles (65 km) north-northeast of Beirut.



Pools for salt production, Tripoli, Lebanon
Karin Gaslioch—Shostal

Founded after 700 BC, it became in the Persian period (300 BC) the capital for the Phoenician triple federation of city-states—Sidon, Tyre, and Arvad (Aradus). Later, Tripoli was controlled by the Seleucids, then by the Romans, and, from about AD 638, by the Muslims. Besieged and partially destroyed during the First Crusade, in the early 12th century, by Raymond of Saint-Gilles (count of Toulouse), the city was rebuilt by the later crusaders and prospered for a time as the seat of a Latin bishopric and as a commercial and educational centre. In 1289 Tripoli was destroyed by the Mamlūks, a Muslim dynasty of Egypt and Syria, which controlled the city until 1516, when it came under Ottoman rule. The new settlement that later arose was built a few miles inland and was connected by broad avenues to the port district. Long disputed by rival Syrian princes, it was occupied by the Egyptians under Ibrāhīm Pasha in the 1830s and was taken by the British in World War I. It was incorporated into the State of Greater Lebanon (Grand Liban) in 1920. During World War II, the city was occupied by the British and Free French, and in 1946 it became part of the independent Republic of Lebanon. Principally Muslim, Tripoli was a centre of insurrection against the Christian-dominated central government in 1958 and again in 1975–76. In 1982–83 Tripoli was briefly a headquarters of the Palestine Liberation Organization (PLO). Syrian soldiers occupied the city from 1985. The city's economy, which was gravely disrupted by the civil war from 1975, began to recover from the late 1980s.

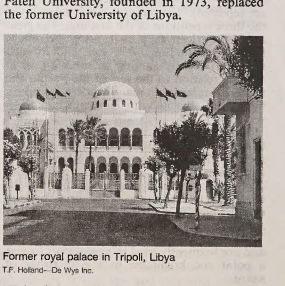
Tripoli has become Lebanon's second city. It is a major port, a commercial and industrial centre, and a popular beach resort. The city serves as an important oil storage and refining centre. Other industries include the manufacture of soap and cotton goods, sponge fishing, and the processing of tobacco and fruits. A coastal railway, which was closed in the mid-1970s because of the civil war, links the city with Beirut.

Historical landmarks include Teylan Mosque (1336), the Great Mosque (1294), the medieval castle of Saint Gilles, and the Tower of the Lions, built at the end of the 15th century to protect the port. Pop. (1998 est.) 160,000.

**Tripoli,** Arabic ṬARĀBULUS, in full ṬARĀBULUS AL-GHARB ("The Western Tripoli"), capital city of Libya. Situated in northwestern Libya along the Mediterranean coast, it is the nation's largest city and chief seaport.

The city was known as Oea in ancient times and was one of the original cities (along with Sabratha and Leptis Magna) that formed the African Tripolis, or Tripolitania (*q.v.*). Occupying a rocky promontory overlooking the sea and located due south of Sicily, the city was founded by the Phoenicians and later controlled by the Romans (146 BC until about AD 450), the Vandals (5th century), and the Byzantines (6th century). During the invasions by the Vandals the walls of the cities of Sabratha and Leptis Magna were destroyed, and this resulted in the growth of Tripoli, which had previously been the least important of the three cities. Conquered by Arab warriors of the Prophet Muḥammad in 645, the city subsequently remained under Arab control (except from 1146 to 1158, when it was taken by Sicilian Normans). It was stormed by the Spanish in 1510 and was conquered by the Turks in 1551, after which it was made a colonial capital of the Ottoman Empire. From 1911 to 1943 it was in Italian hands, and from then until Libya's independence in 1951 it was occupied by the British.

The city is divided into old and new quarters. The ancient walled city, or medina, lies along the harbour and is dominated by a 16th-century Spanish castle. The old quarter contains the marble Marcus Aurelius triumphal arch (AD 163) and the mosques of Gurgi (1883) and Karamanli (18th century), with its distinctive octagonal minaret. The En-Naqah Mosque, often called the "camel mosque," dates from the Middle Ages to the 17th century. Many historical structures benefited from restoration programs in the late 20th century. The modern city, which experienced rapid growth from the 1970s, houses many of the official buildings, theatres, and hotels, as well as the former royal palace. Al-Fateh University, founded in 1973, replaced the former University of Libya.



Former royal palace in Tripoli, Libya
T.F. Holland—De Wys Inc.

Tripoli is a major coastal oasis serving a region growing olives, vegetables, citrus fruit, tobacco, and grains. Fishing is important, and several canneries in the city process the catch. Tripoli's industries include tanning and the manufacture of cigarettes and carpets. An oil depot and a gas-bottling plant are also located there. With its port, nearby international airport, and road connections (a coastal highway links it with Banghāzī and Cairo), it is a busy transshipment centre. Tripoli is the centre of the most densely populated region of Libya; within the city and its environs reside more than 1,000,000 people. Pop. (1995 est.) 1,140,000.

**tripoli,** porous, friable, microcrystalline siliceous rock of sedimentary origin that is composed chiefly of chalcedony and microcrystalline quartz. Although the name tripoli was chosen because of the rock's superficial resemblance to tripolite, a diatomite or from Tripolitania region, Libya, the term does not include diatomite, or hardened diatomaceous earth. Some tripoli is a coherent residuum

from leached limestone, dolomite, or chert; other examples probably are colloidal silica that has been leached from other rocks and earth, gathered together in lumps, and partly recrystallized. The friable variety is more typical. The chemical composition is usually more than 95 percent silica (silicon dioxide, $SiO_2$), but the impurities may impart desirable physical properties.

Tripoli is used mainly as a filler for paints, plastics, and rubber. It is also used as an abrasive in polishing or buffing compounds and hand soaps. Commercial tripoli powder is finely pulverized, much of it being reduced below 0.001 cm (0.0004 inch) in diameter.

**Trípolis,** city and commercial centre of the central Peloponnese, Greece, and the capital and only large town of the *nomós* (department) of Arcadia. It is situated 2,175 feet (663 m) above sea level in the centre of the agricultural Tegéa basin at the foot of Mount Apáno Khrépa (summit 5,115 feet [1,559 m]), a peak of the Maínalon Range.

Trípolis was founded in the 14th century AD as Drobolitza to replace the ancient cities of Pallantium, Tegea, and Mantineia. Called Trípolitza ("Three Cities") and rebuilt in 1770, it became the seat of the Turkish pasha of the Morea. The city prospered until the War of Greek Independence, when it was first captured in 1821 by the Peloponnesian patriot Theódoros Kilokotrónis and then by Ibrāhīm Pasha of Egypt, who destroyed it during the general Ottoman retreat of 1828. The city was rebuilt after 1834.

Trípolis is the seat of a metropolitan bishop of the Greek Orthodox church. Its industries produce carpets, dishware, woodwork, and wine, and the city trades in regional agricultural produce. Pop. (1991 prelim.) 21,772.

**Tripolitan War** (1801–05), conflict between the United States and Tripoli (now in Libya), incited by American refusal to continue payment of tribute to the piratical rulers of the North African Barbary States of Algiers, Tunis, Morocco, and Tripoli; this practice had been customary among European nations and the nascent United States in exchange for immunity from attack on merchant vessels in the Mediterranean.

A demand from the pasha of Tripoli for greater tribute and his dramatic declaration of war on the United States (May 14, 1801) coincided with a decision by President Thomas Jefferson's administration to demonstrate American resolve. Despite his opposition to the expense of maintaining a navy, Jefferson dispatched an American naval squadron to Tripolitan waters. By means of a special "Mediterranean Fund," the navy—which had been partially dismantled and was perhaps nearing extinction—actually increased in size.

During the following years, American warships fought in the waters around Tripoli, and, in 1803, when Commodore Edward Preble became commander of the Mediterranean squadron, greater successes ensued. The intrepid Preble sailed into Tangiers to rescue a number of American prisoners, and, on Feb. 16, 1804, he ordered his young lieutenant, Stephen Decatur, to undertake the spectacular raid in which the captured U.S. frigate *Philadelphia* was destroyed in the harbour of Tripoli.

The combination of a strong American naval blockade and an overland expedition from Egypt finally brought the war to a close, with a treaty of peace (June 4, 1805) favourable to the United States.

**Tripolitania,** Arabic ṬARĀBULUS, historical region of North Africa that now forms the northwestern part of Libya.

In the 7th century BC three Phoenician colonies were established on the shores of the Gulf of Sidra, which was originally inhabited by a Berber-speaking people. These cities—Labqi (Leptis Magna, modern Labdah), Oea (Tripoli), and Sabratha (Ṣabrātah)—later formed the eastern province of the Carthaginian state and account for the late Roman name Tripolitania ("Three Cities"). On the fall of Carthage in 146 BC, Tripolitania became subject to Numidian princes; after the Numidian War (46 BC), it was attached to the Roman province of Africa Nova. The Roman emperor Septimius Severus (reigned AD 193–211) was himself originally a citizen of Leptis and endowed that city with magnificent buildings during his reign. The Vandals seized Tripolitania in 435 but were ousted by the Byzantine Greeks under the leadership of Belisarius in 534.

In 643 the Arabs took Tripoli and sacked Leptis and Sabratha, but they were unable to subdue Berber resistance in the interior for another 60 years. After a period of direct Arab rule from Damascus, Tripolitania became subject to various Arab and Berber dynasties, among them the Aghlabids (9th century), the Fāṭimids (10th century), and the Ḥafṣids (14th century). In 1510 Tripoli was captured by the forces of Ferdinand the Catholic of Spain, who turned it over to the Knights of St. John in 1530. The latter lost the region in 1551 to the Ottoman Turks, who ruled it either directly or through suzerains for the next 360 years. In 1711 the local governor, Aḥmad Karamanli, won recognition from the Ottomans as hereditary pasha (governor), and his dynasty ruled Tripolitania for all but a few years until 1835. Under the Karamanli rulers, Tripoli levied tribute on and plundered shipping in the Mediterranean, a practice that led to the Tripolitan War with the United States in 1801–05. In 1835 Ottoman Turkey resumed direct rule of Tripolitania in an effort to forestall further French expansion in North Africa.

As a result of the Italo-Turkish War of 1911–12, the Italians occupied Tripoli in 1911 and acquired all of Tripolitania from Turkey in 1912. Together with Cyrenaica and Fezzan, Tripolitania was incorporated into the kingdom of Italy in 1939. Tripolitania was the scene of fierce fighting between British and German armoured forces in 1942 during World War II. The three provinces of Tripolitania, Cyrenaica, and Fezzan subsequently formed the independent federal kingdom of Libya when it was created in 1951. These regions were administratively abolished in 1963, when Libya became a unitary state.

**Trippe, Juan T.,** in full JUAN TERRY TRIPPE (b. June 27, 1899, Seabright, N.J., U.S.—d. April 3, 1981, New York, N.Y.), American pioneer in commercial aviation and one of the founders of the company that became Pan American World Airways, Inc.

Trippe was the son of a New York banker and broker of English descent, but he was named for Juanita Terry, the wife of a great-uncle. He graduated from Yale University. A pilot in World War I, Trippe established an "air taxi" service in 1922 with several surplus government aircraft. Three years later he and two former Yale classmates and another friend formed Colonial Air Transport, which began the first airmail contract route between New York City and Boston. In 1927 he arranged a merger between Colonial Air and two other small airlines, forming Pan American Airways, with himself as president. That year Pan American inaugurated the first international air service, flying between Havana, Cuba, and Key West, Fla.

Other firsts followed as Trippe shrewdly parlayed his contacts in government both in the United States and abroad into valuable airmail contracts, extending his company's routes to Europe, Africa, South America, and the Orient. By 1930 Pan American was the largest air-transport company in the world and, for many years, flew more route miles than any other airline. Under Trippe's direction Pan American became the first company to order commercial jets (1955) and one of the first to buy the wide-bodied Boeing 747 jet (1966) for long-distance travel.

**Tripura,** constituent state of India, smallest of the seven states situated in the extreme northeastern part of the country to the east of Bangladesh. Tripura is surrounded by Bangladesh on the north, west, and south; on the east it is bounded by the Indian state of Mizoram and on the northeast by the state of Assam.

A brief treatment of Tripura follows. For full treatment, *see* MACROPAEDIA: India.

Tripura was an independent Hindu kingdom for more than 1,000 years before it became part of the Mughal Empire in the 17th century. Tripura acceded to India upon Indian independence in 1947 and was designated a union territory in 1956. It acquired full status as a state in 1972.

The state can be divided physiographically into two regions: the central and northern Tripura Hills, where four major river valleys—Dharmanagar, Kailāshahar, Kamalpur, and Khowai—are separated from each other by low mountain ranges; and the extensive Tripura (Agartala) Plains in the southwest, which adjoin the Ganges-Brahmaputra lowlands of Bangladesh. A number of rivers, of which the Gumti is the largest, drain the region. Temperatures are hot in the valleys and cooler in the mountains. More than 80 inches (2,000 mm) of rain falls during the southwest monsoon from June to September.

More than half the population speaks Bengali. The second most important language is Tripurī, but there are significant numbers of Hindi, Manipurī, and Oriya speakers. A majority of the people are Hindu, with Muslims, Buddhists, and Christians making up the minorities. Tripura's population is mainly rural. Towns are concentrated on the Tripura Plains and the Dharmanagar and Khowai valleys.

Tripura is primarily an agricultural area. The major crop is rice. Other cash crops include jute, cotton, tea, and various fruits. Livestock includes cattle, buffalo, sheep, goats, horses, pigs, and poultry. Forestry activities produce timber, bamboo, firewood, and charcoal. Sericulture is widespread.

Manufacturing includes many cottage industries such as weaving, carpentry, basketry, and pottery making. Most manufacturing is concentrated in Agartala, the state capital. Small concerns produce tea, sugar, sawn timber, bricks, glass, utensils, and furniture.

Tripura's topography has made communication difficult, and transport to other Indian states is complicated by the highlands to the east and by the partially encircling country of Bangladesh. There is, however, an important road link from Agartala to Assam state, and a railway joins the town of Dharmanagar to Kalkali Ghat, Assam. Most of the rivers carry boat traffic, especially during the rainy season.

The major factor in Tripura's cultural life is its isolation. The members of the secluded tribes who live in the hills are divided into numerous groups speaking a variety of languages and dialects. Most of the population, adhering to Hinduism and speaking Bengali, seem to have cultural links to the rest of India, while the smaller Muslim population seems closer in culture to Bangladesh. Area 4,049 square miles (10,486 square km). Pop. (1991) 2,757,205.

**Tripura Hills,** hills in eastern Tripura state, northeastern India. The Tripura Hills, by way of the Mizo Hills of Mizoram state on the east, form a low western extension of the Purvachal, a strategically located highland region fronting the border with Myanmar (Burma).

The region belongs to the Assam-Burma geologic province, an unstable seismic zone crisscrossed by several faults and extending into Myanmar. The hills are a series of parallel north-south folds, decreasing in elevation to the south until they merge into the Eastern Plains. Each successive ridge of hills to the east rises higher than the one before; the low Deotamura Range is followed by the Artharamura, Langtarai, and Sākhān Tlāng ranges. The Jāmrai Tlāng Mountains, 46 miles (74 km) in length, have the highest peak, Betling Sib (3,280 feet [1,000 m]). The Tripura Hills, once heavily forested, now have patches of bare soil where the region's sparse populations have practiced jhum (shifting cultivation). The Dhalai, Khowai, Longai, Juri, and Deo rivers originate in the Tripura Hills and flow across the valleys; smaller streams are dry during the winter. Soils are generally coarse-textured sandy loams and are almost devoid of humus. The population consists of the Old Tripuri, Deshi Tripuri, Reang, Jamatia, Bodo, Kuki, and Noatia ethnic groups. Agriculture is the major occupation of the region; crops include paddy rice, jute, cotton, oilseeds, potatoes, sugarcane, and fruit. Industries produce handloomed textiles, cane and bamboo products, metalware, and seasoned timber; carpentry, blacksmithing, and embroidery are also important. Dharmanagar and Kailāshahar are the important towns.

**Tripura Plains,** also called AGARTALA PLAINS, plains in southwestern Tripura state, northeastern India, extending over approximately 1,600 square miles (4,150 square km). The Tripura Plains are located on a section of the greater Ganges-Brahmaputra lowlands (also called the Eastern Plains), west of the Tripura Hills. They are dotted with lakes and marshes and there is much forest cover. The soil is thin except in the river valleys, but everywhere the tropical sun and torrential rains have leached minerals from the soils.

Agriculture is the principal occupation; rice, jute, tea, and cotton are the major crops. Industries include cloth weaving; rice and flour milling; fruit canning; utensil making; cane-, bamboo-, and leather-goods production; and soap manufacture. Tree farming and other horticulture as well as fish farming are practiced. Agartala is the principal town; also important are Belonia and Khowai.

**Trique,** any member of an Indian people of Oaxaca state, Mex., speaking a Mixtecan language. They depend for subsistence on farming (principal crops being corn [maize] and beans), hunting, and gathering. The women produce beautifully woven cloth, and some Trique men work outside the community as labourers. Settlements may be compact towns or dispersed hamlets; houses are thatched-roof, one-room buildings. Individuals generally marry within their own village, and the *compadrazgo* ("godparent") system is practiced. Trique religion includes both ancient Indian and Roman Catholic rites and beliefs.

**Triratna** (Sanskrit: "Three Jewels"), Pāli TIRATANA, also called THREEFOLD REFUGE, the three components of the Buddhist and Jain creeds.

In Buddhism the Triratna comprises the Buddha, the dharma (doctrine, or law), and the sangha (the monastic order, or community of believers). From the time of the Buddha, initiation into the order has consisted of the formal recognition of the trinity in the words "I go to the Buddha for refuge, I go to the Doctrine for refuge, I go to the Order for refuge."

In Jainism the three jewels (also referred to as *ratnatraya*) are understood as *samyagdarśana* ("right faith"), *samyagjñāna* ("right knowledge"), and *samyakcāritra* ("right conduct"). One of the three cannot exist exclusive of the others, and all are required for spiritual liberation. The Triratna is symbolized frequently in art as a trident.

**trireme,** oar-powered warship that reached its highest point of development in the eastern Mediterranean during the 5th century BC. Light, fast, and maneuverable, it was the principal naval vessel with which Persia, Phoenicia, and the Greek city-states vied for mastery of the seas from the Battle of Salamis in 480 BC through the end of the Peloponnesian War in 404.

The Athenian trireme, which may be considered the epitome of the type, can be reconstructed with reasonable accuracy on evidence gathered from archaeological excavations, painted pottery, and the writings of classical authors such as Thucydides. Its unprecedented propulsive power was achieved by the arrangement of 170 oarsmen in three tiers along each side of the vessel—31 in the top tier, 27 in the middle, and 27 in the bottom. The hull was a thin shell of planks joined edge-to-edge and then stiffened by a keel and light transverse ribs. Such light construction enabled the trireme to displace only 40 tons on an overall length of approximately 120 feet (37 m) and a beam of 18 feet (5.5 m); no ballast was used. The trireme is said to have been capable of reaching speeds greater than 7 knots (8 miles per hour, or 13 km/h) and perhaps as high as 9 knots under oars. Square-rigged sails were used for power when the ship was not engaged.

The principal armament of the trireme was a bronze-clad ram, which extended from the keel at or below the waterline and was designed to pierce the light hulls of enemy warships. In addition, the ship carried a complement of spearmen and bowmen who attacked enemy crewmen or attempted to board their vessels. By the end of the 4th century BC, armed deck soldiers had become so important in naval warfare that the trireme was superceded by heavier, decked-over ships with multiple rows of oarsmen.

**triśikṣā** (Sanskrit: "threefold training"), Pāli TI-SIKKHĀ, in Buddhism, the three types of learning required of those who seek to attain enlightenment. The threefold training comprises all aspects of Buddhist practices. Arranged in a progressive order, the three are: (1) *śīla* ("moral conduct"), which makes one's body and mind fit for concentration, (2) samadhi ("meditation"), concentration of the mind being a prerequisite to attaining a clear vision of the truth, and (3) prajna ("wisdom"), understood not as a collection of empirical knowledge but as an intuitive experience of ultimate reality, attained in a state of samadhi.

**trisomy 13,** also called PATAU'S SYNDROME, human chromosomal disorder that results from an extra (third) copy of chromosome 13. Infants born with this disorder have profound mental retardation and severe developmental malformations that include a small head, a cleft palate and lip, tiny eyes and eye openings, extra digits on hands and feet (polydactyly), clenched fingers, central nervous system abnormalities, and defects in many internal organs. There is no cure for this disorder, and most infants die in the first few months of life. The only treatment is general supportive care. Trisomy 13 is quite rare, occurring in only one out of 20,000 live births. Its incidence increases in the offspring of women and men over the age of 32.

**trisomy 18,** also called EDWARDS' SYNDROME, human chromosomal disorder that results from an extra (third) copy of chromosome 18. Infants born with this disorder are smaller than average and usually do not survive longer than a few months. Characteristics of the syndrome include severe mental and growth retardation; congenital heart disease and other internal defects; and a multitude of bodily deformities, such as low-set and malformed ears, cleft lip and palate, a receding chin, convex soles of the feet, a webbed neck, and fingers bent in a unique configuration. Trisomy 18 occurs in approximately one in 8,000 live births, and female infants are affected three to four times as often as males. There is no cure for this condition. A higher incidence of trisomy 18 is seen in infants born to women older than 35 years.

**Trissino, Gian Giorgio** (b. July 8, 1478, Vicenza, republic of Venice [Italy]—d. Dec. 8, 1550, Rome, Papal States), literary theorist, philologist, dramatist, and poet, an important innovator in Italian drama.

Born into a wealthy patrician family in Vicenza, a cultural centre in his time, Trissino traveled widely in Italy, studying Greek in Milan and philosophy in Ferrara and frequenting Niccolò Machiavelli's literary circle in Florence before settling in Rome. There he associated with the humanist Pietro Bembo, became close friends with the dramatist Giovanni Rucellai, and served Popes Leo X and Clement VII.

Trissino's most significant cultural contribution was the Hellenization of Italian drama, achieved almost solely through his masterpiece, the blank-verse tragedy *Sofonisba* (written 1514–15, published 1524, first performed 1562), based on a story about the Carthaginian wars by the Roman historian Livy and employing the dramatic techniques of Sophocles and Euripides. *Sofonisba,* though not an interesting drama in itself, incorporated profound innovations in intent, structure, and form. The sources were Greek and devoid of religious or educational purpose; choruses were used to indicate divisions in the action; the unities of time and action were studiously followed; and verso sciolto ("blank verse") was employed extensively for the first time in Italian drama. Trissino wrote a later verse comedy, *I simillimi* (published 1548), based on the Roman playwright Plautus' *Menaechmi.* He also wrote the first Italian odes modeled on the irregular lyric verse of the Greek poet Pindar and the first Italian versions of the Horatian ode. His *La poetica* (1529) used Italian poetry to exemplify his theory.

Trissino also exerted a formative influence on Andrea di Pietro della Gondola, whom he discovered working as a mason on his villa. He educated the young man in his academy, gave him the name Palladio, and took him on two visits to Rome that profoundly affected his development into a great architect.

**Tristan** L'HERMITE, pseudonym of FRANÇOIS L'HERMITE (b. *c.* 1601, La Marche, France—d. Sept. 7, 1655, Paris), dramatist and poet, one of the creators of French classical drama. Long overshadowed by his contemporary Pierre Corneille, he was rediscovered in



Tristan l'Hermite, detail of an engraving
H. Roger-Viollet

the late 19th century and continues to excite scholarly and critical interest.

At the age of 11, Tristan was attached as page to the Marquise of Verneuil but was exiled to England after a duel. This incident and his vagabond life in the years that followed are described in his autobiographical novel *Le Page disgracié* (1643; "The Disgraced Page"). Tristan remained in England until his pardon by Louis XIII in 1621; but it is unlikely, as has been suggested, that his work was influenced by that of William Shakespeare. Like all French classical dramatists, he explores Greco-Roman or Oriental and biblical themes: *Mariamne* (1636), his best-known tragedy, is the story of Herod's jealousy; this and *La mort de Sénèque* (1644; "The Death of Seneca") were successful. Tristan was the first to write French tragedies in which love is central to the action.

Ill health had deprived Tristan of a military career, but he led an adventurous life nonetheless; brave, easily angered, with a free, inquisitive mind, he gambled away his wealth and died in poverty.

**Tristán, Luis,** in full LUIS TRISTÁN DE ESCAMILLA (b. *c.* 1586, near Toledo, kingdom of Castile [Spain]—d. Dec. 7, 1624, Toledo), Spanish painter who was in the vanguard of early Baroque painting in Spain.

A student of El Greco from 1603 to 1607, Tristán came under the influence of another El Greco pupil, Orazio Borgianni. Tristán occasionally borrowed from the works of El Greco, as can be seen in his portrait of "Grand Inquisitor Cardinal Fernando Niño de Guevara" (1612). In his "Holy Family" (1613), however, Borgianni's influence is dominant. "The Last Supper" (1616) and "St. Louis of France Giving Alms" (1620) are distinguished for their early Baroque style.

**Tristan and Isolde,** Tristan also called TRISTRAM OF TRISTREM, Isolde also called ISEULT, ISOLT, or YSEULT, principal characters of a famous medieval love-romance, based on a Celtic legend (itself based on an actual Pictish king). Though the archetypal poem from which all extant forms of the legend are derived has not been preserved, a comparison of the early versions yields an idea of its content.

The central plot of the archetype must have been roughly as follows:

The young Tristan ventures to Ireland to ask the hand of the princess Isolde for his uncle, King Mark of Cornwall, and, having slain a dragon that is devastating the country, succeeds in his mission. On the homeward journey Tristan and Isolde, by misadventure, drink the love potion prepared by the queen for her daughter and King Mark. Henceforward, the two are bound to each other by an imperishable love that dares all dangers and makes light of hardships but does not destroy their loyalty to the king.

The greater part of the romance is occupied by plot and counterplot: Mark and the courtiers seeking to entrap the lovers, who escape the snares laid for them until finally Mark gets what seems proof of their guilt and resolves to punish them. Tristan, on his way to the stake, escapes by a miraculous leap from a chapel on the cliffs and rescues Isolde, whom Mark has given to a band of lepers. The lovers flee into the forest of Morrois and remain there until one day Mark discovers them asleep with a naked sword between them. Soon afterward they make peace with Mark, and Tristan agrees to restore Isolde to Mark and leave the country. Coming to Brittany, Tristan marries Isolde of the White Hands, daughter of the duke, "for her name and her beauty," but makes her his wife only in name. Wounded by a poisoned weapon, he sends for the other Isolde, who alone can heal him. If she agrees to come, the ship on which she embarks is to have a white sail; if she refuses, a black. His jealous wife, who has discovered his secret, seeing the ship approach on which Isolde is hastening to her lover's aid, tells him that it carries a black sail. Tristan, turning his face to the wall, dies, and Isolde, arriving too late to save her love, yields up her life in a final embrace. A miracle follows their deaths: two trees grow out of their graves and intertwine their branches so that they can not be parted by any means.

The archetypal poem, which has not survived, seems to have been a grim and violent work containing episodes of a coarse and even farcical character. Two adaptations, made in the late 12th century, preserved something of its barbarity. About 1170, however, the Anglo-Norman poet Thomas, who was probably associated with the court of Henry II of England, produced an adaptation in which the harshness of the archetype was considerably softened. A mellifluous German version of Thomas' adaptation, by Gottfried von Strassburg, is considered the jewel of medieval German poetry. Short episodic poems telling of Tristan's surreptitious visits to Isolde at King Mark's court appeared in the late 12th century. Of these, the most important are two versions of the *Folie Tristan,* in which Tristan is disguised as a fool, and the *Luite Tristan,* in which he appears as a minstrel. During the 13th century the story—like Arthurian legend—was embodied in a voluminous prose romance. In this, Tristan figured as the noblest of knights, and King Mark as a base villain, the whole being grafted onto Arthurian legend and bringing Tristan and King Arthur's knight Sir Lancelot into rivalry. This version, which recounts innumerable chivalric adventures of a conventional type, had superseded all other French versions by the end of the European Middle Ages, and it was in this form that Sir Thomas Malory knew the legend in the late 15th century, making it part of his *Le Morte Darthur.* A popular romance in English, *Sir Tristrem,* dates from approximately 1300 and is one of the first poems written in the vernacular.

Renewed interest in the legend during the 19th century followed upon discovery of the old poems. Richard Wagner's opera *Tristan und Isolde* (first performed in 1865) was inspired by the German poem of Gottfried von Strassburg.

**Tristan da Cunha,** island and island group belonging to Great Britain, in the South Atlantic Ocean about midway between southern Africa and South America. It consists of six small islands: Tristan da Cunha, Inaccessible, Nightingale, Middle, Stoltenhoff, and Gough. The group is a dependency of the British colony of St. Helena. Inaccessible, Nightingale, Middle, and Stoltenhoff are uninhabited, while a weather station is manned on Gough Island.

The island of Tristan da Cunha, the largest and northernmost of the group, has an area of 38 square miles (98 square km) and is roughly circular, with a coastline of 21 miles and a central volcanic cone (6,760 feet [2,060 m]) that is usually cloud covered. The climate is wet, windy, and mild. About 66 inches (1,675 mm) of rain fall annually on the north coast at Edinburgh, the only permanent settlement. Plant and animal life includes elephant seals and other species not found elsewhere in the world.

Inaccessible is about 20 miles (32 km) westsouthwest of Tristan da Cunha. It has cliffs about 1,000 feet (300 m) high, and beneath the cliffs are occasional narrow beaches. A bird peculiar to Inaccessible is the small, flightless land rail. Nightingale, the southernmost island, is 12 miles (19 km) southeast of Inaccessible and 20 miles south-southwest of Tristan da Cunha. Its coasts have low cliffs where millions of seabirds nest. The tiny islands of Middle and Stoltenhoff abut the north coast of Nightingale.

The island group was discovered in 1506 by a Portuguese admiral, Tristão da Cunha. Two unsuccessful attempts at settlement during the 17th century and one in 1810 preceded the stationing of a British garrison on Tristan da Cunha in 1816, when the island group was formally annexed by the United Kingdom. When the garrison was withdrawn in 1817, three of its members chose to stay, and over the years they were joined by shipwrecked sailors, settlers of European extraction, and women from St. Helena. By 1886 there were 97 inhabitants. The settlement, named Edinburgh, was located on the largest lowland strip, about 0.5 mile wide and 5 miles long. In 1938 the six islands were made dependencies of St. Helena. During World War II, a naval meteorological and radio station was established on Tristan da Cunha; afterward a South African weather station was established.

A volcanic eruption on Oct. 9, 1961, directly threatened the settlement, and the inhabitants were evacuated to England via Nightingale Island. The main body of 198 islanders returned to the island in November 1963. A new harbour was built in 1965–67. Roads and a hospital, as well as electric, water, and sewerage facilities, were later constructed. Potatoes are the main crop and shore-based crawfish fishing the main industry; sales of the island's postage stamps also contribute to revenue.

Gough Island lies about 230 miles (370 km) south-southeast of Tristan da Cunha. It is about 8 miles long by 4 miles broad and is of volcanic origin. Pop. (1990) 289.

**tritium** (T, or $^3H$), the isotope of hydrogen with atomic weight of approximately 3. Its nucleus, consisting of one proton and two neutrons, has triple the mass of the nucleus of ordinary hydrogen. Tritium is a radioactive species having a half-life of 12.32 years; it occurs in natural water with an abundance of $10^{-18}$ of that of natural hydrogen. Tritium was discovered in 1934 by the physicists Ernest Rutherford, M.L. Oliphant, and Paul Harteck, who bombarded deuterium (D, the hydrogen isotope of mass number 2) with high-energy deuterons (nuclei of deuterium atoms) according to the equation $D + D \rightarrow H + T$. Willard Frank Libby and Aristid V. Grosse showed that tritium is present in natural water, probably produced by the action of cosmic rays on atmospheric nitrogen.

Tritium is produced most effectively by the nuclear reaction between lithium-6 ($^6Li$) and neutrons from nuclear-fission reactors, according to the equation $^6Li + {}^1n \rightarrow {}^4He + T$.

Although tritium reacts with other substances in a manner similar to ordinary hydrogen, the large difference in their masses sometimes causes marked differences in chemical properties of the compounds. Thus, tritium is less commonly used than deuterium as an isotopic tracer for chemical reactions. The nuclear reactions between deuterium and tritium have been used as a source of energy for thermonuclear weapons.

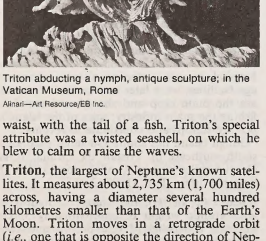
**Comparison of the physical properties of the isotopes of hydrogen**

| | $H_2$ | $D_2$ | $T_2$ |
|---|---|---|---|
| gram molecular volume of the solid at the triple point ($cm^3$) | 23.25 | 20.48 | — |
| triple point, K | 13.96 | 18.73 | 20.62 |
| vapour pressure at triple point (mm Hg) | 54.0 | 128.6 | 162.0 |
| boiling point (K) | 20.39 | 23.67 | 25.04 |
| heat of fusion at triple point (cal/mole) | 28.0 | 47.0 | — |
| heat of vaporization (cal/mole) | 216* | 293† | 333‡ |

*At 20.39 K. †At 23.67 K. ‡At 25.04 K.

The physical properties of the molecular form of the isotope tritium, $T_2$, as compared to the isotope ordinary hydrogen, $H_2$, and the isotope deuterium, $D_2$, are given in the Table.

**Triton,** in Greek mythology, a merman, demigod of the sea; he was the son of the sea god, Poseidon, and his wife, Amphitrite. According to the Greek poet Hesiod, Triton dwelt with his parents in a golden palace in the depths of the sea. Sometimes he was not particularized but was one of many Tritons. He was represented as human down to his



Triton abducting a nymph, antique sculpture; in the Vatican Museum, Rome
Alinari—Art Resource/EB Inc.

waist, with the tail of a fish. Triton's special attribute was a twisted seashell, on which he blew to calm or raise the waves.

**Triton,** the largest of Neptune's known satellites. It measures about 2,735 km (1,700 miles) across, having a diameter several hundred kilometres smaller than that of the Earth's Moon. Triton moves in a retrograde orbit (*i.e.*, one that is opposite the direction of Neptune's rotation) at a distance of about 354,450 km (220,300 miles) from the planet. Triton revolves so slowly that each of its seasons lasts more than 40 years.

Though discovered by the English astronomer William Lassell in 1846, little was known about Triton until 1989, when the U.S. Voyager 2 probe flew to within 38,600 km (24,000 miles) of it. Voyager's observations revealed that Triton has an extremely thin atmosphere of nitrogen and methane. Data from the probe also indicated that the satellite has a surface temperature of −240° C (−400° F), making it perhaps the coldest object in the solar system. Triton is covered with enormous expanses of ice pitted by what appear to be a few meteorite craters as well as by some rugged areas. Other topographic features include long, ridgelike structures that occasionally cut across one another.

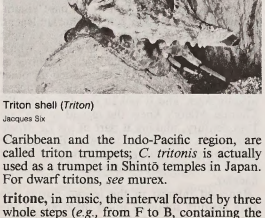
Scientists attribute Triton's unique landscape to a phenomenon termed "icy volcanism." They theorize that a significant amount of the thick layer of nitrogen and methane frost covering the surface evaporates during those seasons when the surface is exposed to sunlight. The decrease in the volume of icy matter results in a reduction in the amount of pressure exerted on subsurface reservoirs of liquid nitrogen and methane. When the confining pressure drops sufficiently, some of this nitrogen and methane vaporizes and is ejected from fissures in the overlying layer of ice. Exposure to the subfreezing temperature of the atmosphere causes the nitrogen and methane to pass directly from the gaseous to the solid phase, resulting in the further accumulation of frost at the surface.

**Triton,** U.S. nuclear-powered submarine that was the first vessel to circumnavigate the globe underwater. At the time of its launch in August 1958, the *Triton* was the largest and most powerfully engined submarine. Its two nuclear reactors gave the ship a speed of 30 knots (nautical miles per hour) and a range of about 110,000 miles (180,000 km) without refueling. It was 447.5 feet (136 m) long and displaced 5,900 tons. The *Triton* completed its circumnavigation on May 10, 1960. The submarine was decommissioned in 1969 and laid up at Norfolk, Va.

**triton,** nucleus of the heaviest hydrogen isotope, tritium, or hydrogen-3. Tritons, which consist of one proton and two neutrons, result from certain nuclear reactions. The collision of a deuteron with another deuteron, for example, sometimes produces a proton and a triton. *See also* tritium.

**triton shell,** any of several marine snails constituting the family Cymatiidae (subclass Prosobranchia of the class Gastropoda), in which the shell usually is spired, the body whorl is large, and the aperture in the first whorl of the shell is broadly or narrowly toothed. The triton's shell may be ridged or knobbed.

Tritons are warm-water predators. Species of the genus *Triton* are among the largest of the family. Those of the genus *Charonia,* of the



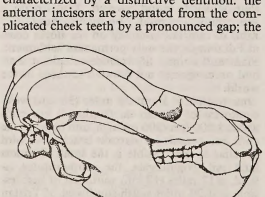
Triton shell (*Triton*)
Jacques Six

Caribbean and the Indo-Pacific region, are called triton trumpets; *C. tritonis* is actually used as a trumpet in Shintō temples in Japan. For dwarf tritons, *see* murex.

**tritone,** in music, the interval formed by three whole steps (*e.g.,* from F to B, containing the whole steps F–G, G–A, and A–B). From the Middle Ages, when it was called the "devil" in music, until about 1900, the tritone was considered particularly offensive, and its use was either forbidden outright or subject to strict limitations.

In musical notation the tritone is written either as an augmented (sharpened) fourth (*e.g.,* F–B or C–F♯, in contrast to the perfect fourths F–B♭ and C–F, respectively) or a diminished (flattened) fifth (*e.g.,* B–F or C–G♭, in contrast to the perfect fifths B–F♯ and C–G, respectively).

**tritylodont,** any member of a genus (*Tritylodon*) of extinct, advanced mammallike reptiles found as fossils in Late Triassic rocks in southern Africa (the Triassic period began about 245 million years ago and ended about 208 million years ago). Tritylodonts are characterized by a distinctive dentition: the anterior incisors are separated from the complicated cheek teeth by a pronounced gap; the



Skull of *Bienotherium,* a tritylodont
Reprinted from A.S. Romer, *Vertebrate Paleontology,* by permission of the University of Chicago, copyright 1933, 1945, 1966; all rights reserved

cheek teeth possess two to four rows of cusps arranged longitudinally. In features of skull construction and general overall skeletal construction the tritylodonts closely approached true mammals, though they were too specialized to have given rise to the mammals and may have been contemporary with some of the earliest of them. In jaw construction and articulation tritylodonts were still therapsid reptiles; the lower jaw still retains reptilian components rather than the single bone, the dentary, that is characteristic of the mammals. It is probable that the habits of *Tritylodon* were similar to those of the later rodents and multituberculates.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**triumph,** Latin TRIUMPHUS, a ritual procession that was the highest honour bestowed upon a victorious general in the ancient Roman Republic. It was an honour granted and paid for by the Senate and was enacted in the city of Rome. The word probably came from the Greek *thriambos,* the name of a procession honouring the god Bacchus. To triumph in republican times a man was required to have been a magistrate *cum imperio* (holding supreme and independent command) who had won a major land or sea battle, killing at least 5,000 of the enemy. The ceremony began with a solemn procession from the Campus Martius to the Capitol, passing through the forum and the Via Sacra ("Sacred Way") along streets adorned with garlands and lined with people shouting, "*Io triumphe.*"

The magistrates and members of the Senate came first in the processions followed by musicians, the sacrificial animals, the spoils of war, and the captured prisoners in chains. Riding in a chariot festooned with laurel, the victorious general (*triumphator*) wore the royal purple and gold tunic and toga, holding a laurel branch in his right hand and an ivory sceptre in his left. A slave held a golden crown over the general's head while repeatedly reminding him in the midst of his glory that he was a mortal man. The general's soldiers marched last, singing whatever they liked, which included ribaldry and scandal against their commander, probably as a way to avert the evil eye from him. On reaching the Capitoline temple the general presented his laurel, along with thank-offerings, to the image of Jupiter. The prisoners were usually slain, and the ceremony concluded with a feast for the magistrates and Senate.

A general who did not earn a triumph might be granted an *ovatio,* in which he walked or rode on horseback, wearing the purple-bordered toga of an ordinary magistrate and a wreath of myrtle.

Under the empire only the emperors or members of their families celebrated triumphs, because the generals commanded under their auspices as lieutenants (*legati*); the only honour the generals received was the right of wearing triumphal costume (*ornamenta triumphalia*) on festivals, and even these were cheapened and lost their military connections. There were still triumphs of Christian emperors (*e.g.,* Honorius in 403), and the theme was revived in new and spectacular forms in Renaissance art.

**triumphal arch,** a monumental structure pierced by at least one arched passageway and erected to honour an important person or to commemorate a significant event. It was sometimes architecturally isolated but usually was built to span either a street or a roadway, preferably one used for triumphal processions.

Although associated with ancient Roman architecture, the origins and significance of the triumphal arch are still not fully understood.



Triumphal arches of (from top) Constantine, Septimus Severus, and Titus, in Rome

(Top and centre) G. Guidotti/M. Grimoldi, (bottom) German Archaeological Institute, Rome

It was a separate structure, having no connection with city gates or city walls, and should not be confused with the Porta Triumphalis, through which the victorious Roman army had to pass before entering the sacred city territory (*pomerium*) of Rome. Its basic form consisted of two piers connected by an arch and crowned by a superstructure, or *attica*, that served as a base for statues and bore commemorative inscriptions. In early arches the attic statuary usually represented the victor in his triumphal chariot; in later ones only the emperor was depicted. The function of the arch, therefore, seems to have been that of an honorary monument of unusual importance; it was so interpreted by the only ancient author who discussed it, Pliny the Elder (AD 23–79).

Few triumphal arches are known from the time of the republic. In Rome three were erected: the first, in 196 BC, by Lucius Stertinius; the second, in 190 BC, by Scipio Africanus the Elder on the Capitoline Hill; and the third, in 121 BC, the first in the Forum area, by Quintus Fabius Allobrogicus. All carried statuary, but little is known of their architectural form, and there are no remains.

Most of the triumphal arches were built during the empire period (27 BC to AD 476). Early in the 4th century AD, for example, there were 36 such monuments in Rome. The imperial-style structure was sometimes expanded to three arches with the central arch reaching a greater height than the two side arches. The triumphal arch of the empire was articulated by a facade of marble columns; ornamental cornices were added to the piers and attics, and the archway and sides were adorned with relief sculpture depicting the emperor's victories and achievements.

In Rome three triumphal arches have survived: the Arch of Titus (AD 81) with relief sculpture of his triumph over Jerusalem; the Arch of Septimius Severus (203–205) commemorating his victory over the Parthians; and the Arch of Constantine (312), a composite product, decorated with reused material from the times of Domitian, Trajan, and Hadrian. Outside Rome, notable ancient examples include: the arches of Augustus in Susa, Aosta, Rimini, and Pola; of Trajan in Ancona and Benevento; of Marcus Aurelius in Tripoli; and of Septimius Severus in Leptis Magna, in North Africa.

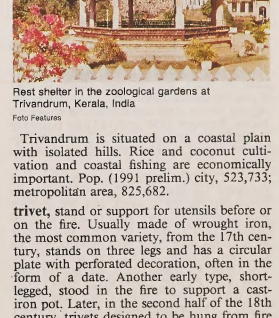
Among the triumphal arches built since the Renaissance, noteworthy examples include: the triumphal arch of Alfonso I (1453–70) in Naples; the 17th-century Porte Saint-Denis and Porte Saint-Martin and Jean Chalgrin's Arc de Triomphe (1836), all in Paris; London's Marble Arch, by John Nash, and the Hyde Park Corner Arch, both designed in 1828; and Stanford White's Washington Arch (completed 1895) in New York City.

**triumvirate,** Latin TRESVIRI, or TRIUMVIRI, in ancient Rome, a board of three officials. There were several types: *Tresviri capitales,* or *tresviri nocturni,* first instituted about 289 BC, assisted higher magistrates in their judicial functions, especially those relating to crime and the civil status of citizens. *Tresviri epulones,* originally a board of three priests, was created in 196 BC to take charge of the banquet of Jupiter, the key event in the festivals of the Ludi Romani and Ludi Plebeii. *Tresviri monetales* were in charge of the mint for Rome and Italy during both the republic and the empire. *Tresviri rei publicae constituendae* ("triumvirate for organizing the state") was the title granted in 43 BC for five years (renewed in 37 for another five) to the group generally known as the Second Triumvirate (Mark Antony, Marcus Aemilius Lepidus, and Octavian [the future Emperor Augustus]). Under it they received absolute authority, dictatorial in scope. The so-called First Triumvirate of Pompey, Julius Caesar, and Marcus Licinius Crassus, which began in 60 BC, was not a formally created commission but an informal understanding of three strong political leaders.

Boards of three persons, usually elected, called *triumviri agris dandis assignandis* (sometimes also *judicandis*) and *triumviri coloniae deducendae* were frequently placed, respectively, in charge of assignments of land and in charge of the founding of colonies during the last three centuries of the republic (3rd–1st century BC).

**Triuridales,** order of monocotyledonous flowering plants comprising the family Triuridaceae, with seven genera of small, nongreen herbs that obtain food from dead organic matter (*i.e.,* as saprophytes). The leaves are reduced to colourless scales, and the flowers are very small, generally unisexual (separately male or female), and have three to eight perianth segments (petallike structures). Plants of the order are distributed in the tropics of South and Central America, Africa, and Asia. The larger genera include *Sciaphila* (50 species) and *Andruris* (16 species). The order is thought to have had an evolutionary origin in common with the water-plantain order (Alismales).

**Trivandrum,** city, capital of Kerala state, southwestern India. The community became prominent under Raja Martanda Varma, who made it the capital of his kingdom of Travancore in 1745. The city's present name is a contraction of Tiruvanantapuram, its ancient name. It is the site of the University of Kerala (1937) and its affiliated colleges and technical schools. It also has a museum, zoological gardens, an observatory, and an art gallery. A large fort contains several palaces and a Vaiṣṇava (Vishnuite) temple, which is a noted pilgrimage centre. Trivandrum's industries include mineral processing, sugar milling, textiles, and handicrafts. It is a rail terminus and road hub and has an airport and a harbour.



Rest shelter in the zoological gardens at Trivandrum, Kerala, India

Foto Features

Trivandrum is situated on a coastal plain with isolated hills. Rice and coconut cultivation and coastal fishing are economically important. Pop. (1991 prelim.) city, 523,733; metropolitan area, 825,682.

**trivet,** stand or support for utensils before or on the fire. Usually made of wrought iron, the most common variety, from the 17th century, stands on three legs and has a circular plate with perforated decoration, often in the form of a date. Another early type, short-legged, stood in the fire to support a cast-iron pot. Later, in the second half of the 18th century, trivets designed to be hung from fire bars were made. These were of two types: an oblong, standing trivet with a handle at one end and projections to fit over the fire bars at the other, and a plate that could be attached to the fire bar. Some of the latter were hung inside the grate supporting a vessel over the fire.

Large quantities of cast-brass fender trivets were manufactured at Birmingham, in England, in the last quarter of the 18th century; these were suspended from the top rails of the fender as muffin and kettle stands. Four-legged trivets that stood under the spit holding the dripping pan were made in the 18th and 19th centuries. The cat, an entirely different type of plate stand that was made in the 18th century, consisted of six spokes, three at the top and three at the bottom; it could be used either way up.

The term trivet is also used in reference to a metal stand with short feet, used on a table to support a hot dish.

**Trnava,** German TYRNAU, Hungarian NAGYSZOMBAT, town, Západní Slovensko *kraj* (region), Slovakia, on the Trnava River and the main Bratislava-Žilina railway.

Founded in the 7th century, Trnava received civic privileges in 1238. Its position north of the limit of Ottoman conquest in the 16th century was important to both Hungarian

and Slovak cultural institutions seeking refuge from Turkish rule. The town became the see (1541–1820) of the bishop of Esztergom and thus the heart of Slovak Roman Catholicism; because of its many religious buildings, it was called the Slovak Rome. After its university (founded in 1635) was transferred to Buda in 1745, the town's importance as a cultural centre declined. Historic structures include the Gothic St. Nicholas Cathedral (1380), the Baroque Church of St. John the Baptist (1637), the town tower (1574), and remains of medieval fortifications. Important ethnographic collections are in the Western Slovak regional museum. The nearby 13th-century Smolenice Castle (modernized) is used for international scientific conferences.

Since the 19th century, industries have developed, notably railway-car manufacture and industries related to local agriculture, such as food processing, sugar refining, and malt production. The district is known for traditional costumes and for fine pottery. Pop. (1991 prelim.) 71,641.

**Trnka, Jiří** (b. Feb. 24, 1912, Pilsen, Bohemia, Austria-Hungary [now Plzeň, Czech Republic]—d. Dec. 30, 1969, Prague, Czech.), motion-picture animator, preeminent master of the Czech puppet filmmaking tradition, painter, designer, cartoonist, and book illustrator.

Trnka, who was trained as a painter in art school, won a design competition organized by the Czech puppeteer Josef Skupa in 1921. He worked with Skupa at his studios for more than 10 years, but his own efforts to start a puppet theatre failed. By 1935 he was designing for the stage and illustrating children's books. Between 1938 and 1945 he primarily worked as a designer for the National Theatre in Prague but illustrated many children's books.

In 1945 Trnka turned to animation and produced his first film, *Zasadil dědek repu* (*Grandpa Planted a Beet*). His first puppet film appeared in 1947, part of a cycle called *Spalíček* (*The Czech Year*). After that, nearly all his films were made with puppets. Among the most notable are *Císařův slavík* (1948; *The Emperor's Nightingale*), *Arie prérie* (1949; *Song of the Prairie*), *Dobrý Vojak Švejk* (1954; *The Good Soldier Schweik*), *Sen Noci Svatojanské* (1959; *A Midsummer Night's Dream*), considered by some critics to be his masterpiece, and *Ruka* (1964; *The Hand*). Trnka redesigned puppets especially for the camera: their range of movement was limited, their heads were enlarged, and their facial expression was limited chiefly to the area around the eyes.

**Trnova** (Bulgaria): *see* Veliko Tŭrnovo.

**Troas,** also called TROAD, the land of Troy (*q.v.*), ancient district formed mainly by the northwestern projection of Asia Minor (modern Turkey) into the Aegean Sea. It extended from the Gulf of Edremit (ancient Adramyttion) on the south to the Sea of Marmara and the Dardanelles on the north and from the Ida mountain range and its northerly foothills on the east to the Aegean on the west. In the southeast corner is Mount Ida (modern Kaz Mountain), which rises to a height of 5,820 feet (1,774 m). The eastern and southern regions are rugged and partly wooded. The Scamander (Küçük Menderes) River, fed from springs on the Ida mountains, has cut its way through the hills to the plain in the northwest and empties into the Hellespont just before the Hellespont flows into the Aegean.

In addition to Troy (later called Ilion), there were a number of smaller Greek cities in the Troas, including Sigeum and Alexandria Troas (whence St. Paul took ship for Macedonia) on the west coast; Assus on the south coast; and Neandria, Scepsis, Palaiscepsis, and Cebrene in the interior.

**Trobriand Islands** (South Pacific): *see* Kiriwina Islands.

**Trobriander,** any of the Melanesian people of the Kiriwina (Trobriand) Islands, lying off eastern New Guinea. Subsistence is based on yams and other vegetables, domesticated pigs, and fish. Storage houses for yams and the chief's house stand in the middle of the village, surrounded by dwellings arranged in circles. Each hut is occupied by a single family. Trobrianders are divided into totemic clans, the members of which trace their descent matrilineally (*i.e.*, from a common ancestor through the female line).

The village is the major social unit; members make their gardens together under the guidance of a garden magician, perform ceremonies, and travel together on trading expeditions. Each village has a headman, and high-ranking headmen, or chiefs, may have authority over several villages. Wealth is extremely important as a sign of power and the means of exercising it.

The Trobrianders are noted for their elaborate intertribal trading system, the *kula* (*q.v.*), which was described in the anthropological classic *Argonauts of the Western Pacific* (1922) by Bronisław Malinowski. Red shell necklaces are traded between permanent trading partners in a clockwise direction around a ring of islands; white shell bracelets are traded counterclockwise. Large seagoing dugout canoes are constructed for the interisland trading expeditions.

*A list of the abbreviations used in the* MICROPAEDIA *will be found at the end of this volume*

**trochee,** metrical foot consisting of one long syllable (as in classical verse) or stressed syllable (as in English verse) followed by one short or unstressed syllable, as in the word hap|py. Trochaic metres were extensively used in ancient Greek and Latin tragedy and comedy in a form, particularly favoured by Plautus and Terence, called trochaic catalectic tetrameter. Trochaic metres are not easily adapted to English verse. In long poems, such as Henry Wadsworth Longfellow's *Song of Hiawatha,* their overall effect is monotony. But they have been used with great effect in shorter poems, particularly by William Blake, as in his well-known poem "The Tyger":

Tyger | Tyger | burning | bright
In the | forests | of the | night

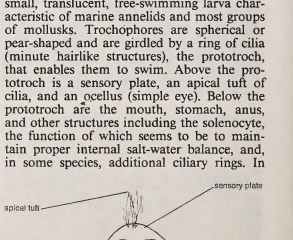
**Trochodendrales,** order of dicotyledonous flowering plants comprising two families (Trochodendraceae and Tetracentraceae), each represented by a single small- to medium-sized tree species. The order is noteworthy as an evolutionary primitive group isolated from other living flowering plants: its wood, for example, is without the specialized water-conducting cells (vessel cells) found in nearly all other flowering plants. In their place is a more primitive cell type, the tracheid, common in gymnosperms and some other non-flowering plants: the tracheid is a long, spindle-shaped cell with numerous lateral openings, or pits, instead of openings at the ends. These cells are arranged in overlapping layers.

Despite the primitive wood, both species have flowers that are considered highly specialized and somewhat advanced, evolutionarily. The wheel tree (*Trochodendron aralioides*), of South Korea, Japan, and Taiwan, is a small broadleaf evergreen tree up to 12 m (about 40 feet) in height with pinnate leaves (*i.e.*, the leaves have a midrib from which lateral veins arise, comblike) and flowers in clusters at the branch tips. The flowers lack sepals and petals (the outer and inner floral whorls or showy flower parts) but have an array of about 70 stamens (male pollen-producing structures) surrounding 5 to 11 or more partially fused carpels (female ovule-bearing structures); the flowers are thus bisexual. It is from the ring of stamens, which has the appearance of a wheel, that the genus receives its name, which means roughly, "wheel tree." *Trochodendron* flowers are insect-pollinated. The plant is sometimes cultivated as an ornamental.

*Tetracentron sinense,* of central and south-central China and northern Myanmar (Burma), is a medium-sized tree, 4.5 to 27 m tall, with palmately (fingerlike) veined leaves and small, wind-pollinated flowers arranged in dangling, slender catkins. It is also cultivated occasionally as an ornamental.

**Trochonema,** genus of extinct gastropods (snails) found as fossils in rocks dating from the Ordovician Period to the Devonian Period (505 to 360 million years ago). The shell of Trochonema consists of a series of turretlike whorls, each ornamented by slight lines. The aperture is large, conspicuous, and roughly circular.

**trochophore,** also called TROCHOSPHERE, small, translucent, free-swimming larva characteristic of marine annelids and most groups of mollusks. Trochophores are spherical or pear-shaped and are girdled by a ring of cilia (minute hairlike structures), the prototroch, that enables them to swim. Above the prototroch is a sensory plate, an apical tuft of cilia, and an ocellus (simple eye). Below the prototroch are the mouth, stomach, anus, and other structures including the solenocyte, the function of which seems to be to maintain proper internal salt-water balance, and, in some species, additional ciliary rings. In some molluscs, the trochophore enters a second stage, the veliger (*q.v.*), before maturing. Rotifers and the larvae (sometimes considered trochophores) of such invertebrates as phoronids and bryozoans are trochophore-like in appearance.



Trochophore
From P.B. Weisz, *The Science of Zoology.* Copyright (1966). Used with permission of McGraw-Hill Book Co.

**troctolite,** coarse-grained, intrusive igneous rock that is composed almost entirely of olivine (often iron-rich) and plagioclase feldspar (labradorite or bytownite). The olivine may be wholly altered to serpentine, which gives the rock a stippled appearance of red, green, brown, yellow, and black spots on a pale background, reminiscent of the skin of a trout (in German, troctolite is *Forellenstein,* "trout rock"). Occurrences of this olivine-bearing gabbro include Wolimierz, Pol.; Oslo, Nor.; and Cornwall, Eng.

**Troelstra, Pieter Jelles** (b. April 20, 1860, Leeuwarden, Neth.—d. May 12, 1930, The Hague), Dutch socialist statesman and poet,

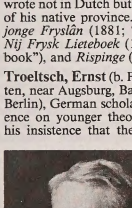
who founded the Social Democratic Labour Party and headed the Dutch labour movement from 1894 to 1924.

An attorney and newspaper editor, Troelstra joined the Social Democratic Union in 1890. When a split developed in the Socialist ranks between Anarchists and a coalition of moderate Marxists and parliamentarians, he formed the Social Democratic Labour Party in August 1894 to reflect moderate views. By 1900 his party controlled the Socialist labour vote; it soon became the nation's second largest political party.

As leader of the Social Democrats in the Dutch Second Chamber (house of representatives) since 1896, Troelstra supported unemployment insurance legislation, passed in 1913. He helped write the 1917 constitutional revision granting universal male suffrage, and he championed female suffrage in local elections and old-age insurance laws that were finally passed in 1919. His party was semi-revolutionary in policy but parliamentary in tactics. When he led a small left-wing faction in an abortive attempt to overthrow Prime Minister Ruys de Beerenbrouck's government in November 1918, the majority of his party and the Socialist trade unions disavowed his actions; his control over the party was severely damaged, though he remained in nominal charge of it until his retirement in 1924.

Throughout his career as a poet, Troelstra wrote not in Dutch but in Frisian, the language of his native province. His works included *It jonge Fryslân* (1881; "The Young Frisian"), *Nij Frysk Lieteboek* (1886; "A Frisian Songbook"), and *Rispinge* (1909; "Rhymes").

**Troeltsch, Ernst** (b. Feb. 17, 1865, Haunstetten, near Augsburg, Bavaria—d. Feb. 1, 1923, Berlin), German scholar of considerable influence on younger theologians of his time for his insistence that the church reexamine its



Troeltsch, *c.* 1919

By courtesy of the Archiv fur Kunst und Geschichte, Berlin

claims to absolute truth. Many of Troeltsch's publications, which span the disciplines of theology, social history and theory, philosophy of religion, and philosophy of history, were integrated into his best known work, *Die Soziallehren der christlichen Kirchen und Gruppen* (1912; *The Social Teaching of the Christian Churches,* 1931).

*Life and works.* Troeltsch's father, a medical practitioner, early instilled in his son a passion for scientific observation and led him to see problems of history and civilization within a framework of the development of the sciences. After Troeltsch's school years at the Augsburg Gymnasium, where he acquired a solid grounding in classical languages and literature, he decided to study theology, which, according to an autobiographical sketch, seemed to him at that time the only study in which his historical, philosophical, and social interests could meet in the investigation of a worthwhile subject matter. He studied Protestant (Lutheran) theology at the universities of Erlangen, Göttingen, and Berlin, becoming in turn *Privatdocent* (lecturer) at Göttingen, extraordinary (associate) professor at Bonn (1892), and ordinary (full) professor in the chair of theology at Heidelberg (1894). He married in 1901, and an only son was born in 1913.

During 21 years at Heidelberg he published, besides his *Grundprobleme der Ethik* (1902; *Fundamental Problems of Ethics*), a large number of articles on various subjects thematically linked with the development of the Christian churches. Many of these were later integrated into his best known work, *Die Soziallehren der christlichen Kirchen und Gruppen.* In that work he explored the relationships between and within social and cultural groups in the context of the social ethics of the Christian churches, denominations, and sects. In 1915, realizing that his strength lay more in the philosophy of religion than in orthodox theology, he moved to a chair of philosophy at Berlin, a post he held until his death in 1923.

*Influence of his thought.* Troeltsch had a considerable influence on younger theologians of his time, especially through his insistence that the church must drastically rethink its attitude toward "absolutist" claims made for the truth of its doctrines. He was both fascinated and troubled by "historicism" (historical relativism): the view that whatever is valued, pursued, conceived, or achieved at any given time or place is relative to, and only understandable in the context of, the conditions of that time or place. Although the view seemed to him in important respects inescapable, he surmised that it applied inadequately to the norms—whether legal, religious, or ethical—that govern human conduct. If consistently applied, the historicist view would, he thought, make any present understanding of past ages impossible. The polymorphous, historically changing dogmas of the church had to be reconciled with the absolute aspects of revealed truth interpreted anew by every generation. Despite this, many theologians have seen in Troeltsch only a critic of the certainties of Christianity. Paul Tillich (1886–1965), a distinguished German-American philosopher and theologian, for example, accused him of sacrificing the absolute to the purely relative in religion (*Kant-Studien,* 1924).

Troeltsch's thought, never purely abstract, is always based on extensive knowledge of historical and factual data. His work has been influential precisely in those aspects that reveal his dislike of very general terms of reference—in its pioneering study of small social units or groups, such as the family, the guild, and the individual state, church, or sect, and also in its advocacy of the comparative approach to religious studies. Within Protestantism, he made important contributions to the study of the genesis of Lutheranism and Calvinism and their differing social ethics and social impact. Here he was in close sympathy concerning the nature of Protestant ethics with his friend the German sociologist and economist Max Weber (1864–1920). Troeltsch was familiar with the Marxist approach to sociology and found its perspective on the socioeconomic substructure of civilization exciting and superior to the then current Hegelian view of history as the forward march of an inevitable dialectical process. Yet he rejected Marxism in favour of a more flexible conception of the interaction of cultural, social, and economic factors. This preoccupation with the problems of historical relativity and what he called the logic of historical development found expression in a late but important work, *Der Historismus und seine Probleme* (1922; *Historical Relativism and Its Problems*).

Troeltsch had more than an academic interest in social and political affairs. He was a member of the Baden Upper House during his years in Heidelberg, later, in Berlin, a member of the Prussian Landtag (the provincial legislature), and, for a number of years, undersecretary of state for religious affairs. Pondering the reasons, in the aftermath of World War I, for Germany's disastrous estrangement from the ethical, political, and social thought of the Western democracies, he put high on his list the glorification of the state at the expense of the rights and dignity of the individual.

A plan to visit England was frustrated by his death in 1923. The course of five lectures, which he was to have delivered in London and Oxford during March of that year, was published posthumously under a title that puts his work in perspective: *Der Historismus und seine Überwindung* ("Overcoming Historical Relativism"), a more revealing title than that of the English edition (*Christian Thought: Its History and Application*). Three volumes of Troeltsch's collected works appeared toward the end of his life, a fourth being published after his death (*Gesammelte Schriften,* 4 vol., 1922–25). They do not contain all his published writings but those for which Troeltsch himself would have wished to be remembered.

(Ev.S.)

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**Trogir,** Italian TRAU, port in Dalmatia in Croatia, sited on an island in the Adriatic Sea and connected by a bridge to the mainland and to the island of Čiovo. It was colonized as Tragurion by Syracusan Greeks *c.* 385 BC and became a part of the Eastern, or Byzantine, Empire in the 6th century AD. Croatians, Normans, Venetians, and Bosnians were among rulers of the region for the next 1,400 years, and Trogir became a part of the new Yugoslav state in 1920. Kamerlengo Castle and St. Mark's tower survive from the Venetian period. The Cathedral of St. Lawrence, Gothic in style with Renaissance additions, is regarded as among the most beautiful in Dalmatia. The town is the site of one of Croatia's major shipbuilding yards. Pop. (1981) 8,588.

**Troglodytidae** (bird family): *see* wren.

**trogon,** any of about 35 bird species common to warm regions. Trogons, who constitute the family of Trogonidae, have the belly bright red to yellow in contrast with the dark chest and upperparts. In Africa and America, males are iridescent above; those of Asia lack the gloss but have a touch of pink or red on the head, chest, rump, or tail. Among the best-known species of the trogon family are the quetzals (genus *Pharomachrus*).

Most trogons are 24 to 46 centimetres (9½ to 18 inches) long, an exception being the resplendent (or Guatemalan) quetzal, also called resplendent trogon (*Pharomachrus mocino*), which is about 125 cm (50 in.) long. The graduated tail, of 12 feathers, is carried closed (square-tipped) and typically has a black and white pattern on the underside (as in cuckoos). The wings are rounded, legs short, feet weak. Uniquely, the second (inner) toe is fixed rearward. The bill is short, curved, and broad, with bristles at the base; in many species it is serrated. The eye is ringed with colourful bare skin. Trogons occur in the New World from the extreme southwestern United States and the West Indies to Argentina; through-

out sub-Saharan Africa; and from India to Malaya and the Philippines. They are most abundant and varied in the American tropics. Most species live in hot lowland forests, but some are found in mountains.



Male resplendent quetzal, or resplendent trogon (*Pharomachrus mocino*)
Michael & Patricia Fogden

Trogons are hole nesters: a natural cavity in a tree may be used, but some dig into rotten wood or into the arboreal nests of wasps or termites (eating larvae and ignoring stings). The two to five eggs are almost spherical and white or weakly tinted. Incubation takes two to three weeks, and fledging occurs two to three and one-half weeks later. Parental duties are fully shared. The quetzal, from southern Mexico to Boliva, was the sacred bird of the ancient Mayas and Aztecs; today it is the national emblem of Guatemala (whose monetary unit is the quetzal). Long blue-green plumes cover the bird's tail, which shows white beneath, in flight. The head, with rounded hairlike crest, and the breast are gold-green, the back blue with curly gold-tinged mantle, the belly red.

**Trogus, Pompeius** (fl. late 1st century BC), Roman historian whose work, though not completely preserved, is important for Hellenistic studies.

Trogus was a Vocontian Gaul from Gallia Narbonensis whose grandfather gained Roman citizenship (and the name Pompeius) from Pompey and whose father was secretary to Julius Caesar. Trogus wrote a zoological work, *De animalibus,* quoted by the elder Pliny, and a history, *Historiae Philippicae,* in 44 books, so called because the Macedonian empire founded by Philip II is its central theme. This work treated the ancient kingdoms from Assyria and Persia to Macedonia and the Hellenistic monarchies, followed by Parthia, Rome under the kings, and Gaul and Spain. Trogus probably took the bulk of his material from the *History of Kings* of Timagenes, his contemporary in Rome. In contrast to Livy's tradition, his perspective is cosmopolitan and Greek, not patriotic and Roman. The original work is lost, but its character is preserved in Justin's *Epitome,* the *prologi* (or summaries of books), and some fragments.

**Troïck** (Russia): *see* Troitsk.

**troika** (Russian: "three"), any vehicle drawn by three horses abreast, usually a sleigh with runners but also a wheeled carriage. The three-horse team is also known as a unicorn team.

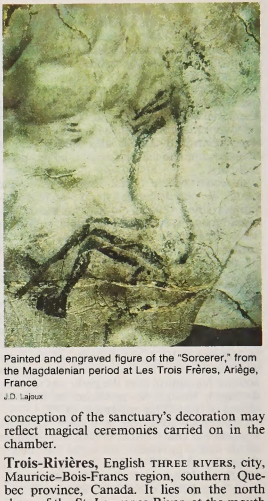
In Hungary and in Russia the troika, drawn by three horses and driven by an elegantly clad coachman, was once the ultimate status symbol. All three horses were lightly harnessed, with the leader, or middle one, between the shafts of the vehicle at a trot, while the two wheelers, or outside horses (pulling at slightly divergent angles in an array shaped like a fan), galloped—one furiously, the other coquettishly. Great care was taken in the harnessing of the animals to see that each performed at the desired gait. The nobility thus made great and colourful ceremonial displays.

**troilite,** variety of the iron sulfide mineral pyrrhotite (*q.v.*).

**Troilus,** Trojan prince in Greek mythology, son of King Priam and Queen Hecuba of Troy. In Homer's epic poem the *Iliad,* Troilus was killed before the action of Greece's war with Troy began; non-Homeric legend records that he had been killed by the Greek hero Achilles. In medieval handlings of the Trojan story he was portrayed as the embodiment of an innocent young lover betrayed by a fickle girl who abandoned him for the Greek hero Diomedes. This story of Troilus' unhappy passion appears to have been invented early in the 12th century by Benoît de Sainte-Maure in a poem, *Roman de Troie.* Benoît called the girl Briseida, a name later modified by other writers to Cressida. The 14th century saw two important treatments of the Troilus and Cressida theme: Giovanni Boccaccio's poem *Il filostrato* (derived from Benoît and from the *Historia destructionis Troiae* of Guido delle Colonne) and Geoffrey Chaucer's *Troilus and Criseyde* (based mainly on Boccaccio). Their story was also the subject of Shakespeare's play *Troilus and Cressida.*

**Trois Frères, Les,** cave in southern France, discovered in 1914, containing an important group of monumental Late Paleolithic (*c.* 40,000–*c.* 10,000 BC) paintings and engravings of the Franco-Cantabrian school, which flourished mainly in the limestone caves of central and southwestern France and northern Spain. The majority of these pictures of animals and half-animal, half-human figures, representing both major phases of Franco-Cantabrian art, the Aurignacian and the Magdalenian, are located on the walls of a deep interior chamber called the sanctuary. Its entrance flanked by two lion's heads, the sanctuary is filled with the overlapping figures of bison, stags, reindeer, horses, and ibex, some 280 figures in all.

The most striking feature of the cave, however, is the prominent representation of human or half-human figures, a theme that is extremely rare in Franco-Cantabrian mural art. Scattered among the figures of animals are several figures that seem to represent human magicians or ritual dancers, shown with the heads and sometimes forequarters of bison. Also among the animals are small, distorted pictures of human faces that have been interpreted as images of the souls of the animals. Finally, unique to the cave, is a painting with engraved outlines of a sorcerer figure, half man and half stag; it dominates the mass of figures from a height of 13 feet (4 m) from the cave floor, with a clarity of composition unusual in Franco-Cantabrian art. The significance of the sorcerer is unknown, but it probably represents some sort of Great Spirit, presiding over the figures of animals and dancers below; perhaps it is conceived as the master of hunting and of animal fertility. The unusual dramatic



Painted and engraved figure of the "Sorcerer," from the Magdalenian period at Les Trois Frères, Ariège, France
J.D. Lajoux

conception of the sanctuary's decoration may reflect magical ceremonies carried on in the chamber.

**Trois-Rivières,** English THREE RIVERS, city, Mauricie–Bois-Francs region, southern Quebec province, Canada. It lies on the north shore of the St. Lawrence River, at the mouth of the Saint-Maurice River. Trois-Rivières was founded in 1634 by the French explorer Samuel de Champlain and named for the three channels at the mouth of the Saint-Maurice. It lies midway between Montreal and Quebec cities and is one of the oldest settlements in Canada. The city has developed from a frontier outpost into a major industrial centre and deepwater port. Hydroelectric power from Saint-Maurice River plants and vast forest resources have helped it to become one of the world's largest producers of newsprint. Other manufactures include pulp, paper, textiles, clothing, electrical appliances, shoes, and rubber. Trois-Rivières is the seat of a Roman Catholic bishopric and the site of an Ursuline convent built in 1697. The city also has a branch of the University of Quebec. The Canadian National Railway, several highways, an airport, and year-round ferry crossings on the St. Lawrence serve the city. Pop. (2001) city, 46,264; metropolitan area, 137,507.

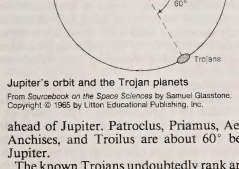
**Troitsk,** also spelled TROICK, city, Chelyabinsk *oblast* (province), western Russia. Troitsk lies along the Uy River at the inflow of the Uvelka River. Founded in 1743 as a fortress, it was chartered in 1784. An agricultural centre for the adjacent steppes, Troitsk also has transport and industrial functions, and a thermal-power station and a nuclear-power plant are located there. The city has colleges for medicine, agriculture, and teacher training. Pop. (2002 est.) 85,700.

**Troitskosavsk** (Russia): *see* Kyakhta.

**Trojan horse,** huge, hollow wooden horse constructed by the Greeks to gain entrance into Troy during the Trojan War. The horse was built by Epeius, master carpenter and pugilist. The Greeks, pretending to desert the war, sailed to the nearby island of Tenedos, leaving behind Sinon, who persuaded the Trojans that the horse was an offering to Athena that would make Troy impregnable. Despite the warnings of Laocoon and Cassandra (*qq.v.*), the horse was taken inside. That night warriors emerged from it and opened the city's gates to the returned Greek army. The story is told at length in Book II of the

*Aeneid* and is touched upon in the *Odyssey*. The term Trojan horse has come to refer to subversion introduced from the outside.

**Trojan planets,** two groups of asteroids named for heroes of Greece and Troy in Homer's *Iliad*. These minor planets revolve around the Sun in the Lagrangian points of Jupiter's orbit. These are positions where a small body can be held, by gravitational forces, at one point of an equilateral triangle whose other points are occupied by Jupiter and the Sun. About 40 Trojan planets are known; Achilles, the first, was discovered by Max Wolf in 1906. Of the named Trojans, Achilles, Hector, Nestor, Agamemnon, Odysseus, Ajax, Antilochus, Diomedes, and Menelaus are near the Lagrangian point 60°




Jupiter's orbit and the Trojan planets

From *Sourcebook on the Space Sciences* by Samuel Glasstone. Copyright © 1965 by Litton Educational Publishing, Inc.

ahead of Jupiter. Patroclus, Priamus, Aeneas, Anchises, and Troilus are about 60° behind Jupiter.

The known Trojans undoubtedly rank among the larger asteroids but appear faint because of their great distance from the Earth. There are probably many smaller and even fainter members as yet undiscovered.

**Trojan War,** legendary conflict between the early Greeks and the people of Troy in western Anatolia, dated by later Greek authors to the 12th or 13th century BC. (*See* Troy.) The war stirred the imagination of the ancient Greeks more than any other event in their history, and was celebrated in the *Iliad* and the *Odyssey* of Homer, as well as a number of other early works now lost, and frequently provided material for the great dramatists of the Classical Age. It also figures in the literature of the Romans (*e.g.,* Virgil's *Aeneid*) and of later European peoples down to the 20th century.

In the traditional accounts, Paris, son of the Trojan king, ran off with Helen, wife of Menelaus of Sparta, whose brother Agamemnon then led a Greek expedition against Troy. The ensuing war lasted 10 years, finally ending when the Greeks pretended to withdraw, leaving behind them a large wooden horse with a raiding party concealed inside. When the Trojans brought the horse into their city, the hidden Greeks opened the gates to their comrades, who then sacked Troy, massacred its men, and carried off its women. This version was recorded centuries later; the extent to which it reflects actual historical events is not known.

**troll,** in early Scandinavian folklore, giant, monstrous being, sometimes possessing magic powers. Hostile to men, trolls lived in castles and haunted the surrounding districts after dark. If exposed to sunlight they burst or turned to stone. In later tales trolls often are man-sized or smaller beings similar to dwarfs and elves. They live in mountains, sometimes steal human maidens, and can transform themselves and prophesy. In the Shetland and Orkney islands, Celtic areas once settled by Scandinavians, trolls are called trows and appear as small malign creatures who dwell in mounds or near the sea. In the plays of the



Troll, illustration from *Norwegian Fairy Tales,* by Peter Christen Asbjørnsen and Jørgen Engebretsen Moe, 1895

By courtesy of the Folklore Society Library, University College, London; photograph, R.B. Fleming

Norwegian dramatist Henrik Ibsen, especially *Peer Gynt* (1867) and *The Master Builder* (1892), trolls are used as symbols of destructive instincts. Trolls in modern tales for children often live under bridges, menacing travelers and exacting tasks or tolls.

**Trolle, Gustav (Eriksson)** (baptized Sept. 21, 1488—d. 1535, Flensburg, Schleswig [now in Germany]), Swedish archbishop who instigated the Stockholm Bloodbath of 1520—the mass execution of 82 Swedish nobles and bishops who had fought against union with Denmark-Norway.

Trolle became archbishop of Sweden in 1514. As head of the council of state, he led the party favouring the election of King Christian II of Denmark-Norway as Swedish king. Opposing this course was Sten Sture the Younger, the Swedish regent, who succeeded in having Trolle deposed in 1517, inaugurating a period of civil war in which the archbishop was imprisoned and his official estate destroyed.

In 1518 Christian II intervened with papal approval and had Trolle reinstated. By the autumn of 1520, after Sture's death in battle, his followers recognized Christian II as king and were granted amnesty. At Trolle's insistence, however, Christian had the party leaders tried and executed for heresy in November 1520 in the Stockholm Bloodbath. Resistance to Christian was immediately rekindled, and Trolle was forced to flee to Denmark. When Christian was deposed in 1523, Trolle joined him in exile and participated in his ill-fated efforts to regain his throne. In the last of these, the Count's War (1533–36), Trolle was wounded and captured in the Battle of Øksnebjerg (June 1535). He died shortly thereafter.

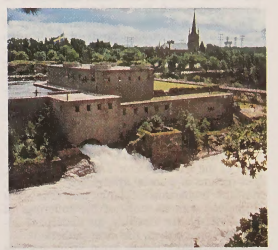
**trolley car:** *see* streetcar.

**trolleybus,** also called TRACKLESS TROLLEY, vehicle operated on the streets on rubber tires and powered by electricity drawn from two overhead wires by trolley poles. It is distinct from a trolley car, which runs on rails rather than on tires and is thus a form of streetcar.

In the late 1880s a number of small transit systems were put into operation using electric power supplied by the system of Leo Daft, of the United States, which used two overhead wires; electrical power was gathered by a small carriage, or troller, running on the wires. The troller was carried on the vehicle by a bent piece called a bow or by a collapsible and adjustable frame called a pantograph. The word trolley came from the little troller of Daft's system. Trolleybuses had the advantages of electric propulsion (more quiet operation, avoidance of fumes, and faster acceleration) and could load passengers at the curb, but they were less flexible than the motor bus.

A number of trolley installations were made in England, particularly London, and in the United States, but they were quickly replaced by buses. Trolleybuses were widely adopted by state-run urban transport systems in the Soviet Union, however, either alone or in conjunction with subways, streetcars, or buses. Other countries of eastern Europe adopted them, as did China, Switzerland, and Italy. By the late 20th century trolleybuses were still a major form of mass transit in many Russian cities, but the trend in most other countries was to replace them with buses.

**Trollhättan,** town, Älvsborg *län* (county), southwestern Sweden. Trollhättan lies along the Göta River, north-northeast of Göteborg and was once famous for its imposing water-



Hydroelectric-power station on the Göta River, Trollhättan, Swed.

Refot

falls. Although the falls are now harnessed for hydroelectricity, they sometimes are reopened in the summer. Trollhättan was incorporated as a town in 1916. Notable features of the town are the state-owned Olide and Hojum power stations, which are largely responsible for electric-power distribution in western Sweden, and the Trollhätte Canal (built 1793–1800), which connects Vänern (lake) with Göteborg and the North Sea, overcoming a difference in height of 107 feet (33 m) by means of locks. The town is dominated by manufacturing, with products ranging from heavy machinery to phosphates and plastics. Pop. (1993 est.) mun., 51,673.

**Trollhätte Canal,** waterway in Sweden, now part of the Göta Canal (*q.v.*).

**trolling,** method of fishing in which a lure or a bait is pulled behind a boat at varying speeds and depths of water according to the nature, habitat, and size of the fish being sought. Trolling is practiced in both freshwater and saltwater and with all kinds of craft; power boats to carry varied tackle and big-game gear are usually used at sea but also on inland waters, where legal. Trolling permits the fisherman to cover a wide area. Trolling for sport is usually done at relatively low speeds and with strong rods having nylon lines and heavy reels. The fisherman sits facing the stern, sometimes in a specially equipped fighting chair. Troll lines are also used by trawler fishermen for commercial catches, principally salmon and tuna.

**Trollope, Anthony** (b. April 24, 1815, London—d. Dec. 6, 1882, London), English novelist whose popular success concealed until long after his death the nature and extent of his literary merit. A series of books set in the imaginary English county of Barsetshire remains his best loved and most famous work,

but he also wrote convincing novels of political life as well as studies that show great psychological penetration. One of his greatest strengths was a steady, consistent vision of the social structures of Victorian England, which he re-created in his books with unusual solidity.

Trollope grew up as the son of a sometime scholar, barrister, and failed gentleman farmer. He was unhappy at the great public schools of Winchester and Harrow. Adolescent awkwardness continued until well into his 20s. The years 1834–41 he spent miserably as a junior clerk in the General Post Office, but he was then transferred as a postal surveyor to Ireland, where he began to enjoy a social life. In 1844 he married Rose Heseltine, an Englishwoman, and set up house at Clonmel, in Tipperary. He then embarked upon a literary career that leaves a dominant impression of immense energy and versatility.

*The Warden* (1855) was his first novel of distinction, a penetrating study of the warden of an old people's home who is attacked for making too much profit from a charitable sinecure. During the next 12 years Trollope produced five other books set, like *The Warden*, in Barsetshire: *Barchester Towers* (1857), *Doctor Thorne* (1858), *Framley Parsonage* (1861), *The Small House at Allington* (1864), and *The Last Chronicle of Barset* (serially 1866–67; 1867). *Barchester Towers* is the funniest of the series; *Doctor Thorne* perhaps the best picture of a social system based on birth and the ownership of land; and *The Last Chronicle,* with its story of the sufferings of the scholarly Mr. Crawley, an underpaid curate of a poor parish, the most pathetic.

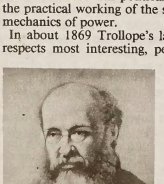
The Barsetshire novels excel in memorable characters, and they exude the atmosphere of the cathedral community and of the landed aristocracy.

In 1859 Trollope moved back to London, resigning from the civil service in 1867 and unsuccessfully standing as a Liberal parliamentary candidate in 1868. Before then, however, he had produced some 18 novels apart from the Barsetshire group. He wrote mainly before breakfast at a fixed rate of 1,000 words an hour. Outstanding among works of that period were *Orley Farm* (serially, 1861–62; 1862), which made use of the traditional plot of a disputed will, and *Can You Forgive Her?* (serially, 1864–65; 1865), the first of his political novels, which introduced Plantagenet Palliser, later duke of Omnium, whose saga was to stretch over many volumes down to *The Duke's Children* (serially, 1879–80; 1880), a subtle study of the dangers and difficulties of marriage. In the political novels Trollope is less concerned with political ideas than with the practical working of the system—with the mechanics of power.

In about 1869 Trollope's last, and in some respects most interesting, period as a writer began. Traces of his new style are to be found in the slow-moving *He Knew He Was Right* (serially, 1868–69; 1869), a subtle account of a rich man's jealous obsession with his innocent wife. Purely psychological studies include *Sir Harry Hotspur of Humblethwaite* (serially, 1870; 1871) and *Kept in the Dark* (1882). Some of the later works, however, were sharply satirical: *The Eustace Diamonds* (serially, 1871–73; 1873), a study of the influence of money on sexual relationships; *The Way We Live Now* (serially, 1874–75; 1875), remarkable for its villain-hero, the financier Melmotte; and *Mr. Scarborough's Family* (posthumously, 1883), which shows what can happen when the rights of property are wielded by a man of nihilistic temperament intent upon his legal rights.

Trollope's final years were spent in the seclusion of a small Sussex village, where he worked on in the face of gradually diminishing popularity, failing health, and increasing melancholy. He was in London when he died, having been stricken there with paralysis.

C.P. Snow's biography, *Trollope: His Life and Art* (1975), is particularly good on his government career and his gifts as a novelist.



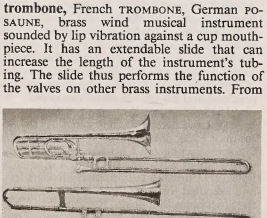
Trollope, oil painting by S. Laurence, 1865; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

**tromba marina** (musical instrument): *see* trumpet marine.

**Trombetas River,** Portuguese RIO TROMBETAS, river in northwestern Pará state, northern Brazil. Formed by the Poana, Anamu, and other headstreams flowing from the southern slope of the Serra Acaraí on the Guyana border, the Trombetas meanders generally southward for 470 mi (760 km). It forms several lakes, including Jamari and Erepecu, before joining the Amazon River upstream from Óbidos. Only the lower course of the Trombetas is navigable; elsewhere falls and rapids interrupt the river flow.

**trombone,** French TROMBONE, German POSAUNE, brass wind musical instrument sounded by lip vibration against a cup mouthpiece. It has an extendable slide that can increase the length of the instrument's tubing. The slide thus performs the function of the valves on other brass instruments. From the 19th century, some trombones have been made with valves, but their use was never universal.



(Top) Modern B♭–F trombone; (bottom) tenor trombone (sackbut) by Jörg Neuschel, Nürnberg, 1567, in the Anthony Baines Collection

By courtesy of (top) Conn Corporation, Oak Brook, Ill., (bottom) Anthony Baines; photograph, Universal Lens-Craft

The trombone is a 15th-century development of the trumpet and, until about 1700, was known as the sackbut (*q.v.*). Like a trumpet, it has a cylindrical bore flared to a bell. Its mouthpiece is larger, however, suited to its deeper musical register, and is parabolic in cross section, like a cornet. The slide is composed of two parallel and stationary inner tubes, thickened at their lower ends, and two movable outer tubes. The two sets of tubes are telescoped in and out by a cross stay manipulated by the player's right hand. The other half of the trombone, the bell joint, passes over the player's left shoulder, counterbalancing the weight of the slide. Its bend usually incorporates a tuning slide.

The most common form is the tenor trombone in B♭, sounding an octave lower than the B♭ trumpet. With the slide drawn in (first position), the notes of the harmonic series of the B♭ below the bass staff are available: B♭$_1$–B♭–f–b♭–d′–f′–a♭′ (approximately)–b♭′–c″–d″, etc. Shifting the slide a few inches to the second position allows the harmonic series of A, a semitone lower, to be sounded. Further extensions of the slide progressively lower the key of the instrument to E (seventh position). A chromatic (12-note) scale is thus available from E below the bass staff, the highest note of the range being determined by the player's ability.

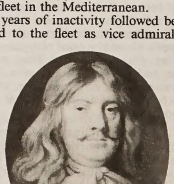
Many orchestral instruments are B♭–F trombones. These have an F attachment consisting of a coil of extra tubing placed in the loop of the bell. A rotary valve actuated by the player's left thumb connects this attachment to the main tube, thus lowering the pitch of the instrument by a fourth. The scale can then be extended down to C, the additional low notes being known as fundamentals, or "pedals." Trombones vary in bore. The older bore, no wider than that of a trumpet, was largely superseded by medium and large bores with wider bells, reaching 9½ inches (24 centimetres) in diameter. The widest bores are made for playing bass trombone parts. The mid-20th-century vogue of the trombone as a virtuoso instrument in dance music is mainly associated with a B♭ tenor instrument of medium-large bore, but most larger dance and jazz orchestras include a bass trombone in the section.

Trombones of the 16th century differ from 20th-century models in little but narrow bells and details of craftsmanship. They were extensively used in polyphonic (many-voiced) music and were built in alto, tenor, and bass sizes, the treble part being supplied by the cornett—a wooden, lip-vibrated instrument with finger holes. The old arrangement survives in the trombone trio of classical orchestration, the parts being written in the old alto, tenor, and bass vocal clefs. In brass bands the tenor trombone is written in the treble clef to sound an octave lower.

**Tromp, Cornelis (Maartenszoon)** (b. Sept. 9, 1629, Rotterdam—d. May 29, 1691, Amsterdam), Dutch admiral, second son of Maarten Tromp. He commanded a series of actions against England, France, and Sweden.

After serving as a lieutenant of his father's ship in 1645, Cornelis became a captain in 1649. He fought the North African pirates in the Mediterranean (1650) and the British in the First Anglo-Dutch War. After taking part in the Battle of Leghorn (1653) against the English, he was made a rear admiral. He always showed a strong need for independent action and found pleasure in a fiery battle. In 1654 he fought the Algerians and in 1656 sailed to the Baltic to take part in the First Northern War (1655–60) between Sweden and Poland. In 1663 he was appointed commander of the Dutch fleet in the Mediterranean.

Some years of inactivity followed before he returned to the fleet as vice admiral (1665)



Cornelis Tromp, detail of an oil painting by Sir Peter Lely and Willem van de Velde; in the Nederlandsch Historisch Scheepvaart Museum, Amsterdam

By courtesy of the Nederlandsch Historisch Scheepvaart Museum, Amsterdam

during the Second Anglo-Dutch War. In 1666 he was promoted to lieutenant admiral of the Admiralty of the Maas and made commander in chief of the Dutch fleet; but, when Adm. Michiel de Ruyter returned from the West Indies, the older and more experienced officer was given Tromp's commission, which caused understandable bitterness on Tromp's part. In 1666 he switched to the Admiralty of Amsterdam and soon came into conflict with de Ruyter. A more serious conflict arose in July 1666 after de Ruyter blamed his defeat by the English on the lack of assistance received from Tromp. This led to the withdrawal of Tromp's commission as lieutenant admiral, after which he left the navy.

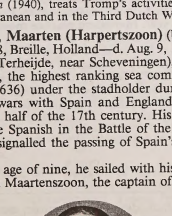
In 1673 Prince William III of Orange was able to reconcile de Ruyter with Tromp, who was a well-known sympathizer of the House of Orange. He was restored as lieutenant admiral of the Admiralty of Amsterdam and fought with de Ruyter in the battles of Schooneveld and Kijkduin in the same year. After the Treaty of Westminster (1674), between England and the Netherlands, he cruised the French coast and then, contrary to his instructions, sailed off to the Mediterranean on an expedition that was unsuccessful. He was censured by the Admiralty.

In 1676 Tromp became commander in chief of a combined Danish–Dutch fleet that operated against Sweden and stayed in Danish service until 1678. Afterward he helped the Elector of Brandenburg to recover the island of Rügen from Sweden. He then returned to Holland and in 1691 received command of the fleet as lieutenant admiral general of the republic; but, being ill, he did not sail and soon died. He had been made a baronet by Charles II of England and a count by the King of Denmark.

BIBLIOGRAPHY. A. Hallema, *Cornelis Maertenszoon Tromp, 1629–1691* (1942); J.C.M. Warnsinck, *Twaalf doorluchtige zeehelden* (1941), contains a brief biography; *Van vlootvoogden en zeeslagen* (1940), treats Tromp's activities in the Mediterranean and in the Third Dutch War.

**Tromp, Maarten (Harpertszoon)** (b. April 23, 1598, Breille, Holland—d. Aug. 9, 1653, at sea off Terheijde, near Scheveningen), Dutch admiral, the highest ranking sea commander (from 1636) under the stadholder during the Dutch wars with Spain and England during the first half of the 17th century. His victory over the Spanish in the Battle of the Downs (1639) signalled the passing of Spain's power at sea.

At the age of nine, he sailed with his father, Harpert Maartenszoon, the captain of a small



Maarten Tromp, engraving by Cornelis Danckerts de Ry, 1639

By courtesy of the Nederlandsch Historisch Scheepvaart Museum, Amsterdam

man-of-war. When his father changed to the merchant fleet, Maarten accompanied him, but in 1609 the ship was taken by an English pirate, his father was killed, and Maarten was forced to serve the pirate captain for two years.

After his return to Holland, he rejoined the navy in 1617 and took part in a successful expedition against Algerian pirates. In 1619 he left the navy to sail with a merchant fleet to the Mediterranean, but in 1621 he fell once more into the hands of pirates. Set free after a year, he became a lieutenant in the Dutch navy. In 1621 the Twelve Years' Truce between the Netherlands and Spain expired, and it became necessary to prepare the fleet for war. In 1624 Tromp received his first commission as a captain, and five years later he commanded the flagship against pirates from Ostend. In 1634 he again left the navy, but in 1636 he returned and was soon appointed lieutenant admiral of Holland, at that time the highest post in the navy under the stadholder, who was also the admiral general of the republic. In February 1639, he defeated a fleet of Dunkirk privateers; he then met a large Spanish armada that was transporting some 13,000 Spanish recruits to Flanders. Commanded by Adm. Antonio de Oquendo and several other experienced captains, the fleet consisted of 45 warships and 30 merchantmen hired as troopships. When Tromp spotted the armada off Beachy Head on Sept. 15, 1639, he had only 13 vessels at his command; his other detachments were cruising in the Strait of Dover and off Dunkirk. More Dutch ships arrived the next day, and the Dutch captains decided to give battle. After six hours of fighting, the armada—overcrowded with recruits who accounted for an extremely high number of casualties—withdrew to repair damages. The next day no action could take place for lack of wind, but the Dutch were reinforced by a Zeeland squadron, and, in the early morning of September 18, Tromp attacked the Spaniards in the Strait of Dover. In the afternoon Oquendo withdrew into the neutral roadstead of the Downs. Tromp, after taking in fresh supplies of gunpowder at Calais, soon followed him there, only to be separated from him by an English squadron under the command of Sir John Penington. By October 10 the Dutch fleet was strong enough to challenge the Spaniards, and on October 21 Tromp attacked Oquendo, and Penington's efforts at protection were of little avail. In the Battle of the Downs, the armada was completely defeated, suffering severe losses in both ships and manpower. Tromp was knighted by Louis XIII in 1640 and by Charles I in 1642 when he visited Dover to escort Queen Henrietta Maria and Princess Mary to Holland.

Tromp's main task during the next years was action against the Dunkirk pirates who continued to attack the Dutch merchant fleet. In 1646 Tromp helped the French capture Dunkirk, after which the Order of St. Michael was conferred upon him. After the Peace of Westphalia in 1648, which concluded the Thirty Years' War, the activities of the Dutch navy diminished until, in 1651, growing privateering between Scandinavia and Gibraltar made it necessary to reinforce the neglected fleet and to protect maritime trade. Relations with England became increasingly strained after the Navigation Act (1651), which was passed to restrict Dutch trade with British possessions, while much resentment was also caused by the English claim to sovereignty over the seas.

A skirmish with Adm. Robert Blake off Dover in May 1652 resulted in the First Anglo-Dutch War, which marked a crisis in the rivalry between England and the Netherlands as carriers of world trade. Although Tromp was unable to stir the English admirals to action later in the year—for which he was censured by the Dutch authorities, who even kept him from his command for some months—he defeated Blake off Dunge Ness in December. But the English fleet was superior to the Dutch; Tromp was unable to continue his successes and lost the three-day battle between Portland and Calais (March 1653), as well as the Battle of Gabbard in June. Tromp was killed in the battle off Terheijde near Scheveningen.

BIBLIOGRAPHY. M.G. de Boer, *Tromp en de Duinkerkers* (1949); C.R. Boxer (ed.), *The Journal of Maarten Harpertszoon Tromp Anno 1639* (1930), a translation of the original manuscript with introduction; "M.H. Tromp, 1598–1653," *The Mariner's Mirror*, 40:33–54 (1954), an excellent survey of Tromp's life with useful bibliography; F. Graete, *De kapiteinsjaren van Maerten Harpertszoon Tromp. Bewerkt door M. Simon Thomas* (1938), treats the period of Tromp's life from 1624 until 1634; J.K. Oudendijk, *Maerten Harpertszoon Tromp*, 2nd ed. (1952), is still the best biography available but without source indications.

**trompa** (musical instrument): *see* horn.

**trompe l'oeil** (French: "deceive the eye"), in painting, the representation of an object with such verisimilitude as to deceive the viewer concerning the material reality of the object. This idea appealed to the ancient Greeks who were newly emancipated from the conventional stylizations of earlier art. Zeuxis, for example, reportedly painted such realistic grapes that birds tried to eat them. The technique was also popular with Roman muralists. Although trompe l'oeil never achieved the status of a major artistic aim, from the early Renaissance on, European painters occasionally fostered illusionism by painting false frames out of which the contents of a still life or portrait appeared to spill, or by creating window-like images suggesting actual openings in the wall or ceiling.

In Italy in the 15th century an inlay work known as intarsia was used on choir stalls and in sacristies, frequently as trompe l'oeil views of cupboards with different articles seen upon the shelves through half-open doors. In America the 19th-century still-life painter William Harnett became famous for his card-rack paintings, on which are depicted various cards and clippings with such verisimilitude that the viewer becomes convinced that they can be lifted off the painted rack. In the late 20th century, muralist Richard Haas painted the exteriors of entire buildings in trompe l'oeil, primarily in Chicago and New York City. Aaron Bohrod was one of the foremost 20th century practitioners of small-scale trompe l'oeil.

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*Where the same name may denote a person, place, or thing, the articles will be found in that order*

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**Troms,** *fylke* (county), extreme northern Norway, entirely situated north of the Arctic Circle. It has a very rugged and indented coastline facing the Norwegian Sea (west), and there are many large offshore islands. Part of Hinnøya, Norway's largest permanently inhabited island, is in the *fylke*. To the south and east it adjoins Sweden and a small projection of Finland. Troms has an area of 10,021 sq mi (25,954 sq km). Of the coastline's many fjords, the largest is Lyngenfjorden. The *fylke* is mainly mountainous; much of its interior supports only livestock raising (sheep and goats). Along the coast and on the islands, fishing is dominant. The city of Tromsø, in the north central part, is the county seat and an Arctic seaport.

There are no railroads in the *fylke,* and the road network is poorly developed because of the sparse population and rough terrain. Communications are by coastal shipping and internal air services (Bardu and Tromsø airfields) and locally by bus and boat. Pop. (1983 est.) 147,709.

**Tromsø,** town and seat of Troms *fylke* (county), northern Norway. It is located on Tromsøy (island) just west of the Norwegian mainland and in the geographical region of Nord-Norge. Because it is located well north

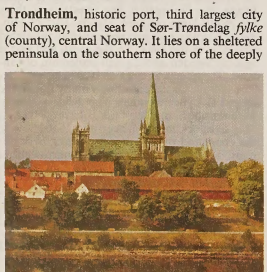
of the Arctic Circle, the sun is visible continuously from late May to late July. The town was established around 1250 and received its town charter in 1794. By the end of the 19th century, it had become a major Arctic trade centre from which many Arctic expeditions originated. During World War II it served briefly as the seat of Norwegian government. Tromsø has Norway's major Arctic fishery, sealing, and shipping facilities, and local industry deals mainly with storing and processing fish. It is the home of the Institute of Meteorology, a university, and a geological observatory. The Tromsø Museum contains maritime exhibits and Norwegian and Lapp folklore displays. Pop. (1991 est.) mun., 51,261.

**trona,** an evaporite mineral, hydrated sodium bicarbonate [$Na_3H(CO_3)_2 \cdot 2H_2O$], occasionally encountered as a saline lake deposit or evaporation product and as an efflorescence on arid soil. Usually associated with natron, thermonatrite, halite, and gypsum, it occurs near Memphis, in the Lower Nile Valley; widely in the soda lakes of Africa, Armenia, Iran, and the western United States; and in the alkali deserts of Mongolia and Tibet. For detailed physical properties, *see* carbonate mineral (table).

**Trøndelag,** geographical region, central Norway, surrounding Trondheimsfjorden. Its area of 15,978 sq mi (41,383 sq km) embraces the counties of Nord-Trøndelag and Sør-Trøndelag. The region is very mountainous, with only small strips of lowlands along the coast, fjords, and interior river valleys. The coastline is rugged and cut by many fjords, the main one being Trondheimsfjorden (*q.v.*), which extends about 80 mi (130 km) inland. Much of the coast is protected by offshore islands, and many lakes dot the interior mountains. The largest river in the region, the Namsen, flows through Namdalen (valley) in the north, while the Nordland Railway and highway, which link northern and southern Norway, also traverse the valley.

The major population and commercial centre of the region is the port of Trondheim (*q.v.*), third largest city in Norway and the administrative centre of Sør-Trøndelag; Steinkjer (*q.v.*; the administrative centre of Nord-Trøndelag), Namsos, and Levanger are other important towns. Lumbering, fishing, farming, manufacturing, shipping, and mining are the basis of the regional economy. Tourism is also important, especially in Trondheim and all along Trondheimsfjorden. Pop. (1991 est.) 378,415.

**Trondheim,** historic port, third largest city of Norway, and seat of Sør-Trøndelag *fylke* (county), central Norway. It lies on a sheltered peninsula on the southern shore of the deeply



Nidaros Cathedral as seen across the Nidelva (river), Trondheim, Nor.
Toni Schneiders

indented Trondheimsfjorden at the mouth of the Nidelva (river), 23 mi (37 km) southeast of the Norwegian Sea.

It was founded in 997 by King Olaf I Tryggvason as the village of Kaupangr; he built a church and a royal residence, Kongsgård, there. The city gained importance as a pilgrimage centre, spurred by the legend of the miraculous preservation of the body of King Olaf II Haraldsson (later St. Olaf ), who had been buried there after his death in battle at nearby Stiklestad (1030). The first church was built on the site of Olaf's grave in 1075; the present edifice, Nidaros Cathedral (12th–14th century; in Norman–Gothic style), is one of the finest churches in Scandinavia. It has frequently been damaged and rebuilt; the latest reconstruction, begun in 1869, is still incomplete. The bishopric of Nidaros was formed in 1152.

During the next 200 years the city prospered as a trade and shipping centre but declined after the German Hanseatic merchants gained control of northern Europe's trade and made Bergen their chief port. The city continued to wane until the late 19th century; its wooden buildings have been devastated by fire no less than 15 times in the last 500 years. It suffered major damage in the 17th-century wars with Sweden. Trondheim's modern expansion dates from 1877, when the first rail link with Oslo was completed. In 1921 a second, more direct rail line was finished.

Trondheim is now a major land and sea transport link of Norway, connecting the more densely settled south with the far-northern regions. It is also a manufacturing centre (metal and paper products, bricks and tiles, textiles); food processing (especially fish) is important.

The cathedral is a national shrine and the traditional coronation place for Norway's kings, although Olaf V omitted the ceremony on his succession to the throne in 1957. Other important sites are Erkebispegården (the archbishop's residence); Stiftsgården (royal residence; a huge all-wooden structure); museums of natural history, industrial arts, music, folklore, and art; the Church of Our Lady, Munkholmen monastery; and the Kristiansten Fortress. The seat of the Royal Norwegian Society of Sciences (1760) is in Trondheim, as is the University of Trondheim (formerly the Norwegian Institute of Technology, founded 1900; achieved university status 1970).

The city has undergone changes in name and (1964) expanded its boundaries considerably. Kaupangr, the original village, was renamed Nidaros ("estuary of the Nid River") in 1016; the name was changed to Trondhjem in the 16th century, back to Nidaros in 1930, and, after opposition by the populace, back to Trondheim (reformed spelling) in the following year. Pop. (1991 est.) mun., 138,126.

**Trondheimsfjorden,** fjord, in the Norwegian Sea, indenting the coasts of Sør-Trøndelag and Nord-Trøndelag *fylker* (counties), west central Norway. Extending some 80 mi (130 km) inland, it serves as a natural boundary between northern and southern Norway. Trondheimsfjorden branches into many smaller fjords, the most important being Orkedalsfjorden in the southwest, Strindfjorden and Asenfjorden in the east, and Beitstadfjorden in the northeast; it also has some islands, of which Ytterøy, near its head, is the largest. The fjord is bordered by a narrow strip of rich agricultural land that quickly gives way to steep mountains. Trondheim, the major export city for the area and third largest city in Norway, lies along the southern shore of the fjord; the town of Verdalsøra is situated at its head.

**Troodos Mountains,** mountain range in southern Cyprus beginning immediately inland from Cape Arnauti. It rises to its highest point at Mt. Olympus, or Khionistra (6,401 ft [1,951 m]), about 35 mi (56 km) southwest of Nicosia, and gradually descends to narrow coastal strips on the south and west and to the central lowlands on the north. The Troodos is a massif of eroded igneous rock dissected by steep valleys covered with stands of pine, cypress, dwarf oak, and cedar, now protected as state forests; its peaks are snow clad from December to March. Since Roman times, copper has been mined; chrome and asbestos are also extracted. Most of the island's rivers descend from its heights. Pano Platres (3,950 ft) and Prodhromos (4,900 ft) are popular resorts.

**troparion,** short hymn or stanza sung in Greek Orthodox religious services. The word probably derives from a diminutive of the Greek *tropos* ("something repeated," "manner," "fashion"), with a possible analogy to the Italian *ritornello* ("refrain"; diminutive of *ritorno,* "return"). Since the 5th century, *troparion* also has designated brief phrases inserted after psalm verses.

*Troparia* vary in length from one or two verses to long poems. After the introduction of the kontakion, a type of sung religious poetry, into Byzantium in the 6th century, individual kontakion stanzas were often called *troparia.* So also, from the 8th century, were stanzas of another sung religious form, the *kanōn.* The early *troparion* was also called *stichēron* (probably from *stichos,* "verse"); and a very brief refrain may have been called *syntomon* ("concise," "brief "). Other designations of *troparia* reflect their liturgical position, manner of performance, or content. Heōthinon ("in the morning") refers to the 11 hymns used only in the morning office; *hypakoē* (from "to respond") was originally a responsorial hymn (having soloist-chorus alternation); *katabasia* (from "to descend") refers to the singing of an ode by left and right choirs descending from their stalls and singing in the middle of the church; *theotokion,* from Theotokos (Mother of God), is a type of hymn relating to the Virgin Mary; and *staurotheotokion* relates to the Virgin standing at the foot of the cross. There are also *troparia* for specific feasts and others that recur several times during the church year. In modern practice most *troparia* are recited, although a few are still chanted. One that has retained a special place in the liturgy is "Ho Monogenēs" ("The Only Begotten Son"), believed to have been written by the Byzantine emperor Justinian I (reigned 527–565). *See also* Byzantine chant.

*Consult the* INDEX *first*

**trope,** in medieval church music, melody, explicatory text, or both added to a plainchant melody. Tropes are of two general types: those adding a new text to a melisma (section of music having one syllable extended over many notes); and those inserting new music, usually with words, between existing sections of melody and text.

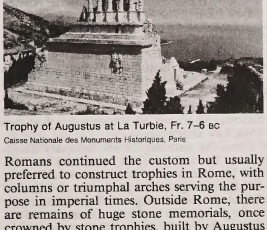
Troping was rooted in similar practices in the ancient Byzantine liturgy and arose in the West, probably in France, by the 8th century. The custom reached the musically important Swiss monastery of Saint Gall by the 9th century and soon became widespread throughout Europe. It was abolished in the 16th century by the Council of Trent.

Two important medieval musical-literary forms developed from the trope: the liturgical drama and the sequence (*qq.v.*). A troped chant is sometimes called a farced (*i.e.,* interpolated) chant.

**trophic level,** step in a nutritive series, or food chain, of an ecosystem. The organisms of a chain are classified into these levels on the basis of their feeding behaviour. The first and lowest level contains the producers,

green plants. The plants or their products are consumed by the second-level organisms—the herbivores, or plant eaters. At the third level, primary carnivores, or meat eaters, eat the herbivores; and at the fourth level, secondary carnivores eat the primary carnivores. These categories are not strictly defined, as many organisms feed on several trophic levels; for example, some carnivores also consume plant materials or carrion and are called omnivores, and some herbivores occasionally consume animal matter. A separate trophic level, the decomposers or transformers, consists of organisms such as bacteria and fungi that break down dead organisms and waste materials into nutrients usable by the producers.

**trophy** (from Greek *tropaion,* from *tropē,* "rout"), in ancient Greece, memorial of victory set up on the field of battle at the spot where the enemy had been routed. It consisted of captured arms and standards hung upon a tree or stake in the semblance of a man and was inscribed with details of the battle along with a dedication to a god or gods. After a naval victory, the trophy, composed of whole ships or their beaks, was laid out on the nearest beach. To destroy a trophy was regarded as a sacrilege since, as an object dedicated to a god, it must be left to decay naturally. The



Trophy of Augustus at La Turbie, Fr. 7–6 BC
Caisse Nationale des Monuments Historiques, Paris

Romans continued the custom but usually preferred to construct trophies in Rome, with columns or triumphal arches serving the purpose in imperial times. Outside Rome, there are remains of huge stone memorials, once crowned by stone trophies, built by Augustus in 7/6 BC at La Turbie (near Nice, Fr.) and by Trajan *c.* AD 109 at Adamclisi in eastern Romania.

**tropic bird,** any member of three seabird species that constitute the family Phaethontidae (order Pelicaniformes). Tropic birds are characterized by pairs of streaming central tail feathers, which may be as long as the bird's body. Sailors call them marlin-spikes and bosun birds. Tropic birds have satiny white plumage, sometimes tinged with pink or orange, and black markings across the eyes and on the wings. They nest in island colonies, usually on cliffs, and plunge into the water for fish or squid. The single grayish-speckled egg, laid on bare ground, is incubated by both parents for about a month; the young are fully fledged about 10 weeks later.

Largest of the three species is the red-tailed tropic bird, *Phaethon rubricauda* (to 50 centimetres [20 inches], excepting the red streamers), of the Indian and Pacific oceans.

**Tropic of Cancer:** *see* Cancer and Capricorn, Tropics of.

**Tropic of Capricorn:** *see* Cancer and Capricorn, Tropics of.

**tropical cyclone,** severe atmospheric disturbance in the tropical oceans between latitudes of approximately 5° and 30° in both hemispheres. These storms are characterized by very low atmospheric pressures in the calm, clear centre of a circular structure of rain, cloud, and very high winds. In the western Atlantic and the Caribbean they are called hurricanes; in the western Pacific, typhoons; and in western Australia, willy-willies (if the surface winds exceed 117 kilometres [73 miles] per hour).

A brief treatment of tropical cyclones follows. For full treatment, *see* MACROPAEDIA: Climate and Weather.

Tropical cyclones are cyclonic whirls 80 to 800 kilometres (50 to 500 miles) in diameter; the winds near the centre form an almost circular vortex with a slight inward motion toward the centre near the ocean surface. Because of the Earth's rotation, the vortex circulation is clockwise in the Southern Hemisphere and counterclockwise in the Northern. The areal extent of tropical cyclones is small compared with storms outside the tropics, but the violence of the weather within the disturbed zone is usually far greater. Sustained winds in excess of 160 kilometres (100 miles) per hour are common near the centre, and winds twice that strong have occurred. Very close to the centre of mature cyclones, however, the winds drop abruptly from their extreme maximum to light breezes or even to complete calm. This central circular calm area bears the name eye of the storm and has an average diameter of 24 kilometres (15 miles). The lowest sea-level pressures on Earth occur in or near the eye of a hurricane.

All tropical storms develop over water that is warm enough to supply appreciable quantities of vapour to the air. Most storms develop along the equatorial convergence zone, where the trade winds of both hemispheres meet. This zone changes position with the seasons, penetrating to about latitude 15° N between July and October and to latitude 10°–15° S from January to March or April. These months represent the principal cyclone seasons of the respective hemispheres. The formation of the storms is most frequent farthest from the Equator, where the Coriolis effect (clockwise or counterclockwise rotation due to the rotation of the Earth) is greater (the effect is zero at the Equator).

As the warm water evaporates, moist air is carried aloft, where it condenses, releases latent heat, and is warmed further. This warming strengthens the updraft, and a low-pressure area is created in the lower atmosphere. Surrounding air moves into this low-pressure region and feeds the updraft. The Coriolis effect causes the developing storm to spiral, and it continually draws energy from the condensation of lifted water vapour. After several days of intensification, this process produces a mature traveling cyclone.

Dissipation of the storms over the tropical oceans is rare. When removed from their oceanic moisture source, however, they lose intensity; even passage over smaller islands of the tropics can result in great reductions in strength.

**tropical medicine,** medical science applied to diseases that occur primarily in countries with tropical or subtropical climates. Tropical medicine arose during the 19th century when physicians charged with the medical care of colonists and soldiers first encountered infectious diseases unknown in the temperate European climate. Several major advances in the control of tropical diseases occurred in the last quarter of the 19th century. Sir Patrick Manson showed that the parasite that caused filariasis was transmitted by mosquito bites. Other tropical diseases were also soon shown to be spread by mosquitoes, including malaria in 1898 and yellow fever in 1900. Within a few years the role of the tsetse fly in transmitting sleeping sickness, the sand fly in kala-azar, the rat flea in plague, the body louse in epidemic typhus, and the snail in spreading schistosomiasis were also discovered. Most early efforts to control tropical diseases involved such measures as the rigorous draining of swamps and other mosquito-breeding areas. These and other environmental measures continue to be among the most effective available, although the introduction of new antibiotics has also had an impact on some common tropical diseases.

The destructive social and economic effects of tropical diseases soon caused the research emphasis to shift from clinical practitioners in the tropics to organized research institutes in Britain and other colonizing countries. National and international commissions were organized by the colonial powers to eradicate plague, malaria, cholera, yellow fever, and other common tropical conditions, at least from areas in which Europeans lived and worked. The first schools devoted to the study of tropical medicine were founded in England in 1899, and many others soon followed. Following the achievement of independence by most former colonies in the 1960s, those nations' independent governments took over most research and prevention efforts, though continuing to receive help from the World Health Organization and from their mother countries as well.

**tropical rain forest:** *see* rain forest.

**tropical splenomegaly** (disease): *see* kala-azar.

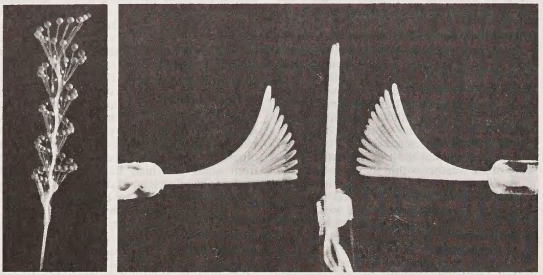
**tropical sprue,** an acquired disease characterized by the small intestine's impaired absorption of fats, vitamins, and minerals. Its cause is unknown; infection, parasite infestation, vitamin deficiency, and food toxins have been suggested as possible causes. It is found primarily in the Caribbean, southeast Asia, India, and areas in which polished rice is a staple food. Sprue often attacks middle-aged adults and is commonly caused by bacterial contamination of the small intestine, which in turn is responsible for inadequate fat digestion and absorption.

The onset of the disease is insidious. In the initial phase complaints include fatigue, weakness, loss of appetite, severe vomiting, dehydration, and numerous bulky, frothy, greasy, light-coloured stools. In infants and children, sometimes weeks or months elapse before a typical pattern is revealed. Often profound behavioral changes occur, as temper and irritability alternate with timidity and withdrawal signs. Notable is the sad, fretful facial expression of youngsters so afflicted. The second stage follows in three to six months with prominent weight loss, inflamed and painfully fissured tongue, fissures of the mouth lining, and swelling and scaling of the lips accompanied by changes in the cornea (hyperkeratosis). If the disease progresses to the third stage, severe anemia and imbalance of protein (*e.g.,* albumins, globulins) and electrolytes (*e.g.,* sodium, potassium, and chlorine in solution) may precipitate total debilitation.

Dramatic improvement occurs after administering folic acid, a chemical of the vitamin B complex found in leafy vegetables and liver and also produced synthetically. Tropical sprue is to be distinguished from celiac disease (*q.v.*), which is also called nontropical sprue.

**tropism,** response or orientation of a plant or certain lower animals to a stimulus that acts with greater intensity from one direction than another. It may be achieved by active movement or by structural alteration. Forms of tropism include phototropism (response to light), geotropism (response to gravity), chemotropism (response to particular substances), hydrotropism (response to water), thigmotropism (response to mechanical stimulation), traumatotropism (response to wound lesion), and galvanotropism, or electrotropism (response to electric current). Most

tropic movements are orthotropic; *i.e.*, they are directed toward the source of the stimulus. Plagiotropic movements are oblique to the direction of stimulus. Diatropic movements are at right angles to the direction of stimulus.



*Tropism*
(Left) Phototropism shown in the multiple exposure of a fungus fruiting body; (right) geotropism shown in the multiple exposure of oat coleoptiles
By courtesy of (left) D. Dennison, Dartmouth College, Hanover, N.H., photograph; (right) Gerard

**Tropites,** genus of extinct cephalopods (animals similar to the modern squid and octopus but with an external shell) found as fossils in marine rocks of the Late Triassic Period (from 230 to 208 million years ago). Because of its narrow time range, *Tropites* is a good index fossil (useful for stratigraphic correlations). *Tropites* is characterized by a distinctive, easily recognizable, globular shell within a central keel.



*Tropites*
By courtesy of the trustees of the British Museum (Natural History); photograph, Imtor

**troposphere,** lowest region of the atmosphere, bounded by the Earth beneath and the stratosphere above, with its upper boundary being the tropopause, about 10–13 km (6–8 miles) above the Earth's surface. The troposphere is marked by decreasing temperature with height and is distinguished from the overlying stratosphere by the nearly constant temperature with height of the latter region. Most of the clouds and weather systems are contained within the troposphere.

**Troppau** (Czech Republic): *see* Opava.

**Troppau, Congress of** (October–December 1820), meeting of the Holy Alliance powers, held at Troppau in Silesia (modern Opava, Czech Republic), at which the Troppau protocol, a declaration of intention to take collective action against revolution, was signed (Nov. 19, 1820). Attended by Francis I of Austria, Alexander I of Russia, and Frederick William III of Prussia, their foreign ministers, and observers from Britain and France, the congress decided to intervene in Naples against the democratic revolution there (July 1820). Having excluded France and Britain from its talks, it also adopted a protocol, generally asserting that states having undergone revolutions would be excluded from the European alliance, that the allied powers would not recognize illegal changes in such states, and that the powers would use force to restore them to the alliance. Austria, Russia, and Prussia then invited the king of the Two Sicilies to attend a congress at Laibach to determine the conditions of the intervention in Naples. Britain and France, however, refused to accept the protocol, demonstrating the division between the eastern and western members of the Quintuple Alliance and seriously weakening it.

**Trossachs, The,** tourist area in the highlands of Central region, Scotland. In popular usage the name is applied to the rugged country extending west of Callander to Loch Katrine but strictly refers to that part of the glen between Loch Achray and the lower end of Loch Katrine. Much of its Victorian fame derived from the poet William Wordsworth's tour in 1804 and the novelist Sir Walter Scott's description in *The Lady of the Lake* and *Rob Roy.* Since 1919 the mountainsides have been extensively planted with conifers.

**trot,** two-beat gait of a horse in which the feet are lifted and strike the ground in diagonal pairs—the right hind and left fore almost simultaneously; then the left hind and right fore. As the horse springs from one pair of legs to the other, twice in each stride all of its legs are off the ground at once.

A rider astride a trotting horse either sits in the saddle and is bumped as the horse springs, or rises to the trot, to allow more weight to bear on the stirrups when one or the other of the diagonal pairs of legs leaves the ground. This latter action, termed posting, reduces the impact of the trot on rider and horse. Trotters are also tried in harness racing.

An extended trot, unlike a collected gait, allows the head and neck of the horse to extend forward. The passage, or elevated trot, and the piaffer, or trot in place, are variations of the three-gaited or collected trot. For record times, *see* Sporting Record: *Horse racing.*

**Trotsky, Leon,** byname of LEV DAVIDOVICH BRONSHTEIN (b. Nov. 7 [Oct. 26, Old Style], 1879, Yanovka, Ukraine, Russian Empire—d. Aug. 20, 1940, Coyoacán, Mex., near Mexico City), Communist theorist and agitator, a leader in Russia's October Revolution in 1917 and later commissar of foreign affairs and of war in the Soviet Union (1917–24). In the struggle for power following Vladimir Ilich Lenin's death, however, Joseph Stalin emerged as victor, while Trotsky was removed from all positions of power and later exiled (1929). He remained the leader of an anti-Stalinist opposition abroad until his assassination by a Stalinist agent.

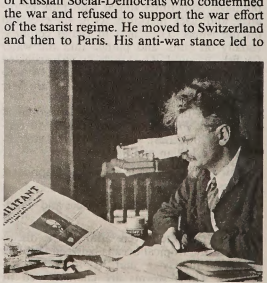
*Early life, education, and revolutionary career.* Trotsky's father, David Bronshtein, was a farmer of Russified Jewish background who had settled as a colonist in the steppe region, and his mother, Anna, was of the educated middle class. He had an older brother and sister and two siblings who died in infancy. At the age of eight, he was sent to school in Odessa, where he spent eight years with the family of his mother's nephew, a liberal intellectual. When he moved to Nikolayev in 1896 to complete his schooling, he was drawn into an underground Socialist circle and introduced to Marxism. After briefly attending the University of Odessa he returned to Nikolayev to help organize the underground South Russian Workers' Union.

In January 1898, Bronshtein was arrested for revolutionary activity and spent four and a half years in prison and in exile in Siberia (during which time he married his coconspirator Aleksandra Sokolovskaya and fathered two daughters). He escaped in 1902 with a forged passport bearing the name Trotsky, which he adopted as his revolutionary pseudonym. His wife remained behind, and the separation became permanent. Trotsky made his way to London, where he joined the group of Russian Social-Democrats working with Vladimir Ulyanov (Lenin) on the revolutionary newspaper *Iskra* ("The Spark").

At the Second Congress of the Russian Social-Democratic Workers' Party, held in Brussels and London in July 1903, Trotsky sided with the Menshevik faction—advocating a democratic approach to Socialism—against Lenin and the Bolsheviks. Shortly before this, in Paris, Trotsky had met and married Natalya Sedova, by whom he subsequently had two sons, Lev and Sergey.

Upon the outbreak of revolutionary disturbances in 1905, Trotsky returned to Russia. He became a leading spokesman of the St. Petersburg Soviet (council) of Workers' Deputies when it organized a revolutionary strike movement and other measures of defiance against the tsarist government. In the aftermath, Trotsky was jailed and brought to trial in 1906. While incarcerated Trotsky wrote one of his major works, "Results and Prospects," setting forth his theory of permanent revolution.

In 1907, after a second exile to Siberia, Trotsky once again escaped. He settled in Vienna and supported himself as a correspondent in the Balkan Wars of 1912–13. At the outbreak of World War I, Trotsky joined the majority of Russian Social-Democrats who condemned the war and refused to support the war effort of the tsarist regime. He moved to Switzerland and then to Paris. His anti-war stance led to



Trotsky
H. Roger-Viollet

his expulsion from both France and Spain. He reached New York City in January 1917, where he joined the Bolshevik theoretician Nikolay Bukharin in editing the Russian-language paper *Novy Mir* ("The New World").

*Leadership in the Revolution of 1917.* Trotsky hailed the outbreak of revolution in Russia in February (March, N.S.) as the opening of the permanent revolution he had predicted. He reached Petrograd in mid-May and assumed the leadership of a left-wing Menshevik faction. Following the abortive July Days uprising, Trotsky was arrested in the crackdown on the Bolshevik leadership carried out by Aleksandr Kerensky's liberal government. In August, while still in jail, Trotsky was formally admitted to the Bolshevik Party and was also elected to membership on the Bolshevik Central Committee. He was released from prison in September and shortly afterward was elected chairman of the Petrograd Soviet of Workers' and Soldiers' Deputies.

When fighting was precipitated by an ineffectual government raid early on November 6 (October 24, O.S.), Trotsky took a leading role in directing countermeasures for the soviet, while reassuring the public that his Military Revolutionary Committee meant only to defend the Congress of Soviets. Governmental authority crumbled quickly, and Petrograd was largely in Bolshevik hands by the time Lenin reappeared from the underground on November 7 to take direct charge of the Revolution and present the Congress of Soviets with an accomplished fact when it convened next day.

Trotsky continued to function as the military leader of the Revolution when Kerensky vainly attempted to retake Petrograd with loyal troops. He organized and supervised the forces that broke Kerensky's efforts at the Battle of Pulkovo on November 13. Immediately afterward, he joined Lenin in defeating proposals for a coalition government including Mensheviks and Socialist Revolutionaries.

*Role in Soviet government.* As foreign commissar, Trotsky's first charge was to implement the Bolsheviks' program of peace by calling for immediate armistice negotiations among the warring powers. Germany and its allies responded, and in mid-December peace talks were begun at Brest-Litovsk, though Trotsky continued vainly to invite support from the Allied governments. In January 1918, Trotsky entered into the peace negotiations personally and shocked his adversaries by turning the talks into a propaganda forum. He then recessed the talks and returned to Petrograd to argue against acceptance of Germany's annexationist terms, even though Lenin had meanwhile decided to pay the German price for peace and thus buy time for the Soviet state. Between Lenin's position and Bukharin's outright call for revolutionary war, Trotsky proposed the formula "no war, no peace." When the Germans resumed their offensive in mid-February, the Bolshevik Central Committee was compelled to make a decision; Trotsky and his followers abstained from the vote, and Lenin's acceptance of the German terms was endorsed.

Following the conclusion of the Treaty of Brest-Litovsk, Trotsky resigned as foreign commissar, turning the office over to Georgy Chicherin, and was immediately made commissar of war, theretofore a committee responsibility. As war commissar, Trotsky faced the formidable task of building a new Red Army out of the shambles of the old Russian Army and preparing to defend the Communist government against the imminent threats of civil war and foreign intervention. Trotsky chose to concentrate on developing a small but disciplined and professionally competent force. His abandonment of the revolutionary ideal of democratization and guerrilla tactics prompted much criticism of his methods among other Communists. He was particularly criticized for recruiting former tsarist officers ("military specialists") and putting them to work under the supervision of Communist military commissars. Trotsky's military policies were resisted unsuccessfully by a coalition of ultraleft purists and rival party leaders, notably Stalin, with whom Trotsky had an acrimonious clash over the defense of the city of Tsaritsyn (later Stalingrad, now Volgograd), Trotsky's approach was, however, vindicated by the success of the Red Army in turning back attacks by the anti-Communist White armies in 1918 and 1919.

With the triumph of the Communist forces and the end of the Russian Civil War in 1920, Trotsky, retaining his office as commissar of war, turned his attention to the economic reconstruction of Russia. He first proposed a relaxation of the stringent centralization of War Communism to allow market forces to operate. Rejected in this, he endeavoured to apply military discipline to the economy, using soldiers as labour armies and attempting to militarize the administration of the transportation system.

During the Civil War and War Communism phase of the Soviet regime, Trotsky was clearly established as the number-two man next to Lenin. He was one of the initial five members of the Politburo when that top Communist Party policy-making body was created in 1919. In intellectual power and administrative effectiveness, he was Lenin's superior and did not hesitate to disagree with him, but his backed facility in political manipulation to win party decisions. Trotsky took a prominent part in the launching of the Comintern in 1919 and wrote its initial manifesto.

In the winter of 1920–21 widespread dissension broke out over the policies of War Communism, not only among the populace but among the party leadership as well. The point at issue in the controversy was the future role of the trade unions. The utopian left wing wanted the unions to administer industry; Lenin and the cautious wing wanted the unions confined to supervising working conditions; Trotsky and his supporters tried to reconcile radicalism and pragmatism by visualizing administration through unions representing the central state authority.

The crisis came to a head in March 1921, with agitation for democracy within the party on the one hand and armed defiance represented by the naval garrison at Kronshtadt on the other. At this point Trotsky sided with Lenin, commanding the forces that suppressed the Kronshtadt Rebellion and backing the suppression of open factional activity in the party. Trotsky accepted Lenin's retreat from ideal communism in favour of the New Economic Policy, including his conventional view of the trade unions. This degree of accord, however, did not prevent Trotsky from losing a substantial degree of political influence at the 10th Party Congress in March 1921.

*The struggle for the succession.* When Lenin was stricken with his first cerebral hemorrhage in May 1922, the question of eventual succession to the leadership of Russia became urgent. Trotsky, owing to his record and his charismatic qualities, was the obvious candidate in the eyes of the party rank and file, but jealousy among his colleagues on the Politburo prompted them to combine against him. As an alternative, the Politburo supported the informal leadership of the troika composed of Zinovyev, Lev Kamenev, and Stalin.

In the winter of 1922–23 Lenin recovered partially and turned to Trotsky for assistance in correcting the errors of the troika, particularly in foreign trade policy, the handling of the national minorities, and reform of the bureaucracy. In December 1922, warning in his then secret "Testament" of the danger of a split between Trotsky and Stalin, Lenin characterized Trotsky as a man of "exceptional abilities" but "too far-reaching self-confidence and a disposition to be too much attracted by the purely administrative side of affairs." Just before he was silenced by a final stroke in March 1923, Lenin invited Trotsky to open an attack on Stalin, but Trotsky chose to bide his time, possibly contemplating an alliance against Zinovyev. Stalin moved rapidly to consolidate his hold on the Central Committee at the 12th Party Congress in April 1923.

By fall, alarmed by inroads of the secret police among party members and efforts to weaken his control of the war commissariat, Trotsky decided to strike out against the party leadership. In October he addressed a wide-ranging critique to the Central Committee, stressing especially the violation of democracy in the party and the failure to develop adequate economic planning. Reforms were promised, and Trotsky responded with an open letter detailing the direction they should take. This, however, served only as the signal for a massive propaganda counterattack against Trotsky and his supporters on grounds of factionalism and opportunism. At this critical moment Trotsky fell ill of an undiagnosed fever and could take no personal part in the struggle. Because of Stalin's organizational controls, the party leadership easily won, and the "New Course" controversy was terminated at the 13th Party Conference in January 1924 (the first substantially stage-managed party assembly) with the condemnation of the Trotskyist opposition as a Menshevik-like, illegal factional deviation. Lenin's death a week later only confirmed Trotsky's isolation. Convalescing on the Black Sea coast, Trotsky was deceived about the date of the funeral, failed to return to Moscow, and left the scene to Stalin.

Attacks on Trotsky did not cease. When the 13th Party Congress, in May 1924, repeated the denunciations of his violations of party discipline, Trotsky vainly professed his belief in the omnipotence of the party. The following fall he took a different tack in his essay *The Lessons of October 1917,* linking the opposition of Zinovyev and Kamenev to the October Revolution with the failure of the Soviet-inspired German Communist uprising in 1923. The party leadership replied with a wave of denunciation, counterposing Trotskyism to Leninism, denigrating Trotsky's role in the Revolution, and denouncing the theory of permanent revolution as a Menshevik heresy. In January 1925 Trotsky's was removed from the war commissariat.

Early in 1926, following the split between the Stalin–Bukharin leadership and Zinovyev–Kamenev group and the denunciation of the latter at the 14th Party Congress, Trotsky joined forces with his old adversaries Zinovyev and Kamenev to resume the political offensive. For a year and a half this "United Opposition" grasped at every opportunity to put its criticisms before the party membership, despite the increasingly severe curbs being placed on such discussion. Again they stressed the themes of party democracy and economic planning, condemned the leadership's concessions to bourgeois elements, and denounced Stalin's theory of "Socialism in one country" as a pretext for abandoning world revolution.

The response of the leadership was a rising tide of official denunciation, supplemented by an anti-Semitic whispering campaign. In October 1926 Trotsky was expelled from the Politburo and a year later he and Zinovyev were dropped from the Central Committee. After an abortive attempt at a demonstration on the 10th anniversary of the Revolution, the two were expelled from the party.

*Exile and assassination.* In January 1928, Trotsky and his principal followers were exiled to remote parts of the Soviet Union, Trotsky himself being assigned to Alma-Ata in Central Asia. In January 1929 Trotsky was banished

from the territory of the Soviet Union. He was initially received by the government of Turkey and domiciled on the island of Prinkipo. He plunged into literary activity there and completed his autobiography and his history of the Russian Revolution. In 1933 Trotsky secured permission to move to France. After Hitler's victory in Germany, Trotsky gave up the hope of reforming the Communist International and called on his followers to establish their own revolutionary parties and form a Fourth International. This movement (whose American branch was the Socialist Workers' Party) proved to be little more than a shadow organization, although a small founding conference was officially held in France in 1938.

In 1935 Trotsky was compelled to move to Norway, and in 1936, under Soviet pressure, he was forced to seek asylum in Mexico, where he settled at Coyoacán. He was represented as the principal conspirator, in absentia, in the treason trials of former Communist opposition leaders held in Moscow (1936–38). The evidence of treasonable plotting, however, was later proven to be fictitious.

Trotsky was the object of two assassination attempts, presumably by Stalinist agents. The first, a machine gun attack on his house, failed. The second, by Ramón Mercader, a Spanish Communist who had won the confidence of the Trotsky household, was successful. The Soviet government disclaimed any responsibility, and the ax murderer was sentenced to the maximum 20-year term under Mexican law.

*Assessment.* Trotsky was undoubtedly the most brilliant intellect brought to prominence by the Russian Revolution, outdistancing Lenin and other theoreticians both in the range of his interests and in the imaginativeness of his perceptions. He was an indefatigable worker, a rousing public speaker, and a decisive administrator. On the other hand, Trotsky was not successful as a leader of men, partly because he allowed his brilliance and arrogance to antagonize the lesser lights in the Communist movement. Perhaps he fatally compromised himself when he became a Bolshevik in 1917, subordinating himself to Lenin's leaderhip and accepting the methods of dictatorship that he had previously condemned.

Had Trotsky won the struggle to succeed Lenin, the character of the Soviet regime would almost certainly have been substantially different, particularly in foreign policy, cultural policy, and the extent of terroristic repression. Trotsky's failure, however, seems almost inevitable considering his own qualities and the conditions of authoritarian rule by the Communist Party organization.

(R.V.D./Ed.)

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**Trotskyism,** a Marxist ideology based on the theory of permanent revolution first expounded by Leon Trotsky (1879–1940), one of the leading theoreticians of the Russian Bolshevik Party and a leader in the Russian Revolution. Trotskyism was to become the primary theoretical target of Stalinism (*q.v.*) in Russian Communist circles in the 1920s and 1930s.

Trotsky's theory of "permanent revolution" held that, historically, an economic system had to be seen as a world system rather than a national one. All national economic development was affected by the laws of the world market, even though such regional factors as location, population, available resources, and pressure from surrounding countries made the rate of development different in each country. Thus, in Trotsky's view, the Russian Revolution, to be permanently successful, would have to depend on revolutions in other countries, particularly in western Europe. His theory also emphasized the hegemony of the working class over the revolutionary class because of their strategic position in industry and other advanced sectors of the economy.

Counterposed to Trotsky's ideas of permanent revolution was "Socialism in one country," an attitude of national self-sufficiency and self-centredness that became Stalin's watchword in 1924. It declared a world economic system as a combination of national systems, so that Socialism could be built in any single country without dependence on other revolutions.

The development of the Soviet Union's productive forces was controlled by the Communist Party, which in the 1920s was becoming increasingly bureaucratized. Trotsky in 1924 launched an attack on the bureaucracy, the so-called Bolshevik Old Guard. He called for more democracy outside and within the party, which meant more dependence on the rank and file workers at their plants and within the party cells. He opposed the conception of a monolithic party and called for more freedom for various trends of thought as long as they adhered generally to the party program.

Stalin, after consolidating his power, exiled Trotsky and other opponents in 1929. Thereafter, Trotskyists intensified their attack on the Soviet bureaucracy—calling it "Bonapartist," meaning a rule based on the dictatorship of one man—and developed the concept of a "degenerated workers' state," a state in which the means of production have been nationalized but in which a bureaucratic regime rules.

With the rise of Fascism in Germany in the early 1930s and the subordination of the Comintern (*see* International, Third) to Stalin, Trotskyists advocated a "united front" with the trade unions to fight Fascism and the development of a Trotskyist Fourth International (*see* International, Fourth) to replace the Comintern.

After Trotsky's murder in Mexico in 1940 by Stalin's agent Ramon Mercader, a small Trotskyist movement continued to exist. However, Trotskyism has since become a loose generic term for extreme revolutionary doctrines of various kinds, whose advocates are united only in their opposition to the "bourgeois" Soviet form of Communist rule.

**Trotter, Wilfred (Batten Lewis)** (b. Nov. 3, 1872, Coleford, Gloucestershire, Eng.—d. Nov. 25, 1939, Blackmoor, Hampshire), surgeon and sociologist whose writings on the behaviour of man in the mass popularized the phrase herd instinct. A surgeon at University College Hospital, London, from 1906, and professor of surgery there from 1935, Trotter held the office of honorary surgeon to King George V from 1928 to 1932. In the history of surgery he is especially noted for his work on the regeneration of sensory nerves in the skin.

As early as 1908 Trotter began to publish articles on herd behaviour and its predictability in gregarious animals, including man. His *Instincts of the Herd in Peace and War* (1916; 2nd ed., 1919, reissued 1953) was written during World War I and revised in the light of wartime socio-psychological developments.

**Trotti, Joachim-Jacques:** *see* La Chétardie, Joachim-Jacques Trotti, marquis de.

**trotting,** horse racing event in which Standardbred horses drawing sulkies compete. *See* harness racing.

**troubadour,** lyric poet of southern France, northern Spain, and northern Italy, writing in the *langue d'oc* of Provence; the troubadours, flourished from the late 11th to the late 13th century. Their social influence was unprecedented in the history of medieval poetry. Favoured at the courts, they had great freedom of speech, occasionally intervening even in the political arena, but their great achievement was to create around the ladies of the court an aura of cultivation and amenity that nothing had hitherto approached. Troubadour poetry formed one of the most brilliant schools that ever flourished, and it was to influence all later European lyrical poetry.

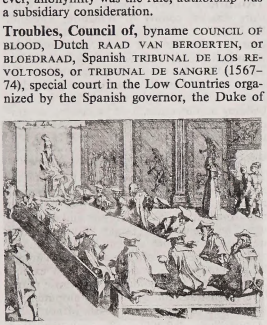
The word troubadour is a French form derived ultimately from the Occitanian *trobar,* "to find," "to invent." A troubadour was thus one who invented new poems, finding new verse for his elaborate love lyrics. Much of the troubadours' work has survived, preserved in manuscripts known as *chansonniers* ("songbooks"), and the rules by which their art was governed are set out in a work called *Leys d'amors* (1340). The verse form they used most frequently was the *canso,* consisting of five or six stanzas with an envoy. They also used the *dansa,* or *balada,* a dance song with a refrain; the *pastorela,* telling the tale of the love request by a knight to a shepherdess; the *jeu parti,* or *débat,* a debate on love between two poets; the *alba,* or morning song, in which lovers are warned by a night watchman that day approaches and that the jealous husband may at any time surprise them. Other forms were frameworks for a lyrical conversation between two or more persons discussing, as a rule, some point of amorous casuistry or matters of a religious, metaphysical, or satirical character.

Troubadour songs, put to music, are monophonic (consisting solely of unharmonized melody) and comprise a major extant body of medieval secular music. Somewhat fewer than 300 melodies survive. Set to a remarkable variety of poems, they display a certain consistency of style yet are far more varied than was once suspected. Some of the melodies were composed by the poets themselves. The Provençal "life" of the troubadour Jaufré Rudel states that he wrote many songs "with fine melodies but poor texts." Evidently the writer thought the melodies were by Jaufré and that his distinction lay therein.

Many of the melodies, however, were not by the poet. According to a contemporary account, Raimbaut de Vaqueyras wrote his famous poem "Kalenda maya" ("The Calends of May") to a dance tune played by some *vielle* (fiddle) players at Montferrat (now Monferrato, Italy). At least four troubadour songs are based directly on Latin sacred melodies. Several troubadour melodies are slightly different in form from the poem to which they are attached, and it must be assumed that these were originally composed for another poem, perhaps in another language. Conversely, many troubadour melodies were appropriated from

songs in French and German. Even when a melody was written expressly for its poem, it is possible that the poet devised it with the help of a more experienced musician. Most of the poems have attributions, for the poets valued their originality. For the music, however, anonymity was the rule; authorship was a subsidiary consideration.

**Troubles, Council of,** byname COUNCIL OF BLOOD, Dutch RAAD VAN BEROERTEN, or BLOEDRAAD, Spanish TRIBUNAL DE LOS REVOLTOSOS, or TRIBUNAL DE SANGRE (1567–74), special court in the Low Countries organized by the Spanish governor, the Duke of



"The Council of Troubles" ("The Council of Blood"), engraving, 1567
By courtesy of the Rijksmuseum, Amsterdam

Alba, which initiated a reign of terror against all elements suspected of heresy or rebellion. Alba's dispatch to the Netherlands at the head of a large army in the summer of 1567 had been occasioned by a violent, iconoclastic outburst by the growing minority of Calvinists. His council, which was composed of loyal Netherlands magnates and Spanish officials (who actually controlled it), condemned thousands to death or imprisonment without due process of law. The purpose of the council, in addition to enforcing adherence to Roman Catholicism, was to put an end to the particularism of the Low Countries stemming from their traditional privileges, rights, and customs, which had served as an impediment to absolutist control by Philip II of Spain.

The Council of Troubles' first victims were magnates who had, in 1566, petitioned Margaret, Duchess of Parma, Alba's predecessor, for a relaxation of religious persecution against Protestants. In the wake of the unlawful arrest of two magnates, counts Egmond and Hoorne (both later executed), thousands of nobles and Calvinists fled abroad, to return in 1568 as the "Beggars" (Geuzen), the guerrilla, privateering "shock troops" of the Netherlands' revolt against Spain (1568–1609). The estates and property of all whom the council condemned were declared forfeit and fell to the treasury of the central government.

Alba used the council to intimidate the citizenry, especially the town and provincial governments, into accepting his scheme for a general, permanent 10 percent sales tax—the Tenth Penny—which would give the central government financial independence and thus break the particularism of the Netherlands. Announced in March 1569, though the measure was not to go into effect until 1571, the Tenth Penny caused general discontent; all provincial and local officials who balked at the tax were arrested, tortured, and imprisoned. A general pardon—excluding the more zealous rebels—was enacted in 1570, but the Tenth Penny proposal had united Roman Catholics and Calvinists against Spain and breathed life into the rebellion. The Council of Troubles disappeared with the departure of Alba, who left the Netherlands in 1573. The council was abolished the following year.

**Troubles, Time of,** Russian SMUTNOYE VREMYA, period of political crisis in Russia that followed the demise of the Rurik dynasty (1598) and ended with the establishment of the Romanov dynasty (1613). During this period foreign intervention, peasant uprisings, and the attempts of pretenders to seize the throne threatened to destroy the state itself and caused major social and economic disruptions, particularly in the southern and central portions of the state.

The Time of Troubles was preceded by a series of events that contributed to the country's instability. In 1598 Fyodor, the last in the line of the Rurik dynasty, died; he was succeeded as tsar of Russia by his brother-in-law Boris Godunov. Boris was faced with problems of famine (1601–03), boyar opposition, and the challenge of a Polish-supported pretender to the throne, the so-called False Dmitry, who claimed to be Dmitry, half brother of the late tsar and legitimate heir to the throne. (The real Dmitry had died in 1591.) Boris was able to maintain his regime, but when he died (April 1605), a mob favouring the False Dmitry killed Boris' son and made "Dmitry" tsar (June 1605).

The boyars, however, soon realized that they could not control the new tsar, and they assassinated him (May 1606), placing the powerful nobleman Vasily Shuysky on the throne. This event marked the beginning of the Time of Troubles. Although Shuysky was supported by the wealthy merchant class and the boyars, his rule was weakened by a series of revolts, the most important of which was a peasant rebellion led by the former serf Ivan Isayevich Bolotnikov in the southern and eastern sections of the country. Shuysky also had to contend with many new pretenders, particularly the Second False Dmitry, who was supported by the Poles, small landholders, and peasants. Claiming to have escaped assassination in 1606 and recognized by the wife of the First False Dmitry as her husband, the new Dmitry established a camp at Tushino (1608) and besieged Moscow for two years. A group of boyars, including the Romanovs, joined him at Tushino, forming a government there that rivaled Shuysky's. While elements of "Dmitry's" army took control of the northern Russian provinces, Shuysky bargained with Sweden (then at war with Poland) for aid. The arrival of Swedish mercenary troops caused "Dmitry" to flee from Tushino. Some of his supporters returned to Moscow; others joined the Polish king Sigismund III, who declared war on Muscovy in response to the Swedish intervention and in September 1609 led an army into Russia and defeated Shuysky's forces (June 1610).

Disappointed with Shuysky, the Muscovites deposed him; and the conservative boyars, fearing the rule of "Dmitry," whose supporters desired radical social changes, agreed (August 1610) to accept the compact already made between Sigismund and the boyars who had been at Tushino, named Władysław (son of the Polish king) tsar-elect, and welcomed Polish troops into Moscow. "Dmitry," however, was killed by his own allies (December 1610), and Sigismund, changing his mind, demanded direct personal control of Russia and continued the Polish invasion (autumn 1610). This finally stimulated the Russians to rally and unite against the invader. The first resistance, an alliance—instigated by the patriarch Hermogen—between small landholders led by Prokopy Petrovich Lyapunov and some Cossacks, quickly disintegrated. But it was followed in October 1611 by a new movement, composed of landowners, Cossacks, and merchants. Prince Dmitry Mikhaylovich Pozharsky led the army, and the merchant Kuzma Minin handled the finances. The army advanced toward Moscow and, threatened by the approach of Polish reinforcements, attacked and captured the garrison (October 1612). The following year a widely representative *zemsky sobor* ("assembly of the land") elected a new tsar, Michael Romanov, establishing the dynasty that ruled Russia for the next three centuries.

**trough, oceanic:** *see* oceanic trough.

**trousers,** also spelled TROWSERS, an outer garment covering the lower half of the body from the waist to the ankles and divided into sections to cover each leg separately. In attempting to define trousers, historians often



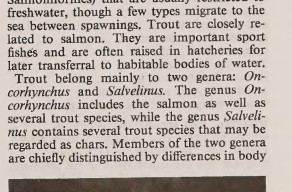
Man wearing trousers, 1919
By courtesy of *The Tailor and Cutter*

explain that if any portion of a garment passed between the legs, it was an ancestor of the trousers. Thus defined, trousers can be traced to ancient times as worn, for example, by the Scythians, Persians, Japanese, and Hindus.

Until the end of the 18th century, bifurcated European garments took forms such as breeches, knickerbockers, and pantaloons. By 1820, trousers as they are known today had come into general use among men. Since then, they have been the basic style of dress for men, varying in style from the narrow cut to the extremely wide Oxford bags of 1924. A fashion revolution in the second half of the 20th century made trousers acceptable women's wear for almost all activities.

**trout,** any of several prized game and food fishes of the family Salmonidae (order Salmoniformes) that are usually restricted to freshwater, though a few types migrate to the sea between spawnings. Trout are closely related to salmon. They are important sport fishes and are often raised in hatcheries for later transferral to habitable bodies of water.

Trout belong mainly to two genera: *Oncorhynchus* and *Salvelinus*. The genus *Oncorhynchus* includes the salmon as well as several trout species, while the genus *Salvelinus* contains several trout species that may be regarded as chars. Members of the two genera are chiefly distinguished by differences in body



Golden trout (*Oncorhynchus aguabonita*)
© Tom McHugh, The National Audubon Society Collection/Photo Researchers

colouring, the shape of the vomer bone in the roof of the mouth, and the teeth. *Salvelinus* trout tend to have red- or cream-coloured spots on a darker-coloured body. They are further distinguished by teeth set on the head (front) of the vomer, not on its shaft. Members of *Salvelinus* whose vomer is boat-shaped rather than flat are properly called char (*q.v.*). *Oncorhynchus* trout tend to have red or black spots on a lighter-coloured body; their teeth are sparser and are on the front and shaft of the vomer. Several trout species that were formerly classified in the genus *Salmo* are now placed in the genus *Oncorhynchus;* the brown trout is the only trout still classified as *Salmo.*

These distinctions notwithstanding, the trout remain among the most difficult fishes to classify. The confusion stems from the aforementioned irregularities in anatomy and from great variation in colour and habits. The classification of species into genera remains problematic because of the ease of hybridization among trout and the intermixing of introduced and native species.

Trout usually live in cool freshwater, often among submerged objects or in riffles and deep pools. They are native to the Northern Hemisphere but have been widely introduced to other areas. Their diet consists of insects, small fishes and their eggs, and crustaceans. Trout spawn between fall and spring and bury their eggs in a gravel nest scooped out by the female on a streambed. The few forms that migrate to sea between spawnings return to streams at this time. The eggs take two to three months to hatch, and the newly hatched trout, or fry, become known as fingerlings when they leave the nest and begin feeding on plankton.

The genus *Salvelinus* contains the brook trout, Dolly Varden trout, lake trout (*qq.v.*), and bull trout. These are all species of chars. The genus *Oncorhynchus* contains the cutthroat trout, rainbow trout (*qq.v.*), and the golden trout. The golden trout (*O. aguabonita*) is a mountain trout of clear waters in the western United States. The brown trout (*q.v.*), *Salmo trutta,* is a common European trout that has been widely introduced into suitable waters around the world. Salmon trout is a common name for the brown, lake, cutthroat, and sea-run rainbow trout. Sea trout is the common name for various trout and chars that enter the sea.

**trout-perch,** either of two species of small, dark-spotted fishes of the genus *Percopsis* (family Percopsidae), found in freshwaters of North America. The larger species, *P. omiscomaycus,* grows about 15 cm (6 inches) long and is found in central North America. The second, *P. transmontana,* is about 10 cm long and lives in the Columbia River system. Trout-perch are notable in being structurally intermediate between the more primitive soft-rayed fish, such as trout, and the more advanced spiny-rayed fishes, such as perch.

**trouvère,** also spelled TROUVEUR, any of a school of poets that flourished in northern France from the 11th to the 14th century. The trouvère was the counterpart in the language of northern France (the *langue d'oïl*) to the Provençal troubadour (*q.v.*), from whom the trouvères derived their highly stylized themes and metrical forms. The essence of trouvère rhetoric lies in the combination of traditional themes and the use of established forms in which to express them. The audience gained pleasure from familiarity with these clichés rather than from the poet's originality. It is thus perhaps the least characteristic trouvères, such as Rutebeuf (flourished 1250–80), generally considered the last and greatest of the trouvères, who are most appreciated today.

Communication between northern and southern France was facilitated and encouraged by the Crusades, and a number of trouvères, such as the Châtelaine de Coucy and Conon de Béthune, took part in them. Their poetry is sometimes satirical and sometimes (as in the case of Colin Muset) concerned with the pleasures of the good life, but the basic theme remains that of courtly love, in which the poet describes his unrequited passion for an inaccessible lady.

Trouvère lyrics were intended to be sung, probably by the poet alone or with instrumental accompaniment provided by a hired musician. Although originally connected with feudal courts, around which the trouvères traveled looking for patronage, their poetry was not just popular with aristocratic circles, and they tended increasingly to find their patrons in the middle classes. Half the extant trouvère lyrics are the work of a guild of citizen poets of Arras. Many of the trouvères, such as Gace Brûlé (late 12th century), were of aristocratic birth; Thibaut de Champagne (1201–53) was king of Navarre. But others, including Rutebeuf, were of humble origin. *See also* jongleurs.

The songs of the trouvères were monophonic (consisting solely of melodic line). Their exact mode of performance is not known. The form of the instrumental accompaniment is unknown, but it almost certainly included preludes, postludes, and interludes.

The trouvères used a variety of musical forms, some for any of several of the various poetic categories and some linked to the type of the verse. Four broad categories can be discerned: musical forms based on multiple repetitions of a short phrase, as in a litany; dance songs with refrains; songs based on pairs of repeated lines; and through-composed songs (*i.e.,* using no repetition).

Compositions with no repetition within the stanza include the *vers* and the chanson. In the chanson, however, a short initial section is repeated, and a piece of the opening section may recur at the end. Most surviving trouvère music is written in a notation that indicates the pitch of the notes but not their relative duration or accentuation, an omission that has given rise to much debate as to rhythmic interpretation in the edition of the songs for modern performance.

**Trouville,** in full TROUVILLE-SUR-MER, seaside resort of the English Channel, Calvados *département,* Basse-Normandie *région,* northwestern France. It is situated where the Normandy Corniche drops to the right bank of the Touques estuary, opposite Deauville-les-Bains, with which community there are ferry and bridge links. Wooded hills above Trouville give way to a magnificent sandy beach. The high approach yields splendid views of the twin towns and along the Côte Fleurie. Near the beach is a casino, with a theatre and a local history museum. The combined towns are among the most frequented French resorts on the English Channel. Local fishing boats supply a bustling market. Pop. (1990) 5,645.

**trover,** a form of lawsuit in common-law countries (*e.g.,* England, Commonwealth countries, and the United States) for recovery of damages for wrongful taking of personal property. Trover belongs to a series of remedies for such wrongful taking, its distinctive feature being recovery only for the value of whatever was taken, not for the recovery of the property itself (*compare* replevin).

Trover damages are measured by the market value of the object (not its replacement cost) plus compensation for deprivation of use and compensation for other losses naturally and proximately caused by the wrongful taking. Plaintiff can also recover interest that would have been earned by the money value of the object and any expense (except attorney's fees) incurred in attempting to recover the object. If the taker sold the object for more than its market value, plaintiff receives that higher price. If the taker has made improvements on the object (*e.g.,* repainted it), the value of such improvements are not deducted from plaintiff's recovery unless the taking was by mistake.

**Trowbridge,** town ("parish"), West Wiltshire district, county of Wiltshire, England. St. James' parish church dates from the 14th century; other notable buildings include the town hall (1899) and the county hall (1940). The fine woolen cloths manufactured by the town are famous. Its other diversified industries now include light engineering, brewing, bedding manufacture, food processing, creameries, and printing. Trowbridge is the county town (seat) of Wiltshire. Pop. (1981) 23,123.

**trowsers:** *see* trousers.

**Troy,** Greek TROIA, also called ILIOS, or ILION, Latin TROIA, TROJA, or ILIUM, ancient city in northwestern Anatolia that holds an enduring place in both literature and archaeology. The legend of the Trojan War is the most notable theme from ancient Greek literature and forms the basis of Homer's *Iliad.* Though its present-day ruins are not of vast extent, Troy is a key archaeological site whose many layers illustrate the gradual development of civilization in northwestern Asia Minor.

*Geography.* Ancient Troy commanded a strategic point at the southern entrance to the Dardanelles (Hellespont), a narrow strait linking the Black Sea with the Aegean Sea via the Sea of Marmara. The city also commanded a land route that ran north along the west Anatolian coast and crossed the narrowest point of the Dardanelles to the European shore. Troy probably used its site astride these two lines of communication to exact tolls from trading vessels and other travelers using them. This practice probably accounted for the wrath of ancient Troy; it may also have been the Greeks' actual motive in waging war against the city, which chronically interfered with their trade through the Dardanelles.

The Troad (Greek Troias; "Land of Troy") is the district formed by the northwestern projection of Asia Minor into the Aegean Sea. The present-day ruins of Troy itself occupy the western end of a low descending ridge in the extreme northwest corner of the Troad. Less than 4 miles (6 km) to the west, across the plain of the Scamander River, is the Aegean Sea, and toward the north are the narrows of the Dardanelles.

*Archaeology.* The approximate location of Troy was well known from references in works by ancient Greek and Latin authors. But the exact site of the city remained unidentified until modern times. A large mound, called Hisarlik (or Hissarlik) by the Turks, had long been known to hold the ruins of a city named Ilion that had flourished in Hellenistic and Roman times. In 1822 Charles McLaren suggested that this was the site of Homeric Troy, but for the next 50 years his suggestion received little attention from classical scholars, most of whom regarded the Trojan legend as a mere fictional creation based on myth, not history. The German archaeologist Heinrich Schliemann deserves full credit for adopting McLaren's identification and demonstrating to the world that it was correct. In seven major and two minor campaigns between 1870 and 1890, Schliemann conducted excavations on a large scale mainly in the central area of the Hisarlik mound, where he exposed most of the remains of the Early Bronze Age. After Schliemann's death in 1890, the excavations were continued (1893–94) by his colleague Wilhelm Dörpfeld and later (1932–38) by an expedition from the University of Cincinnati headed by Carl W. Blegen.

Before excavations began, the mound rose to a height of 105 feet (32 m) above the plain. It contained a vast accumulation of debris that

was made up of many clearly distinguishable layers. Schliemann and Dörpfeld identified a sequence of nine principal strata, representing nine periods during which houses were built, occupied, and ultimately destroyed. At the end of each period when a settlement was destroyed (usually by fire, or earthquake, or both), the survivors, rather than clear the wreckage down to the floors, merely leveled it out and then built new houses upon it.

The nine major periods of ancient Troy are labeled I to IX, starting from the bottom with the oldest settlement, Troy I. In periods I to VII Troy was a fortified stronghold that served as the capital of the Troad and the residence of a king, his family, officials, advisers, retinue, and slaves. Most of the local population, however, were farmers who lived in unfortified villages nearby and took refuge in the citadel in times of danger. Troy I to V corresponds roughly to the Early Bronze Age (*c.* 3000 to 1900 BC). The citadel of Troy I was small, not more than 300 feet (90 m) in diameter. It was enclosed by a massive wall with gateways and flanking towers and contained perhaps 20 rectangular houses. Troy II was twice as large and had higher, sloping stone walls protecting an acropolis on which stood the king's palace and other princely residences, which were built of brick in a megaron (*q.v.*) plan. This city came to an end through fire, and Schliemann mistakenly identified it with Homer's Troy. In the "burnt layer's" debris were found a trove of gold jewelry and ornaments and gold, silver, copper, bronze, and ceramic vessels that Schliemann named "Priam's treasure." The burning of Troy II seems to have been followed by an economic decline; each of the citadels of Troy III, IV, and V was fortified and somewhat larger than its predecessor, but the houses inside the walls were much smaller and more closely packed than in Troy II.

Troy VI and VII may be assigned to the Middle and Late Bronze Ages (*c.* 1900 to 1100 BC). Troy at this time had new and vigorous settlers who introduced domesticated horses to the Aegean area. They further enlarged the city and erected a magnificent circuit of cut limestone walls that were 15 feet (4.5 m) thick at the base, rose to a height of more than 17 feet (5 m), and had brick ramparts and watchtowers. Inside the citadel, which was now about 650 feet (200 m) long and 450 feet (140 m) wide, great houses were laid out in ascending, concentric terraces. Troy VI was destroyed by a violent earthquake a little after 1300 BC. Dörpfeld had identified this stage as Homeric Troy, but its apparent destruction by an earthquake does not agree with the realistic account of the sack of Troy in Greek tradition. Moreover, the city's date, as indicated by imported Mycenaean pottery found in the earthquake debris, is too early for the Trojan War.

The survivors of the earthquake quickly rebuilt the town, thus inaugurating the short-lived Troy VIIa. The ruins were leveled and covered over by new buildings, which were set close together and filled all available space inside the fortress. Almost every house was provided with one or several huge storage jars that were sunk deep into the ground, with only their mouths above the level of the floor. Troy VIIa probably lasted little more than a generation. The crowding together of houses and the special measures to store up food supplies suggest that preparations had been made to withstand a siege. The town was destroyed in a devastating fire, and remnants of human bones found in some houses and streets strengthen the impression that the town was captured, looted, and burnt by enemies. Based on the evidence of imported Mycenaean pottery, the end of Troy VIIa can be dated to between 1260 and 1240 BC. The Cincinnati expedition under Blegen concluded that Troy VIIa was very likely the capital of King Priam described in Homer's *Iliad,* which was destroyed by the Greek armies of Agamemnon.

The partly rebuilt Troy VIIb shows evidence of new settlers with a lower level of material culture, who vanished altogether by 1100 BC. For about the next four centuries the site was virtually abandoned. About 700 BC Greek settlers began to occupy the Troad. Troy was reoccupied and given the Hellenized name of Ilion; this Greek settlement is known as Troy VIII. The Romans sacked Ilion in 85 BC, but it was partially restored by the Roman general Sulla that same year. This Romanized town, known as Troy IX, received fine public buildings from the emperor Augustus and his immediate successors, who traced their ancestry back to the Trojan Aeneas. After the founding of Constantinople (AD 324), Ilion faded into obscurity.

*The Trojan War.* The classical legends of the Trojan War developed continuously throughout Greek and Latin literature. In Homer's *Iliad* and *Odyssey,* the earliest literary evidence available, the chief stories have already taken shape, and individual themes were elaborated later, especially in Greek drama. The story of the Trojan origin, through Aeneas, of Rome helped to inspire Roman interest; book ii of Virgil's *Aeneid* contains the best-known account of the sack of Troy. Finally there are the pseudo-chronicles that go under the names of Dictys Cretensis and Dares Phrygius.

The Trojan War fought between the Greeks and Troy originated in the following manner. King Priam of Troy was wealthy and powerful; by his wife Hecuba and by concubines he had 50 sons and 12 daughters. But his son Paris was invited to judge which of the goddesses Aphrodite, Hera, and Athena was entitled to receive the golden apple marked by the goddess Eris (Discord) "for the most beautiful." Aphrodite promised Paris the most beautiful woman in the world: he therefore awarded her the apple and went to Greece, where he won the love of, and eloped with, Helen, wife of Menelaus, the king of Sparta.

To recover Helen, the Greeks launched a great expedition under the overall command of Menelaus' brother, Agamemnon, king of Argos or Mycenae. The Trojans refused to return Helen. Small towns in or near the Troad were sacked by the Greeks, but Troy, assisted by allies from Asia Minor and Thrace, withstood a Greek siege for 10 years. The gods also took sides, notably Hera, Athena, and Poseidon for the Greeks, and Aphrodite (who had a son, Aeneas, by the Trojan Anchises, grandson of Assaracus), Apollo, and Ares for the Trojans. The *Iliad,* which is set in the 10th year of the war, tells of the quarrel between Agamemnon and Achilles, who was the finest Greek warrior, and the consequent deaths in battle of (among others) Achilles' friend Patroclus and Priam's eldest son, Hector.

After Hector's death the Trojans were joined by two exotic allies, Penthesilea, queen of the Amazons, and Memnon, king of the Ethiopians and son of the dawn-goddess Eos. Achilles killed both of these, but Paris then managed to kill Achilles with an arrow. Before they could take Troy, the Greeks had to steal from the citadel the wooden image of Pallas Athena (the Palladium) and fetch the arrows of Heracles and the sick archer Philoctetes from Lemnos and Achilles' son Neoptolemus (Pyrrhus) from Skyros; Odysseus and Diomedes achieved all these. Finally, with Athena's help, Epeius built a huge wooden horse. Several Greek warriors hid inside it; the rest of the Greek army sailed away to Tenedos, a nearby island, pretending to abandon the siege. Despite the warnings of Priam's daughter Cassandra, the Trojans were persuaded by Sinon, a Greek who feigned desertion, to take the horse inside the walls of Troy as an offering to Athena; the priest Laocoon, who tried to have the horse destroyed, was killed by sea-serpents. At night the Greek fleet returned, and the Greeks from the horse opened the gates of Troy. In the total sack that followed, Priam and his remaining sons were slaughtered; the Trojan women passed into slavery in various cities of Greece. The adventurous homeward voyages of the Greek leaders were told in two epics, the *Returns* (*Nostoi;* lost) and Homer's *Odyssey.*

The few Trojan survivors included Aeneas, whose descendants continued to rule the Trojans; later tradition took Aeneas' Trojans to Italy as the ancestors of the Romans.

*Medieval legends.* Medieval European writers, unacquainted with Homer at first hand, found in the Troy legend a rich source of heroic and romantic storytelling and a convenient framework into which to fit their own courtly and chivalric ideals. The chief sources for medieval versions of the story were fictitious eyewitness accounts of the Trojan War by Dictys Cretensis and Dares Phrygius. The key work in the medieval exploitation of the Trojan theme was a French romance, the *Roman de Troie* (1154–60), by Benoît de Sainte-Maure (*q.v.*).

Later medieval writers used the *Roman de Troie* until it was superseded by a Latin prose account. the *Historia destructionis Troiae* (*c.* 1287; "History of the Destruction of Troy"), by Guido delle Colonne. The French author Raoul Le Fèvre's *Recueil des histoires de Troye* (1464), an account based on Guido, was translated into English by William Caxton and became the first book to be printed in English as *The Recuyell of the Histories of Troye* (*c.* 1474). *See also* Trojan War.

**Troy,** city, seat (1793) of Rensselaer county, eastern New York, U.S. It lies on the east bank of the Hudson River, opposite Watervliet and the junction of the Hudson with the Mohawk River and the New York State Barge Canal. With Albany and Schenectady, it forms an urban-industrial complex. Its site was originally part of the Kiliaen van Rensselaer patroonship (estate) granted by the Dutch West India Company in 1629 to encourage Dutch colonization. In 1707 the Vanderheyden family acquired the property, which was laid out in 1786 as Vanderheyden's Ferry and renamed in 1789 for the ancient city of Troy. During the War of 1812, large contracts for U.S. Army beef were filled by Samuel Wilson (locally called "Uncle Sam") of Troy. Government purchasers stamped "U.S. Beef" on the barrels, misinterpreted as "Uncle Sam's beef"; this traditionally gave rise to the popular national symbol of the United States.

Troy was an early seat of the American iron and steel industry. The city's clothing industry supposedly originated with the invention in the early 1800s of the detachable collar by a Troy housewife. Clothing dominated the city's economy after the introduction of the sewing machine in 1852. It remains important, but a more diversified economy (including auto, electrical and aircraft engineering industries) now prevails. Troy is the home of Rensselaer Polytechnic Institute (1824), Russell Sage College for women (1916), and Hudson Valley Community College (1953). Inc. village, 1794; city, 1816. Pop. (1992 est.) city, 54,153; Albany-Schenectady-Troy MSA, 872,000.

**Troy, Jean-François de,** de Troy also spelled DETROY (baptized Jan. 27, 1679, Paris, France—d. Jan. 26, 1752, Rome, Papal States [Italy]), French Rococo painter known for his *tableaux de mode,* or scenes of the life of the French upper class and aristocracy, especially during the period of the regency—*e.g.,* "Hunt Breakfast" (1737; Wallace Collection, London) and "Luncheon with Oysters" (1735; Condé Museum, Chantilly, Fr.).

As a youngster he studied with his father, François de Troy (1645–1730), a portrait

painter from Toulouse, but moved to Italy at 14 years of age. He designed two large series of tapestries for the Gobelins, served as director of the French Academy in Rome for several years, and was famous as a portraitist and decorator.



"Luncheon with Oysters," oil painting by Jean-François de Troy, 1735; in the Musée Condé, Chantilly, Fr.

By courtesy of the Musee Conde, Chantilly, Fr., photograph, Giraudon—Art Resource/EB Inc.

**Troy Hills** (New Jersey, U.S.): *see* Parsippany–Troy Hills.

**troy weight,** traditional European system of weight based on the grain, pennyweight (24 grains), ounce (20 pennyweights), and pound (12 ounces). The troy grain, pennyweight, and ounce have been used since the Middle Ages to weigh gold, silver, and other precious metals. The name derives from the city of Troyes, site of one of the major medieval fairs. The troy pound was adopted by the U.S. Mint for the regulation of coinage in 1828.

The troy pound is equal to the apothecaries' pound and to approximately 0.82 avoirdupois pound and 0.37 kilogram.

**Troyes,** town, capital of Aube *département,* Champagne-Ardenne region, northeastern France. The town was the historic capital of Champagne.

Before Julius Caesar's conquest, Troyes was already a town of the Gauls; under Augustus it became the capital of the Gallic tribe known as the Tricasses (hence its name). Converted to Christianity in the 3rd century, the town was threatened by the Huns in the 5th century and was defended against them by its bishop, St. Loup. Sacked by the Normans in 889, it soon came under the authority of the counts of Champagne, who founded a number of churches and almshouses there and established the great fairs which gained an international reputation and brought Troyes exceptional prosperity. The city also gave its name to the troy weight. The end of the 15th century and the beginning of the 16th were periods of prosperity, but in 1524 a fire destroyed 1,000 houses in Troyes. Calvinism had considerable success there, but in 1572 a great number of Protestants were put to death. Louis XIV's revocation of the Edict of Nantes in 1685 dispersed the town's Protestant population and greatly damaged its industrial prosperity; incessant war and increases in taxes completed the decline of the town. It was only during the 19th century that Troyes began the development which has continued since.

Of the 25 churches which formerly existed in the town, 9 have survived. Most of these have stained-glass windows, paintings, and statues, many of which belong to the early 16th-century Troyes school of sculpture. The church of Saint-Urbain in bold Gothic style was almost certainly begun in the 13th century by Pope Urban IV, who was a Troyes shoemaker's son. In the church of Saint-Jean-au-Marché (14th–17th century) on June 2, 1420, Henry V of England married Catherine of Valois, daughter of Charles VI. The Treaty of Troyes (May 21, 1420) had just recognized Henry as heir to the throne of France. The remarkable cathedral of Saint-Pierre-et-Saint-Paul (13th–17th century) is built in a variety of Gothic styles and has about 180 magnificent stained glass panels. A 20th-century inscription at the base of the tower records that Joan of Arc, escorting Charles VII to his crowning at Reims, was feted there in solemn dignity in 1429, after receiving the surrender of Troyes. The cathedral of Saint-Remy (14th–16th century) is notable for its 197-ft- (60-m-) tall spire. Troyes's notable secular buildings include the 16th-century Hôtel de Vauluisant, which houses a hosiery museum displaying among its collections stockings as worn by the kings of France. The building also houses a museum of the history of the province of Champagne. Troyes Municipal Library (1651) is housed in the former abbey of Saint-Loup and has a valuable collection of old books and manuscripts.

Modern Troyes has important factories on the road to Paris; tire manufacturing is particularly significant. Its industries include the manufacture of hosiery and textile machinery and food processing. Pop. (1982) 62,946.

**Trubetskoy** FAMILY, Russian noble family of considerable influence in the 19th century. One of its members, Sergey Petrovich (1790–1860) was a prominent Decembrist and one of the organizers of the movement. Close to N.M. Muravyov in his views, he was declared the group's leader on the eve of the December 14 uprising in 1825 but failed to appear. He was consequently arrested and sentenced to death, but the sentence was commuted to hard labour for life. In 1856 he was included in the amnesty.

Other prominent family members are Sergey Nikolayevich (1862–1905), a religious philosopher and publicist, the editor of a philosophical journal, and the author of several historical and philosophical studies, and his brother Evgeny Nikolayevich (1863–1920), also a religious philosopher and a follower of V.S. Solovyov. The linguist Nikolay Sergeyevich Trubetskoy (*q.v.*; 1890–1938) was the son of S.N. Trubetskoy.

**Trubetskoy, Nikolay Sergeyevich,** also spelled NIKOLAJ SERGEJEVIČ TRUBETZKOY (b. April 16, 1890, Moscow—d. June 25, 1938, Vienna), Slavic linguist at the centre of the Prague school of linguistics, noted as the author of its most important work on phonology, *Grundzüge der Phonologie* (1939; "Principles of Phonology"). Influenced by Ferdinand de Saussure and in turn influencing Roman Jakobson, Trubetskoy redefined the phoneme functionally as the smallest distinctive unit within the structure of a given language, and he further broke these phonemes into their distinctive features.

Trubetskoy was the son of a Russian prince and professor of philosophy. In 1913, after obtaining his degree from Moscow University, Trubetskoy enrolled at the University of Leipzig. He taught at Moscow University and at the universities of Rostov and Sofia. In 1922 he was appointed professor of Slavic Philology at the University of Vienna. The Nazi occupation of Vienna contributed to Trubetskoy's death: he suffered a severe heart attack after being persecuted for having published an article critical of racist theory.

**Truce of ——— :** *see under* substantive word (*e.g.*, God, Truce of ).

**truck,** any of a class of motor vehicles designed to carry freight or heavy articles.

A brief treatment of trucks follows. For full treatment, *see* MACROPAEDIA: Transportation.

The first motor truck, built in 1896 by the German automotive pioneer Gottlieb Daimler, had a four-horsepower engine and a belt drive with two forward speeds and one reverse. In 1898 the Winton Company became the first American firm to produce a truck—a delivery wagon with a single-cylinder, six-horsepower engine. Trucks came into widespread use in both Europe and the United States during World War I, and by the 1920s they were firmly established as a major means of freight conveyance.

Because trucks must transport heavy loads, frequently over long distances, they require powerful engines. The engine of a large truck may have more than 400 horsepower. Until the 1930s gasoline engines were widely used, especially in the United States, but since World War II most large trucks have been equipped with diesel engines. Although diesels can develop more power, they generally operate within a relatively narrow speed range and require transmissions with a greater number of forward speeds. Modern long-distance load haulers may have as many as 16 forward speeds operating in dual-range transmissions. This capability gives the truck both maximum power for climbing hills and maximum speed for freeway driving.

There are two basic types of trucks, the straight truck (in which all axles are attached to the frame) and the articulated truck (in which two or more frames are connected by suitable couplings). A common articulated truck consists of a towing truck, or tractor, and a semitrailer equipped with one or more rear axles and constructed so that its front end rests directly on the tractor. The tractor thus carries part of the weight of the semitrailer and its load, while the rear axles of the semitrailer carry the balance of the load. The semitrailer is connected to its tractor by what is called a fifth wheel, which consists of an articulated trunnion (pivot assembly) plate and a latching mechanism mounted on the tractor, into which a kingpin mounted on the semitrailer fits and latches firmly.

Truck and tractor frames are usually separate from the body and cab and are built of channel sections of alloy steel. Semitrailers are built with a wide variety of bodies on similar frames, although the integral construction method—in which body structural members are designed to bear the load—is becoming more common. Since 1960 many truck and tractor frames have been built with individual front suspension and with rear suspensions varying according to need. A truck or tractor may have a single or a double powered rear axle, which is attached to the frame by leaf springs. The weight is carried by the axle housings, so that the driving axle bears no load.

Until the advent of power steering in the early 1950s, steering a truck required great strength because of the weight of the load and the width of the tires. The Ackerman system, which provides a kingpin for each front wheel and power assist, has greatly relieved this problem. Power steering has also made possible the construction of larger trucks having two steering axles. Four-wheel brakes were introduced in trucks in 1925, seven years after the introduction of air brakes. Most trucks and truck-tractors now have air brakes on all the wheels. The DD3 actuator, an emergency-brake system, applies the brakes after being actuated, and a mechanical lock holds them on even if air pressure is lost.

# List of Abbreviations

| | |
|---|---|
| A.B. | Bachelor of Arts (Latin *Artium Baccalaureus*); Army Base |
| Ac | actinium |
| AC | alternating current |
| A.C.T. | Australian Capital Territory |
| AD | in the year of the Lord (Latin *anno Domini*) |
| A.F.B. | Air Force Base |
| Afg. | Afghanistan |
| A.F.S. | Air Force Station |
| Ag | silver (Latin *argentum*) |
| AG | Limited-liability Company (German *Aktiengesellschaft*) |
| AH | in the year of the Hegira, or Muslim era (Latin *anno Hegirae*) |
| Al | aluminum, aluminium |
| Ala. | Alabama |
| Alb. | Albania |
| Alg. | Algeria |
| Alta. | Alberta |
| Am | Americium |
| AM | before noon (Latin *ante meridiem*) |
| AM | amplitude modulation |
| A.M. | Master of Arts (Latin *Artium Magister*) |
| Amer. | American |
| Ant.B. | Antigua and Barbuda |
| Ar | argon |
| Arg. | Argentina |
| Ariz. | Arizona |
| Ark. | Arkansas |
| Arm. | Armenia |
| Arpt. | Airport |
| As | arsenic |
| A.S. | Air Station |
| A.S.S.R. | Autonomous Soviet Socialist Republic |
| At | astatine |
| Au | gold (Latin *aurum*) |
| Aug. | August |
| Austl. | Australia |
| Av. | Avenida (Spanish: "Avenue") |
| Ave. | Avenue |
| Azer. | Azerbaijan |
| b. | born |
| B | boron |
| Ba | barium |
| B.A. | Bachelor of Arts |
| Bah. | The Bahamas |
| Bangl. | Bangladesh |
| Barb. | Barbados |
| BC | before Christ |
| B.C. | British Columbia |
| BCE | before the Common Era, or Christian era |
| Be | beryllium |
| B.Ed. | Bachelor of Education |
| Bela. | Belarus |
| Belg. | Belgium |
| Bfld. | Battlefield |
| Bge. | Bridge |
| Bi | bismuth |
| Bk | berkelium |
| Bldg. | Building |
| Bldgs. | Buildings |
| Blvd. | Boulevard |
| Bol. | Bolivia |
| Bos.-Her. | Bosnia and Hercegovina |
| Bots. | Botswana |
| BP | before the present |
| Br | bromine |
| Braz. | Brazil |
| Brit. | British |
| B.S. | Bachelor of Science |
| B.Sc. | Bachelor of Science |
| Bulg. | Bulgaria |
| Burk. | Burkina Faso |
| c. | about, approximately (Latin *circa*) |
| C | carbon; Celsius |
| C. | Cape |
| Ca | calcium |
| C.A.R. | Central African Republic |
| Calif. | California |
| Camb. | Cambodia |
| Camer. | Cameroon |
| Can. | Canada |
| Cay.Is. | Cayman Islands |
| Cb | columbium |
| Cd | cadmium |
| C.d'I. | Côte d'Ivoire |
| Ce | cerium |
| CE | Common era, Christian era |
| cf. | compare (Latin *confer*) |
| Cf | californium |
| cg | centigram(s) |
| Cia. | Company (Italian *Compagnia;* Portuguese *Companhia;* Spanish *Compañía*) |
| Cie. | Company (French *Compagnie*) |
| Cl | chlorine |
| cm | centimetre(s) |
| Cm | curium |
| CMSA | consolidated metropolitan statistical area |
| Co | cobalt |
| Co. | Company; County |
| Colo. | Colorado |
| Colom. | Colombia |
| Conn. | Connecticut |
| Cord. | Cordillera |
| Corp. | Corporation |
| cos | cosine |
| cot | cotangent |
| Cr | chromium |
| C.Rica | Costa Rica |
| Cro. | Croatia |
| Cs | cesium |
| csc | cosecant |
| Cu | copper (Latin *cuprum*) |
| Czech. | Czechoslovakia |
| Cz.Rep. | Czech Republic |
| d. | died |
| DC | direct current |
| D.C. | District of Columbia |
| Dec. | December |
| Del. | Delaware |
| Den. | Denmark |
| Dept. | Department |
| D.F. | Federal District (Spanish *Distrito Federal*) |
| Djib. | Djibouti |
| D.Litt. | Doctor of Letters (Latin *Doctor Litterarum*) |
| Dom.Rep. | Dominican Republic |
| Dr. | Doctor; Drive |
| Dy | dysprosium |
| E | east |
| Ecua. | Ecuador |
| ed. | edited; edition; editor |
| Ed. | *Britannica* editor, or editors |
| eds. | editors |
| *e.g.* | for example (Latin *exempli gratia*) |
| E.Ger. | East Germany |
| El Salv. | El Salvador |
| Eng. | England; English |
| Eq.Guin. | Equatorial Guinea |
| Er | erbium |
| Es | einsteinium |
| est. | estimate; estimated |
| Est. | Estonia |
| *et al.* | and others (Latin *et alli,* or *aliae*) |
| *et seq.* | and following page(s) (Latin *et sequens, sequentese,* or *sequentia*) |
| etc. | and so forth (Latin *et cetera*) |
| Eth. | Ethiopia |
| Eu | europium |
| Expwy. | Expressway |
| F | Fahrenheit; fluorine |
| Fe | iron (Latin *ferrum*) |
| Feb. | February |
| ff. | and following pages |
| Fig. | Figure |
| Fin. | Finland |
| fl. | flourished (Latin *floruit*) |
| Fm | fermium |
| Fla. | Florida |
| FM | frequency modulation |
| Fr | francium |
| Fr. | France |
| Fr.Guia. | French Guiana |
| Fr.Poly. | French Polynesia |
| Ft. | Fort |
| g | gram(s) |
| Ga | gallium |
| Ga. | Georgia (U.S.) |
| Gd | gadolinium |
| Ge | germanium |
| Geo. | Georgia (country) |
| Ger. | Germany |
| Gib. | Gibraltar |
| GmbH | Company with Limited Liability (German *Gesellschaft mit beschränkter Haftung*) |
| Green. | Greenland |
| Gren. | Grenada |
| Guad. | Guadeloupe |
| Guat. | Guatemala |
| Guin.Bis. | Guinea-Bissau |
| h | hour(s) |
| H | hydrogen |
| Ha | hahnium |
| Hbr. | Harbour |
| He | helium |
| Hf | hafnium |
| Hg | mercury (Latin *hydrargyrum*) |
| H.K. | Hong Kong |
| HMS | His, or Her, Majesty's Ship, or Service |
| Ho | holmium |
| Hond. | Honduras |
| Hosp. | Hospital |
| Hung. | Hungary |
| Hwy. | Highway |
| I | iodine |
| I. | Island |
| *ibid.* | in the same place (Latin *ibidem*) |
| Ice. | Iceland |
| *i.e.* | that is (Latin *id est*) |
| Ill. | Illinois |
| In | indium |
| Inc. | Incorporated |
| Ind. | Indiana |
| Ind. Res. | Indian Reservation |
| Indon. | Indonesia |
| Inst. | Institute |
| Intl. | International |
| Ir | iridium |
| Ire. | Ireland |
| Is. | Islands |
| Jam. | Jamaica |
| Jan. | January |
| Jr. | Junior |
| K | potassium (Latin *kalium*); Kelvin; Köchel catalog number |
| Kazakh. | Kazakhstan |
| Kan. | Kansas |
| kg | kilogram |
| KG | Limited Partnership (German *Kommandit Gesellschaft*) |
| Kiri. | Kiribati |
| Kitts/N. | Saint Kitts and Nevis |
| KK | Limited-liability Company (Japanese *Kabushiki Kaisha*) |
| km | kilometre(s) |
| Kr | krypton |
| Ky. | Kentucky |
| Kyrgyz. | Kyrgyzstan |
| L. | Lake |
| La | lanthanum |
| La. | Louisiana |
| Leb. | Lebanon |
| Leso. | Lesotho |
| Liech. | Liechtenstein |
| Lith. | Lithuania |
| LL.B. | Bachelor of Laws (Latin *Legum Baccalaureus*) |
| LL.D. | Doctor of Laws (Latin *Legum Doctor*) |
| log | logarithm |
| Lr | lawrencium |
| Ltd. | Limited |
| Lu | lutetium |
| Lucia | Saint Lucia |
| Lux. | Luxembourg |
| m | metre(s) |
| MA | metropolitan area |
| M.A. | Master of Arts |
| Maced. | Macedonia |
| Madag. | Madagascar |
| Malay. | Malaysia |
| Mald. | Maldives |
| Man. | Manitoba |
| Marsh.Is. | Marshall Islands |
| Mart. | Martinique |
| Mass. | Massachusetts |
| Maurits. | Mauritius |
| mbH | Limited; with Limited Liability (German *mit beschränkter Haftung*) |
| Md. | Maryland |
| M.D. | Doctor of Medicine (Latin *Medicinae Doctor*) |
| Mem. | Memorial |
| Mex. | Mexico |
| mg | milligram(s) |
| Mg | magnesium |
| Mich. | Michigan |
| Micron. | Micronesia |
| Mil. | Military |
| min | minute(s) |
| Minn. | Minnesota |
| Miss. | Mississippi |
| Mlle | Mademoiselle |
| mm | millimetre(s) |
| Mme | Madame |
| Mn | manganese |
| Mo | molybdenum |
| Mo. | Missouri |
| Moldv. | Moldova |
| Mon. | Monument |
| Mong. | Mongolia |
| Mont. | Montana |
| Monts. | Montserrat |
| Mor. | Morocco |
| Mozam. | Mozambique |
| MP | member of Parliament |
| Mr. | Mister |
| Mrs. | "Missus" |
| M.S. | Master of Science |
| MSA | metropolitan statistical area |
| M.Sc. | Master of Science |
| Mt. | Mount |
| Mtania. | Mauritania |
| Mtn. | Mountain |
| Mts. | Mountains |
| mun. | municipality |
| Mus. | Museum |
| MV | Motor Vessel |
| Myan. | Myanmar |
| N | nitrogen; north |
| Na | sodium (Latin *natrium*) |
| NA | National Association |
| Namib. | Namibia |
| Natl. | National |
| Natl. Pk. | National Park |
| Nat. Res. | Nature Reserve |
| Nb | niobium |
| N.B. | New Brunswick; Naval Base |
| N.C. | North Carolina |
| Nd | neodymium |
| N.D. | North Dakota |
| Ne | neon |
| NE | northeast |

| | |
|---|---|
| Neb. | Nebraska |
| NECMA | New England county metropolitan area |
| Neth. | The Netherlands |
| Neth.Ant. | Netherlands Antilles |
| Nev. | Nevada |
| New Cal. | New Caledonia |
| Nfld. | Newfoundland |
| N.H. | New Hampshire |
| Ni | nickel |
| Nic. | Nicaragua |
| N.Ire. | Northern Ireland |
| N.J. | New Jersey |
| N.Kor. | North Korea |
| N.M. | New Mexico |
| no. | number |
| No | nobelium |
| Nor. | Norway |
| Nov. | November |
| Np | neptunium |
| NS | Nuclear Ship |
| N.S. | New Style (calendar) |
| N.S.W. | New South Wales |
| N.Terr. | Northern Territory |
| NV | Limited-liability Company (Dutch *Naamloze Vennootschap*) |
| NW | northwest |
| N.W.Terrs. | Northwest Territories |
| N.Y. | New York |
| N.Y.C. | New York City |
| N.Z. | New Zealand |
| O | oxygen |
| Oct. | October |
| Okla. | Oklahoma |
| Ont. | Ontario |
| op. | opus |
| Ore. | Oregon |
| Os | osmium |
| O.S. | Old Style (calendar) |
| p. | page |
| P | phosphorus |
| pA | Limited (Italian *per Azioni*) |
| Pa | protactinium |
| Pa. | Pennsylvania |
| Pak. | Pakistan |
| Pal. | Palace |
| Pan. | Panama |
| Para. | Paraguay |
| Pb | lead (Latin *plumbum*) |
| Pd | palladium |
| P.E.I. | Prince Edward Island |
| Pen. | Peninsula |
| perf. | performed, performance |
| pH | potential of hydrogen (acidity-alkalinity factor) |
| Ph.D. | Doctor of Philosophy (Latin *Philosophiae Doctor*) |
| Phil. | Philippines |
| Pk. | Park; Peak |
| Pkwy. | Parkway |
| Pl. | Place |
| Plat. | Plateau |
| PLC | Public Limited Company |
| Pm | promethium |
| PM | afternoon (Latin *post meridiem*) |
| PMSA | primary metropolitan statistical area |
| P.N.G. | Papua New Guinea |
| Po | polonium |
| Pol. | Poland |
| pop. | population |
| Port. | Portugal |
| pp. | pages |
| Pr | praseodymium |
| P.R. | Puerto Rico |
| prelim. | preliminary (census) |
| Prov. | Province |
| Prov. Pk. | Provincial Park |
| Pt | platinum |
| Pu | plutonium |
| *qq.v.* | which see (plural; Latin *quae vide*) |
| Que. | Quebec |
| Queen. | Queensland |
| *q.v.* | which see (singular; Latin *quod vide*) |
| R | Rankine |
| R. | River |
| Ra | radium |
| Rb | rubidium |
| Rd. | Road |
| Re | rhenium |
| Res. | Reservoir; Reservation |
| rev. | revised; revision |
| Rf | rutherfordium |
| Rh | rhodium |
| R.I. | Rhode Island |
| Rn | radon |
| Rom. | Romania |
| Ru | ruthenium |
| s | second(s) |
| S | South; sulfur |
| SA | Limited-liability Company (French *Société Anonyme;* Italian *Società Anònima;* Portuguese *Sociedade Anónima;* Spanish *Sociedad Anónima*) |
| S.Af. | South Africa |
| Sask. | Saskatchewan |
| Saud.Ar. | Saudi Arabia |
| S.Aus. | South Australia |
| Sb | antimony (Latin *stibium*) |
| Sc | scandium |
| S.C. | South Carolina |
| Scot. | Scotland |
| SCSA | standard consolidated statistical area |
| S.D. | South Dakota |
| Se | selenium |
| SE | southeast |
| sec | secant; second(s) |
| Seneg. | Senegal |
| Sept. | September |
| Seych. | Seychelles |
| S.F.S.R. | Soviet Federated Socialist Republic |
| Si | silicon |
| sin | sine |
| Sing. | Singapore |
| S.Kor. | South Korea |
| Slvk. | Slovakia |
| Slvn. | Slovenia |
| Sm | samarium |
| Sn | tin (Latin *stannum*) |
| Solo.Is. | Solomon Islands |
| Som. | Somalia |
| SpA | Limited-liability Company (Italian *Società per Azioni*) |
| Spr. | Spring |
| Sprs. | Springs |
| Sq. | Square |
| Sr | strontium |
| Sr. | Senior |
| Sri L. | Sri Lanka |
| SS | Steamship |
| SS. | Saints |
| S.S.R. | Soviet Socialist Republic |
| St. | Saint; State; Street |
| St. Pk. | State Park |
| Ste. | Saint (French *Sainte*) |
| S.Tomé/P. | São Tomé and Príncipe |
| Str. | Strait |
| Strs. | Straits |
| Suri. | Suriname |
| SW | southwest |
| Swaz. | Swaziland |
| Swed. | Sweden |
| Switz. | Switzerland |
| Ta | tantalum |
| Tajik. | Tajikistan |
| tan | tangent |
| Tanz. | Tanzania |
| Tas. | Tasmania |
| Tb | terbium |
| Tc | technetium |
| Te | tellurium |
| Tenn. | Tennessee |
| Terr. | Territory; Terrace |
| Terrs. | Territories |
| Th | thorium |
| Thai. | Thailand |
| Ti | titanium |
| Tl | thallium |
| Tm | thulium |
| Tpk. | Turnpike |
| trans. | translated; translation; translator(s) |
| Trin. | Trinidad |
| Trin./Tob. | Trinidad and Tobago |
| Tun. | Tunisia |
| Tur. | Turkey |
| Turkm. | Turkmenistan |
| U | uranium |
| U.A.E. | United Arab Emirates |
| Ugan. | Uganda |
| U.K. | United Kingdom |
| Ukr. | Ukraine |
| UN | United Nations |
| Univ. | University |
| Uru. | Uruguay |
| U.S. | United States |
| USGPO | United States Government Printing Office |
| USS | United States Ship |
| U.S.S.R. | Union of Soviet Socialist Republics |
| Uzbek. | Uzbekistan |
| v. | versus |
| V | vanadium |
| Va. | Virginia |
| var. | variant |
| Venez. | Venezuela |
| Vic. | Victoria |
| Viet. | Vietnam |
| Vinç./G. | Saint Vincent and the Grenadines |
| Vir.Is. | Virgin Islands |
| vol. | volume(s) |
| Vol. | Volcano |
| Vt. | Vermont |
| W | west; tungsten (wolfram) |
| Wash. | Washington |
| W.Aus. | Western Australia |
| W.Ger. | West Germany |
| Wis. | Wisconsin |
| W.Samoa | Western Samoa |
| W.Va. | West Virginia |
| Wyo. | Wyoming |
| Xe | xenon |
| Y | yttrium |
| Yb | ytterbium |
| Yugos. | Yugoslavia |
| Zamb. | Zambia |
| Zimb. | Zimbabwe |
| Zn | zinc |
| Zr | zirconium |

# Table of Measurement Conversions

| To convert | Into | Multiply by |
|---|---|---|
| acres | hectares | 0.40468564 |
| Celsius (centigrade) | Fahrenheit | $(C° \times 9/5) + 32$ |
| centimetres | inches | 0.3937008 |
| cubic feet | cubic metres | 0.028316847 |
| cubic metres | cubic feet | 35.31467 |
| Fahrenheit | Celsius (centigrade) | $5/9(F° - 32)$ |
| feet | metres | 0.3048 |
| gallons (U.S. liquid) | litres | 3.785412 |
| grams | ounces (troy) | 0.032150747 |
| hectares | acres | 2.471054 |
| inches | centimetres | 2.54 |
| inches | millimetres | 25.4 |
| kilograms | pounds | 2.2046226 |
| kilometres | miles (nautical) | 0.5399568 |
| kilometres | miles (statute) | 0.6213712 |
| litres | gallons (U.S. liquid) | 0.26417205 |
| metres | feet | 3.2808399 |
| metres | yards | 1.093613298 |
| miles (nautical) | kilometres | 1.852 |
| miles (statute) | kilometres | 1.609344 |
| millilitres | ounces (U.S. fluid) | 0.03381402 |
| millimetres | inches | 0.03937008 |
| newtons | pounds (of force) | 0.224809 |
| ounces (troy) | grams | 31.1034768 |
| ounces (U.S. fluid) | millilitres | 29.57353 |
| pounds | kilograms | 0.45359237 |
| pounds (of force) | newtons | 4.44822 |
| square kilometres | square miles | 0.38610216 |
| square miles | square kilometres | 2.58998811 |
| yards | metres | 0.9144 |